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CULTURAL
R>EVOLUTION

Edited by Olli Tapio Leino

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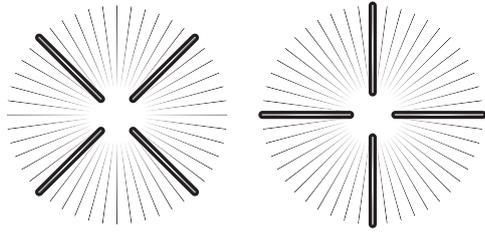
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Preface and Acknowledgements

The 22nd International Symposium on Electronic Art, ISEA2016, was held in Hong Kong from 16 to 22 May, 2016. The Symposium was co-organised by City University of Hong Kong's School of Creative Media, The Hong Kong Polytechnic University's School of Design, Videotage, and, Microwave Festival. It featured a conference, a juried exhibition, performances, events in public space, an artist residency programme and exhibition, and satellite and parallel exhibitions and events. The conference consisted of two days of workshops at The Hong Kong Polytechnic University on 16 and 17 May, 2016, and four days of parallel sessions and keynotes at City University of Hong Kong from 18 to 21 May, 2016.

Contributions to ISEA2016 were solicited through an open call: authors and artists were invited to respond to a number of topics specified under the Symposium's theme Cultural R>evolution. Each full paper, short paper, and panel discussion submission was reviewed in a double-blind peer review process by at least two members of the Symposium's International Programme Committee. The final selection of contributions in full and short paper and panel discussion categories was made by the track chairs and the conference chairs based on the IPC members' recommendations. The Conference programme of ISEA2016 featured also artist / work-in-progress talks, poster presentations, and institutional presentations, which were selected based on their relevance by the respective chairs outside the peer review process. Some submissions rejected from the juried exhibition and peer-reviewed full and short paper and panel discussion categories were accepted in the non-peer-reviewed categories. This volume contains the peer-reviewed full and short papers and panel discussions, and, the abstracts of the poster presentations selected by conference chairs. The contributions in this volume are by no means an exhaustive representation of the response the ISEA2016 Call for Participation: the artworks in the ISEA2016 juried exhibition and in the Open Sky Gallery, the performances, and the events in public space are documented in the Exhibition Catalogue of ISEA2016.

The themes of ISEA2016, described in the next section, result from a process of collective authorship. While some of the themes rather straightforwardly reflect the specific interests of people involved, others were collectively deemed as warranted by the intellectual climate affecting the tone and mood of discussions about technology, art, culture, and society. To borrow a notion from Andrew Pickering, the "dance of agency" that led to the themes in ISEA2016 Call for Participation happened in places of work and leisure both online and offline between 2013 and 2015 with varying periods of intensity. It was a delightfully productive game of broken telephone, in which discussants faded in and out, brought along their associates, lost and re-gained interest, and planted seeds which later grew into previously unpredictable intellectual forms. Due to the obvious difficulty of attributing authorship of the themes in the Call for Participation, the listing of themes in the next section mentions the names of track chairs who oversaw the review of paper and panel submissions in their respective topic areas and made the acceptance recommendations to ensure a coherent and high-quality paper programme.

ISEA2016 would not have been possible without the institutional support from City University of Hong Kong, The Hong Kong Polytechnic University, Videotage, and Microwave. The sponsorship and other forms of support from a number of partners listed elsewhere in this volume was equally indispensable. ISEA2016 is greatly indebted to Prof. Richard Allen, the Dean of School of Creative Media at City University of Hong Kong, who ensured the School's full support to the Symposium. I would like to thank the Artistic Director of ISEA2016, Prof. Jeffrey Shaw and the Co-Director, Prof. Cees de Bont, for bearing the responsibility and bridging together the inter-disciplinary and inter-institutional team behind ISEA2016. This volume was prepared before the Symposium and given to every registered delegate. Readying the diverse forms of intellectual biomass to fit between two covers already before the Symposium took a great deal of effort from everyone involved. I would like to express my gratitude to all the authors who responded to our call, to the IPC members — whose names are listed elsewhere in this volume — who diligently went through the submissions, and, to the accepted authors who toiled away at revisions within tight deadlines. Also to thank are the session chairs, moderators, and volunteers, without whom it would not have been possible to get together to transform the discursive currents in this volume into face-to-face conversations at the conference.

On behalf of the ISEA2016 conference team,
Dr. Olli Tapio Leino
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Topics and Track Chairs

ISEA2016 Hong Kong Cultural R>evolution

Electronic media exemplifies the dual meaning of revolution: to always create new while returning to the old. In this dynamic, where multiple centers and margins compete for attention, and borders to be transgressed are shifting, paradigms and practices must be replaced, repackaged and re-appropriated to keep up with the parallel evolutions in art, creativity, culture, society, and politics.

The New Geopolitics of (Art-)Making: D.I.Y. Ontologies and (De)institutionalization

Dr. David Jhave Johnston
For a long time, the southern region of China, including Hong Kong, has been known as the 'factory of the world'. However, the geopolitical landscape in which electronic art practitioners operate is changing. The emergence of DIY movements and Fablabs parallel to established artistic, technological, economic and educational institutionalized practices bring rapid manufacturing technologies and factory-grade prototyping facilities within the reach of artists, hackers and makers. Movements like Open Hardware destabilize the reliance on factory-made boxed computers. What kind of new avenues of artistic and scholarly enquiry do these shifts open up? What kind of strategies and tactics are available for scholars and art practitioners to deal with the geopolitical, industrial and financial implications of the DIY and the new immediacy of micro-scale manufacturing? This trend recasts concepts into paradoxes: degrowth economy, economies of waste, and ecological-manufacturing. How are these emerging practices to be related to prevailing ontologies underpinned by rhetorics of progress and efficiency?

Game Over - Play Again Y/N

Dr. Olli Tapio Leino
Media-archaeological excavations during the past decades have found traces of a technological, perhaps also cultural, origin shared by computer games and electronic art. Despite their shared origins, the discourses of 'electronic art' and 'art games' remain largely separate. We believe that cross-exposing these paradigms is mutually beneficial: 'playability' emerges as a waypoint on the art-historical trajectory of interactive art. Not unlike 'plot' in film or 'image' in visual arts, playability's presence in an artwork is subject to exclusion and incoherent implementation. How does the taking into account of the possibility of play challenge the existing paradigms of aesthetics and critique? Playable works oscillate between performance and signification — what are the strategies for dealing with this ambiguity? If play absorbs its players utterly and completely, what role does critical reflection play in playable art? What is to be learned from 'serious games' that aim for simultaneously critical yet pleasurable play?

The Animal and the Technological: Para/Post-Human Paradoxes

Dr. Hanna Wirman
Non-human agency and beings are typically approached either from the point of view of technological or animal others. The technological and the animal seem to be the opposite ends of a spectrum. Traditionally defined, technology is artificial, refined, organised and masculine, while nature evokes instinctive chaotic grounded femininity. Containing both, we merge the extreme others in ourselves: human, dispersed across an arbitrary middle, is both a cyborg and an animal. In light of this coexistence of cultural, technological, and natural, we ask: where are the intersections of technological and animal(istic) agency? When, why, and how do the two meet and what is the friction that occurs? Is it possible, through closer explorations, to substitute the bipolar distinction with more flexible and fluid accounts? Could the teleological trajectories of humanity be supplemented with parallel alternatives? How to conjointly define feral, native, subhuman, posthuman, or parahuman in code and nature?

Massless: Liquid E-Occupy

Dr. David Jhave Johnston
After a 20th century of mass movements, labor revolutions, and explorations of the psychoanalytic subconscious, the

21st signals the birth of new methods of massless collectivity that (dis)empower the (dis)embodied: low-orbit ion-cannon DOS, doxing, whistleblowers, wikileaks, liquid democracy, e-occupy, Internet 'votations', distributed sit-ins and long-tail internet-niche ideological-ecologies... What are the shapes of future real-time populist movements? Is the era of the street over, or is fiberoptics impotent without blood? What technically-optimized granular strategies can displace dystopia?

Code, Language, Network, Politics

Dr. Daniel Howe
For millennia literature and politics have been inextricably linked, both by those recognizing the emancipatory potential of the word, and by those attempting to leverage it for control. As computational, networked services play an increasingly critical role in contemporary life, algorithmic practices represent a new confluence for writing and politics, one in which symbolic, aesthetic, and political elements are inextricably entwined. What does it mean for new writing to take a form that is at once symbolic and executable? What will the next generation of writers (whether human, machinic, or hybrid) be able to tell us as linguistic practices continues to (r)evolve?

Noise Contra Signal

Dr. Damien Charrieras
Modern communication technologies aim to minimize noise in signals, privileging 'purity' in the transmission of information. The quality of digital representations are judged by the minimisation of noise and artefacts. Media transmitted across the network spawn countless identical copies, such that the notion of any 'original' signal is no longer relevant. This sub-theme invites participants to question this paradigm, foregrounding noise (margin) over signal (center), the mutation over the exact copy, and the unexpected over the predictable. Why have interactions between humans and computers proven so often to be noisy and unexpected, rather than smooth and predictable? How, as theorists and practitioners, can we act as accumulators and curators of such disturbance, leveraging new forms of noise in networked culture? How can we inject creative and critical noise into dominant cultural signals, obfuscating their 'original' con/in/tent and imbuing them with new meanings?

Biopolitics/biopower: Genetics (G), Nanotechnology (N) and Robotics (R)

Dr. Olli Tapio Leino
The ancient human urge for dominion (control/power) over all living things re-emerges as simultaneously the promise of augmented evolution and the threat of the anthropocene. In this context, Foucault's notions of 'biopolitics' and 'biopower' offer a chance for informed interdisciplinary investigations of what Ray Kurzweil refers to as "the three overlapping revolutions" of the Singularity: genetics, nanotechnology and robotics. The increasing sophistication of drone warrior and/or companion robots, micro-medicine and/or CRISPR gene-editing suggest the emergence of customized organisms and robotic presences (at all levels of scale) both as research vectors and as commodified entities. Can modalities of increased synthetic control be fused with a revived ethics? In what ways do 'biopolitics' and 'biopower' offer ways to re-think agency and relations? How does the entropy of current GNR developments alter the problematics of political rationalities and social governance?

Crypto-Finance

Dr. David Jhave Johnston
Regardless of ideological labels, after most revolutions, oligarchies homeostatically reclaim power. Currently the international art-market propagates core values through branded artists, mega-galleries, investor collecting, superstar art-fairs, illicit flows, freeports and tax-havens; recently the peripheries are in flux: gift-economy gatherings, crowd-sourced start-tups, high-frequency-traders, crypto-currencies, and data-driven virtual trade. What do digitally-networked transactions, diffusion, exchange and value imply for aesthetic/conceptual interventions? How do emergent economic digital forms (blockchains, micropayments, etc.), de/re-stabilize ancient inequity? How can mediated art expose the anatomy of financial power inherent in data flows?

Techno-Sex

Dr. Katrien Jacobs, Dr. Hanna Wirman, Dr. Isaac Leung, Dr. Olli Tapio Leino
Digital extensions of commercial sex toys, computer games that celebrate sexuality, porntubes and VR porn, and intercourse with robotic entities are examples of how advanced technologies enter private human encounters. Surrounded by excitement and titillation, as well as fear and anxiety, digital enhancements of human/human or human/technology sex have created a lively and restless pornosphere. How are techno-sex, womens' rights campaigns and online sexuality contributing to the fields and ideologies of social networks? What gender considerations or gender and queer activism results from globalized tech industries? What is the role of art in exploring the ethics and socio-cultural aspects of these

changes? Who are the cyber-queers online and offline? Where do reproductive technologies meet robotic partners? And finally, since techno-sex and the pornosphere in greater China are governed by a battle over civil rights, how do people and online citizens creatively use them and what are the major issues of social activism?

New Media and Cultural Heritage

Dr. Kimburley Choi
Museums, archives, and other institutions dealing with cultural heritage are increasingly turning into new media for the purposes of preserving, researching, and disseminating both tangible and intangible cultural heritage. How can new media meaningfully support scholarly, archival, and educational practices involving cultural heritage? Which cases are worth special attention to learn from? How does the pervasiveness of social media challenge the screen-based paradigms in the context of new media in museums? How are recent innovations in immersive display and information visualisation technologies reflected in the discourse of cultural heritage? How do the historical, social, economical, institutional, and political complexities of cultural heritage practices map with those of new media technologies, and vice versa? What kind of creative and institutional strategies appear feasible for dealing with these complexities?

Contents

Part I

Full Papers (peer-reviewed)

Aesthetics of Adaptive Behaviors in Agent-based Art

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Abstract

Since the post-war era, a number of artists have been exploring the use of embodied, artificial agents, in parallel to scientific research associated to Computer Science in domains such as Cybernetics, Artificial Intelligence and Artificial Life. While notions of adaptation and learning have been an extremely important component of that research, artists and media theorists seem to have focused on the concept of emergence. Whereas emergence offers a rich ground for art-making, adaptation is an equally important, yet complementary dimension of it. In an effort to re-position adaptive systems within the theoretical and practical field of agent-based artworks, an aesthetics of computationally adaptive artistic installations is proposed in this article. To do so, I examine (1) the historical context surrounding adaptive systems; (2) its relationship with the concept of emergence; and (3) the aesthetic potential of Machine Learning algorithms by examining their intrinsic characteristics. An aesthetic framework based on the morphological aspects of the temporal unfolding of agent behaviors is offered as a tool to comprehend both adaptive and non-adaptive behaviors in works of art.

Keywords

Adaptive Systems, Aesthetics of Behavior, Agent-based Art, Artificial Life, Cybernetics, Machine Learning, Media Art Installations.

Introduction

Since the 1960s, media artists have been creating bodies of work using and/or inspired by computer technologies. In this article, I am interested in a specific branch of artistic works that make use of artificial agents, which include works such as Nicholas Schöffer's cybernetics sculpture *CYSP1* (1956), Ken Rinaldo's artificial life installation *Autopoiesis* (2000) and Yves Amu Klein's living sculpture series. Artist and media theorist Simon Penny calls these kinds of work "embodied cultural agents" or "agents as artworks" and integrates them within the larger framework of an "aesthetic of behavior", a "new aesthetic field opened up by the possibility of cultural interaction with machine systems" [24]. These works are distinct from so-called generative art which uses computer algorithms to produce stabilized morphologies such as images and sound: their aesthetics is about the real-time performance of a program as it unfolds in real-time in the world through a situated artificial body.

This paper focuses on a particular facet of this broader work: agent-based *adaptive* computational artistic installations. It argues for an aesthetics of adaptive agents rooted in the distinctive way behavior morphologies unfold in time.

Among the significantly vast literature that exists in media theory, art history and STS on the topic of artificial agency and machinic life in art and science, most studies focus on related concepts such as embodiment/situatedness [23, 6], autonomy [5] and emergence [4, 29], while very few directly address questions of adaptivity and machine learning.

I hereby wish to fill this gap by proposing an aesthetics of adaptive agent-based installations. My main objective is to provide a description of the experiential mechanisms that are made possible by adaptive behaviors in media installations by connecting the dots between the scientific perspectives over such systems and the aesthetic effects they afford. While artistic media installations cannot be separated from their visual and audio qualities, the focus of my analysis is on their processual dimension.

This paper is concerned with providing conceptual tools to support reflection and creation by artists and researchers engaging with adaptive systems. To contextualize my research, I first present an overview of the history of adaptation from the 1950s onwards, focusing mainly on cybernetics, artificial life, and machine learning, showing their impact on new forms of art. Building upon Cariani's categorizations of adaptive and emergent systems, Penny's "aesthetics of behavior" and Xenakis' theory of morphological evolution, and looking at specific considerations surrounding Machine Learning technologies, an aesthetic framework is put forth to understand the evolution of behaviors through time.

Historical Context

History is imbued with a fascination for human-fabricated life, from Al-Jazari's 13th century's moving peacocks to Jacques Vaucanson's digesting duck (1739). A change in paradigm operated in the post-war era with the advent of computers which, contrary to mechanical automata, are uniquely powerful in both their speed and programmatic capacity. But while often seen as fixed, logic-based systems, an important strand of research in computer science rather focuses on their malleable, organic properties, approaching them as adaptive, self-organized, statistics-based devices. This section offers an overview of this research while examining its role in contemporary media art.

Cybernetics, Perceptrons and Classic AI

The first conceptions of adaptivity in organisms can be found in the work of early, so-called "first-order", cyberneticians. Norbert Wiener's notion of control in Cybernetics systems is closely linked to the concept of *teleological* or *negative feedback*. In a system that displays such negative feedback control, the difference between the goal of the system and its current outputs is sent back to the inputs, allowing the system to correct its course; in other words, to constantly adapt to small changes in its environment. [32] A key and related concept is that of *homeostasis*, referring to the ability of living systems to maintain stability within an unstable milieu using self-regulation. [3]

Building upon both cybernetician models of the brain [3, 19] and psychologist Donald O. Hebb's theory of self-assembling neurons [14], Frank Rosenblatt proposed in the late 1950s one of the first adaptive connectionist devices, the *perceptron* [25], a simplified model of a human neural network that maps a set of binary data (input neurons) to a binary output (output neuron) using a layer of parametric values called weights (representing the synapses) which are initialized randomly. The training procedure allows the model to adjust its weights based on a series of example inputs for which the expected output is known, using a feedback error-correcting mechanism.

The excitement for such connectionist structures which was growing in the 1950s received a cold shower with the publication of Minksy and Papert's forceful critique of perceptrons [20]. By showing that even simple problems are unsolvable by such linear neural networks, the book put a halt to the non-symbolic and distributed approach which had great attention in the field since the 1940s. The funding switched sides and for two decades, AI research turned towards the symbolic and heuristic approach pioneered by Minksy, Papert and Simon, which would later be known as "classic AI" or Good Old Fashioned AI (GOFAI).

Systems Aesthetics

Whereas the impact of the advent of computer science on Western societies in the 1940s and 1950s has been thoroughly documented, often overlooked is how it affected the artistic world. In 1961, Roy Ascott's fascination for Cybernetics made him envision a new conception of art as embodied in interactive systems rather than in physical objects. As a replacement for "visual art" which has become too narrow to describe the new paradigm he attempts to describe, Ascott suggests the name "behavioural art" which he defines as "a retroactive process of human involvement, in which the artifact functions as both matrix and catalyst" whose "structure must be adaptive" with feedback as its core mechanism [2, p. 128].

Jack Burnham's "systems aesthetics" echoes Ascott's vision of emergent, adaptive, behavior-based art. Burnham considered how art as an institution could be understood as a hierarchical system, with artists as its basis being "similar to programs and subroutines", while at the very top a "metaprogram" constantly rearranges the long-term objectives of art. Key to Burnham's vision is the conclusion that this self-organizing, adaptive system does not produce new objects, but rather new information, embodied in the creation of works of art [8].

Artificial Life

At the beginning of the 1980s, classic approaches in AI were still dominating, showing no interest in any form of biologically-based computation such as genetic algorithms and neural computation. Nonetheless, two strands of research would come to life in that era, challenging the statu quo: Artificial Life and Machine Learning.

In the 1970s, chaos theory and complex system theory had revealed how highly non-linear systems often display *emergent* properties, that is, unpredictable behavior as the result of simple interactions between a large number of entities. Emergence directly challenges the distinction between human and machine: starting from simple rules, we can simulate complex and unpredictable behavior on the computer. This idea is core to the early 1980s apparition of Artificial Life (ALife), a synthetic approach to biology that seeks to create "life-like behaviors". This new "biology of possible life", directly influenced by Cybernetics, supplements traditional biological sciences: "By extending the empirical foundation upon which biology is based beyond the carbon-chain life that has evolved on Earth, Artificial Life can contribute to theoretical biology by locating *life-as-we-know-it* within the larger picture of *life-as-it-could-be*." [18, p. 1]

Like Cybernetics in the 1960s, the field of ALife would open up a whole new territory for artists. New media theorist Mitchell Whitelaw remarks that ALife is an area of experimental science which is less preoccupied by observation and representation than it is by intervention and action. Tracing through the interests for synthetic life in art history, he hypothesizes that "a-life art" might just be the latest addition to "a modern creative tradition that seeks to imitate not only the appearance of nature but its functional structures" by using or appealing to technology. ALife might then just be the true destiny of art and the realization of Jack Burnham's vision of a "living, cyborg art form". [31, p. 19]

Machine Leaning

In parallel, part of the people in the AI community had become interested in questions of learning systems [17, p. 275], paving the way to the institutionalization of a new research field within AI that would employ mathematical models to classify and make predictions based on data or experience rather than on logical rules.

At its beginnings, the new field of Machine Learning was still mostly based on symbolic methods such as decision trees and logic. But in mid-decade, a major breakthrough would suddenly bring connectionism back on the scene as David E. Rumelhart, Geoffrey E. Hinton and Ronald J. Williams proposed an algorithm known as *backpropagation* to train a multi-layer perceptron (MLP) [27], a model which consists in stacking several perceptrons on top of each other in interconnected layers. Each layer projects the previous layer's outputs using a non-linear threshold, circumventing the main caveat of perceptrons as pointed out

by Minsky and Papert: their inability to separate non-linear data [20].

The revival of connectionist adaptive systems in the 1980s irremediably changed the field of Machine Learning, moving it away from logic towards statistics and biologically-inspired methods. In particular, the field of neural computation would gain impetus. In 1987 took place the first Conference on Neural Information Processing Systems (NIPS) took place, bringing together researchers interested in connectionist approaches from both neurosciences and computer science. It would become, over the years, the most important conference in the field of Machine Learning.

Adaptation and Emergence

Emergence has been widely studied by scholars interested in questions of artificial cognition and living systems. It is often associated with self-organization, such as in ALife, Cybernetics and Connectionism. However, emergence also evokes an idea that somehow goes beyond the automated configuration of a system: the generation of novelty. [29] Within an artistic context, emergence promises to spawn unforeseen patterns and to surprise even its own designer. [12]

Peter A. Cariani has contributed a stimulating ontology of artificial systems that establishes a clear relationship between adaptation and emergence in Cybernetics systems [9]. Differentiating Cybernetics devices on the basis of their adaptive qualities, he identifies three kinds of such systems: formal, adaptive and evolutionary. *Formal* devices are purely (formal-computational) or partly (formal-robotic) symbolic apparatus that respond to a fixed set of instructions and are thus non-adaptive. *Adaptive* systems are capable of adapting their computational structure based on experience but are limited by their fixed semantical components (sensors and effectors). Machine Learning systems and even adaptive robotic agents are part of that category.

Finally, *evolutionary* devices are those that are able to adaptively construct their own sets of sensors and effectors. [9, p. 132] This last category can be refined by considering systems that have adaptive semantics but a non-adaptive syntactic part, such as the immune system. *General evolutionary* devices are those that are both *adaptive* and *evolutionary*, in other words that display both semantics and syntactic adaptiveness, and there are plenty of examples of such systems in the biological world. The main "advantage" of evolutionary devices as compared to adaptive or formal systems lies in their ability to generate novelty, which Cariani directly associates with emergence (p. 148).

Cariani uses *emergence-relative-to-a-model* (or "observer-centric emergence") to integrate adaptation and emergence in a comprehensive framework. First developed by theoretical biologist Robert Rosen, it defines an emergent event as "a deviation of the behavior of the physical system under observation from its predicted behavior" (p. 30). In other words, emergence comes from the fact that since we dispose of only a finite number of observable dimensions whereas the universe contains a potentially infinite number of attributes, it follows that our models of the world are always incomplete accounts of it. (p. 157)

The taxonomy of adaptivity at the core of Cariani's theory can now be attached to the emergent qualities of a system's behavior:

> When the behavior of the physical system, in this case the device itself, bifurcates from the behavior of the model, another model will have to be constructed which will capture subsequent behavior of the physical system/device. (p. 158)

This "bifurcation" from the model's behavior is thus, according to Cariani and Rosen, the locus of novelty emergence in the agent's behavior. That emergence is realized by the agent through its adaptive capabilities, either syntactic, semantic, or both. Thus, one could say that adaptivity is the means by which emergence is realized. In that context, adaptivity is seen not just as a way for systems to self-organize but as a necessary condition for creativity.

Cariani's framework provides useful tools to think about adaptation and emergence. However, his perspective is that of a cognitive scientist, not an artist, hence it is limited when applied to works of art. Expanding upon Cariani's work, Joan Soler-Adillon has developed an extensive aesthetic framework to understand interactive artworks that make use of emergent systems [29]. This analytical tool is rooted in the distinction between two forms of emergence: self-organization emergence (SOE) – which is related to works in Cybernetics and ALife – and Generation of Novelty Emergence (GNE) – which is directly connected to Cariani's emergence-relative-to-a-model.

But Soler-Adillon's aesthetics of emergence is specific to the case of interactive works and is thus, at best, imperfectly applicable to the case of adaptive systems. Adaptation presupposes a form of self-organizing emergence through which the agent will adapt the structure underpinning its behavior. As we have seen, it also provides an anchor point for understanding novelty generation, being the process by which emerging-relative-to-one model is achieved.

Furthermore, whereas emergence is often associated with living systems, it is certainly not a sufficient condition to life, as there are many non-living systems that can be described as emerging, such as weather or cosmic phenomena. In other words, emergence can happen independently of any kind of agency. But as it presupposes an agent whose behavior allows it to evolve in the environment, I posit that adaptation brings us one step closer to *aliveness*. When brought into the arts, it promises to generate behaviors that are more "lifelike" and perhaps, also, closer to more complex forms of life such as the brain, in line with the life-imitating artistic tradition underscored by Whitelaw. [31]

With that in mind, in the coming sections, I examine the aesthetic potential of Machine Learning techniques. Combining Simon Penny's "aesthetics of behavior", Cariani's ontology of adaptive and emergent systems and Xenakis and Di Paolo's study of morphogenesis, I suggest a framework to think aesthetically about adaptive and emergent behaviors rooted in their evolution in time.

Machine Learning Aesthetics

Cybernetics-style adaptive systems evolved through the 1980s onwards into the science of Machine Learning, bringing together a vast multitude of approaches ranging from statistics, stochastics and Bayesian logic to neural and genetic computing, under a common research program within AI. Machine Learning explores algorithms that are able to make inferences and predictions about the world by looking at large quantities of data.

These techniques were, of course, never intended to be used for artmaking. Still, anyone looking at an agent tentatively trying to balance an articulated pole [30], achieving acrobatic stunts with a toy helicopter [22] or finding new ways to play Pong [21] can assess to the aesthetic qualities of these performances. But what are the dimensions of Machine Learning algorithms that can be exploited for artistic expression, and how can they be utilized as such? To approach that question, let us look at the fundamental characteristics of learning methods and explore ways they can be harnessed for art creation.

A Machine Learning algorithm comprises four components: (1) the *category of task* one is trying to solve; (2) the *model* used to address it; (3) the *loss function* against which the model is trained; and (4) the *search or optimization* procedure. These items represent dimensions of a learning system which all influence its outcomes in terms of efficiency, but also – and this is, of course, what should interest us the most here – relatively to the aesthetic effects it affords.

To these elements, we need to add a key component of Machine Learning: the *data* that is fed into the system. This comprises the choice of inputs and outputs and the distribution from which the examples are taken. In a real-life setting, all these elements can be understood as the context in which the learning agent is situated, including both the observables and hidden variables that form its environment.

Tasks

The field of Machine Learning is divided in three sub-fields, corresponding to three different classes of problem: supervised learning, unsupervised learning and reinforcement learning.

Supervised learning (SL) – the most common category – concerns the problem of predicting an output associated with a certain input data, based on a dataset containing examples of data points with expected target response (typically hand-labelled by humans). *Unsupervised learning* (UL) refers to classes of problems where there are no precise outputs that need to be predicted, typically referred to as "unlabeled data". Rather, the algorithm needs to learn "something about the data distribution".

Reinforcement learning (RL) tries to address problems involving an agent that tries to take actions in an environment in order to maximize its reward over time. [30] The agent learns by taking actions and receiving positive or negative feedback from the world through rewards. A reward is a single-value information given to the agent in response to his state or actions. In line with Holland's definition of adaptation, the goal of a reinforcement learning agent is to modify its inner structure in order to maximize its performance – represented as the rewards it collects over time –

as it evolves in the environment. [15]

While RL seems to be the most adapted to agent-based installations, it has been scarcely used in practice. One of the few examples is the installation/performance work *N-Polytope: Behaviors in Light and Sound After Iannis Xenakis* created by Chris Salter in collaboration with Sofian Audry, Marije Baalman, Adam Basanta, Elio Bidinost and architect Thomas Spier, in which RL is used to simulate bursts of light "chasing" one another along the cables that form the structure.

One of the most widespread ML techniques used in such pieces involve Genetic Algorithms (GAs) which are a form of Supervised Learning. In Karl Sims' 1997 installation *Galápagos*, a series of twelve computers each show a single virtual 3D organism whose morphology and movements are the phenotypic outcomes of a digital genotype. Visitors supervise the evolution of the organisms by selecting the ones they prefer, directly impacting the next generation of artificial beings [28].

Self-Organizing Maps (SOM) are a kind of neural network used in Unsupervised Learning tasks which have also been abundantly used in works of art. Many of Yves Amu Klein's *Living Sculpture* works make use of them, such as *Scorpibot* and *Octofungi* [16]. Nicolas Baginsky uses a similar approach in *The Three Sirens*, a robotic music band who plays improvisational rock music: the guitarist and the bassist use SOMs to direct their actions, playing live music in response to the sound environment they generate in real-time.Finally, artist Ben Bogart's *Context Machines* use SOM as part of image-based installations that play on the questions of memory association and dreaming [6].

All three approaches can be mixed together, as well as with non-adaptive components. *Zwischenräume* is an installation by artist Petra Gemeinboeck and computer scientist Rob Saunders that features robotic agents that are "sandwiched" between the gallery wall and a temporary wall. Each one of them is equipped with a motorized system that allows it to move vertically and horizontally, covering a specific region of the wall, a puncturing device that allows it to make holes through the surface, as well as a camera and a microphone for sensing the environment. The system allows the robots to extract features from the camera and from the audio signal, combining these informations into a system that mixes SOMs to detect similarities between images and a RL program that tries to "maximise an internally generated reward for capturing 'interesting' images and to develop a policy for generating rewards through action" where the level of interest is based on a measure of "novelty and surprise" where "'novelty' is defined as a difference between an image and all previous images taken by the robot" and "'surprise' is defined as the unexpectedness of an image within a known situation" [13, p. 217].

Components of a Machine Learning Algorithm

Machine Learning algorithm can be qualified by the interoperability of three constituents: the model, the optimization procedure and the evaluation function. The optimization process gradually improves the model based on its performance over the evaluation function [1, pp. 35–36].

Models in Machine Learning refer to the computational

structure that gets modified through learning. The best way to think of a model is as a function that tries to approximate as close as possible a distribution of data, based on a sample of that distribution (the dataset). The model contains free parameters that will be adjusted by the training algorithm, such as the "weights" or "synapses" in a neural network.

Models are the object of important debates in the field of Machine Learning, being the defining flagships of different research strands. However, when it comes to artistic works, they are possibly the least explored dimension, as most adaptive artworks involve either GAs or SOMs. This is likely because scientists and artists have different goals and expectations: an apparently small improvement in the performance of a model can be seen as revolutionary from a scientist's perspective but will not change much how artwork is experienced.

Nonetheless, there are at least three ways in which models can affect artistic outcomes. First, the nature of the model is often an important part of the concept of a piece: the imaginary space deployed by neural nets differ from that of evolutionary computation or decision trees. The second way is the kind of artistic "hijackings" a model can allow because of its nature. For example, in the outdoor installation *Vessels* (2015), a GA is used as ways for a community of water-dwelling robots to share their personalities, evolving a kind of family resemblance. The third process by which models can impact artistic works is more subtle and has not been the object of much analysis. It has to do with the fact that, indeed, different models will yield, or afford, different kinds of behaviors. The types and variety of behavioral strategies that the model allows, and the "smoothness" – or "abruptness" – in the evolution of these strategies during learning, are examples of how models can affect agent aesthetics.

The *optimization procedure* – also called *search* or *training algorithm* depending on the context – changes the parameters of the model in an attempt to improve its responses over time. Different kinds of such procedures exist, each with their own advantages and domain of application, although most are deeply tied to specific models. For example, there is a vast amount of research on training algorithms for neural networks, using different optimization approaches such as gradient descent (backpropagation), genetic algorithm, and simulated annealing.

The *evaluation function* measures the performance of the model on its task. In both Supervised and Unsupervised learning, it is usually referred to as the *loss function* or *cost function*. In a classification task, for instance, the category predicted by the model given an example is compared to the expected target category: the more the model misses the target, the larger the loss. In RL, the evaluation function is called the *reward function*, while in GAs, it corresponds to the *fitness function*.

Among the three dimensions of a Machine Learning algorithm, the evaluation function is probably the one that is the most readily useable for authoring. This is because it has been designed specifically for the purpose of bringing a human input into the equation. Models and optimization procedures are meant to be rather agnostic: the evaluation function determines the kind of "problem" one tries to solve.

Artists can play with evaluation functions and look at how the agent responds. An evaluation function can also be learned or attributed by another agent. Finally, evaluation functions can be interactive, with either the artist or the audience replacing the function by directly giving an evaluation of the system's performance. In the case of evolutionary computation, this technique is known as Interactive Genetic Algorithm (IGA), an approach first proposed by Richard Dawkins [10]. Sims' *Galápagos* is a most famous example of using IGAs in an interactive installation [28].

Another example is the "chasers" algorithm in *n-Polytope*, which simulates agents moving across the installation's cables using a RL algorithm combined with an MLP. Each cable represents a one-dimensional "world" with twelve (12) discrete locations/cells. At any specific moment in time, an agent occupies one and only one of the twelve cells and can choose to either stay in place or move to one of the adjacent cells. The only information (observation) the agent receives is the distance (in number of cells) between itself and the next agent, in both directions. The agents' positions are represented by lightening the corresponding LED on the cable.

The reward function is the sum of three different components: (1) *touch* rewards (or penalizes) the agent for being on the same spot as another agent; (2) *move* rewards the agent for moving in a given direction (and punishes it for going the opposite way); and (3) *stay* rewards the agent for staying put (and punishes it for moving). By playing with these parameters, different behaviors can be promoted, such as prey, predation, movement, and collision avoidance.

Data

Data is an often overlooked, yet crucial dimension when thinking about adaptive behaviors, especially in an artistic context. There are practical concerns when dealing with data encoding and challenging issues that arise when dealing with high dimensional spaces, such as is the case with image or speech recognition, which are largely beyond the scope of this dissertation.

The first things to consider are the kinds of inputs and outputs that will be fed into the system, in other words, what the agent will be able to observe and how it will be able to respond to these observations. In order to be effective, these inputs and outputs need to be carefully chosen to afford the kind of experience the artist has in mind. Moreover, there needs to be a way for the agent to make inferences, otherwise no learning will happen. For example, a system that can only detect light cannot be asked to learn about the sounds made by visitors.

Second, it is self-evident that the data distribution from which the examples are picked has an important influence on the reactions and establishment of the system's behavior. One of the most dreaded issues in Machine Learning is *overfitting*, a problem that arises when a system estimates "too perfectly" a specific dataset, thus becoming less efficient at making predictions on unseen samples (ie., taken outside of the training dataset). While overfitting is a plague for data scientists, it might actually be exploited

creatively by artists, by hand-picking data (such as by creating a constrained environment) to encourage a specific response in the system.

Morphologies of Behavior

The temporal dimension of agent behaviors is charged with aesthetic potential. Existing taxonomies of cybernetics systems have mainly focused on their relational and structural aspects [26, 9]. In this section, I propose an ontological frame that focuses on the aesthetics of agent behaviors as they unfold in time.

The "zero-degree" of that categorization is the "behavioreness" of the system, that is, whether it should be considered to have a behavior or not. The initial differentiation criterion, I argue, lies in the structural capacities of the system, more precisely in the existence of an internal state. Stateless devices are akin to mathematical functions: their outputs/actions only depend on their inputs/observations. By design, they are incapable of accumulating experience.

Such systems are known in the field of digital media art as *mappings*. Their widespread popularity is evidenced by the prevalence of data-flow softwares such as Max/MSP or PureData, often appearing under names such as "visualisation" or "sonification". In his critique of the hegemony of mapping in interactive arts, artist Marc Downie argues that its apparent generality, which is often seen as an advantage, actually makes it ineffective and sterile, acting as "a normative idea" of how "numbers get transformed into numbers". [12, p. 17]

Devoid of any kind of autonomy and agency, mapping-based devices are *behaviorless*, their conduct relying almost entirely upon the data fed into them. Whatever sense of aliveness associated with them truly lies in the system that generates this data, be it a human performer or a natural phenomenon. Their statelessness imprisons their "performance" into the instant: their world, if they have any, is a *succession of independent moments*. They are, in other words, *zero-order behaviors* (ie., "nonbehaviors").

Agent-based systems, which are the focus of both this and Downie's dissertations, are *behaviorful* in their ability to extend their world into the past through the use of some kind of inner structure. These stateful devices possess some sort of "memory" (whether it is discrete, continuous, long or short) which is modified by their interactions with the environment. In other words: *their past experiences influences their present actions* (at least within a certain time window).

This statefulness, which implies some kind of structure or trace, can be found in a vast variety of computer programs. For instance, formal devices as defined by Cariani can possess states, typically recognizable in computer code as named variables of different types (ie., booleans, integers, floats), however these syntactic components are fixed. Behaviors generated by these systems are thus bound within a certain domain. Hence, while its response to sensory data may change depending on context, the agent's behavior *itself* does not change through time: it will, inexorably, come to repeat similar patterns after a while. We will thus refer to these conducts as *first-order behaviors*.

To understand this idea better, consider how a behavior can have a certain, recognizable *morphology* that exists in a domain different from other forms of non-computational, "stabilized" media, so to speak, such as image of video, or even, as I explained earlier, real-time mappings such as sonifications or visualizations. The shape of a behavior is parameterized by the sensors, effectors and processing capacities of the system that generates it, and evolves within a certain space-time territory. Morphology and morphological processes have been used to describe time-based behaviors in the writings of contemporary music composers such as Iannis Xenakis and Agostino Di Scipio [33, 11].

Because of their inability to generate new forms and/or to transform their own form, I argue that the behavioral morphologies produced by formal, rule-based systems, are viscerally different from those produced by adaptive and evolutionary agents. The latter produce *second-order behaviors* or "metabehaviors", which involves the coming-into-being, and possibly transformation, of their own (first-order) behavior. They therefore exist in a "different time" than their formal/fixed counterparts, which in turn affects the overall aesthetic effect they are allowed to engender.

I propose to use the concepts of *morphogenesis*, *morphostasis* and *metamorphosis* to further characterize the different processes by which behavioral morphologies exist, emerge and/or change over time. These notions are related, each in their own way, to ideas of emergence, self-organization, self-regulation, novelty and autonomy. As the focus on processes related to forms, they seem particularly appropriate to support an aesthetics of behaviors.

Morphostasis refers to the process whereby a behavior hovers around a stable state of being. While they might look like they are changing when considered over a certain period of time, morphostatic behaviors quickly exhaust the space of dynamic patterns they can generate and start appearing repetitive. These behaviors are immutable: they stay constant through time.

Morphogenesis is the mechanism by which emergent behaviors develop their form in a continuous manner. Only adaptive and evolutionary devices, which are capable of self-organization, are able to support morphogenetic behaviors. The category implies the production of new processual morphologies through a system's interaction with the world.

Metamorphosis is intimately related to morphogenesis and refers to the process by which behaviors change *from one shape into another*. In essence, it should be understood much like its everyday usage, that is, as an outstanding transformation in the demeanor of a person or other living being. The two main dimensions of metamorphosis are (1) the *metaboly*, that is, the magnitude of the transformation undergone by the behavior; and (2) the *speed* at which the behavior transits from one form into the other.

Consider the evolution of robotic behaviors in *Vessels*. When the robots are first started, the DNA in which their behavior is rooted is initialized randomly, resulting in very diverse "personalities". Within the scope of an hour, they evolve towards a collective behavior (morphogenesis) into which they stabilize (morphostasis). But as time goes and as the environment changes (weather, ambient light, distribution of robots across the space) they also modify their

behaviors, slowly adjusting to the new conditions (meta-morphosis). Change happens in two different ways. First, in a very specific, personalized, yet slow way, where each robot adjust its personality based on its own reading of the environment. Second, at a regular rythm (about one per 2-3 minutes), a random robot will become a "hub" and call the other robots, promoting rapid adaptation to its own personality. These two mechanisms interoperate in the making of the global aesthetic experience of the piece.

These aspects of an agent's performance should be seen less as hard-cut categories but rather as conceptual tools for describing second-order processes of behavior formation. For example, from that perspective, both formal systems as well as self-regulated devices such as early Cybernetics systems [3], or pre-trained machine learning algorithms, produce purely morphostatic behaviors. However, they are distinctive in the kinds of first-order, repetitive patterns they produce, which are related to their different structural and processual properties, as highlighted before. Importantly, most agent-based adaptive installations bring together a mixture of different systems, staging different kinds of zero-, first- and second-order behaviors, intertwining phases of morphological stasis, genesis and transformation intervening at different rates.

At the opposite end of the spectrum, some morphogenetic systems freely move from one behavioral embodiment into another, constantly metamorphosing, never fully coming into being. These systems are often referred to as "generative": they evolve behaviors regardless to their fitness or value. [7]

Adaptive processes, on the other hand, transform their morphologies in relationship to a usually indeterminate "optimal" behavior which they try to approach and match. Adaptation, like intentionality, requires an object: systems do not just adapt, they adapt *to* something. Their experiences affects their inner structure so as to improve their prospective performances. In other words, *their past feeds their futurity*.

Typically starting from a state of pure randomness, adaptive agents run through a learning process of morphogenesis where they progressively and asymptotically modify the shape of their behavior to better perform in relationship to the cost/fitness/reward function. When they reach their final form, they enter a state of morphostasis, exploiting the stabilized, learned behavior which they converged to. Some adaptive systems have the ability to depart from this crystalized demeanor, either as a result of an internal intentionality, or as a response to environmental changes that require drastic adjustments to their performance. Figure 1 compares the temporal evolution of different kinds of behaviors.

The aesthetic experience of these behaviors is dependent on a number of factors. The ratio between the magnitude of change and the time period necessary to perform it during metamorphosis (which in the case of machine learning systems is directly related to the learning rate) can be used as a measure of intensity. Abrupt, fast transformations can bring a sense of astonishment or angst in the recipient, while noticeable changes that are more spread-out might activate feelings of curiosity or anxiety. An important chal-
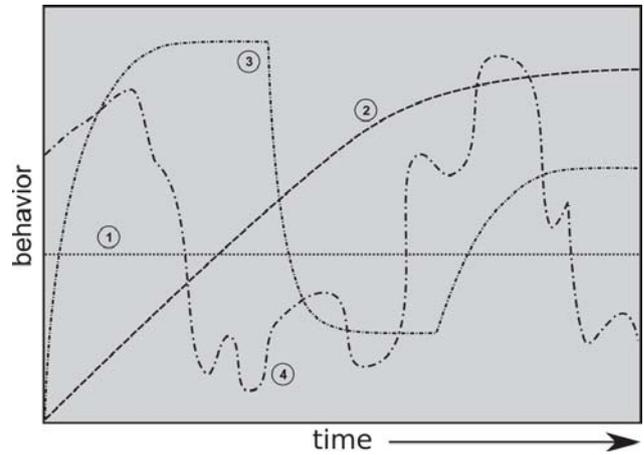
Fig. 1: Example temporal evolution of different kinds of behaviors: (1) first-order behavior; (2) adaptive behavior converging into morphostasis; (3) adaptive behavior running through different phases of metamorphosis and morphostasis; (4) non-adaptive second-order behavior (generative).

lenge in designing interactive media experiences is to learn how to play with these parameters to generate the desired effects in the audience.

Conclusion

In this article, I have examined adaptive behaviors in embodied agent-based artworks from an aesthetics perspective. After contextualizing adaptive systems historically in both science and art, I examined Cariani's theoretical framing of emergent and adaptive systems as an approach to aesthetic understanding. An insider's view over Machine Learning algorithms was used to outline intrinsic features of such systems that can be harnessed for art practice. The temporal aspect of adaptive behaviors was finally examined through the elaboration of an ontology based on morphologies.

Marc Downie explains that emergence is problematic in artistic creation when contrasted with the question of *authorship*. He argues that emergence-based approaches try to avoid the question of authorship altogether by trying to create processes that work by themselves, without human intervention. However, despite decades of efforts, we are still waiting for the advent of higher-order emergent artificial life structures. [12, p. 29]

As I argue, the process by which emergence-relative-to-a-model realizes itself is adaptive in nature. Hence, Machine Learning offers a set of tools to navigate in the development of emergent behaviors by providing concrete ways to achieve authorship, such as playing with models, datasets, and evaluation functions. I hope that the conceptual tools that I developed here might be useful to artists and researchers who are working with self-organizing, agent-based systems.

Acknowledgments

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Paradoxical Bodies: Animal Human and Machine Hybrids

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Abstract

Many age old assumptions and practices are coming into question, long held views about nature, human nature, about the definition of life are being re- examined and in many cased abandoned in what has been termed, the emerging BioTech Century[1]. The proliferation of new technologies and media, advances in biotechnologies and genetic engineering are provoking a re-examination of the constitution of the terms "nature", "human" and "machine". Subsequently, the re- examination of these "essential" categories are likewise reshaping notions of self, society and other, and provoking some new and potent configurations of what constitutes life. One boundary to be breached in addition to organism/machine is the distinction between animal/human. Current developments in biotechnologies - xenotransplantation, michrochimerism – suggest that biology does matter and that the machine/human coupling is expanding into the machine/human/animal hybrid. In this paper I would like to explore a more thoughtful awareness of the complicated connections between bodies -human, animal, machine, and material bodies. I will look at some early examples of human-animal hybrids and then discuss an interactive and kinetic sculptural art project entitled Pelt (Bestiary) that explores some of these ideas. In Pelt (Bestiary) I wanted to give digital technology back its pelt. To bring the bestial and the messiness of the world back into the realm of digital technology; to continue my work in grounding the digital experience in the material realm.

Paradoxical Bodies: Animal Human and Machine Hybrids

The proliferation of new technologies and media, advances in biotechnologies, and recent work in ecology and materialism are provoking a re-examination of the constitution of the terms "nature", "human" and" machine". Subsequently, the re-examination of these "essential" categories are likewise reshaping notions of elf, society and other to include other non-human forces. For some this has been cause for a re-entrenchment of Cartesian or humanist ideals and a re- inscription of familiar cultural narratives in these new domains. But new technologies and media also have the potential to challenge traditional assumptions in interesting and unique ways and to provoke some new and potent configurations.

One of these new configurations come from the fields of Artificial Life. Artificial Life is a term assuming a new importance in light of research in emergent, intelligent behaviour among complex systems, networks and machines. Artificial Life advocates for an evolutionary, materially based, context driven model, a model that understands intelligence from the perspective of systems that are physically embodied in the world: in other words, in complex and changing environments.

This model, often termed "bottom up", is a strategic term and differs significantly from the hierarchical approach of traditional or classical Artificial Intelligence which focuses on the idea of representation of the world rather than action in the world. Artificial Life's approach of situated, adaptive, reactive and embodied systems provides a unique model that takes into account and responds to the post- millennial climate of accelerating technological change and its attendant social and political change, while raising provocative questions around issues or representation, simulation, and the uncanny persistence of antiquated cultural narratives in these new fields, narratives of transcendence, of the separation and privileging of mind over matter. Based in keen observation of animal and human perceptions, actions and cognition, it represents a new model for approaching art and life that is not human-centred nor anthrocentric. This concept of emergence - of behaviours emerging out of their own accord based on simple rules and interactions in a dynamic environment counters the model of the discrete, sovereign body. The Western notion of the individual who functions as a discrete entity, contained by the impermeable boundaries of the skin. In this view, as Margrit Shildrick states, "the body is reduced to the status of personal property, to be modified at will: cut up; supplemented by prostheses; or have its part replace by organic material from other bodies."[2]

All of these questions have the potential to challenge the humanist litany of dualities and the view of a technological telos – technological research as an inevitable, evolutionary march forward. The French philosopher Michel Serres suggests that humanity should make a new nature contract to replace the old outdated social contract. As many scientists are increasingly becoming farmers and bio materials and reproductive technologies are creating new hybrids, perhaps a new contract could be one of integration rather than subjugation[3]. It is interesting to note that the cow and

the pig are among the animals most compatible with human beings for transplants and gene transfer technology. For example, the porcine heart valves commonly used in humans - surgeons have been able to transplant heart valves from pigs into patients for more than two decades. Made from the animal tissue of specially bred pigs, the prosthetic valve is mounted on a sewing ring made of metal or plastic, sheathed in a knit fabric (usually Dacron or poly-tetr-fluor-ethylene), which is sewn into the orifice of the natural valve. Another area is xenotransplantation that is the transfer of living cells, tissues and or/or organs from non human animal species into humans.

In this paper I am trying to explore a more thoughtful awareness of the complicated connections between bodies - human, animal, machine, and material bodies. For political theorist, Jane Bennett, agency emerges as the effect of arbitrary configurations of human and non-human forces. She suggests that agency is distributed and not the sole domain of humans and asks us to consider the vitality of non-human forms[4]. I will speak about an ongoing project that I have been working on entitled, Pelt (Bestiary), that touches on some of these ideas.

Representations of aberrational human forms are common to all cultures and all historical periods. But excessive bodily hair as the iconographic convention of otherness is specific to European culture. While notions of the 'monstrous peoples' have been perpetuated from classical times through the Middle Ages – both Herodotus in his Historia, 5th Century BC and Augustine in Alexandrine Legends describe the species in detail, but prior to the12th century, no accounts exist that describe these wild or monstrous men as covered with hair. The wild man remains a European invention, essentially conforming to the inner nature of Western culture. Hairiness is the visual cipher bestowed unto the wild man.
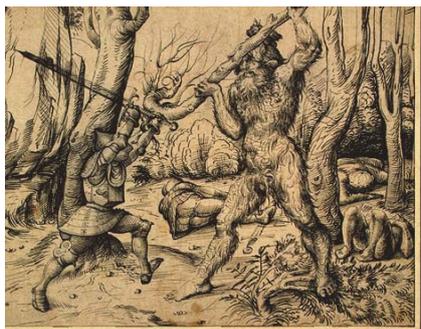
Fig 1. The Flight in the Forest, c 1500, Hans Burgkmair
©wikipedia commons

Typically the wild men were social outcasts, agents of evil, savagery, representative of the 'other'. The wild man is a mythic creation literary and artistic invention who differed from man mainly in his thick coat of hair that left only his hands and feet and face exposed with female breasts. The wild man served as a counterpoint to accepted norms and standards of conduct

in society, and was considered aberrant and a symbol of suppressed sexuality. The Wild Man represented the uncivilized in fearful, physical reality. He was the embodiment of Medieval fear and his terrifying nature made hi the focus of a wide range of anxieties and the scapegoat for unexplained calamities and quirks of nature, everything from failed crops to premature deaths. In this image, The Fight in the Forest by Hans Burgkmaire, the Wild man is depicted covered in hair.

Fig 2. Moors and Wild Men in Battle, c 1431
©www.mfa.org

And in the 15th century German Tapestry, Wild Men and Moors, we see a double 'othering'. In this series of tapestries the wild men are depicted as serving the 'good', a rare depiction, by killing animals and humans, in this case, the Moors (in the middle ages this meant Muslims of Arabic and Berber descent).

Hair is a unique material, existing simultaneously inside and outside of the body, a liminal site between the internal and external, the private and public realms, a material that is both alive and dead (alive inside the body and dead outside of it). It is an inescapable reminder of our animal nature and highlights the often conflicted responses we have to that association. In the West, hair has historically been associated with the primitive, the inferior, the bestial and the highly sexual

Fig. 3 *The Assumption of Mary*, c 1490-92, Tilman Riemenschneider ©National Bayerisches Museum

In this beautiful medieval limewood sculpture of the Assumption of Mary Magdalene (c1490-92) by Tilman Riemenschneider, we see the penitent prostitute's

legs completely covered with a soft down of hair, meticulously carved in the hard wood.

An abundance of hair is also connected with physical and sexual prowess concurrent with intellectual and spiritual deficiencies. An Elizabethan proverb, "Bush natural, more hair than wit," suggesting that an abundance of hair is an indicator of stupidity. Later, a 10th century study by Giovanni Battista Moraglia compared the bodily hair of prostitutes with other women. He came to he conclusion that both very thick body hair and more than the usual amount of down on the face were indicators of sexuality[5]. And in Angela Carter's compelling story, "The Tiger's Bride", she highlights the erotic element of hair. In this contemporary retelling of the fairy tale Beauty and the Beast, hair is linked to sexual awakening. Beauty's return to the Beast in this version can be interpreted as Beauty's self conscious acknowledgement of her desire as a sexual being.

> He dragged himself closer and closer to me, until I felt the harsh velvet of his head against my hand, then a tongue, abrasive as sandpaper. 'He will lick the skin off me!" And each stroke of this tongue ripped off skin shining hairs. My earrings turned back to water and trickled down my shoulder; I shrugged the drops off my beautiful fur. [6]

Contrarily, contemporary science fiction tends to depict the cyborg – the hybrid of the machine and the human – as hard, hairless, dry bodies.

Fig 5. Child Robot, Hiroshi Ishigurothe, 2011
© Ars ELectronica

In contrast, contemporary robot prototypes offers another approach. (I am not sure which one is more frightening.) This four foot 4' child robot with a bio-mimetic body, built by Hiroshi Ishigurothe at Osaka University in Japan is also still firmly rooted in the human as model for life. As does the Geminoid F, a life like female robot, also created by Ishigurothe at the Osaka University. (And clearly not just any human but a young, fit, idealized female).
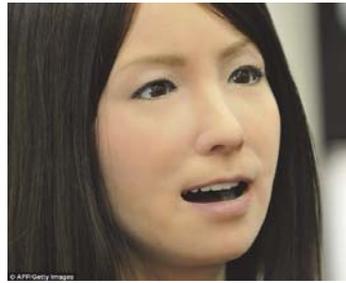
Fig 6. *Geminoid F*, Hiroshi Ishigurothe, 2015
© Getty Images

Fig. 7 *Pelt (Bestiary)*, Ingrid Bachmann 2012-14
©Ingrid Bachmann

In the project, Pelt (Bestiary) I wanted to explore the potential of a new hybrid life form. I have often had the sense that technology is naked, that is has drifted from its animal roots. In Pelt (Bestiary) I wanted to give digital technology back its pelt. To bring the bestial and the messiness of the world back into the realm of digital technology; to continue my work in grounding the digital experience in the material realm.

It involved the creation of textile and other material surfaces that change their form in response to external stimuli. This stimulus includes touch, proximity, movement, temperature, or sound. The project is similar to one's "hair standing on end". When humans become excited or frightened, the arrector pili muscle at the base of each hair follicle contracts, resulting in the hairs on the body quite literally stand straight up. .

In this project I want to give technology back its pelt, to reintroduce the animal, the bestial back into technology, to explore the disruption of boundaries between human/animal/machine to create new hybrids and problemmatize the cultural and historical distinctions

Fig. 8 *Pelt (Bestiary),* Ingrid Bachmann 2008-12
© Ingrid Bachmann

between animal/human/machine. It consists of six still, kinetic and interactive sculptures. Some react to human presence, some ignore human presence and others move of their own accord. On the walls, are large scale portraits, drawn in charcoal of the beasts. We look at them, they look at themselves and each other.

Fig. 8 Pelt (Bestiary), Ingrid Bachmann 2008-12
©Ingrid Bachmann

Their surface is made of a tufted neo-prene rubber, a surface that I hoped would be simultaneously attracting and repellent. A surface that mimics natural fur or hair, but one that is clearly synthetic.

After years of working with interactive media I became I wanted to see how subtle I could make interactive and kinetic works and yet have them still be engaging. I became tired of the spectacle, the one-liner action-reaction dynamic of interactivity. I have always been interested in the idea of tender or even pathetic technology, to use technology for ends that are not productive in the usual sense of the word.

I am currently working on the next generation of the beasts, they will be more hybrid in material, have more autonomous movement, and may be partially dependent on mechanical aids. Automatons that are not at our (human) service. I wanted to generate a more thoughtful awareness of the complicated connections between bodies human, animal, and machine bodies. Janet Bennett theorizes a vital materiality that runs through and across both human and non-human bodies.

What are the consequences if we acknowledge that agency emerges as the ad hoc reactions and configurations of human and nonhuman forces? Perhaps by acknowledging this idea of distributed agency - agency that is not the sole purvey of humans, - we might develop a more responsible and ecological politics.

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The Condition

Towards Hybrid Agency

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Abstract

This exposition paper presents the background for and central themes of *The Condition* (2015-2016), an artwork by the authors. The cultural and scientific values underlying research in the cloned Christmas trees that are part of the installation are discussed. So are historical microgravity studies on plants and recent insights of plant science into the sentient, agential and social aspects of plant life. The artwork is contextualized historically as a continuation of a decades long artistic interest in combining robots with plants. Through this, the hybrid agency inherent in its specific merger of cloned plant life, robotic technology and a self-organizing algorithm is articulated.

Introduction

Recent decades have witnessed an acceleration of developments taking place at the intersection of the technological and the biological. Things we have hitherto associated with the adjective *natural* have by now become malleable and thoroughly imbricated with technological devices. [1] *The Condition* (2015-2016) looks into questions concerning organisms in hybrid conditions that result from the contemporary entwinement of technological, economic, biological and cultural factors. The artwork consists of twelve rotation boxes each housing a small cloned Christmas tree. The rotation speed and direction of the trees is governed by a self-organizing map algorithm driven by input data from space weather measurements. The tree species in question, Nordmann fir (*Abies nordmanniana),* has become a representative of the perfect Christmas tree for Danes and has gained success through its suitability for growing in the Danish climate conditions. It has also become the economically most important tree species in Danish forestry. [2] Currently, this species is being tested and developed for cloning with an aim for improved profit through efficient mass production of high-quality Christmas trees.

The Christmas tree has been selected as a focus of attention for the work due to the fact that it is at the same time a biological organism and a cultural artifact. The interest has been in probing genetic selection and cloning of Christmas trees as a cultural, economic and technological practice. The work equally seeks to explore the adaptability of an organism to changed living conditions and the messy web of hybrid agencies that emerge when a culturally defined biological organism merges with robotic elements and information and communications technology.

Postnatural Christmas Trees

The artistic research underlying the project started with a realization that Denmark, where the authors are based, is one of the major producers of Christmas trees in Europe. Approximately 90% of the Danish Christmas trees are exported to other parts of Europe – Germany, Britain, France among others. The remaining 10%, equaling approximately one million trees, stay in the small country of 5.6 million inhabitants. [3] Typically a large percentage of the trees produced with traditional methods would not qualify as 'elite' and would be sold cheaper, or used only in part as decorative branches, or categorized as waste. [4] This problem, however, is currently being addressed by the development of cloned Christmas trees, an active research and development area at Copenhagen University. [5]

Fig 1. Cloned Nordmann firs with the same genetics but different ages. Photo: Laura Beloff 2015.

The developed cloning process of the trees not only produces large numbers of trees that aesthetically please the customers, but also enables better control over the different phases of the growth season. But this also has a flip side – if a selected tree is prone to attracting a pest such as a specific fungus, all the clones will be

vulnerable to it as well, and in the worst scenario this may cause the whole harvest to be decimated.

Fig 2. Cloned seedlings at an early stage. Photo: Laura Beloff 2015.

Notwithstanding this risk, it is predicted that the cloning process of the trees will greatly improve the amount of 'elite' trees in the production, resulting in a rise in the economic profit of the branch. [6]

Fig 3. Small clones at Copenhagen University's Tissue Culture Laboratory. Photo: Laura Beloff 2015.

One of the first questions emerging while investigating the ongoing development of the cloning process in Denmark was: How does one define criteria for a perfect Christmas tree? This crux of the cloning attempts is obviously a point where the cultural aspects start taking over the technological and biological ones. It has become explicitly clear in the discussions with Christmas tree cloning experts, that the normative criterion is mainly an aesthetic one: the selection of a perfect Christmas tree is based on visual appearance and whether or not the tree complies with the customers' wishes in this regard. In other words, one can argue that cultural tradition and aesthetics determine the controlled existence of this biological organism in the fields of Denmark. Nordmann fir is also strongly connected to an economic value chain in a Danish context. The species is thus an exemplar of the complex situation involving culture, economics and biological nature that also underlies domestication.

Richard Pell and Lauren Allen have recently coined the term *postnatural* in reference to anthropogenic interventions into evolution that are both intentional and heritable, regardless of their potential subsequent unintentional consequences. In their definition, postnatural is an adjective used to describe the purposeful and permanent modification of living species by humans through domestication, genetic engineering and synthetic biology. [7] Pell and Allen's definition of postnatural refers specifically to organisms that are carbon-based and belong to the category of things, which we are used to perceiving as 'natural' but which today - to an increasing extent - are designed by us. An often-cited example of such a long-term human postnatural modification is the domestication of dogs, which cast these non-human animals as a companion species to humans. As the example of the Danish Christmas trees show, Pell and Allen's term, however, has a much wider application in our current situation.

Rotation Within Plant Science – Producing Microgravity Conditions

The Condition, sees cloned Nordmann fir trees embedded in an installation comprised of plant rotation boxes, which are hung on the wall in a 3 by 4 matrix structure (see fig. 6). Within the study of plant physiology, rotating plants have a long history notably in connection with the seminal instrument known as a *clinostat*. One of the many findings obtained through use of this device is that rotational movement can actually be beneficial for plants, as it helps distribute the growth hormone Auxin throughout the plant's structure resulting in faster growth rates and greater strength. [8]

The basic principle of the clinostat is to use continuous rotation to negate the effects of gravitational pull on plant growth and development. Commonly the device is constructed to have a plant attached with its stem positioned horizontally during the rotation.
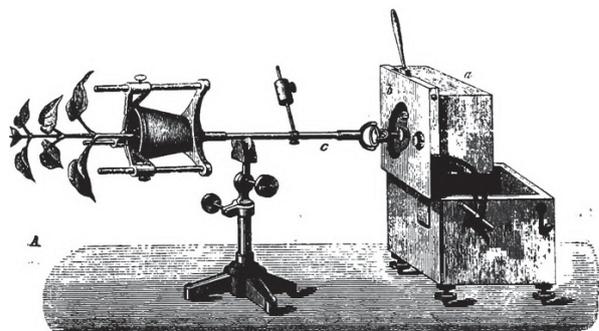
Fig. 4. Illustration showing the simple clinostat. Used under creative commons license. [9]

Several historical scientists have experimented with plant physiology and gravitation by using rotational devices. The British botanist Thomas Andrew, for example, described in a letter to the Royal Society in 1806 how he eliminated the force of gravity while germinating seeds by rotating them with a vertically positioned wheel and later with a horizontally positioned wheel. [10] A similar kind of instrument was also used by the German botanist Julius von Sachs in 1873, who coined the term "clinostat" [11]. Von Sachs used slower rotation speeds than Knight. When the clinostat is rotating slowly – about one to three minutes per revolution – the rotating plant experiences a gravitational pull that is averaged over 360 degrees, but only negligible rotational forces, thus approximating a weightless environment more closely. [12]

The further development of instruments for studying the effect of gravitation in organisms is visible in a three-dimensional version of the clinostat. Also known as a *random positioning machine* (*RPM*), this device was invented by Japanese researchers Hoson et al in 1986. The more recent version of the RPM was developed in 2000 by Dutch Airbus Defence and Space technology agency. [13] The use of the RPM has been very much in line with the original aims of the clinostat – to achieve a simulation of microgravity environments. The contemporary RPM is constructed with two axes and a container with samples connected to these axes, which is rotated by the machine at random speeds in all directions. The RPM's rotation minimizes the influence of Earth's gravity on samples inside the container. [14]

Contemporary rotational experiments involving plants do, however, not only focus on gravity nullification. An additional interest has been in growing fresh vegetables in stuffed urban spaces where space and light are scarce. [15]

Within the arts, scientific rotational instruments have been put to use by a few contemporary projects, which address the idea of changing conditions for living organisms. The RPM was appropriated by Zbigniew Oksiuta in his *Cosmic Garden* (2007), in which the artist used it for germinating seeds on agar inside a polymer sphere under microgravity conditions. [16] The simple clinostat has been a part of *The Moon Goose Analogue* (2011/2012) project by Agnes Meyer-Brandis for speculating on Dandelion growth under non-directional gravity. [17]

Most of the scientific and artistic experiments involving plant rotation, cited above, are related to observing the effects of non-terrestrial conditions on organisms. While space suits and space stations are designed for human survival in space environments, typically by aiming to bring the terrestrial environment with us, rotational instruments are used to observe the physiological growth and survival of non-human organisms in simulated space-like environments on Earth. They are devices, whose construction relates to a long-term human foresight about possibly living on other planets or under radically different conditions. In our era of the Anthropocene, such speculations still abound, as the conditions on planet Earth could change even more drastically over the course of time than what we currently anticipate. [18] Some of the questions emerging from this envisaging include: What kind of life forms will survive with us or without us in other kinds of conditions than the ones we currently have on planet Earth? What ecology is forming at the intersection of technological and biological evolution and human intentionality?

To engage these speculative issues, a novel rotational device was constructed from scratch. The rotational boxes used in the installation thus displaces the standard rotational axis commonly used with the simple clinostat and adds elements that might facilitate a more independent existence for the rotating trees, namely a watering container and grow lights for each plant.

Fig. 5. One of the plant rotation boxes used in the installation. Photo: Jonas Jørgensen 2016.

Robotic Plant Systems in the Arts

A central conceptual move underlying *The Condition* has been to consider the group of twelve rotating cloned Christmas trees as a collective organism, a kind of coherent artificial forest, instead of treating the trees as individuals. This thinking is in part inspired by recent insights of plant science that have emphasized the interconnectedness and communicative links between

forest trees in their local ecologies. Plant scientists have also recently shown how certain plant species are able to recognize their own genes and enter into a mutually beneficial, rather than competitive, relationship with plants have the same heredity as themselves. And it has been demonstrated, that plants are able to hear, see and move to a degree previously unthought-of. [19]

Fig 6. *The Condition*. Installation view, Kunsthall Grenland. Photo: Laura Beloff 2016.

In *The Condition*, the inherent ephemeral connections that each tree naturally has with its genetic clones and the outside world is further amplified and enhanced via the technological layer. The installation receives input in the form of current space weather measurements in the solar system (from online real-time data), which serve as input for generating the overall movement pattern of the group, i.e. the rotation speed and direction for each individual tree. [20] The ensemble of technology and plants is thus endowed with the ability to sense changes that occur at a planetary scale and respond with movement patterns that have a continuous and organic distribution over the grid structure.

Robot-Plant Artworks Historically
In the pioneering artistic work on interfacing plants with robotic technology performed by Tom Shannon fifty years ago, which is evident in the artwork *Squat* (1966), a merger of a simulation of life (robotics) and an actual living organism (a plant) took place. Yet these two elements were spatially separated. Moreover, the human spectator was construed as the active agent in the setup where the plant was used as a kind of push button or haptic interface, which allowed the user to start and stop the movements of a robotic structure through touch. The much later seminal work *Telegarden* (1995-2004) by Ken Goldberg and Joseph Santarromana, instead allowed a community of users to control a robotic plant maintenance and observation system, and through

telepresence establish a community garden using, at the time, still emergent Internet technology. In *Telegarden*, a distribution of agency that favored the human user was thus still basically at play, as the plants in the artwork were attributed the role of passive elements, which the user community could organize and care for as they saw fit. The focus on interactivity and control central to these two historically important works has, however, been abandoned in a number of more recent artistic plant-robotic works, which seek to grant agency and movement abilities to plants. Examples of this tendency include Masaki Fujihata and Yuji Dougane's *Orchisoid* (2001), Gilberto Esparza's *Nomadic Plants* (2008-2013), Ivan Henriques' *Jurema Action Plant* (2011) and Shannon McMullen and Fabian Winkler's *Soybots* (2015). In line with these works is also the commercial *Ga.ia* robot, which has been announced for release by the Still Human company.

The Next Step: Towards Dispersed Hybrid Agency
In the recent plant-robotic artworks listed above, the human spectator is not conceived as the sole active agent nor are plants reduced to passive entities. A similar intuition underlies *The Condition* but the focus of previous artworks on enhancing or empowering an individual plant has been left behind. Instead, the responsive behavior of the bio-hybrid installation is linked to notions of group behavior and intelligence and concepts of emergence and self-organization within Artificial Life research, swarm robotics, biological systems and cybernetic theory. [21]

The rotational patterns of the plant boxes evidences this, as they are governed by an algorithm known as a *Kohonen Feature Map* or a *self-organizing map* (*SOM*). The SOM algorithm is characterized by being able to learn how to classify information without supervision. [22] It receives input from online space weather data and maps this data set as rotation speeds onto the grid of boxes. The data is then gradually organized until each box is in a steady state at a fixed number of revolutions per minute. Some time after this equilibrium has been reached, the system will come to a halt and then restart with a new data set, which includes the most recent measurements of space weather conditions. This is then followed by a new process of self-organization.

The SOM algorithm serves as a unifying element in the work, as it makes the hybrid setup of individual plants and technological elements cohere. It allows the system as a whole to adapt intelligently through an overarching organizational scheme. But at the same time the obtained organization is continually upset by external data input in the form of fresh space weather data. The steady rotational movement of the clinostat, which could serve to even out the effects of gravity wherever the plants might be in the Universe, is thus no longer present, but has been supplanted by constantly changing

rotational speeds. The setup of *The Condition* thus also in part entails a testing of how Christmas trees are able to cope with changing environments, and an exploration of an open-ended physical alteration process brought on by human intervention and technological evolution in conjunction with natural forces.

Fig. 7. Two plant boxes undergoing rotation. Photo: Jonas Jørgensen 2016.

Conclusion

The Condition makes a case for the hybrid ontology of Danish cloned Nordmann fir trees as at once biological organisms and cultural artifacts, whose mode of being is highly indicative of a contemporary situation wherein technological, economic, biological and cultural factors have become thoroughly entwined.

The installation simultaneously probes futuristic speculations on the possibility of plant societies living under radically different conditions – perhaps in a malleable symbiosis with technology, relying on alteration of the effects of gravity or enhanced sensorial connections with foreign ecologies of a vast scale.

How do we relate to non-human organisms now and in the future? If the evolution of a plant is thoroughly interwoven with Western cultural tradition and tied to contingent aesthetic preferences, what happens if this cultural basis disappears? Will the organism live on, and in what sense - what would its ontological status be without? And more broadly - what is the center or origin

of agency when organic matter, cultural meaning and the technological merge – a life force inherent in all organisms, human logos or autonomous technique? Hoping to answer these questions in the abstract, is obviously an illusory notion, but preliminary attempts at posing them and interrogating their contemporary material instantiations seems more pertinent than ever.

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The virtual thematic route Emil Benčić − From Experience to Infinity

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Abstract

This project addresses the creation and implementation of new media activities regarding the importance of the artistic work of Croatian artist Emil Benčić (1930–2011). The problem/purpose is to ensure that knowledge about him survives the physical limitations of human life. The general mission is to encode his heritage permanently for present and future generations through new media methods and to preserve it in the new media space and be accessible and relevant to people.

In the context of the research-oriented and practice-focused process, we investigated alternate digital heritage platforms and examples of good practices, we mastered available tools and technologies, and we realized creative solutions up to the public presentation stage. The result of the research is the multimedia project *The virtual thematic route Emil Benčić − From Experience to Infinity*. In its current stage, the content is implemented in eight subprojects, designed on infinity shape (∞) and is virtually located on the Istrian peninsula Punta Busola (Croatia). The practical outcomes are databases, applications for mobile devices, video, cymatics, graphical sound, performance, installation, storytelling, and gamification.

Problem Definition and Goals

This project addresses the creation and implementation of activities regarding the importance of the artistic work of Croatian artist Emil Benčić (1930–2011) for Croatian art heritage. [1] Emil Benčić realized wooden, porcelain, glass sculptures and faience artworks. He has had over sixty solo exhibitions and participated in numerous group exhibitions at home and abroad. He has received significant awards and recognition at national and international level.

The problem/purpose is to ensure that knowledge about him survives the physical limitations of human life. The general mission is to encode his heritage permanently for present and future generations through new media methods and preserve it in the new media space.

The methods to reach the goal in practice are: research and edit existing content, disseminate content to the public, generate a new content through new media techniques, produce and stimulate the generation of new ideas and new media works by other artists, and store existing and newly created content in the new media space. In practice, the results were presented at the exhibition (as a prototype) and virtual as the final product.

In the project, we researched and looked for answers to intrinsically interesting questions about the importance of preserving the current knowledge and interest in a person, in this case an artist, through digital media works. How is it possible to resist and really keep the public interested about an artist's life in the age of new media and oppose the forgetfulness of history? How can his work be showcased and brought to the public? How could original place, space, and time be altered by new media techniques and what does this imply for the experience and interpretation of an artist's life?

Background

In the modern world, every day generates a huge amount of data, information, and documents that are kept in different media, resulting in questions regarding the preservation, storage, accessibility, limitation of the technology, the indispensability of transfer, and the translation into other media. In dealing with the problems of the real world, digital media have proven effective at facilitating, archiving, and retrieval. One of the characteristic features of new media technologies is their capacity to transform the elements they reproduce to produce new elements in new arrangements and forms of connections.

Historical conception of time was linear: "stream, which ran from the past to the future, which are not currently hold and take her with you all." [2] Exceeding this notion, we extend the scope of the present digital media. Digital media are at all times accessible from practically any location, but they also may be – like all civilizations – very vulnerable; everything can be shattered in an instant. Therefore, trying to implement the project on an infinite timeline is the most intriguing in this project.

The Impact of Research on the Practical Project

The action mode of theoretical research best suited to the objectives of the practical project was *The virtual thematic route Emil Benčić – From Experience to Infinity*. We investigated new media methods, we mastered available tools and technical skills, we have done our creative part, and we transferred the knowledge to the realization stage.

The survey of the use of digital media in today's cultural heritage institution was a prerequisite for the

high-quality design and realization of the project *The virtual thematic route Emil Benčić – From Experience to Infinity*. We learned most of the platforms – especially tools, technologies, and good practices to effectively achieve the target user groups – from a set of platforms for the European digital culture Europeana Network, INDICATE, MINERVA, and e-learning materials F-MU.S.EU.M. [3] [4] [5] [6] Reasonable guidelines of the professional association Europeana Network, the choice of tools and technologies (as recommended by INDICATE and F-MU.S.EU.M. literature), and financial and technological resources and knowledge were crucial for the successful realization of the project. [4] [6] Moreover, we were curious to explore tools, techniques, and technologies that are not yet common in contemporary museum practice.

Virtual Thematic Route

Definition

The form of virtual thematic route is chosen for specific objectives, as it is the most appropriate expression form and a way of deepening and enriching knowledge on specific topics. The most important task of the virtual thematic route is that it connects the structure and content and helps users understand these links (for example geographically). Therefore, virtual thematic routes are often didactic applications and apply specific study purposes. Topics of thematic virtual routes can be extended independently of the spatial and temporal location and origin of the various documents. These may be literary text, quotes, multimedia documents, and any other contributions or connections that help to shed light on a fairly homogeneous content topic. Virtual thematic routes do not have the pretence that they were detailed, but they do have an interpretative framework that will help users understand the topic and discover new aspects that may be proposed. [3]

Virtual thematic route users

Flusser defines man as a creature that stores and transmits information. Information, their ubiquity and accessibility, determinate new sociality, based on the establishment of communication and interaction systems and sophisticated new technologies. New technologies allow a user to find the information directly in the shortest possible time and with less effort. Also, new technologies increases the user's freedom and creativity. [2]

According to MINERVA "A user is a professional person or not, a specialist or not, who casually or with specific aims, occasionally or systematically uses the cultural Web Application. User identity is extremely variable depending on cultural profile, aspirations for cultural growth, professional aims and even momentary curiosity." [7]

Virtual thematic route users' needs "constitute a complex pattern including the desire for content which is reliable, comprehensible, rich, and up-dated, and can be used to satisfy purposes as diverse as curiosity, personal and professional growth, and scientific research." [8]

With regard to current trends, we noticed features strongly oriented toward cooperation with users and advanced interaction and distribution of users across networks. [9] When describing the user, Toffler introduced the concept of "prosumer" (producer + consumer), which extends Marshall McLuhan, a Canadian philosopher of communication theory, seeing that the classical user turns into a hybrid, individual "transceiver" (transmitter + receiver), who is also the addressee of the contents and the source of their own multimedia productions. [9] Toffler defined such "proactive consumers" as persons who have become active in order to transform and/or improve goods and services according to their requirements. In short, in the "many-to-many transceiver culture," an individual is a user, from time to time he is a "prosumer," consumer, client, audience, surfer, visitor, viewer, player, and downloader. [10]

Kanellos detected and analyzed the problem from several angles and depths of knowledge in different decision-motivated users, as well as the need for resources to be modelled in a way that could embrace both extremes – from purely informative to detailed and from passive to creative. [11]

Styles and aspects

Different styles of virtual thematic routes described below, are the result of the choices and means of expression through which their content is organized and transmitted to the user. According to Kalfatovic, the curator of virtual thematic routes has to use one or more combinations of contents based on different approaches. [12] Aesthetic beauty is organized around an object. The emotional route is selected in order to accomplish the user's emotions. The evocative route aims to create an evocative atmosphere. Didactic routes are built for the acquisition of knowledge. A fun way of presentation is only intended for leisure.

Virtual thematic routes are characterized by different aspects of the content, structure, presentation, and behaviour. The content contains information that should be communicated to the user. The better the quality content is, the higher the value that the user gets. The structures may differ in terms of navigational (system connections) and logical structure. Different modes of presentation determine how the structure is presented to the user and how it is handled.

Project Production

The production of *The virtual thematic route Emil Benčić – From Experience to Infinity* comprises all planned phases: conception/planning, design, implementation, testing, and public release. Project goals (activities and results) that were set in November 2012 have been realized within the scheduled period, costs, and scope (until November 2014).

The project's production is fully developed in the context of the master study Media Art and Practices at the School of Arts, University of Nova Gorica[1] (Slovenia), and supported by ADRIART consortium[2].

Project conception/planning

The project conception/planning includes specifically set objectives and tasks: editing existing content (Benčić's sculptures, poems, stories, archive photos, and video documents), generating new content through new media methods, causing and promoting the generation of new ideas and new media works by other artists (remakes), and storing existing and newly created content (artworks) in the new media space.

Project design

The virtual thematic route Emil Benčić – From Experience to Infinity is located on the Istrian peninsula Punta Busola (Croatia). This small peninsula is one of the few uninhabited areas of natural and unspoiled land, close to the largest tourist facilities on the north-Adriatic coast. Rare visitors/tourists visit this peninsula on bike or by foot, especially during the summer season, to enjoy peace and quiet. We see them as a project users.

This untouched jewel of nature represented for the artist Emil Benčić an environment for inspiration and reflection during his entire life. Countless walks among the pristine nature of Punta Busola inspired his sculptural opus. The plant and animal motifs and geomorphological phenomena of the sea, seabed, and coastal area are the central theme of his work. [13]

Project implementation

The virtual thematic route is designed as the imaginary trail. The imaginary trail takes the form of the infinity symbol (∞), which coincides with the ground plan form of Punta Busola (Figure 1).

Two applications – *Guide to the Virtual Thematic Route* and *Augmented Reality View* of the virtual thematic route – provide the spectators with a content overview and virtual space orientation.

In the project's current stage, we implement eight multimedia stops/subprojects on the infinity-shaped trail (see description in 4.3.3). Those outcomes are inspired by Benčić's works (work databases; personal memories; his attitude toward art; his aphorisms; clay, porcelain, and glass sculptures; documentary photos; etc.) and are realized/transmediated in practice as educational databases, applications for mobile devices, video, panography, videosimulation, videoinstallation, cymatics, graphical sound, performance, installation, storytelling, and gamification.

Guide to the Virtual Thematic Route

The *GuidiGo* application is proven as the most appropriate solution to illustrate the virtual thematic route content and goals. [14] One can download it and use it without an Internet connection – irrespective of the location – on the site or anywhere else. Documents shift from one stop to the next in different views (map view, list of stops view). Each virtual stop in this guide tells about the selected story in adequate digital media technology and links to the original sources. Virtual stops are equipped with photographs, texts, and links to subproject sites, acting in harmony with a user's view during the visit to the site or anywhere else to entertain, inform, and immerse the user in a multimedia experience.

The time of the visit is flexible and self-paced. The recommended flow of the virtual visit (stops from 1 to 8), average time of visit (2:00 h), and the distance between the stops and the total distance (1.76 km) are marked (Figure 1). The application is intended for GoogleGlass, iPhone, iPad, and Android devices.
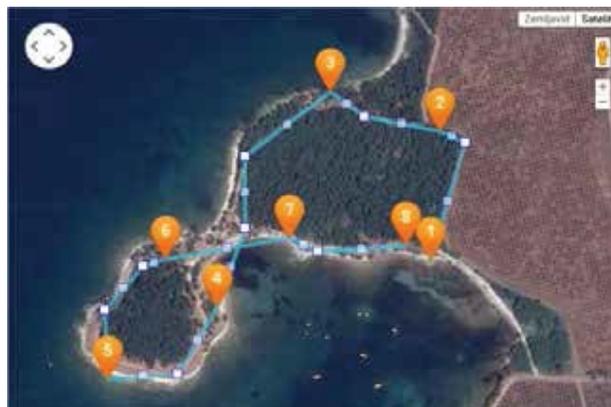
Figure 1. *GuidiGo* application for mobile devices, 2014, Virtual stops are designed at the imaginary trail in the infinity shape (∞), which coincides with the ground plan form of the peninsula Punta Busola (GPS 45.2656211853027, 13.5808448791504). Source: authors archive, Benčić 2014.

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[1] University of Nova Gorica, School of Arts, http://www.ung.si/en/study/school-of-arts/. Mentoring by Dr. Peter Purg, University of Nova Gorica, School of Arts, (Slovenia).
[2] ADRIART Regional Collaborations in the Media Arts and Practices MAP Master Program.

Augmented Reality View
of the Virtual thematic route

The audience may explore the position/microlocations of subprojects/virtual stops in 3-D using augmented reality technology. The entrance point can be reached by reading a QR code with the free viewer *Junaio* and an Internet connection (Figure 2). [15]

Figure 2. Augmented reality 3-D view in Junaio viewer, 2014, Source: authors archive, Benčić 2014.

Eight practice-focused multimedia subprojects/virtual stops

TP01

Project TP01 is an educational database and application for mobile devices. It includes photographs that are works of Emil Benčić. Each record of the work sets out ten parameters (textual, numerical, and photographic) and consists of the following four phases.

Through the QR code reader on a smart phone, the user scans one of the six QR codes at the cube. The user opens the URL. On the mobile smart device display[3], the user reviews the content (the photo of the motif) and selects one. The user remembers the basic information (year and the name of the work) and finds the photograph of the selected work in the box. The user determines the position of the selected work on the timeline and places it in a pocket. The user can write contact information or ideas on the back of the photo.

The user gains secondary knowledge and skills in project TP01 that include reading QR codes, using phone screen or beam online, memorizing characteristics of visual contents, and sorting visual content by parameters.[4]

0-18-81-0

The video is taken in the elevator, located in a skyscraper eighteen floors high in Ljubljana, where Benčić Lavoslava (the author of the paper) moved in 1981 when she was eighteen years old.

The elevator is symbolically seen as a "zone" between the inner and outer world. When Benčić Lavoslava get out of it or enter in to it, she often relive the happy moments, impressions, and experiences she enjoyed with Emil Benčić. He passed away in his eighty-first year.

Such remembering is actually like a spiral motion. In the traditional understanding of the world, spiral circulations are found in legends, fairy tales, dances, and religious practices in a variety of forms (e.g., patrolling of houses, dancing around the wells, fortune-telling by spinning the crystal ball around its axis). Similar procedures are maintained in contemporary beliefs, rituals, and practices and act as a deliberate way of interaction through which one can enter into another world and come out of it.[5]

Schattenobjekt Uhrturm (Clock-tower Shadow object)

With project Schattenobjekt Uhrturm, we investigate the attitude toward misunderstanding and disregard of the cultural heritage by today's society. We warn about the threat of impoverishment and the disappearance of all forms of cultural heritage artifacts.

In particular, against the "deadliness" and a misunderstanding of Emil Benčić's artworks, we try to spread interest in spiritual values and messages that emanate from his works. We create and run remediations in this video simulation.

The clock-tower on Schlossberg is a symbol of the city of Graz (Austria). Its position as well as its history is essential for the reputation of this city. In 2003, Styria artist Markus Wilfling "materialized" the Grazer clock-tower shadow as a steel structure: Schattenobjekt Uhrturm. In 2004, the commercial center Seiersberg Graz bought the Schattenobjekt Uhrturm and repositioned it to the middle of the traffic circle in the front of the commercial center.

We felt the displacement of Schattenobjekt Uhrturm as an incentive to express our views. Ten years later, we gave the idea of the Grazer Schattenobjekt Uhrturm back to the citizens in an interaction with the BIX façade – an oversized urban screen of the Graz Art Museum[6]. As a weightless spatial element, we transposed the Schattenobjekt Uhrturm in another time and space using the shape and motion of a 3-D model. Schattenobjekt Uhrturm is now hovering (floating) above the Earth's surface, seeking its original identity. It appears in the new manifestations as fragile, even impalpable, although undoubtedly an inseparable part of the Grazer clock-tower identity.

We suggest Schattenobjekt Uhrturm as a symbol of all artworks to which history was not kind and whose futures remain uncertain.[7]

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[3] … or on the mobile beam (e. g. Samsung Galaxy Beam).
[4] TP01. http://vsu-ng-cm-nm.wirenode.mobi. (Benčić, TP01 2013)

[5] 0-18-81-0. https://vimeo.com/99245182. (Benčić, 0-18-81-0 2013)
[6] Kunsthaus Graz, BIX-Medienfassade, http://www.museum-joanneum.at/kunsthaus-graz/bix-medienfassade/konzept. (Kunsthaus Graz 2013)
[7] Schattenobjekt Uhrturm. https://vimeo.com/95387460.

The Purpose of Life

The video installation The Purpose of Life is based on the artist's Emil Benčić's quote: "The purpose of life is not to warm up, but to burn up!" (Source: Emil Benčić diary, unpublished.)

The primary display represents energy and the purity of artists' ideas. We generated content by using the graphical sound method (or drawn sound techniques). Applying the quote above, we remediated newly created sound structures in cymatics[8]. This experiment is realized using crystallized sugar as a medium.

In the secondary display the quote transformed to cymatics became the initiation and inspiration for a spontaneous body performance[9]. The video installation The Purpose of Life[10] represents the example of viral influence caused by the quote's sound frequencies and compatibility between different media.

Both videos as a whole tell us that all art has to "burn" to trigger authors, encourage curators, and excite spectators on the way to a positive and complete relationship with the authors' creativity.[11]

Eol & Glorija

The sound and video installation Eol & Glorija is inspired by the Emil Benčić story, "Thank You, Eol!" and Ranko Marinković's drama, "Glorija." The characters are Eol and Glorija. Eol is the god of wind. He represents Glorija's friend, counselor, trustee, and comforter in a critical situation. Glorija is the main character in Ranko Marinković's drama. She is a woman with two lives: a dancer on a trapeze and a nun. She is deep disappointed in her father, love, and the Catholic church. She needs a friend for conversation before her suicide.

The background of the installation is related to memories of Komižans on Ranko Marinković, especially on his birth centenary in 2013. In these circumstances, transmediatizing his work becomes meaningful to the present day Komiža and also presents the occasion to educate non-Komižans.

In everyday life, wind is important for the success of Komižan's fishermen. Their catch depends on the wind's inclination and power.

The sound and video installation is based on dialogues of dramatic treatment of the theme from the five-scene drama "Glorija" between Glorija and Eol and the wind's visualization. Glorija is represented by an actress's voice. Four Eols are sounds/frequencies, a transmediated data archive of wind power and direction in Komiža gathered from March to May 2013. Visualization is a globular video projection of Benčić's ceramic inlays in a circular

movement according to the local wind. Spectators listen to dialogues in the middle of the soundspace and look at the circular visualization on the floor.[12]

La Danza de la Muerte

La Danza de la Muerte is a multimedia project, an interpretation of a medieval didactic poem through graphics, typography, and graphical sounds.

"La Danza de la Muerte," in accordance with a medieval didactic poem written by Spanish poet Juan de Mena (1414–1456), tells of the inescapable facts that we will all die, in death we are all equal, and the departure from the real world cannot be ignored or redirected. The character of Death reminds us of the fragility of life and demonstrates the absurdity and vanity of wealth, power, and prestige. The truth talked about in the satiric social poem "La Danza de la Muerte" is certainly one of the most painful lessons for civilization.

Six selected Emil Benčić's sculptures (units) symbolize characters (victims) from "La Danza de la Muerte" (King, Pope, Policeman, Beggar, Trader, Murder) and the camera (screen) is in the role of Death. The camera symbolizes the entrance into new media space (archive/reusage medium). Visual interpretation of each character is the background for sound creations. The final remediation are six-unit sets, created as audio-visual interpretations of the message. This remediation is generated into a still actual spirit of medieval poem.

The purpose of visual-graphic changes and adjustments is to create such a sound structure that evokes feelings and reactions, which is closest to the actual message of the medieval poem "La Danza de la Muerte." The sound is created by the method of graphic sound, which analyzes the visual elements and transforms them into a sound structure based on a spectrogram algorithm. The spectrogram algorithm works on a logarithmic scale and may vary in time or frequency and resolution.

The initial screen illustrates the circular dance and introduces the victims randomly. Spectators access the screen as victims confess, then watch and listen to the victims.

3D Timespace

3D Timespace is a web-based interactive database. It informs the user about the life and work of the artist Emil Benčić in chronological order in three-dimensional space. (The artist's biography is published in Baričević 2009, 154–165.) Users can explore and share the content on the Internet.

Functionalities are presented on five parallel strips and include the artist's biography, the list of self-depending exhibitions, the list of collective exhibitions, the list of awards he achieved, and the list of symposia and colonies he attended. [16] The database consists of 174

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[8] The study of wave phenomena, esp sound, and their visual representations (http://www.collinsdictionary.com/dictionary/english/cymatics).
[9] performance by Nika Mišković
[10] unpublished work.
[11] The Purpose of Life. Primary display: https://vimeo.com/95312785. (Benčić, The Purpose of Life. Primary display. 2013). Secondary display: https://vimeo.com/95778307. (Danial and Musović, The Purpose of Life. Secondary display. 2013).

[12] Eol & Glorija. https://vimeo.com/92764887. (Benčić, Eol & Glorija 2013).

total units. Some units provide links to additional content (photo, video, and audio).

This subproject is very much in a developmental stage and is currently in the process of digitalization and entry of the materials contained in the database. 3D Timespace will be updated according to future, relevant activities.[13]

Digital Story Creator

Digital Story Creator is a gamified experience that vivifies the project *The virtual thematic route Emil Benčić – From Experience to Infinity*, improves the number of return users, and transforms them into active participants.

Its elements support the entertainment/ discovery/creative visit genre of the content that corresponds to a general group of users on the peninsula Punta Busola. Users spontaneously explore their creative skills through narrative (storytelling). Their ideas may become the inspiration for future projects and may be an important factor for the sustainability of the main project.

The gamified experience uses the power of storytelling to engage players. Users create stories strongly related to visual project content. The interface allows and encourages competitive key actions by different types of players and their collaboration in the endgame stage.

A gamified experience is created from provided (offered) visual content (photos from the database and from Emil Benčić's mobile phone gallery). The content is ordered in four categories (Hero 1, Hero 2, Location, Random).

At the beginning of the gamified experience, building elements are selected randomly (∞) using one photo from each category as an inspiration. Photos help participants to build personalized stories. In the midgame stage, the user writes the narrative/plot and publishes it on the project site. In the endgame stage, narratives are scored. The best-scored narratives are rewarded and published. Winners are honoured and become mentors or "storytelling experts."

This version of Digital Story Creator is very much a developmental version, and the application is currently in the process of being improved. The gamified experience presently works off-line on Android mobile devices.

Project testing and public release

During the production period of the project, we presented our work-in-progress at select exhibitions in Slovenia, Croatia, Italy, Malta, Romania, Serbia, United Kingdom and United States.[14]

The entire project *The virtual thematic route Emil Benčić – From Experience to Infinity* was presented to the public at the Batana Center of Visual Arts in Rovinj (Croatia) in September 2014 as a completed, stand-alone multimedia exhibition (Figure 3). [17]

Figure 3. *The panoramic view on the entire project* – a stand-alone, multimedia exhibition – showing the eight subprojects, also distributed in the form of the infinity sign, 2014, Batana Center of Visual Arts, Rovinj (Croatia). Source: photo by L. Benčić 2014.

The exhibition as a prototype and form of public release was the means of expression as well as an occasion to test by visitors the use of digital media in memory-preserving, managing and communicating cultural heritage in current practice. Observing and collecting visitor's impressions was a important step to determine project's future direction.

Conclusion

Cultural heritage shows us something about ourselves and about the world to which we belong. The importance of the heritage interpretation is to raise awareness and to recognize what the user, in a certain sense, already owns. It seems that the principles of new media offers a lot of options to achieve this kind of recognition and enable a high level of communication with users of all forms of artefacts and their authors. Web and digital technologies represent the most radical forms of these facilities (i.e., overcoming the uniqueness of the works and their creators, approaching them spatially and temporally). Users recreate the place and time of the meeting itself; they reproduce, manipulate, and transform the works and the image of their creators. Such active experience may be interpreted as a ritual that impresses deep in the user's memory. In such practice the original (work and its author) may lose the basic context but also may arise importance and actuality of the user's world and may cease to be historical. Continuous repetition and upgrade of this kind of transformation by motivated authors probably leads to infinity.

The action mode of theoretical research is best suited to the objectives of the practical project *The virtual thematic route Emil Benčić – From Experience to Infinity*. We investigated alternatives, we mastered available tools and technical skills, we have done our creative part, and we transferred the knowledge to the

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[13] 3D Timespace. http://www.tiki-toki.com/timeline/entry/293341/Emil-Beni-From-Experience-to-Infinity/#vars!date=1928-09-09_09:39:26! (Benčić, 3D Timespace 2014).

[14] The list of work-in-progress at select exhibitions: Itinerant Workshop at Specific Locations, Rijeka (Croatia), 2013; Patosoffiranje IX, Smederevo (Serbia), 2013; IX. Simultan Festival, Timisoara (Romania), 2013; 14. Pixxelpoint, Gorizia (Italy), 2013; Zametki, Ljubljana (Slovenia), 2013; MAP in Motion, Rijeka (Croatia), 2014; Patosoffiranje X, Smederevo (Serbia), 2014; MAP in Motion,

Ljubljana (Slovenia), 2014 and Europeana Creative Chalenge Event (at FutureEverything festival), Manchester (UK), 2015, 10th Conference on the Art in Society, London (UK), 2015, Speculum Artium, Trbovlje (Slovenia), 2015, Valletta 2018: Debating Places and Spaces, Valletta, (Malta), 2015 and ICIT Symposium / New Expressions: Women in music technology, Irvine, (US).

realization stage and a public presentation. The impact of research on the transfer of knowledge into practice was direct. With the introduction of their knowledge and views, practitioners[15] involved in the project have had an impact on solving design problems and influenced methods and interpretations. Audience feedback and self-reflection in practice were immediate and specific. Audience actively explored the media purposefulness: they played, listened, wrote, danced, discussed and asked about Emil Benčić's work.

We set in motion a series of new media possibilities, some of which are not applied all over the world. Currently, this possible inaccessibility of the relative software and hardware may be an obstacle to such an extent that the public (even if sufficient digitally literate) may miss another invisible layer of the project. At the same time, on top of all these works, we build a database of knowledge (texts, images, sounds), a heritage that is floating in the virtual space that can be accessed only through the new media key.

We set and carried out *The virtual thematic route Emil Benčić – From Experience to Infinity* as an example of artistic practice and application of new trends in the design of the memorial space. I offer informational, instructional, authorial and expert in-depth materials (video, visualizations, spatial installations, sound projects), which attract the interest of digitally literate audience for virtual contents.

In the future, we will continue communicating with the public. I pursue the goal that the knowledge about life and the importance Emil Benčić's artworks survive the physical limitations of human life and that it will be permanently encoded for future generations by using new media techniques and preserved in the new media space.

This project answers the question and offers the guidance on how to achieve data and practically develop the platform that could be used also in other virtually designed cultural heritage projects of preserving the memory on the artist and his inheritance.

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Evaluating Art Hacking Events Through Practice

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Abstract

The hackathon format, which began as a commercial digital model, has been modified across different communities within the arts and cultural sectors. Adjusting the hack to work within the arts presents logistical challenges to organisers. The authors of this paper, an arts curator and artist-practitioner, have organised and run hack-style events together since 2014. In this research, they define hacks and cite examples of recent art and cultural hacks. They then present a series of three case studies that describe their collaborative projects. An analysis of this research shows that the format of the hack event has been modified in a variety of ways across different projects. These include removing competitive aims, considering needs that are specific to arts participants, strategically planning materials and resources, and carefully considering exhibition and showcase formats.

Introduction

In recent years, curators, cultural organizations and arts practitioners have been presenting and producing hack events within the arts and cultural sectors. Suzy O'Hara and Victoria Bradbury have been developing hack-style events together since they initiated the 'Thinking Digital Arts // Hack' in Newcastle, UK, in 2014. O'Hara comes from a curatorial and arts production background while Bradbury is a media artist, teacher, and maker. These different perspectives have strengthened their partnership in developing and delivering this series of projects.

Through this paper, the authors review current practice alongside an analysis of the projects that they have produced with other collaborators. Through these methods, they interrogate the questions; how can a structure that originated with the commercial digital sector, which is fundamentally based around competition, problem-solving, and commercial software development, influence artistic strategies that aim to generate knowledge through organic research, process, and inquiry? How is this format being utilised within the arts and how it has been modified across different communities?

What is a Hack?

Hackathons, which are more commonly referred to as 'hacks', are a format for the production of collaborative projects. They are intensive events that occur over a short time frame (usually from a half-day to 48 hours), that encourage problem solving and content generation. They have become an increasingly prevalent mode of working within the commercial and artistic digital sectors. Hacks originated within the commercial digital sector as an innovation strategy for developers to think creatively about solving technical problems. This format has been appropriated by the arts and cultural sectors more recently as a way for artists and organisations to work with the commercial digital sector skill set in an experimental, low-risk way. [8]

Wikipedia has defined hackathons as they are most commonly known within the commercial digital sector, stating,

> "A hackathon [...] is an event in which computer programmers and others involved in software development and hardware development, including graphic designers, interface designers and project managers, collaborate intensively on software projects in competition with other teams." [12]

Hacks, however, have been used by cultural institutions and by artists as a strategy to generate discourse, collaboration, and as a starting point for new artworks and ideas. These hacks represent anti-disciplinary practices emerging at the intersection of arts, culture, creative digital industries, design, and engineering. Hack formats are shaped by the motivations that drive their development. Various agendas reveal the needs of vastly differing communities of professionals including artists, hackers, makers, creative coders, engineers, scientists, data architects, technologists, arts and cultural professionals, venues and business. Unlike a traditional artist-in-residence programme, which is particular to the arts and literature, the hack format has proven to be portable and work well in both commercial and arts based contexts.

Hacks within the Arts and Cultural Sectors

Since 2011, a series of funded programmes have been delivered to develop the 'culture hack' methodology across the UK. These include 'Culture Code'[1] and 'Culture Hack, Sync'[2], and 'Culture Shift, British Council'[3]. Each of these programmes enables the creation of innovative digital prototypes that catalyse

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[1] http://www.culturecode.co.uk/

[2] http://culturehack.org.uk/about/

[3] http://creativeconomy.britishcouncil.org/projects/culture-shift/

cultural data through collaborative practice while creating new working relationships across the arts, technology and the creative industries. These events seek "…to embrace technological innovation and find new ways for emerging creative practitioners to benefit from the digital revolution…" [6] They are usually linked to a particular cultural organisation or museum and tend to appropriate the competitive format from the commercial sector with a cultural motivation and output.

The cultural sector has primarily used the hack methodology to develop tools and explore new business models. These capitalize on income generation opportunities brought about by digital technologies while exploring ways in which cultural data can be accessed, utilised and monetised. The format of these events has traditionally been to host participants in an appropriately resourced space for up to 48 hours to create collaborative projects in a competitive environment. Prizes are usually given to winning pitches. In some cases, this has taken the form of a winning team being granted support to further develop a prototype. 'Culture Shift', for example, has partnered with digital firms such as Google to grant funds and "…provide a level of support and incubation in order for [participants'] ideas to become a reality." [6] Typically, hack participants are not paid for their time, but their expenses and logistics may be covered. The value of developing collaborative projects and networking is emphasised over financial payment.

An example of a culture-hack at a major UK venue is 'Hack the Space'. This large-scale event was presented at the Tate Modern Turbine Hall on 14 June 2014 as a stage to re-launch The Space[4] online platform. 'Hack the Space' was the first hack event held at Tate Modern and employed an open innovation[5] business strategy to access external expertise and nurture innovation within a contemporary art venue. A wide offering of data was made available to the participants, including data supplied by artists such as Ai Wei Wei. Whilst 'Hack the Space' was hosted by Tate Modern, the event was delivered by 3 Beards, "…an events company that exists to grow and support the global startup community…'' [1]

Victoria Bradbury participated in 'Hack the Space' as part of the British Council team, creating the 'Pharmaceutically Active Crustaceans' project[6]. Bradbury observed that 'Hack the Space' appropriated and applied a commercially orientated methodology to shape a competitive context in which participants would generate a range of creative outputs. Like the 'Culture Shift' hack, "…participants pitch a finished prototype to a panel of judges…" [6] to win funding for development.

The high profile of the artists who presented the data used in the event paired with the brand value of the venue (Tate Modern), propelled 'Hack the Space' from a grassroots activity amongst individuals (artists, makers, commercial technologists) to a nationally reviewed event that boasted a live audience of over ten thousand people. As with all commercial hack events, invited participants were not paid for their time, however, the promise of further development funding, the opportunity for participants to raise their profile through media attention, and access to both a professional and public audience continued to hold value. Like geeks-in-residence programmes[7], 'Hack the Space' provided value for the institution (Tate Modern) by bringing a digital mind-set into their venue and fostering relationships with the new media arts and commercial, creative digital and technology industries, while capitalizing upon the existing infrastructure and working practices of the contemporary arts sector.

Another project investigating applications of the hack model in the arts is 'Inhabiting the Hack'. This research was led by Dr. Helen Thornham, Associate Professor of Digital Cultures at University of Leeds, UK and aims to provide a critical perspective on current practice within hacks as sites of meaningful production for the arts. 'Inhabiting the Hack' was part of the Communities and Culture Network and ran through December 2015. The project examines "…the notions of innovation and creativity ingrained in digital culture…" and seeks to interrogate hacks and the "…relationships between innovation, practice, imagination and material…" that they uncover, capture and exploit. [9]

'Inhabiting the Hack' researchers are working with a range of UK arts organisations to develop "…alternative styles of hack events, often informed by traditional arts activities such as residencies and retreats…" [9] rather than commercially driven methodologies which evolved for a different sector. These alternative events are guided by an intent to avoid challenges with the hack format as it is migrated to the arts and cultural sectors. The researchers view traditional hackathons as,

"intensive events, which make things invisible and in which,
* Play hides work (and worker's rights e.g. minimum wage legislation, etc).
* Pitches and prizes hide intrinsic value.
* Product focus hides reflections and learning.
* Emphasis on pre-planning and problem solving inhibits exploration.
* Extra-curricular dates/times exclude carers
* Appropriation of language (hack, retreat, kata, camp, pattern) loses wider cultural significance in translation.
* Focus on the 'pitch' as end-product privileges hylomorphic design over material." [10]

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[4] http://www.thespace.org

[5] "…a more distributed, more participatory, more decentralized approach to innovation, based on the observed fact that useful knowledge today is widely distributed, and no company, no matter how capable or how big, could innovate effectively on its own." [7]

[6] http://www.theguardian.com/artanddesign/2014/jun/16/hack-the-space-tate-modern

[7] http://www.theguardian.com/culture-professionals-network/culture-professionals-blog/2014/feb/28/geeks-residence-tech-arts-developer

The authors of this paper have noticed similar challenges with the hack format when it is applied within the arts and cultural sectors.

Challenges with the Hack Format

From a practitioner's perspective, there can be a number of challenges with the hack format. The rapid nature of the hack can create the impression that art made with technology is 'quick and easy'. This is something that Bradbury has become aware of while teaching electronic art to undergraduate students; the public perception of technology is that it makes things 'easier' and 'faster'. When used in creative contexts, however, this is not true. Fiber artist Annet Couwenberg addresses this idea in an interview when she states that beginning to use technology in her work "…didn't make things easier…" [11] Technology is an art medium like any other; it requires knowledge and skill to implement alongside of creative and conceptual considerations. While open source code, pre-built software, API's, and libraries allow artist-coders to avoid programming everything from scratch, there is still a great deal of work to be done to employ these technologies effectively in projects. These considerations are particularly acute when projects are generated collaboratively over a short time frame.

In relation to the exhibition of hack outputs, organisers must carefully consider the implications of possible modes of presentation. Facilitators must be sensitive to the professional needs of participants, many of whom work to build their public profiles as artists, both off and online. In her PhD research, Bradbury states,

> "There is scope for further research on the structuring of public exhibitions following art hacks, perhaps by de-emphasising organised displays of prototypes and classifying post-hack events as informal showcases. Advertising the results of an art hack or workshop as an exhibition requires artists to display work publicly that has been created quickly. This can be difficult for artists as they strive to develop and curate a public profile in order to control how their work is viewed." [5]

This issue of exhibitions after hacks has been notably considered in relation to Art Hack Day[8] events. Art Hack Days are globally peripatetic, driven by a particular theme and held in collaboration with venues and events within the new media art field. Unlike the for-profit 3 Beards, Art Hack Day is a non-profit organization that runs hack events and aims to,

> "…bridge the gap between art, technology and entrepreneurship with grassroots hackathons and exhibitions that demonstrate the expressive potential of new technology and the power of radical collaboration in art." They are "…dedicated to hackers whose medium is art and artists whose

medium is tech…" and they "… believe in non-utilitarian beauty through technology and its ability to affect social change for public good." [2]

Thus, the motivations that shape Art Hack Day events are radically different from the curatorial model employed during 'Hack the Space', which emphasised outputs. However, the Art Hack Day organization and the hack format in general received criticism from arts communities for the event format used in the 2014 Transmediale Festival in Berlin, Germany. The Transmediale 'Afterglow' Art Hack Day involved a 48-hour research and development period during which invited artists would produce work for a 'flash' exhibition. This would then be presented as major exhibition for this high-profile international festival. Artist Constant Dullaart publically declined his invitation to the Transmediale 'Afterglow' Art Hack Day event, highlighting emerging issues around the real costs of "…experimental innovation…" [3] that utilize commercially based methodologies to generate art for an exhibition context. In an open letter to the Transmediale 'Afterglow' Art Hack Day organizers, Dullaart raised tangible issues around the motivation, agenda, working practices and dissemination strategies that were employed. Dullaart expressed concern around the "…creative corporate…" [3] hack format, time frame and context being created for art production, stating,

> "A fast, cost effective, even competitive, corporate way in which a large quantity of approaches can be included, competing with each other, stimulating ridiculous work hours, without any fee or compensation. Stimulating easy and quick solutions to personalise mass produced technology with an artistic flair. After which the work is presented without any chance of contemplation, or for that matter curatorial intervention..." [3]

From Dullaart's point of view, issues of finance, payment and fair working practices need to balance the perceived value of the experience of collaboration. The curatorial decision to host an exhibition following a research and development-focused art hack event can be detrimental to the experience of the work produced, the artists involved and the intended audience.

The hack format presents potential challenges for organisers, venues and participants when it is migrated from the commercial digital sector into an arts and cultural context. O'Hara and Bradbury became aware of these issues through personal contacts, online content, and first-hand experience as they organized and presented the following three case study projects from May 2014 – November 2015. The authors aimed to be sensitive to the above issues while remaining experimental and testing a range of organisational strategies.

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[8] See: http://www.arthackday.net

Thinking Digital Arts // Hack

The 'Thinking Digital Arts // Hack' ('TDA//H')[9] took place on Tuesday 20 May 2014 in Newcastle, UK. It was part of the 'Thinking Digital Arts' programme, which was curated by Suzy O'Hara to run alongside 'Thinking Digital', a TED-style commercial tech conference that is produced annually by Herb Kim at the Sage Gateshead and attended by delegates from around the UK and internationally. 'Thinking Digital Arts' is part of O'Hara's PhD research into intersections between the commercial and artistic digital sectors. 'TDA//H' invited artists and designers from around the UK and Europe as well as 'Thinking Digital' conference delegates to come together for a day of collaborative making.

Fig 1. *Thinking Digital Arts // Hack*, 2014, initial brainstorming session. Photograph by Lalya Gaye.

Strategies of Organizers:

While planning 'TDA//H', the organisers, Suzy O'Hara (Curator) and Victoria Bradbury and Lalya Gaye from Attaya Projects[10] (Lead Artists), became aware of the concerns that had been raised by the new media art community around the recently presented Transmediale 'Afterglow' Art Hack Day. O'Hara, Bradbury, and Gaye wanted to be sensitive to these issues as they moved forward with inviting artists and planning the event, particularly around the presentation of outputs.

The theme of 'TDA//H' was 'Decentralisation', inspired by the simultaneous public conversations about the 2014 Scottish Referendum and questions raised about the tendency of UK arts to be London-centric [11]. Newcastle, as the hub of arts and culture in North East of England, was an ideal place to bring participants together to discuss this topic through collaborative projects.

'TDA//H' also had a materials focus because of the Lead Artists' personal interests in physical computing and sculptural new media artworks. Bradbury and Gaye made it a central goal to acquire and present quality materials for 'TDA//H' participants. They did this by using some of the project the budget to purchase high-

quality materials such as electronics, Arduinos, sensors, and conductive fabric and thread. This was also achieved through partnering with New Bridge Project[12] and Maker Space Newcastle[13]. These two venues sit side-by-side on New Bridge Street, a central avenue of the city. Holding the event across these two spaces meant that participants could move between them, drawing upon the resources available in the gallery space (including projectors, monitors, and video equipment) and also have access to the maker space's facilities and materials (including a laser cutter, 3-D printer, basic wood and electronic tools). Maker Space supported this effort by offering volunteers who participated in the hack while also monitoring and facilitating the use of their space. Finally, 'TDA//H' also partnered with House of Objects[14], who provided upcycled materials for the artists to work with during the event.

The experiences of the artists and organisers of Transmediale 'Afterglow' Art Hack Day influenced the curatorial decision not to host an exhibition of the work produced during 'TDA//H'. A decision was made to instead market the public event as an 'informal showcase' of the work that would emerge. However, while the language may have been modified from 'exhibition' to 'informal showcase', and understood by those working in the field, it had little bearing on audience expectations on the evening of the event. The lack of curatorial input into the showcase raised criticism from audiences who, despite the marketing message, still expected a curated exhibition. This underlined the fact that both the language and strategies used in organising art hacking events is still being defined and understood.

Fig 2. *Thinking Digital Arts // Hack*, 2014, Prototyping phase. Photograph by Lalya Gaye.

Outputs

Because of the Lead Artists' emphasis on sculptural and physical computing materials and equipment, 'TDA//H' resulted in mostly physical and sculptural projects. The participants made use of the resources provided and found a balance between play, serious inquiry, and final

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[9] http://blurringartandlife.com/vb/thinkingdigitalarts_hack.html

[10] http://attayaprojects.com

[11] http://www.hannahfestival.com

[12] http://thenewbridgeproject.com

[13] www.makerspace.org.uk/

production at the end of the day-long event. A range of projects emerged from the five groups, including a bird flocking algorithm and sculptural prototype, a pair of glasses made of upcycled CDs that allow a person to see behind himself as he walks while following commands from a computer programme, a mapping the city video artwork, an unplayable board game made of dissected laser-cut maps, and an interactive installation using web coding and Makey Makey[15] that presented the miles that different foods travel to reach Newcastle food markets.

Strategies of Participants

In order maximize productivity during the short one-day timeframe, the 'TDA//H' organisers broke the day into three distinct phases: conceptualisation, prototyping, and execution. After the conceptualisation phase, there were short presentations by each of the groups. During this early stage of the event, the groups with more participants from the commercial digital sector had refined their ideas to a project that they would pursue through the prototyping and execution phases. This was mapped out quite clearly during their presentations and the outputs that these groups realized at the end of the day were very similar to what they had initiated early in the event.

The groups that consisted of more artists presented a vague and broad scope of what they planned to investigate throughout the day. In the end, these groups showed projects that were further removed and much more surprising in relation to what they had presented after the initial conceptualisation phase.

The City is The City (is The City)

'The City is The City (is The City)'[16] ('TCTCTC') project was supported by Baltan Laboratories and took place as a one-day event in Eindhoven, Netherlands on 19 June 2015. Suzy O'Hara and Victoria Bradbury organised 'TCTCTC' with the aim to investigate citizen journalism through artistic practice. The project description reads,

> "The rise and development of citizen-journalism is a form of reporting that specifically uses citizen media and user-generated content to construct the news, disrupting the audience-broadcaster divide. Caught in the cross-fire between a disappearing illusion of privacy and an increasing dependence on networked services and infrastructures, the attitudes we recast towards roles of participation assume a new urgency. Indeed, what has this new world of meta-data and democratized tools offered us if not an opportunity to enact, by implementing resources, techniques, and technologies, new investigations of these tools through artistic response? Provocations were explored through experimentation,

questioning; How is artistic practice informed by the practical and theoretical challenges that simultaneous networked perspectives present?" [4]

Fig 3. *The City is The City (is The City)*, 2015, Web activity. Photograph by Beryl Graham.

Strategies of Organizers

'TCTCTC' employed an initial web activity to create brainstorming groups. When the participants arrived, they found their name attached to one of a number of strings that were woven across the room (Fig. 3). Each followed his or her string around the lab, ducking under and climbing over strings and each other to locate the end of the line, which was attached to one of the tables. At each table was the terminus of 4-5 strings as well as large papers with two of the key themes developed by organizers (ie: Verification Threads, Mobilisation, Privacy vs. Sharing). The initial groups discussed these themes, writing ideas on large sheets of paper. These theme sheets were then hung on walls around the perimeter of the room and participants were invited to gravitate toward a particular theme in order to amalgamate project groups for the day. Once groups were formed, the day was broken down into the same conceptualization, prototyping and execution phases used during 'TDA//H'. These phases were timed and announced by the organisers to keep the day moving forward. 'TCTCTC' ended with each group presenting what they had created to the other participants and organisers. This removed any kind of public exhibition component and the event ended with informal conversation among participants.

Outputs

'TCTCTC' involved participants from diverse backgrounds who were from the Netherlands and the UK. These included four journalism students, an information architect, artists, curators, and academics. Unlike 'TDA//H', which afforded travel and accommodation in the budget, 'TCTCTC' participants funded their own attendance costs. Three teams formed and four different projects were created; the 'News Buddy' app, 'Data That You Don't Want to Share and

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15 http://makeymakey.com

16 http://blurringartandlife.com/vb/tctctc.html

No One Wants to Know', a hidden text t-shirt, and a data glove.

Fig 4. *The City is The City (is The City)*, 2015, 'Data That You Don't Want to Share and No One Wants to Know'. Photograph by Sas Enzo.

Strategies of Participants

The group that created the 'News Buddy' app consisted of an information architect, an artist and two curator-artists. This group was driven by a highly linear process; they followed the phases of the day strictly through conceptualisation, prototyping, and execution. They took their time brainstorming and refining their idea on paper, then prototyped and executed the project as a website. Their final presentation showed a firm concept that was closely related to the topic of citizen journalism.

The group who created 'Data That You Don't Want to Share and No One Wants to Know' followed a much more organic project evolution cycle. Their conceptualisation phase extended throughout most of the event. Finally, they settled upon an idea and executed two prototypes during a rapid burst of production at the end of the day. This group consisted of a curator/academic, a mid-career artist, a filmmaker and a journalism student. The journalism student was enamoured with learning physical computing strategies and excited about the open process that didn't involve specific commands or outputs. This group's presentation was lively and subversive, involving prototyped versions of a male and female genital sensor that showed genital data in a humorous way onscreen. This project didn't relate closely or in a didactic way to the topic of citizen journalism. Rather, the group employed the spirit of an art hacking event to create a new media art project prototype through collaborative means.

The third group consisted of early career artist-designers and a journalism student. It took this group most of the day to find a path to pursue, but they tried out many ideas and technologies along the way. There appeared to be some difficulty in the collaborative process with this group, evidenced at the end when they presented two separate project ideas. Both ideas seemed to have been developed quickly and privately as neither showed evidence of development throughout the phases of the day. The first project was a design for a t-shirt that displays a hidden-message when photographed. The

second was a data-glove prototype made from a conglomeration of materials including tape, fabric, and wires. These were put together to illustrate a mode of data transfer between two people wearing the gloves.

Rewriting the Hack

'Rewriting the Hack' ('RtH') is the final case study. This project explored the theme of 'Industrial and Post Industrial North East' (UK). It was a female-only hack that focussed on issues related to women and tech with an emphasis on histories and archival materials. The two-day event examined the hack format as a site for producing collaborative, interdisciplinary artworks while examining issues of gender diversity in art and tech culture and in the hack format itself, particularly as it is an increasingly popular model for creative production. 'RtH' was held at The Core, Science Central building in Newcastle, UK on 21-22 November, 2015 and included participants from around the UK and Europe. It was supported through 'Inhabiting the Hack' (discussed above), who suggested that a female-only hack model be produced in Newcastle and provided funds for the event.

Strategies of Organizers

'RtH' was organised and delivered by Suzy O'Hara and digital artist Shelly Knotts with Victoria Bradbury in an advisory role during the planning process. The first day of the event began by presenting a live-theatre piece, a monologue by Katherine Beaumont about women's history in the North East of England. Next, Jennifer Hillyard presented materials that the Mining Institute had digitized for use at the hack. After these presentations, Knotts used the live-coding environment Super Collider[17] to randomise initial groups for brainstorming the key topics of Systemic Obstacles, Structural Inequalities, Voice and Visibility, Revealing Narratives, and Feminising Code. 'RtH' then following the 'TCTCTC' model of initial sub-group discussions of themes, followed by short presentations and hanging the topics on the walls of the space. After a break for lunch, participants were invited to gravitate toward particular themes and form groups for project conceptualisation, prototyping and execution.

Participants were selected who were librarians as well as artists, designers, musicians, filmmakers and businesswomen. They gathered to create with archival materials relating to the North East of England's industrial heritage as well as current open data sets representative of the region's post-industrial present. In the weeks leading up to the event, the Mining Institute digitized materials on women's history in relation to mining. One example of this was the digitization of several chapters of a book called *We are Women We are Strong* that discusses women's roles in the 1980's mining strikes. This digitization was a notable result of the hack – the event brought pieces of women's history into online archives that hadn't previously been there.

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[17] http://supercollider.github.io

Outputs

Three groups formed from the thirteen hack participants. One focused on a single collaborative diorama project that activated mining history data called 'Haway the Lasses'. Two larger groups worked in more divergent ways, creating a variety of projects around a single topic. These included a series of explorations of business models in relation to gender and a series of projects examining women's inclusion or exclusion in histories.
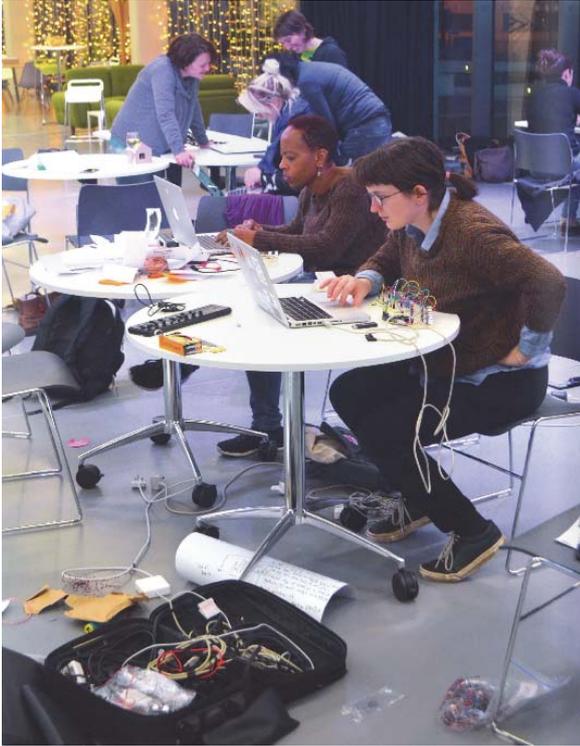
Fig 5. *Rewriting the Hack,* 2015. Participants Carmin Karasic and Joanne Armitage. Photograph by Mark Hursty.

Strategies of Participants

The 'Haway the Lasses' group were highly focused, knew the project they wanted to create from the beginning, and moved forward with its development in a focused and linear way. This diorama examined the domestic side of mining history, drawing quotes from women who were miner's wives, mining statistics, and key events that happened when mining was most active in Britain (such as World War I). The diorama included a timeline with activated LED's and a pick ax that moved based upon shifting data.

The business and gender group created a publication called '29 Things to do at Work' and an embroidered tablecloth that questioned business etiquette for use as a centerpiece at business meetings. They also wrote a script that examined biographies of ninety male and thirty female professors from Northumbria University, making a quiz about words that were used in the biographies and creating an award in the form of a power-biography.

The group considering women's narratives challenged the authority of histories with two key outputs. The first was a loudspeaker that projected male or female voices reading stories from 'We are Women We are Strong'. The voice changed to male or female based on proximity of a viewer. Another member of this group considered what would happen if histories were altered and wrote a script for removing men from the operating system of her computer.

An informal public showcase was held at the end of the second day of 'RtH'. This allowed time for participants to discuss the future of the projects created during the event and served as a buffer between a period of meeting and intense collaboration and finally parting ways.

Analysis

How is this format being utilised within the arts and how it has been modified across different communities?

Hacks have been presented by cultural organisations to explore unique agendas. One way that this has been achieved is by employing data sets inherent to the institutions (including archival information such as collections, visitor data, artist-provided data, etc.) in new ways. When an institution presents a hack event, they exhibit their knowledge of evolving digital technologies and their ability to incorporate these into programming using cutting-edge formats. These types of cultural hack events tend to follow the commercial tech hackathon model closely, including maintaining the competitive format.

The art hacks presented in the case studies represent a type of event that is different from the cultural model. These tend to be presented and organised by curators, artists, and academics. They take place at galleries, labs, science buildings, and maker spaces. The facilitators of these events are led by the motivation to present opportunities for mixed groups of participants to meet, develop ideas, and begin to collaborate on new projects. They are a type of incubator but with financial and competitive incentives removed as driving factors.

How can a structure that originated with the commercial digital sector, which is fundamentally based around competition, problem-solving, and commercial software development, influence artistic strategies that aim to generate knowledge through organic research, process, and inquiry?

Presenting hack events in arts contexts transfers a format from a realm that is interested in problem solving into a realm that tends to ask questions rather than answering them. When the hackathon is modified for the arts, there are a number of issues that must be considered, particularly in relation to participants. The hack format aligns closely with methods that are already practiced within the arts and cultural sectors. These include

interdisciplinary practices, collaboration, creating quick prototypes, brainstorming, and thinking through action. While these similarities exist, there are also many differences, particularly in relation to the aims of artist-participants in non-commercial contexts. Organisers must be open to the idea that art hack participants will pursue goals during the event that will further their own creative and professional agendas; the exploration of new ideas is a key currency for the artists involved.

When the hack format was originally used within the commercial tech sector, it was focussed around the goal of writing and developing code for commercial applications. Writing code and creating programmatic artworks is only one of many outcomes and strategies that are undertaken in art hacks. Artists are accustomed to thinking laterally and applying art-making methodologies across a variety of media. During an art hack, this occurs through experimentation with media and materials as part of the phases of project conceptualisation, prototyping and execution. Art hacking events, therefore, do not necessarily result in technology-based art projects, but rather, a wide range of results can be possible. Some of these results utilise technology while others do not. Participants often ignore technological media altogether and work with analogue materials or performance. This can be even an even more effective use of their time, circumventing the possibility that learning a new technical skill will encumber the development of new work.

Organisational models that are presented by facilitators will have a major impact on the kinds of projects that result from art hacking events. How these are shaped depends largely upon the interests, skillsets and backgrounds of the organisers. Different modifications of the hack format have been tested across the case study projects and this has produced a variety of results. An example of this is seen in 'TDA//H'. This event resulted in many physical computing and sculptural projects that were made possible by the materials and resources available in the New Bridge Project and Maker Space venues. Groups were able to use materials such as laser cut cardboard, Makey Makey, and video monitors in their final presentations.

The mode of selection of participants (including invited guests, open call curated selection, or open invitation) will be reflected in event outcomes. Different types of participants, when grouped, will have different expectations and results will therefore differ. The authors have seen this across the three case studies, which involved participants as diverse as artists, journalists, designers, archivists, librarians, filmmakers, and web programmers. The combinations that arise in groups, whether by chance or by design, will affect the methods used to create projects and thus the outcomes of the event. This was evident in 'TCTCTC', which included a group that was highly organised in the planning and execution of the 'News Buddy' app and a group that was highly organic in the conceptualisation and implementation of 'Data That You Don't Want to Share and No One Wants to Know'.

The structure of a hack can be compared to pedagogical models employed in art universities, particularly in foundations programs in which students are led to plan and implement projects quickly while simultaneously expanding their ideas and their uses of materials. When the competitive format and the pressures to exhibit work are removed from the commercial hackathon format, participants in art hacking events are able to create more freely and push the bounds of their practice and usual modes of working.

Organisers of hack events presented within the arts must be aware of the types of considerations that are unique to artist-participants. Outcomes of art hacking events will be both tangible and intangible. These include physical artworks, virtual artworks, ideas (intellectual property), relationships, and collaborations. It would be impossible to monetise or place a concrete value on these types of results. It is important that participants who work collaboratively in art hacking contexts discuss intellectual property before the end of the event. If individuals decide to move forward with a project, all group members will be aware of what kind of credit or remuneration was discussed.

Issues of intellectual property and participant visibility extend to the fact that artists labour throughout their careers to build a personal brand. They usually serve as their own marketing department, creating a website, archiving imagery of their practice, and acting as the social media arm of their own identity and career. This raises questions as to whether an artist wants to link his or her name with a project that has been created quickly and collaboratively and is then showcased immediately either in an exhibition format, on social media, on a project website, or in articles about the event.

Conclusion

Evolving strategies employed in hack events presented within the arts and cultural sectors have modified the original commercial tech hackathon model. Organisations, facilitators, and institutions have pursued a wide range of models for planning and implementing these events. Some follow the tech hack model more closely than others.

In planning and delivering the case study projects, Bradbury, O'Hara, and their collaborators have worked to de-emphasise the original competitive nature of hacks as well as the need for a public exhibition of hack results. This has been implemented while attention has been focussed on deriving value from collaboration, idea generation, and networking. A key ethos of this hack model emphasises the idea that artists tend to raise questions and create problems rather than answering questions and solving problems. Raising questions can create insight and lead to new ways of thinking that can be considered a valuable type of innovation.

After this research, there is scope for further investigation into the effects of the presence of videography, photography, media and social media on

the outcomes of art hacking events. Additionally, further research into the framing of hack events as projects in and of themselves should be undertaken. This research raises questions as to how these types of projects are documented and presented after they occur – are the hacks themselves the projects of the organisers or is there shared ownership of the event among the organisers, participants, and venues? Additionally, from a curatorial perspective, how can expectations of audiences be managed when these events are presented in venues such as galleries and museums? How does this change when they take place in labs or maker spaces?

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Ideational Drawing as a Foresight Method in Designing Future States of Objects

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Abstract

This paper examines how artists and product designers could develop objects in a technological social era by using foresight and ideational drawing as a method of inquiry and anticipated development. It examines methods how artists and designers can consider future states of objects that bridge social engagement between users. It also provides a framework for design considerations of how objects may outgrow its technological value over time. The methodology of foresight and ideational drawing aids in understanding how designers can approach and create an understanding how the object could operate in various future world states and its possible co-mingling.

This paper examines how a nested framework process informs how product designers and the designing of objects are interrelated to techno-social experiences. A nested framework process is a series of applied research methods used in combination to approach a complex problem. It argues for the inclusion of ideational drawing as a method to be included in the Popper diamond.

Foresight as Method

Foresight horizon scanning and matrix development are used in this research as a method to develop possible futures of objects.

As a research method, foresight can be used to create insights, learn demands of new markets, and develop implications for action in complex territories. By using foresight methods to develop new products, a context is created to directly enable creativity within the constraints and frameworks in design. The generative phase of foresight is the foundation for a process of inquiry. It consists of gathering, analyzing and synthesizing of existing knowledge, in order to codify knowledge into a new vision of the future. Rafael Popper indicates three main stages of this generative phase: Exploration, Analysis and Anticipation. [1]

Exploration provides an understanding of main issues, trends and drivers. A driver is the understanding of what is propelling the trend. Analysis is an understanding how the main issues; trends and drivers influence each other. Anticipation examines previous considerations and aims to develop possible futures.

Ideational Drawing as Method

To consider adding ideational drawing as a research method, one must understand how drawing is used in the ideation and research phase. Bill Buxton writes in "Sketching User Experiences", that even if the designer laboured for hours, or days over a drawing, the rendering style is intended to convey the opposite, by conveying it was done in minutes a sketch indicates "I am disposable, so don't worry about telling me what you really think, especially since I am not sure about this myself". [2] Buxton further qualifies sketching adds to the design process by indicating that it is quick, timely, inexpensive, disposable, plentiful, and provides a distinct gesture with minimal detail. This type of 'thinking drawing' provides an appropriate degree of refinement that corresponds to the designer's level of certainty in the designers mind, and asks to suggest and explore a subject rather than to confirm with providing a level of ambiguity that will be able to be interpreted in different ways. [3] This incompleteness of a drawing, providing a vague description, allows the outcome to be discussed and iterated in the reading of image, which is integral to the design process. Buxton identifies and classifies drawing into five categories: sketch, memory drawing, presentation drawing, technical drawing and description drawing. Sketching, is articulated as a type of thinking drawing, memory drawing is a render made to record and capture ideas, presentation drawing is a type made for a customer and may be more refined, technical drawing as type of drawing to use for a fabrication and description drawing which is intended explain something such as an illustration for an emergency exit. [4] Buxton clearly delineates the use of sketching and its role in the design process from that of prototype. A prototype has different properties than drawing. It must be didactic, describe, refine, answer, test, resolve, be specific and act a depiction. [5]

Buxton argues that the act of drawing is integral to the user experience design process as both ideation and conversation based tools are used in technical user design processes. Deanna Petherbridge articulates additional examples how drawing is used is for dialogue purposes by architects, engineers planners and designers. Defined as such, she refers to drawing that is used mainly in three capacities: as a medium for communication, a medium for design and as a medium for analysis specifically as a means of knowledge and understanding. [6] For the purposes of this paper, sketching or drawing is examined as a process of knowledge and understanding to think through concepts.

Petherbridge refers to the research work of Kathryn Henderson, who claims "Sketches are at the heart of design work". They serve as thinking tools to capture fleeting ideas on paper where they can be better understood, further analyzed and refined and

negotiated". [7] Henderson further articulates and refers to sketching as "Messy Practice", or hand sketching and a "mixed practice" of computer graphics. In this study the notion of drawing as Petherbridge describes as a "boundary object", and its ability to be a "holding ground and negotiation space for both explicit and yet to be made explicit knowledge" and its potential for a tool of communication. [8]

In this process, sketching as ideational drawing is used to think through problems, and create new ones, as part of the problem framing process. Drawing a user's experience with a potential new object presents a context for product designers to think about how to draw objects of experience that may be networked in a way not previously conceived. Petherbridge introduces this as a "boundary object", however it can also be considered as a proof of concept, and a method to describe and illustrate a potential new problem to solve.

Terry Rosenberg refers to ideational drawing as an act of raw thinking, specifically "thinking-in-action and action-as-thinking". He refers to ideation drawing as thinking space, where space is thinking and is presented as artifact, and makes the clear distinguished point that ideation drawing is "thinking" and not "thought." Drawing is used to ideate as a present activity and the "immediacy of the thinking-act". [9] Rosenberg cites the examples of the work of John Rhys Newman, a senior Design manager of Nokia Design's Insight and Innovation team. Newman describes the process of his drawings in meetings and conference calls where he is "half listening, half drawing" and the semi-preciousness and semi-focus of the drawing and the accidents that occur as his focus drifts. Part of his process is to date stamp the drawing, and place the drawings in a set of manila envelops to file, as an effort of producing the drawing itself as a relinquishing of a hold on thinking, to see what happens as a leap of thought through drawing. Rosenberg further articulates Newman's drawings into three categories: "Fictions", "In Sight and Mind", and "Generative Drawings". All drawings are done in pencil on copier paper and identified with a date stamp.

Fiction Drawings as classified by Newman are "musings or doodles" as they are not illustrative of anything specific and are more reflective a thinking act. In 2006, a series of fictional drawings involved issues of flooding, in particular influenced by global warming and the floods in New Orleans. The drawings show objects stacked high, using chairs to levitate boats and atypical awkward gathered objects, absent of water. The objects drawn in this space construct an imagine space as a result of a flood. This disruptive act of the flooding can change how objects are normally viewed and used in its designed space. It is in this misuse of objects that new shapes begin to form, and through the act of drawn repetition new ideas can emerge from shapes that erupt from a semi-illustration of an imagined flood.

In the category of "In Sight and Mind" Newman's drawings show a few identifiable objects, illustrating the artifacts he uses as drawing aids (pencils, paper, paper clip, eyeglasses etc.). The drawings start as observation drawings, a pair of glasses is drawn in a meeting for example and is built upon, as Rosenberg describes "a world of alternative logic". [10] These drawings typically are derived by what is in front of him on his desk. They are semi-observational, as the drawing practice tends to be interrupted with other activities such as being on the phone, or in a meeting. Objects are layered on top of each other, and this tracing of objects on a desk, observed and have imagined in distraction, form new types of objects that are not typically depicted from pure representational drawing. These examples offer valuable insight into how designers can use drawings in various ways in the creative process and speak to the importance of generative and ideation drawing because it permits a non-language based method to build new products.

The third category of Newman's drawings, are generative drawings. In these drawings Newman poses an exploratory question, for example "Why do we build sandcastles?" Some of these drawings are as a result of conversations; some identify key elements of building sandcastles such as buckets and spades. In some of Newman's drawing the material and scale shift the buckets from industrial to playthings. Again, repetition is used here to ideate and replicate the act of building a sand castle. By posing questions, Newman has introduced constraints on his drawing, and is using drawing as point to answer a question non-verbally through shape and form. In shifting scale and tools he begins to change *what is a sand castle*, and how could it be re-imagined. In drawing these new playful shapes, they act as a record to be considered when addressing a new design problem and how to approach a new form of a new object that does not yet exist.

Ideation, generation and fiction are significant to this research because it articulates how designers are already using drawing as a method of inquiry as it allows ideas to build quickly in an action based way.

Ideational Drawing as Foresight Method

Buxton, Henderson and Rosenberg research argues, that ideational drawing is integral to the generative design process. This paper argues that ideational drawing should be included as method in the Popper diamond, as a method of semi-conscious brainstorming as part of the ideation process of design. The diamond demonstrates a practical framework of thirty-three methods articulated by Popper. As shown in the modified diamond, ideational drawing should situate in the creative polarity of the diamond as a research method for design. Ideational drawing is closest to the essay or scenario writing as a research method, as it suggests a narrative or reasoning. While several approaches have been used as my methodology, their pedagogical similarities offer a complimentary approach and its divergence create greater understandings of this method as a specific creative based foresight method.

Developing a Matrix Approach

Kees Van Der Heijden states a matrix approach is appropriate in situations of considerable uncertainty. [11] In terms of understanding inter-relationships of driving forces, typically a two by two matrix of critical uncertainties generates several plausible scenarios for plausible worlds. The cube model, developed with three individual axes looked at the polarities in function, ownership and technology in product design to act as grounding points of considerations for product designers. A cube can examine the three axes of polarities to create eight possible future world scenarios, which are to act as a guide of reimagining the product through different lenses. These scenarios are valuable because they present a well-rounded view of the possible world the objects are designed for. A cube model is not typical of the foresight process, perhaps as Heijden elaborates, the matrix model maximizes the range of scenario outcomes and the potential impact. However, the cube model can participate in the foresight process in a significant way by allowing elaborated worlds and maximize outcomes. The nature of the choice for scenario dimensions are what is high impact and highly uncertain for a large range of possible impacts. [12] The choice to investigate the cube model was to elaborate on possible futures with a stable framework. Trends texture and develop the world design to create future uncertainty as stated, additional criteria are implemented through a variable set of trends. These design criteria allow us to imagine objects in new ways from its origin and predicting its future. Ideational drawings are generative in nature and inform questions as to how objects are constructed in this world. This criterion acts as a guide in ideation for a designer to contemplate how to think about approaching an object's complexity in the future through a creative process.

The Double Diamond approach [13] elaborates the "Discover, Define, Develop and Design" cycle as a method for designers to consider when developing products. The double diamond model is a well-considered product design mode. It articulates a method of expanding and funneling the design process. Ideational drawing for example could be part of the discovery process when brainstorming possible solutions and feasibility of the product. What the double diamond model does not incorporate an on going service based model for products engaged with a community. It also does not articulate the designer's responsibility to consider post-delivery of the product. The Stanford University ME310 Design Innovation Process was developed as part of a curriculum for a project-based engineering design course at Stanford University. [14]

The cycle considers a five-phase approach that: define the problem by observing the needs of the intended users; benchmarks what technologies exist to identify design opportunities; brainstorm to develop new ideas; prototype to create a proof of concept and Test and iterate to improve the design.

The second it can be assumed that a variety of methods can be used between the brainstorm and prototype process prior to the model stage. Ideational drawing for example would be used as method to think through concepts, and generate ideas on how to approach the problem. Ideational drawing as a primary generative method to the brainstorming process considers new scenarios for the future. It is proposed that once the problem is defined, and benchmarking phase has been completed, setting a time frame would be an important next step for designers to consider developing products. A time frame could be cast to a point where conceived technologies have radically shift, however it suggested time horizon could be no more then ten years for products with a reasonable intention to reach a marketplace. Beyond a ten-year horizon drawings may be considered as a design fiction.

A STEEP V process can inform the brainstorming process. To develop a broad set of trends signals will need to be identified and clustered. These can be categorized under Social, Technology, Economy, Environment, Political, and Value based trends. Widening the scope of the trend index beyond only one category (such as technology) allows for a greater possible range of implications to consider. Having identified three to five trends per category naming trends is important. It will also be important to note what drives this trend. Trends were categorized identifying implication of Function, Ownership and Technology axis polarities. This step will allow trends to texture the world design, as the formation of eight possible worlds to consider.

Now with eight possible worlds as a source for potential future for objects to inhabit this allows for a rich basis to ideate and brainstorm possible objects for the identified problem. It is important to note, that if an intended problem is focused on only one polarity (i.e.: single owner, one function) all worlds may not need to be explored.

Ideational generative drawing is a suggested method of brainstorming where ideas can free flow and be articulate in a visual way.

As the perimeters of the worlds are firmly set, additional questions can be asked to start the drawing purpose. As part of this research paper, these were part of the questions ask prior to drawing:

- What does this world look like? Who lives here?
- What would the identified person(s) use in this world?
- What common objects might not exist in projected time frame?
- How will an object change in the projected time frame?
- How do trends identified influence this world and affect objects?
- What new problems are suggested by the drawing?

The purpose of the drawings would be to generate a volume of ideas in a rapid way. Sharing ideas is an important part of this phase with visual examples to

support conversation and collaboration, especially when working in cross-disciplinary teams.

When moving to a prototyping phase, it is an important to keep in mind the adapted Norman Model incorporating Green's Context proposition. This model will help guide questions on the object's relationship to its intended audience, and its context and activity within a community. Dreyfuss' approach to consider utility and safety, maintenance, cost, sales appeal and and appearance may occur in the final prototype and testing phases. [15] This among other reasons, may reframe the problem initiated and may need to be further iterated and refined.

Conclusion and areas for further inquiry

Developing a trend deck of current signals in the changing ground of social, technology, ecology, economic and value factors challenge both the object and its design in the future. By developing eight world scenarios, although it allowed a certain complexity in how to consider an object, it creates difficulties and problematizes the parameters in the design idea process.

Although Heijden elaborates that this model to maximize the range of scenario outcomes and potential impact, its complexity is often difficult to navigate and differentiate when in the moment of creation of design ideas through ideational drawing itself. One concern presented using the model itself is that it does not factor in the possibility of waste. If an ideational drawing is developed using this framework, and if an ideational drawing did not fit the specific criteria, where does it go? This research has boldly taken on these questions in order to illuminate insight on the future of product design process and considers the impact towards incorporating contextual value of products while firmly understanding both limitations on utility and ownership.

In a scenario design with extreme perimeters it was difficult to contemplate drawings within an absolute plausible future and started to move into design fiction. The extreme reveals the potentiality of objects if pushed to its limits.

Although ideational drawing was a strong research method to iterate and ideate it has its limitations to convey what the object was or how it worked possible in its complexity in a network. It should be noted, that handwriting was an interesting by product to the ideational drawing. With difficulty drawing techno-social aspects to the object handwriting became a notation to self, illustrating what the object was and how it functioned. This literation became part of the drawing. The scrawling of the notion became a record of a thought in the moment.

In closing, the marriage of foresight and ideational drawing leads to a new language construct in how designers can approach object design in the complexity of a techno-social age.

This research has taken an innovative approach by developing a nested framework and adds significantly to design discourse through the analysis of the ideation process for product design and the incorporation of new methods to contemplate how products can design new objects for the future. Although ideational drawing was a strong tool to iterate and ideate it has its limitations to convey what the object was or how it worked possible in its complexity in a network.

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Digital Musicianship Training for
Classically Trained Music Students in a Laptop Orchestra

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Abstract

Laptop orchestra is a music platform that focuses on collaborative music making within a computer-mediated environment. It is usually formed by an interdisciplinary team with expertise in different disciplines such as music, composition, multimedia, and computer science that contribute to various aspects of a laptop orchestra. The iLOrk presented in this paper is a laptop orchestra from the Hong Kong Institute of Education that specializes in teacher education. It was formed by a group of music education students who were not familiar with computer music and performance technology. To complement the team's lack of a technical foundation, it is necessary to develop iLOrk members' knowledge and skills in the manipulation of digital instruments and participation in a laptop orchestra performance. A series of activities were designed to transform their classically oriented musical competencies into technologically oriented digital musicianship, including (1) development of an iOS app *i-Orchestra* for orchestral simulation; (2) the use of MIDI controllers as musical instruments; and (3) compositional work dedicated to a laptop orchestra. This paper details the strategies and pedagogical considerations in the digital musicianship training of classically trained members of this laptop orchestra.

Keywords

iLOrk, laptop orchestra, digital musicianship, i-Orchestra, iOS app

Introduction

Laptop orchestra is a music platform that has recently become available as a result of advancements in mobile computing and audio signal processing technology. It enables individuals to perform music collaboratively in a computer-mediated environment. As a new type of collaborative music-making platform, a laptop orchestra shares various performance practices with other conventional music ensembles, such as orchestras, choirs, and concert bands. Those existing forms of music ensemble follow their historically informed practices that have accumulated for centuries. Without an established performance practice framework, a laptop orchestra is more open to sonic experimentation. For example, a composer's musical ideas may not necessarily be represented by conventional staff notations with fixed pitch and timbre, regular rhythm, and standard instrumentation. A laptop orchestra is usually formed by an interdisciplinary team with expertise in different disciplines such as music, composition, multimedia, and computer science that contribute to its various aspects.

Early documentation of laptop orchestras can be traced back to Truman [1], who explored the motivation of the formation of the Princeton Laptop Orchestra (PLOrk), which was founded in 2005 driven by the curiosity of music creation with a large group of people playing computer-based meta-instruments. The Stanford Laptop Orchestra (SLOrk) is another successful premier laptop ensemble founded by Ge Wang in 2008 [2]. Most laptop orchestras are affiliated with higher education institutions where people with expertise in different areas could gather and at the same time functions as a classroom for interdisciplinary exploration in the electronic and sonic arts.

The laptop orchestra presented in this paper, iLOrk, is a laptop orchestra affiliated with the Hong Kong Institute of Education, a higher education institution that specializes in teacher education programs. Instead of a combination of students from various disciplines, iLOrk is composed solely of students from the music education programs, in which the curriculum mainly covers music knowledge content, pedagogy, and educational studies. Despite some basic training on music technology as part of their curriculum, the knowledge and skills they possessed are incomprehensive in covering the necessary knowledge and skills required in a laptop orchestra; the absence of an interdisciplinary composition results in a lack of a technical foundation, which is one of the important components of a laptop orchestra. Therefore, it is necessary to develop the iLOrk members' knowledge and skills in the manipulation of digital instruments and participation in a laptop orchestra performance.

Digital Musicianship

Musicianship from the Western art tradition encompasses a range of musical competencies including aural perception skills of intervals, rhythm, and chords, music reading, and harmonization skills [3]. Technological elements are included in the set of musical competencies in a laptop orchestra, which repositions the center of the

musicianship framework to a more technological orientation. These sets of musical competencies are not only located in the musicians' interactions with the musical instruments, but also *within* the instruments, because they are also responsible for the design and preparation of the digital tools [4] [5]. To develop iLOrk members' knowledge and skills in the manipulation of digital instruments and participation in a laptop orchestra performance, one of the aims of iLOrk is to broaden their musical horizons via digital musicianship training. A series of activities were strategically planned to transform the iLOrk members' classically trained musical competencies into technologically oriented musicianship necessary for collaborative music making in a laptop orchestra.

Digital Musicianship Training in iLOrk

The activities for digital musicianship training in iLOrk included: (1) development of an iOS app for orchestral simulation; (2) the use of MIDI controllers as musical instruments; and (3) compositional work dedicated to a laptop orchestra.

i-Orchestra - iOS App for Orchestral Simulation

Software samplers and synthesizers are the key elements that turn general-purpose laptops into musical devices for performance. To let iLOrk members become familiar with the use of a non-acoustic instrument in a performance, an iOS app *i-Orchestra* was developed to simulate orchestral instruments in a mobile setting. It voices orchestral instrument samples by transmitting a MIDI message to the app via a MIDI keyboard to the iOS device. Each member simulates an orchestral part using the app, and the team collaborates to form a virtual orchestra in the setting of a mobile device ensemble. They were directed to perform a classical symphony - a musical style with which classically trained students are familiar.

The pedagogical consideration here is to train the iLOrk members to manipulate performance technology while keeping them in the comfort zone of conventional music performance practices, including the use of conventional staff notation, keyboard instruments, and orchestral timbres. In additional to the MIDI keyboard, the iLOrk members were also responsible for adjusting the parameters on the app, including volume, articulation, and key. Figure 1 shows the user interface of the app *i-Orchestra* on an iPhone.

Fig 1. App icon and user interface of iOS app *i-Orchestra* on iPhone.

Using MIDI Controllers as Musical Instruments

Laptop orchestra performances seldom make use of MIDI keyboards for two reasons. First, not all laptop orchestra players are trained pianists or keyboardists. Second, the use of MIDI keyboards limits the interaction between the player and the laptop to the finger-style playing techniques of keyboard instruments, which contradicts the notion of a laptop orchestra as breaking through the traditional performance practices. Various types of controllers are widely used in laptop orchestras, making available more input methods, including gesture control, touch sensitivity, and triggering mechanisms.

To further digital musicianship training, the iLOrk members were directed to practice conventional music with non–keyboard-type MIDI controllers. They were assigned various types of MIDI controllers, including Launchpad (an 8 × 8 grid multi-button controller), EWI (electronic wind controller), and nanoPad2 (X-Y touchpad and trigger pads). Pure Data patches were designed for some of the MIDI controllers to convert the controller messages into meaningful MIDI messages to the software sampler and synthesizer. By driving iLOrk members away from keyboard instruments, they recognized that score music could be interpreted not only by finger-style playing techniques but also linearly, two-dimensionally, or in other manners offered by those MIDI controllers.

A range of musical styles, including classical concertos, jam sessions, and choral music were explored by the iLOrk members with those MIDI controllers. Figure 2 shows the use of the wind controller as a solo instrument for a classical concerto.

Fig 2. *Andante in C for Flute and Orchestra,* K.315 by Wolfgang Amadeus Mozart, featuring a wind controller as the solo instrument.

Compositional Work

The conventional staff notation that is widely used nowadays to visually represent musical ideas originated in European classical music and was specifically designed for musical performance in the Western music tradition. A laptop orchestra does not conform to the music-making idiom of the Western art tradition, and thus conventional staff notation was rarely used to represent the composers' musical ideas. It is therefore necessary for iLOrk members to explore the possibilities of musical expression via unconventional notation methods. Compositional works that incorporate linear representation and free improvisation for various parameters such as pitch, tone, amplitude envelope, and frequency modulation were created specifically for iLOrk as both a performance repertoire and a learning tool. Figure 3 shows an example of the compositional work for iLOrk.

Fig 3. *Moonrise* (2015) by Lee Cheng.

In this piece, iLOrk members must perform with conventionally notated music and at the same time adjust the parameters according to the paired effect track using

linear representation so as to achieve the aesthetic expectation of the compositional work, which is not represented in the conventional staff notation. Sessions of collective free improvisation allowed the individual musicians a higher degree of autonomy for creation of their own timbre through their aesthetic judgment by adjusting the above-mentioned parameters and therefore involved the members in the musical instrument design process.

Future Work

The above-mentioned activities account for the first phase of digital musicianship training of iLOrk in one semester. The activities in the first phase have largely focused on complementing the lack of technical foundation of the laptop orchestra's members. The iLOrk members have made progress in manipulating basic hardware and software in the collaborative music making process, along with a more developed understanding of the laptop orchestra as a new musical platform. The advantages of an entire team with a high level of musical ability began to emerge when the iLOrk members were asked to improvise with their digital instruments. They were able to achieve an impressive improvisational performance featuring the characteristics of the timbral and textural variety offered by those digital instruments with remarkable progress.

Despite the interim improvement of the iLOrk members' competencies in manipulating the digital instruments and participating in a computer-mediated performance, extra knowledge and skills are necessary for a laptop orchestra, including the ability to develop, construct, and set up a digital instrument, which is a core competency in digital musicianship. The next phases of training shall incorporate the learning of digital audio signal processing, multimedia programming language (e.g., Pure Data, Max/MSP), electronic circuit broad design (e.g., Arduino), and compositional techniques for an electronic ensemble.

Conclusions

Laptop orchestra is a computer-mediated musical platform that radically reshapes the conventional music-making context coined in the Western art tradition. The digital musicianship training in iLOrk demonstrated that a laptop orchestra is not only a platform for new musical expression, but also a vehicle for music students' digital musicianship training. It could be used in a classroom that transforms classically trained students' musical competencies into technologically oriented musicianship, allowing them to penetrate the framework of conventional musicianship and fostering their virtuosity in digital artistry for production of a convincing and expressive performance [6].

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The Impoverished Image: Online Video Art Exposure

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Abstract

Curatorial trends in contemporary digital video art exhibition practices are very much reliant on both the standards and restrictions of digital art preservation, as well as new forms of art production and distribution. This paper assesses current approaches to the exhibition of video artworks that were either created for online distribution or first exhibited via online content sharing platforms. Often politically charged, these online works voluntarily take a marginal position in opposition to institutional exhibition modes. This paper addresses the specificities of online video art exposure and distribution, such as distributed aesthetics within contemporary cultural economies. We claim that online distribution and access are manifested in the digital video itself, through critical aesthetics of noise, compression and precarity as defined by Fetveit (2013). From our viewpoint, the act of commissioning online video artworks, as well as the preservation of online-generated aesthetics, is a mode of inquiry in contemporary digital culture and critical curating. We further discuss four curatorial models that expose online video works by contextualizing them in the art space. In this paper, we present case studies of video artworks that both demonstrate expressive or political use of noise and are distributed through online video sharing platforms. We analyze how the aesthetics of these videos—their poverty—operate in the conditions of cultural economy and how these videos circulate in between online and onsite exhibition modes.

Introduction

Recent discourse on the exhibition of new media art is increasingly reliant on the concept of authenticity and artist intent, where any loss or change to the original artwork is understood as "compromising the integrity of a unique object" [1]. Referring to Laurenson, Jones cites Stan Douglas' video installation *Nu*tka* (1996) as an example where the deviation from any artist's specifications changes the meaning of an artwork. This discussion of authenticity is tied to the challenges of network-based art preservation and exhibition modes. While original network-based artworks were considered ephemeral, many of them have now been archived. Among these websites – online platforms for software-based art preservation such as Turbulence.org, Runme.org, dam.org, and more. However, this contextual change in the archiving network-based art affects the discourse manifested in the video aesthetics. Many video artworks discussed in this paper adopted the online aesthetics [1] of image poverty based on the intentional use of noise and image degradation, which in its turn contributed to their meaning.

Apart from artist's intentionality, the fluidity and mobility of media, video files in particular, challenge the approaches to video art exhibition and preservation [27]. Digital image can move between various platforms, from the HD screen, to iPhone and projection [27]. We are curious to know how the meaning of a video artwork changes when it is moved from one platform to another? What are the cultural implications of this change?

Most of the early discussion around the curation of art on the Internet was dedicated to net art as it was the first art genre that emerged with the expansion of the Internet, which augmented the web artforms through experimentation and involvement of an audience. The affordances of early net art works - mainly, their ability to generate reciprocal feedback - are fundamental for understanding of their communicative mechanisms as well as Internet-based art works per se. The reciprocity of online environments and access are one of the reasons for online artworks distribution. However, digitization of analog works and preservation of ephemera strives to reach the same goal: to ensure access to the artworks.

Online databases such as Rhizome, Video Data Bank, Electronic Arts Intermix, ADA [23, 24, 25, 26] represent both online and off-line forms of digital artworks. All of these video and media art archives have curated collections. In the case of Rhizome, the online-curated exhibitions usually coincided with on-site exhibitions at the New Museum, in New York, where Rhizome.org acts as an affiliate organization.

Hence, it is important to distinguish two categories of inference that define online video art preservation:
1. access (i.e. Rhizome, Video Database designed for unlimited access by cultural and educational institutions, art galleries);
2. preservation (VDB, ADA and more).

While these two categories are linked, the former questions online distribution as potentially open and free zone for content access. Declared in the "Introduction to Net Art" manifesto, all networked-based art was defined as "maintaining independence from institutional

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[1] Here we refer to Bolter and Grusin's concept *hypermediacy* of new media, online environment augmented by computer technology and manifested in user interfaces, text, online images and images (Bolter J, Grusin D., 1998)

bureaucracies… working without marginalization" [6]. Yet what is more important is how this economic and cultural perspective of network-based art has changed in the past few years. YouTube, in particular, as "the world's default media archive" has proved to be a challenge for archivists and curators [7]. According to Prelinger, the primacy of YouTube questions the importance of classical archives and their relevance as YouTube offers free access and circulation.

Both institutional approaches mentioned above aim at transferring analog files to "uncompressed or "lossless" digital video files, thus ensuring that the digital archive can be made available for online distribution [24]. Negotiating between offline and online, this paper discusses the works whose online aesthetics is central to its reception and exhibition. Therefore, we look at the current curatorial approaches to present and conserve artworks that are *compressed* and that *lost quality to* preserve its artistic, political and social value.

It is therefore important to highlight the difference between what is usually referred to as *online exhibition* vs. exhibition of online-based art. We define *online exhibition* as an online version of the onsite exposition such as exhibition documentation and supporting texts.

In this paper we look at several curatorial approaches to present online artworks. A good example to illustrate this distinction is monthly online exhibition of online art projects presented by New Museum, NYC. *First Look: New Art Online* is an *online-only* exhibition featuring series of live screenings and presenting the latest commissions of the New Museum[2]. Curators present online works without keeping the site (i.e. online platforms) that are central reception methods preservation. Ann Hirsch produces online works analyzing the issues of female sexuality in socio-political context. The exhibition presents Hirsch's video originally posted on Vimeo. Therefore, the context of the artwork presentation has not changed keeping its original aesthetics that affect audiences' reception.

In this paper we address the concept of *the imperfect image* manifested in noise, image degradation and precarity and its expressive use. We then analyze video artworks by VOINA and Philip Huang to argue for the social use of noise. We continue discussing video and its poverty affected by online distribution to analyze the video by Martin Kohout. Apart from the videos on YouTube, we discuss those distributed through the marginal online platforms such as BEFNOED by Eva and Franco Mattes. We close our discussion with analyzing the video artworks by Lisa Byrne and the Valie Export Society that mimic online amateur aesthetics of online-distributed non-professional videos thus using this imperfection as an expressive technique.

Impoverished Image

Noise as phenomenon in digital culture represents the limitations and deficit in communication signal [28, 31]. This aesthetics of technology failure **-** "precarious aesthetics"[3] - draws attention to the opaque as opposed to the transparent thus pointing at the limitations of the technology [3]. Precarious aesthetics is characterized as "an aesthetic style or artistic strategy, which is reliant upon compromising this perceived transparency associated with visual and aural recordings" [3]. It can be due to disturbances during the recording process or technology failure such as motion blur, capturing street noise, or glitch. Elements of noise and diverse aspects commonly thought of flaws can in some cases create "a work of art's allure" rather than alienating the viewer from it [5]. Fetveit [3,4] argues that these factors position the viewer "at a threshold of knowledge", thus generating "unique rhetorical and affective powers".

The potential of *poor image*[4], as discussed by many scholars, lies in its fundamental complexity and ability for affective powers [8, 9, 3]. Video artists voluntarily exploit the expressive use of noise that demonstrates the liminalities of digital technology and demand of the purity of information. In this paper we provide examples of video artworks and the significance of the online noise preservation.

First, we should distinguish the following video aesthetics categories based on the context of noise and distributed networks protocols[5] [28]:

1. expressive use of noise (consciously producing failure, generated failure through the experimentation with technology and longing for analog physicality, mimicking analog errors of the video art)

2. unexpected errors and failure of technology during the recording process (artist intentionality to keep the errors and poor quality of the artwork)

3. online-generated noise (media marked by compression, re-shared, fragmented media)

In terms of media production, digital video implies the availability of digital tools that allow for theoretically infinite reproduction with no loss of quality [14, 31]. The loss of quality and any kind of noise, according to Shannon and Weaver are defined as all changes in the message. Instead of looking at noise and precarity of the video as a phenomenon that should be eliminated, we

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[2] The latest series can be viewed on the New Museum website
http://www.newmuseum.org/exhibitions/online

[3] A term coined by Fetveit A., 2013a
[4] Here we refer to Hito Steyerl's essay "In Defense of Poor Image" (2009)
[5] Galloway's concept of protocol and distributed networks, the economy and politics of the information flow and participation. (Galloway, 2014)

look at it as a social and cultural marker [31]. As an example, we analyze politically-charged videos "No One Gives a F* about Pestel" (VOINA, 2008) and "Lunar Homosexual Agenda" (Philip Huang, 2010) that intentionally preserve the poverty of the image for the online distribution.

Motion Blur and Technology Failure in Activist Video Art of VOINA and Philip Huang

As Marks notes [11], some artworks purposefully mimic digital errors like "skipping of a CD" or abrupt cuts. Some artists are doing this intentionally, experimenting with hardware and looking for analogue touch for the digital works. Within the activist performance domain, such technology flaws celebrate its political and social marker. The disturbances during the recording process and interruptions in editing point to following aspects of this art genre: ephemerality, its immediacy and constraint conditions of the recording process.

Decemberists Commemoration or No One Gives a F about Pestel* by Art-Group VOINA (2008) combines the viscerality of the performers' bodies with the abrupt cuts, glitch and intricate changes of view. Art-Group Voina is an art collective whose work is based on socio-political critique of the current regime in Russia. They use radical approaches such as provocations of authorities as well as mockery and performance, street art, video. This performative video exemplifies the use of performative intervention as tactics that both attracts the attention of police forces and security and to creating the politically radical situation, and that also experiment with the public space familiar to a random viewer. Visually dense, the multiplicities of the layers can roughly be differentiated by 1) those arise from cameras mobility, and 2) low resolution. The former are represented in shaky camera, motion blur and opaque framing and motion noise. The latter - dither, glitch, artifacts and motion noise. These disruptions in the flow reveal the following conditions. First, the performance was recorded in restricted conditions (ephemerality of performance, security and police forces). The artists were, most likely, unable to use more professional equipment due to the activist nature of the performance. Furthermore, these interruptions point to certain media qualities of the technology used: its low-fi resolution, portability, ease of use. One of the reasonings for artists to keep the video mostly unedited and not try eliminating this noise is because it is easier for a viewer to contextualize this video aesthetics as long as it invokes certain level of familiarity on the aesthetic level as the viewer has encountered the home-video footages and, most likely, produced it [18]. Juhazs points out that much of the content on YouTube is produced by non-professionals [17]. Davies suggests that the popularity of YouTube is explained by the appeal of amateur aesthetic many viewers can relate to in their everydayness [18]. Interestingly, the connection between the amateur production and online platforms has been widely

discussed, apart from media art, in computer music. Cascone, while reflecting on the notion of *post-digital,* argues that composers use noise as a response to contemporary commercial music production. Referring to McLuhan, Cascone discusses specific tools and affects to produce computer music rather than digital technology in general [36].

Art-group VOINA occupies a marginal position within the institutional art domain. VOINA's video artworks are not exhibited onsite mainly due to the artists' political views. The official video posted on YouTube by the official art group VOINA account has a description in English. It was posted in 2012 while the actual performance took place in 2008. The original video posted in 2008 was banned by YouTube as mentioned in the artists' blog. Therefore, the audience for this version is mostly English-speaking, which is evidenced by the comment thread. This video was re-shared by the channel targeted for English-speaking audience RT[6]. The

Fig 1. *Decembrists Commemoration or No One Gives a F About Pestel*, 2008. Art-Group Voina, video, Copyright Alex Plutser-Sarno.

re-shared video has a logo of RT channel and the links to RT official social networks. Interestingly, the video is shorter than the original and the first 3 seconds are in black and white.

The Russian version of the same performance, though, posted in 2008 has a different title. It does not contain any description and soundtrack. The video is marked by the noise. It is not the recording noise while filming, rather the digital noise that one gets when filming with no sound on a very low-end equipment. Presumably, the official version was intended to be with soundtrack but this one leaked online. Interestingly, this version has much more views (187, 741 in comparison to 9,855).

Philip Huang is a Taiwan-born performance artist whose art practice explores gender and sexual discrimination throughout public interventions and provocations. The *Lunar Homosexual Agenda* by Philip Huang (2010) also uses unedited footage to preserve the ephemerality of a performative intervention into an anti-

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[6] RT (originally Russia Today) is a state-funded TV channel launched in 2005.

gay protest by the Westboro Church, Kansas, USA. While it would be possible for curators to exhibit this work in a gallery setting, its online circulation is reliant on its online amateur aesthetics. Similar expressive techniques can be found in both citizen journalism and amateur participatory news making by using personal digital communication technologies [16].

Overlooked Networks

High resolution ensures that a digital video can be accessed in any format without loss of information from the digital image [29]. Considering the disturbances during the recording process and devices used, the resolution in the majority of the artworks discussed in this paper is relatively low (854x480, 2000 Kbps). Steyerl [11] categorizes poor images as "copies in motions" affected by free distribution, slow digital connections, compression and reproduction [11]. Her influential essay on the poor image touches upon an important theme on the "class society of images": how do we differentiate images? High end from poor? Resolution is attributed, hence, to market and class structure. Activist art videos, including VOINA and Huang, voluntarily took on the marginal position eliminating themselves from elite world of the institutional art market. When circulating online, their low-end quality and marginality become even more apparent.

Unlike the political economy of YouTube, the distribution mechanisms that have become possible with Internet on video blogs has provided multiple opportunities for self- exposure beyond professional contexts. The amount of amateur and everyday footage is beyond available despite YouTube's aforementioned monetization strategies.

Much scholarship of video on YouTube looks at phenomena self-referentiality [21], documentation and memorialization on YouTube [22] and more. Grusin [15] proposes to look at YouTube to analyze the participatory paradigm of contemporary culture. He suggests that the popularity of YouTube as a video sharing platform is explained by the fact that it provides users with more mediation events that are easily shared and distributed [15, p.65]. Following Jenkins' concept of convergence [20] Grusin sees YouTube as bridging the old and the new. Similarly, Michael Wesh suggests looking at the distributed through the YouTube media from an anthropological perspective [32]. Media transmitted on YouTube shapes the communication modes and the exchange of information in particular.

While acknowledging its proliferation of diverse media forms and network environments, Grusin [15] highlights the notion that YouTube is fragmentary and niche-oriented, unlike the network television in 1950-1970s. [15, p.66]. Almost half a century later the situation has not changed much. Alternative non-governmental channels are only available to a small

minority. TV still dominates as a lead information source. While YouTube positions itself as a user-generated platform, the media corporation privileges major companies as its clients rather than nonprofessionals. Various techniques and monetization strategies are adopted by the site to privilege one content over the other [33].

Another important aspect to discuss is how the marginal position of the networked video art contributes to their reception online. In particular, we are interested in the transformations of the digital video when distributed online. Steyerl notes [11] that video resolution is a mark of class and market structures. Similarly, low-resolution encourages faster distribution [34]. Digital images, as well as digital video, proliferate online due to the ease of diffusion. Put differently, the videos' agency is as important for the viewer's engagement as the context in which the video was produced and the content of the image [35].

Marks [19] referring to media artworks based on the algorithms, suggests that many political systems operate through compression of the circulated information, thus provoking artists to be interested in the break-down of the code rather in it running flawlessly. She refers to the video Probleme 5 by Mohssin Harraki (2009). In this short video the artist is breaking down the genealogical diagram. While the video is aesthetically similar to the artworks discussed above, Harraki doesn't have online presence on the video-sharing platforms and is only represented by the institutional art spaces.

Affected Image. 0100101110101101.org and Martin Kohout

According to Willis [14] in terms of media production, contemporary digital video tools allow for infinite reproduction with no loss of quality that, in its turn, contributes to the participatory art production such as remix [14]. Videos, both analog and digital, lose resolution when re-shared, copied, re-mixed [14]. It is especially evident when videos migrate from one platform to another. Marks points out that compression, used to get the best resolution, is an economical strategy to store and distribute data avoiding redundant details [14]. This model is used in the countries where the bandwidth is low. Low resolution, she claims, diminishes individuality, while compression forces the signal to conform to filters [14].

The resolution of peripheral video-sharing platforms is lower than YouTube (480 maximum, while YouTube allows viewers to distribute HD videos). Aesthetically hybrid videos capturing the physicality of the performing bodies stress the politics of distributed aesthetics and how these mechanisms function. The work by Eva and Franco Mattes, known as 0100101110101101.org, questions the dominance of YouTube. "Performances By Everyone For No Every Day" is a participatory online performance by Eva and Franco Mattes. The collective crowd-sourced anonymous non-professional performers

and gave them instructions for performance and recording. All performances were recorded on webcams and mobile phones and posted to Vimeo and many of the more obscure social networks around the world such as LiveJournal (Russia), YouKu (Japan). The distributed aspect of this piece – that is, introduction of alternative social networks - indexes the socio-political qualities of the video and its production.

"Watering Fish" (Figure 2), one of the "instructed performances" can only be accessed on YouKu through getting the client certificate. If the user is denied the certificate, instead of the performance video the commercial of HSBC plays. Distributed aesthetics is simultaneously dealing with the asynchronous production and multi-user access [12]. This social level of distribution is marked by the way users engages in conversation online. In this particular project, we see tendencies in the aesthetic usage of cameras and how cameras capture the ritual.
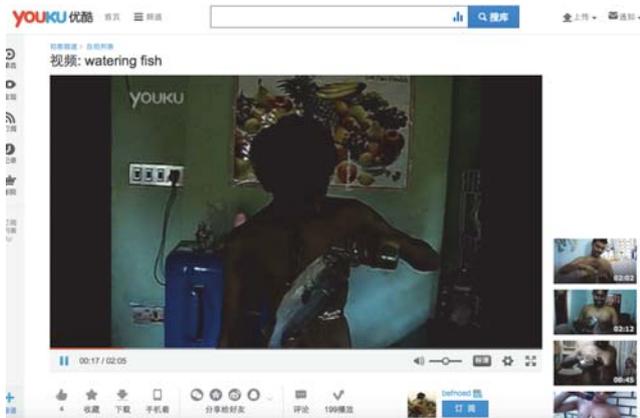
Fig 2. *BEFNOED* 2014, Eva and Franco Mattes, Video.

In 2014-2015 the work was commissioned by the Postmasters Gallery (NY), Philip Feldman Gallery at PNCA. Videos were screened at the gallery and presented as a video installation. Performance "The Rude Dude" was presented at the LISTE – Young Art fair (2010).

Another example of the "affected image" is Martin Kohout's *Moonwalk* (2008). The video (Fig. 3) replicates YouTube's interface infinitely unfolding on the YouTube screen. The YouTube control bar appears on the screen multiple times eventually blurring when the video ends. While the video was shortlisted in the YouTube Play exhibition at the Guggenheim (2010), it is still questionable if the artwork can and should be shown on the platform other than YouTube and small screen. On the other hand, the display mode used by the Guggenheim curators amplifies the video's reference to the YouTube and the mass media omnipresence.
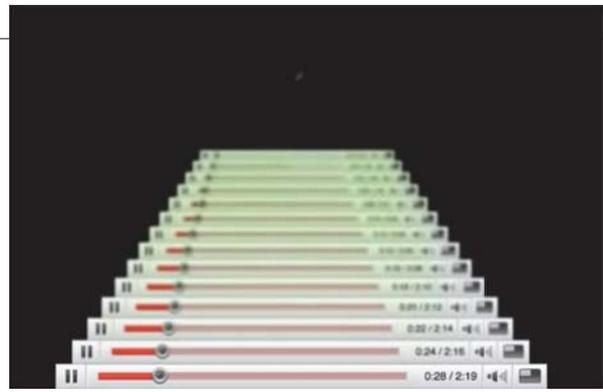
Fig 3. *Moonwalk*, 2010, Martin Kahout. Video

Mimicking Digital Errors

Valie Export's famous performance "Touch Cinema" (1968) exploits female body as an interface, though giving the artist a leading role in controlling the time for interaction. The artist performs on Munich's crowded Stachus Square. She uses a cardboard box located on her body. A box represents a mock-up of a cinema theatre where the viewer is invited to open the box and touch the artist's body. Another performer is inviting the audience to participate in this activity. It is the dichotomy of the vulnerability of the nude female objectified body while the artist stays in control of the time one is allowed to touch the artist's body. An integral aspect of documentation is to capture the crowd, show the live audience the chaos of the performance surrounded by crowd. Camera captures a close up of a young woman walking; it follows a man approaching the artist and zooms in the megaphone. The editing is very basic and plays an arbitrary sequential role.

Remakes of "Touch Cinema" as well as "Homomeeter 2" (2000) performed by Valie Export Society mimic the aesthetics of the original video. Following Marks' argument, it becomes obvious that the video looks as if it was produced in 1968. In "Touch Cinema" (2000), camera captures the performers walking in the streets of Tallinn, approaching the passersby. Recorded at night, the images are quite poor and grainy which, in this particular case, adds to the feeling of alienation. The presence of megaphone in the empty dark square loses its meaning as well as liveness of the act compared to the original performance of 1968. In one sequence (5:42 min), the camera captures a crowd of people approaching the performer. Shaky camera, blurry image and audio disturbances combine the liveness of the performance with "the shock of indexicality" [11]. This sequence emphasizes the evocative and thrilling appeal of bodies materialized in front of the cameras and the conscious use of degraded aesthetic to capture those.

Videos by the Valie Export society are available on YouTube and have 2520 and 8539 views for the "Touch Cinema" and the "Homomeeter 2" accordingly. Apart from YouTube, the videos are available on dailymotion.com, video hosting available in 35 countries. At the same time, videos are available for registered members of artfacts.net, a professional database featuring more than 25 thousands artworks.

The Poverty of Video Art Documentaries

Nina Gerlach in her discussion of museal exhibition of online videos refers to the *interconicity and post-digitality* of the video [10]. While we suggest to not analyze the intermediality of video per se, this approach leads to a discussion of genre aesthetics appropriation. Referencing documentary, contextually and aesthetically, Lisa Byrne's "Taxi III - Stand up and Cry Like a Man", 2007, is a collage of short interviews with taxi drivers in Ireland. Similar to Martin Kahout's video, Byrne's artwork was selected by the YouTube Play jury and screened at the Guggenheim [10]. Byrne's work is one of the examples how the poverty of image is a reference to certain social conditions and events.

F*ig. 4. Taxi III. Stand Up and Cry Like a Man. 2007.* Lisa Byrne.

The video (Fig.4) features the interviews with taxi drivers, sharing their memories about the paramilitary attacks in Northern Ireland. Building a bridge from the past to present, Byrne uses low-fi digital camera to capture the drivers in their cars from various angles, sometimes partially or completely hiding their faces. The style replicates both the documentary and amateur genres. The YouTube version is only 480p resolution. However, it was screened on the huge HD displays during the YouTube Play showcase.

Conclusion

Exhibition and reception of online video art is still a challenging theme for curators and conservators. While the change towards online video curating has been undertaken in the last several years, it remains neglected by the majority of institutions. HD video is a dominating mode both for the production of video and for museum acquisition of these works [25]. Sharing an aesthetic similar to that of amateur footage that flourishes online, the artistic and cultural value of online-based video art is thus questioned. What is referred to as self-inventing, online video art distinguishes itself from other media imagery, thus forming a self-distinctive area of aesthetics [10].Online video imperfections are crucial to understanding this area. Poverty of the video particular to the media and distribution mechanisms require

curators and media theorists to come up with strategies for apprehending, producing and distributing online-based video art. The importance of preservation of the online-generated aesthetics lies in its fundamental self-referentiality. Precarity and poverty of networked digital videos point to the conditions of contemporary economy when the boundaries between life and art are merged, thus creating fertile soil for amateur image production and consumption. The key concepts and affordances of the online video art include imperfect image manifested in motion blur, technology failure, poor image as an expressive technique, and image marked by the distribution and compression.

BEFNOED by Eva and Franco Mattes emphasizes digital video properties and active viewers participation both conceptually and contextually. Therefore, the exhibition strategies for curators are very limited. Moving the videos from online platforms to onsite distorts its cultural complexity. The use of low-fi technology makes videos easier to produce, edit and embed. Instead of attempting to clean the image and eliminate the noise, its offsite presentation often distorts its meaning and decreases its validity. Similar to BEFNOED, videos by Philip Huang and VOINA represent the complexity of camera work by preserving the videos' authenticity and using minimal editing techniques. This complexity lies in the socio-political demarcation of online-based video art. Precarious aesthetics of online-based videos is the aesthetics of the socially invisible. Precarity and imperfections of these videos represent the fragility of the cameramen and performers and exposure to social and political contexts. *Moonwalk* is a critique of YouTube as a dominant video archive through objectification. Showing the familiar to the spectator YouTube control bar, the video is a metaphor for the obsession with the mass media production and distribution mechanisms.

Video artworks we have discussed in this paper position themselves in between contexts and domains thus making a critique of contemporary exhibition and exposure strategies, and the digital culture within which they are embedded.

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Plasticity and Feedback:
Schemas of Indetermination in Cybernetics and Art

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Abstract

The paper addresses the problem of representation of the processes of change in dynamic systems, specifically focusing on the mechanisms of feedback and plasticity. How adequately can diagrams and schemas explain temporal relations and predict behavior in exceedingly complex systems? How can we know and render visible what happens in between the discrete moments in which decisions are made? How does the material medium of signal transference affect the resulting mechanisms and schemas that represent them? The aspect of representation forms here a special tension with what Andrew Pickering (in reference to cybernetics) names performative epistemologies and ontology of unknowability. In this paper I explore the ways of describing the mechanisms of signal transference and feedback loops in three different types of systems – neuronal network, electro-chemical assemblage, and live organism, each of which represents different scale and principles of biophysical organization. In particular, I consider Warren McCulloch's diagrams of neural circuits, Gordon Pask's and Stafford Beer's experiment with chemical computers developing new senses, and a work by a Russian art collective "Where the Dogs Run", in which the activity of a live mouse in a labyrinth is determined by the movements of its virtual doppelgangers.

Introduction

In this paper I concentrate on the concepts of feedback and plasticity as lenses for exploring processes of self-organization and decision-making in systems as diverse as neuronal circuits, an electro-chemical assemblages, and live organisms. By examining closely the nuances of their work I aim to demonstrate the potential of these concepts as analytical tools applicable to broader humanistic research. The initial connections within cybernetics between computational and cognitive sciences have proven their implications for psychology and wider social sciences; whereas the studies of plasticity within neuroscience have stimulated discussions in the humanities about the political and ethical connotations of the brain's ability to repattern itself. For instance, as acknowledged by Catherine Malabou, the adaptive and relational nature of neuronal structures (e.g. Spike-Timing-Dependent Plasticity, or STDP) may be instrumental in the transformation of the conception of the self as a fixed entity towards understanding of it as fluid and plastic, with a potential for creativity and freedom. [1] Yet, this provokes many questions, such as: What and where exactly is (if at all) a "self", or "subject" of change in case of neuronal

activity? How to represent the dynamic process in a static image? And more generally: How does the material medium of signal transference and its spatial conditions affect the resulting mechanisms and schemas that represent them? I propose to address these questions by comparing cases of visual manifestation of dynamic relations in cybernetics research (Warren McCulloch's diagrams of neural circuits, and Gordon Pask's and Stafford Beer's experiment with chemical computers) and media art ("1, 4 ... 19" by "Where the Dogs Run"). But first, let us take a closer look at some of the most critical aspects around the issues of feedback, plasticity, control, and representation.

Feedback as Enactment of Plasticity

Human brains, live organisms and artificial systems are independent complex domains, different in scale and constituting elements, yet they can be related, particularly in terms of behavioral and adaptation mechanisms, issues of agency, control, and – what is most interesting for me here – decision-making processes. It was the study of feedback that initially allowed scientists to approach neural nets as trainable machines, and thus to create parallels between the realms of the organic and the artificial, modeling the latter after the former. Feedback, communication and control were the central interests of cybernetics; and one of the main goals of comparison of these processes in living organisms, machines and organizations was to reveal the capabilities for learning and self-management.

These systems were interpreted in terms of the *epistemic autonomy* of their behavior, i.e. ability to develop qualitatively new functions without external guidance. It is epistemic because it reflects decision-making, or "thought" processes that occur during feedback loops. In cybernetics, it was the "margin of error" that was needed to correct the behavior, and in that case the feedback is called negative, i.e. "the signals from the goal are used to restrict outputs which would otherwise go beyond the goal." [2] The behavior is considered a "non-feedback" when "there are no signals from the goal which modify the activity of the object *in the course of the behavior*". [3] The principle of feedback loops is, thus, the basis of algorithmic processes as decision-making mechanisms that are first of all time-based. [4] Another important aspect raised by cybernetic theory is the relation between the

information (a "thought") and its medium, the chains of "decisions" and the material of their implementation. Either in case of neuronal, or electrochemical activity (the growth of metallic iron threads between electrodes in Pask's experiment) the "decisions" are made and corresponding events happen within the matter itself. Information – in a form of electrical signals – does not serve here as a purely abstract concept of exchange, but rather as an instigator of simultaneous individuation of both thought and matter. [5] This view is the opposite of the dominant definition of information as a signal, formalized by Claude Shannon and Norbert Wiener, who conceptualized it as an entity distinct from the substrates carrying it. [6] The material, embodied, situated and performative qualities of information and its transference is (once again) a subject of vibrant discussions in today's media studies, computer science and cognitive neuroscience. Likewise, self-organization theory does not only imply abstract algorithms, but is materially grounded.

Feedback is an operational principle and describes not a static, but a dynamic relation: it has to be enacted. There is an element of dialectics in this statement that may be critical for understanding the ontological dimensions of self-organization and plasticity - the processes that take place prior to their evaluation by an external observer. The notion of "principle" assumes certain pre-determined connections that can also be called virtual (from *virtus* – strength, potential, something existing in potential, not actuality). These virtual, or potential connections can, then, be either actualized/realized or not. But how to discover the hidden, not-yet-realized qualities? How to describe them scientifically and visually? Aside from mathematical graphs, what are the other forms of representing all the possibilities at once? What is the difference between existing in potential and in actuality and how does it matter for thinking about plasticity, self-organization, and the "self"/ "subject" itself?

The word "plasticity" etymologically derives from "plastic", from Greek *plassein,* "to model" or "to mold". As an adjective, plastic means "to be susceptible to changes of form", or "to be malleable", i.e. capable of receiving and of giving form. Form itself is the potential "other" that the initial substance can "take on" or become. "Taking form" is similar here to "organization": to acquire an observable structure that keeps an entity (or "whole") in balance. Form negotiates the liaison between the inside and the outside and maintains the integrity and internal cohesiveness of the structure. As Catherine Malabou shows, the concept of plasticity – as describing transformation of form – challenges the relationship between "self" and "other": "plasticity renders possible the appearance or formation of alterity where the other is absent... Plasticity designates the form of a world without any exteriority." [7] The "other" is already within the "self', and only needs to be triggered in a certain way to reveal itself.

The "other" plays a role in feedback relations only if the self can recognize it as such and respond to it, and

in this sense it should be already a part of the self. As Lacan points out, "This discourse of the other is not the discourse of the abstract other, of the other in dyad... it is *the discourse of the circuit in which I am integrated*. I am one of its links." [8] Hence, feedback helps us to re-envision the concept of the self – to see it not as an entity, but a circuit, a set of flexible links, both actual and potential. The concept of the circuit, similarly to plasticity (in some way), helps to surpass the classical dichotomies of subject-object relations and the principles of power dynamics imbedded in them. Instead, it may offer a form of organization and more flexible and inclusive structuring.

This brings us back to the question of how to describe and represent these links, especially those that are not easily predictable and not yet activated. In the case of dynamic processes, there are models and simulations. But a simple, more schematic version is also offered by diagrams. A diagram is a form of notation, a type of registering information in a visual form, located in between word and picture, and thus, according to James Elkins, in between *poesis* and *pictura*, inscription and figure, coded and uncoded, discourse and figure, the attenuated and the replete. [9] Each of these poles represents a certain logic, structure, and dynamism. Diagrams follow rules and their schematism gives us a sense of transparency and rationality. Diagrams can be orderly, elements are not connected to everything else, but only to certain elements, there is a hierarchy, arrows or no arrows in the connecting lines. Most importantly, they can represent temporal relations, slicing up the flow of time onto discrete events. Yet, the challenge with representation of self-organization and plasticity processes is to capture the entanglement of past, present, and future that is so key to them.

Integrated Subjectivity of Neuronal Circuits. Neuronal Neuroticism

This challenge is vivid in the diagrams of neuronal activity, particularly in those by psychologist, neurophysiologist and engineer Warren McCulloch. Like other cyberneticians, he was interested in creating mechanisms based on psychic structures, but unlike others, he treated them first of all as "existential objects" – confused, delusional and neurotic. The case of McCulloch is interesting because he was one of the first to explore the nature of neural activity from psychological/ psychoanalytical and ontological/ existentialist points of view. McCulloch's method of investigation, which he termed "Experimental Epistemology", involved understanding of each model "as lively in its own manner, as a different species, posing the question of different forms of life and knowing to different circuits." [10] (In a way, his approach was a precursor of the restraint from predispositions towards research objects in today's science and technology studies, inspired by Latour and Haraway). In 1943, together with Walter Pitts,

McCulloch co-authored a paper "A Logical Calculus of the Ideas Immanent in Nervous Activity" that became seminal in the field of neural nets. There, they proposed a series of diagrams that depicted the process of neuronal firing, emphasizing the temporal relations between individual spikes and showing the complicated nature of decision making activity of the neurons.
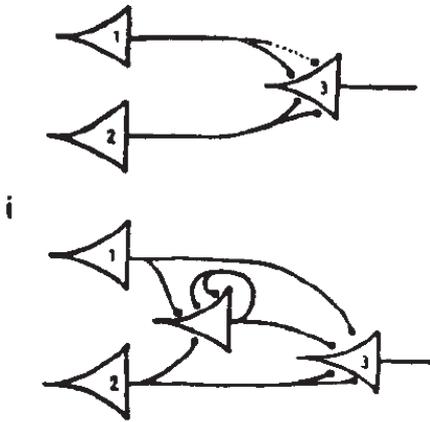
Fig. 1. Firings in the "memory neuron". Source: Warren McCulloch, Walter Pitts, "A Logical Calculus of the Ideas Immanent in Nervous Activity," 1943, 128, fig. 1.

Indeed, contemporary theories of neuroplasticity confirm that plasticity in biological nervous systems is "dependent upon the spike-timing activity in connected neurons." [11] That implies the crucial role of the temporal order of pre- and post-synaptic spiking for the resulting longer term effects, such neuronal rewiring – strengthening or weakening of connections between certain neurons and sets of neurons, and even formation of new synapses (which is ultimately the neurological basis for continual learning and adaptation).

McCulloch's examples include a memory neuron (fig. 1) that, once activated, keeps firing itself in every subsequent time state in order to stay activated. Continuation of action depends on what happened before, which in this case means a circular process. In his analysis of McCulloch's work, Joseph Dumit emphasizes the temporal logic of the neural processes: "One of the key properties of a nervous net is that looked at from outside, they are deterministic forward in time, but undetermined backward. That is, given the state of a net at time T, the state of the net at time T+1 is predictable (to a certain degree). But the state of the net at time T-1 is not. In the case where two different neurons could have caused the action, the previous state might have been either one. A third possibility is that there was a misfiring." [12] The order of firing events cannot be re-created according to linear logic, i.e. cannot be backtracked. One can know with certainty only the state of the neurons in the present moment, but not the exact details of the past that led to it. In case of the memory neuron, the circular action "'represents' a memory, not of the time it was activated, but only of

having been activated at some *indeterminate* time in the past" (emphasis added). [13] It is a signifier of 'the past in general'. What this example shows is that if the details of the past are not be fully reconstructable, the event cannot be reproduced with accuracy and certainty, meaning that each constellation of events in a way is unique.

Moreover, this example brings up an original understanding of subjectivity. Can an entity that, apparently, does not have a traceable memory be considered a subject or agent of action? Are the circular firings enough to constitute its "whole"? According to Dumit's interpretation (that also takes into consideration Lacan's question about the subject in the circuit), this neuron diagram shows that "the subject is the gap in time between the two states, traversing them: the circles are signifiers, the subject represents the signifier to another signifier, repeatedly. The subject is in the circuit, integrated." [14] This means that subjectivity is more about the connections, rather than an entity; an intertwining of the potential and the actual, rather than what has happened and what can be backtracked. The complex temporal logic of the memory neuron's firing complicates the initial Lacanian conception of the subject integrated into the circuit, since the circuit itself is constituted by order of events and not their co-dependent pre-givenness. The repetition of the firing can indeed be perceived as a neurotic behavior, an expression of some existential hesitation, a form of neurosis. The "subject" of the circuit can also be understood as the one defining the "truth" or "falsity" of a signal (every signal is "on" or "off", but it is not the same as "true" or "false", which depends on the subject's opinion). Each part of a circuit is therefore in a sensory relation to another part and produces *judgment* about it (upon which the subsequent decisions would be made). "True" can mean "real", or "valid" and be opposite of hallucinatory, illusionary (the signal does come, but it is not taken as "real"/ "meaningful"/ consequential). [15] This also constitutes specific "experience" of both the individual neuron and a network that it is engaged in; this experience, in its turn, directly affects the adaptation and plasticity processes. It may be impossible to avoid neurosis and hesitation completely, but they are natural steps on the way of re-organization of the self.

Marking Transformation. Material Traces

While the case of McCulloch's diagrams features an attempt to describe idealized neuronal firing from an existential, or "subjective" point of view, the experiments of another well-known cybernetician, Gordon Pask, deal with plasticity in autonomous electrochemical assemblages. Both neurons and Pask's "organic computers" (or "chemical", according to Pickering) are materially organized, but the ways in which their dynamic workings can be depicted/ grasped/ captured are different. As we could see,

neuronal states cannot be backtracked, whereas in case of Pask's assemblages each stage of their growth processes manifested itself materially, leaving a trace that serves as a direct evidence of the occurrent events.

Pask is known for his advocacy of more naturally (not only algorithmically) adaptive mechanisms of self-management in complex systems. According to him, these mechanisms could be discovered in any medium that would satisfy a "high-variety" criterion – a concept derived from Ashby's argument that "a controller can control an environment only if it has variety in its states greater or equal to the variety in the disturbances on its inputs." [16] This goal went along with the general goal of cybernetics (termed by Ashby as Descartes' Dictum): to design a device that outperforms the designer him/herself. Along with other cyberneticians, Pask also agreed that the "performance" of a device would reflect its own autonomous thinking, or capacity to adaptively construct its own perceptual categories and its own means of implementing changes in the world. Yet, he put a special emphasis on organic principles of evolution of sensory modalities, their "growth". As Pask described it, "a thinking process both builds up and employs conceptual categories. These categories are defined in terms of attributes which may be common to a number of objects in the environment, or to other categories or to both. ... Objectively the categories are not clear cut, and decisions appear to be made between imperfectly specified alternatives. ... The overall process is the growth of a concept," that can be equaled to a process of finding a "labile category." [17]
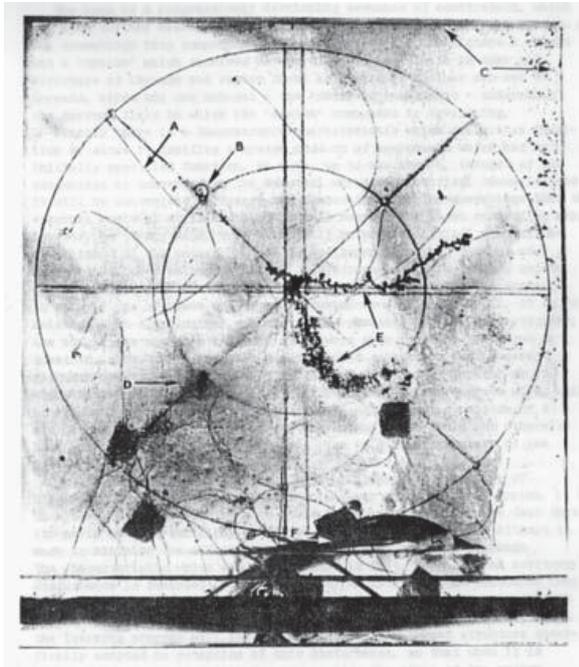
Fig. 2. Threads growing in a chemical computer. Source: Gordon Pask 1959, 919, fig. 12.

Through the early and mid 1950's Pask experimented with electrochemical assemblages, passing current through various aqueous solutions of metallic salts (e.g. ferrous sulphate) in order to construct an analog control system (fig. 2). The main difference of such a system from others in existence was that its design would not be pre-specified. As current is passed through the electrodes, filaments of iron (or "threads", as Pask called them) grew outward from their tips into the liquid between electrodes where maximum lines of current were flowing. [18] "These metallic threads have a low resistance relative to the solution and so current will tend to flow down them if the electrical activation is repeated. Consequently, the potentials at the electrodes are modified by the formation of threads. If there is an ambiguous path, then a thread can bifurcate. As the total current entering the system is restricted, threads compete for resources. However, when there are a number of neighboring unstable structures, the threads can amalgamate and form one cooperative structure. Over time a network of threads literally grows dynamically stable structures." [19] These electrochemical systems, thus, display an elementary form of learning. The "reward" consisted of an increase in the current supply, a form of positive reinforcement. As Andrew Pickering puts it, "the growth of the thread structure exhibits a path dependence in time: it depends in detail on both the history of inputs through the electrodes and on the emerging responses of the system to those. The system thus has a memory, so it can learn." [20] The "threads" are unstable: they grow in regions of high current density but dissolve back into solution otherwise, and they are unpredictable. And yet, over time the system as a whole develops abilities to recognize patterns of the current flow and respond to that.

In one of his most famous and intriguing experiments – one which can perhaps be seen as a precursor of "deep learning" – Pask tested how the "computer" would react to sound. It was conducted in 1956 (or 1957) together with Stafford Beer. A microphone was held out of the window to collect the street noise and "feed" it to the computer via electrical current. In response, the "machine" "grew an ear" and acquired new sensitivity to magnetic fields. Beer vividly recalls the night of that experiment in his memoirs. The decision to check the response to sound came during the discussion of Ashby's concept of ultrastability and the ability of machines to adapt to unexpected changes. As Pask described it: "We have made an ear and we have made a magnetic receptor. The ear can discriminate two frequencies, one of the order of fifty cycles per second and the other of the order of one hundred cycles per second. The "training" procedure takes approximately half a day and once having got the ability to recognize sound at all, the ability to recognize and discriminate two sounds comes more rapidly. [...] The ear, incidentally, looks rather like an ear. It is a gap in the thread structure in which you have fibrils which resonate at the excitation frequency." [21] The

experiment was significant as, according to Beer, this "was the first demonstration either of us had seen of an artificial system's potential to recognize a filter which would be conducive to its own survival and to incorporate that filter into its own organization." [22]

The "ear" experiment is illustrative of Pask's method, which is also similar to McCulloch's "Experimental Epistemology", with the only difference that it does not stop at the observation level and includes more active participation of the researcher. The observer, in Pask's case, creates change by intervening into the initial processes. The metallic threads can be seen as both graphical, representational and live, performative entities. This methodology, thus, goes well with Andrew Pickering's idea of performative ontology: "we should understand science not as a body of representations of the world, but as a mode of performative engagement with it." [23]

This experiment also helps to address in a new way the question of the self in the circuit: the circuit will have to include not only input-output relations, but also the observer/ researcher that sets the parameters of the experiment (even in minimum way). The observer becomes a part of a larger self, and hence the whole question can be reverted: it is not the observer having impact on the system, but the system "absorbs" his/her actions, offering a feeling of wonder and excitement at such a collaboration. There are also still questions, such as: how an external observer determines when a device or agent has acquired a new sensory modality/ "perceptual concept" (the problem of recognizing functional emergence); what the self-constructing, epistemically autonomous ("organizationally closed") observer-participants and their networks be like. [24]

Fate of Tricking the Fate

The discussion of the observer effect helps us to transition to the third case – an artistic installation "1,4 ... 19" (2014) by "Where the Dogs Run" collective (fig. 3, 4, 5). Art sets up another approach, other than scientific one (observations of neuronal behavior by McCulloch), or more pragmatic and applied ones (in the end, Pask's goal was to use the "organic computers" for managing real factories). Using similar principles – creating and observing self-organizing systems – art more than any other field emphasizes aesthetic parameters as an investigative tool. In addition to the sensations of surprise and wonder, artists attempt to evoke and cultivate more complex "existential" feelings. Often, as in the case of today's interactive art (which is part of the longer history of "cybernetic art" proper), the viewer is invited to participate in the behavior of a system. [25] The effects most worthy of discussion are usually not the straight-on excitement, but confusion, perplexity, and new questions (utterable and not).

The work by the group "Where the Dogs Run" collides the virtual into physical reality, and thus makes

us return to the issue of matter-form-information interaction and the ontological, epistemological and aesthetic effects it produces. "1, 4 ... 19" features the interaction between the movements of a live organism, a mouse put in a labyrinth with controlled dynamic structure, and its virtual doubles that embody the decisions that the real mouse did not make. The movement of the mouse is followed by a camera. Every time it makes a turn, its virtual doubles make the opposite decision. To prevent the "collapse" between the real and a virtual mouse, labyrinth's corridors can be closed (the real mouse runs into real walls that appear in response to the movement of the virtual mouse). The system is constructed to demonstrate the presence of the unrecognized dimension of the alternative possibilities to all our everyday actions. What does it mean to make a decision? What does it involve? What happens if you simply avoid/ await making it, and linger in the in-between zone? The observations of two different mice' behaviors showed that indeed, the more experienced one figured out the ways to trick the control mechanism by hiding in the corners or simply sitting still (in that case the virtual mice do not appear and all her movement options through the maze are open).
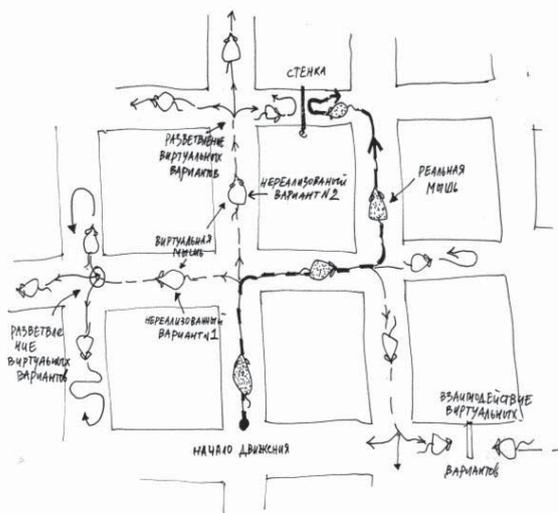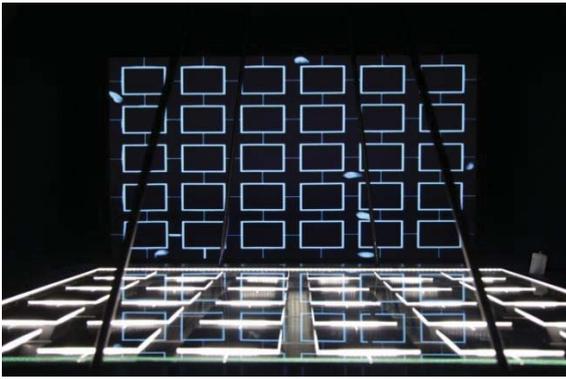
Fig. 3, 4, 5. *1,4 ...19*, 2014, Where the Dogs Run, mixed media. Courtesy of the artists.

Virtualization serves here a role of an enacted diagram – a model answering a question "what if?" put in action. The screen displays a simulation of a possible course of events. It is both a doubling of the existing world, and its expansion: making visible the invisible, activating and playing out the potential scenarios. The simulation here informs the real right away, and in this sense it is not a predictive model. The interaction between the virtual and the actual is continuous. This process can also be read along the lines proposed by a German philosopher Vera Bühlmann in her analysis of the ontological aspects of modeling – as "creative management of the frame of reference within which 'something' takes up its specific meaning." [26] The virtual model itself becomes literally a "frame of reference" for the real mouse's actions, and the meaning is what the mouse makes of its own experience in this system. Each individual mouse can interpret the "on" and "off" (open and closed doors) signals in its own way, as "true"/ "false", "relevant" or not, with its own behavioral consequences.

"1, 4 ... 19" shows an interplay between a situation that is unfolding in a given time and space and is observable by the third parties, and the processes that can possibly be happening in the mind of a mouse – the logical calculations that are presented as the doppelganger mice movements. This subjective processing is objectified; the whole future "fate" is laid out on a screen. But the logical schema is not only a representation, but an enactment of the relationship between the layers of the real and the virtual (the *possible* course of events). The real events are immediately translated into a logical algorithm and played back in a form of other real events (closing walls), provoking the mouse to adjust its actions and to think of the consequences of every move. Observing this process, the viewer is also caught in the moment of translation, attempting to imagine the connections between the events before they actually happen, i.e. to anticipate the movements of the mouse, almost to live through this experience *for* and *with* it. This challenge of *imagining through an experience* is what makes the artistic strategy special. The viewer-observer is not only a reference point (as it is in Pask's experiment), but a valid experiencing subject – troubled, disoriented and in search for solutions, together with the animal in the maze. The diagram of possible courses of events drawn on the screen is not a precise mathematical model, but rather an intuitive imaginary version of multiple parallel realities coming together. The algorithm behind the model includes both calculable statistical factors and the parameter of randomness. The latter can also be compared to the indeterminateness of the neuron's stimulus – if one attempts to reconstruct it – in McCulloch's example. The 'circuit' here has its 'gaps' too, and they remain there to be filled by the acts of the viewer's imagination (along with the effectively active mouse).

What is the meaning and status of the pathways of the virtual mice? Can they be read as traces, and do they help with predicting what would happen next? Multiple lines filling the passages of the maze on the screen are not marks of the past, but alternatives for the movements happening in the present. Thus, they compress in one image past, present and future – all at once. Yet, their role is different than of the arrows in McCulloch's diagram, which shows firings that took place in some speculative, indeterminate, but past. It is also different than the role of metallic threads in Pask's experiments, where electro-chemical constellations "train" the system over time, again – by taking place over and over, and eventually becoming a past. To be more precise, the 'traces' in "1, 4 ... 19" are represented by the video-images of virtual mice (edited recordings of live mice running through the same corridors), i.e. they are not only vectors, but alternative beings, convincing of their realness. The diagrammatic 'schema' of potential actions is shown here in a form of a video – a mirrored image of the real labyrinth structure. This is another technique that produces a very particular aesthetic effect – the surrogate non-actual realities *feeling* real.

It is relevant also to return to the question of the subject of action and how to define it in this case. Is it an individual mouse, or the circuit – a mouse together with its doppelgangers? Are the virtual mice only the limiting conditions, the "frame of reference", or – as representations of the potential actions for the real mouse in present time – are they visualizations of its mental processing, i.e. its own products? An answer to this question would mark out the overall stand on what exactly the factor of in/determination is – in this work and more generally.

Conclusion

The described systems are examples representing the wide spectrum of how plasticity can manifest itself organically and artificially. Each of them answers in its own way the posed questions about the place of the selfhood, temporal logic, connections between matter and information, virtual and actual, levels of controllability and the role of the observer. In all three

cases considered above we observe relational circuits that – as the people behind them attempt to demonstrate – may be more open, plastic and indeterminate than it seems at first: a neuron firing with more probability if it is activated several times just before that; metallic salts concentrating around stronger flows of electric current time after time; and a live organism trying to apply learned experience to the present circumstances by playing through imaginative scenarios of possible actions. One of the important issues that remains to be explored is the relevance and the potential parallels between the ways of being and experience of the micro-material structures (be it neurons or iron particles) and the human perspective on cognitive processes: how we think we think (including how we think a mouse thinks). Understanding plasticity in terms of its structural qualities helps to create predictable representational models. At the same time, as we saw, not all of them may work ("1, 4 ... 19" is an ironic take exactly on this). Their purpose is not only to predict possible future behavior of a system, but to provoke us to reflect on what it means and how it may *feel* to have a machinic diagram within oneself. These models should find ways of representing openness of the system for participation and allow for performative manifestation of alternative possibilities, i.e. include the dimension of the virtual and the potential as a means to break away from deterministic temporal logic. Experiencing the enactment of such models, then, may already be an exercise of plasticity.

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2. Arturo Rosenblueth, Norbert Wiener, Julian Begelow, "Behavior, Purpose and Teleology," in *Philosophy of Science* Vol. 10, No. 1. (Jan., 1943): 19.
3. Arturo Rosenblueth et al., "Behavior, Purpose and Teleology," 19-20.
4. It is interesting to think of the place of a goal in these processes; cyberneticians (in particular, Ross Ashby) described it as a state of homeostasis, or equilibrium. The difficulty is that if in case of machines this kind of goal can be defined by the very organization and the logic of the machine, in case of a human, homeostasis as a goal may be an obstacle for transformation and transition onto the level of a different state, different logic of organization (especially in case of brain work).
5. Within any system of relationships – and at the base of any individuation (the term of French philosopher Gilbert Simondon) – lies a heterogeneous manifold of potential differences, a pre-individual field of singularities. The tensions of singularities frame a *marge d'indetermination* ("margin of indeterminacy"), described by Simondon as a characteristic in machine/ human creator relationship, a concept that opens towards the broader paradoxes of structural and ontological causality (quantum indeterminacy). Relationships are always relative, never pre-existent. Rather, they emerge transductively through differentiation. An

individual is always within the pre-individual field which was the condition for its genesis, which precedes it ontologically.
6. See Katherine Hayles, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics*. (Chicago: The University of Chicago Press, 1999), xi.
7. Catharine Malabou, *Plasticity in the Dusk of Writing*, 66-67. In her thinking, Malabou follows the arguments of Hegel and Heidegger. For instance, plasticity in Hegel characterizes the internal mobility of the system, and in Heidegger, it relates to "the very movement of being". "In *Being and Time,* he [Heidegger] clearly puts the world in touch with the absence of any outside-of-the-world. Being-in-the-world, existing, amounts to experiencing an absence of exteriority, which is equally an absence of interiority. There is neither an inside nor an outside of the world" (Malabou, 68).
8. Jacques Lacan, *The Seminar of Jacques Lacan, Book II: The Ego in Freud's Theory and in the Technique of Psychoanalysis*, ed. Jacques-Alain Miller (New York: Norton, 1988), 89-90.
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12. Joseph Dumit, "Plastic Diagrams," 227.
13. Joseph Dumit, "Plastic Diagrams," 228.
14. Joseph Dumit, "Circuits in The Brain and How They Got There," manuscript, used with permission, 14.
15. See more in Joseph Dumit, "Neuroexistentialism," in *Sensorium*, ed. Caroline Jones (Cambridge, MA: MIT Press, 2006).
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17. Gordon Pask, "Physical Analogues to the Growth of a Concept," in *Mechanisation of Thought Processes: Proceedings of a Symposium Held at the National Physical Laboratory on 24th, 25th, 26th and 27th November 1958*, 2 vols. (London: Her Majesty's Stationery Office, 1959), 880.
18. "Iron-wire" neural models have been around since the turn of the century. Many of these early experiments around self-organizing devices passed current through metallic structures (iron, tin, silver) dipped into an acidic milieu (sulphuric, nitric acid), generating nerve-like properties. For instance, from 1909 into the mid-1930's R.S. Lillie investigated such properties as a potential model for nervous conduction. "His iron wires in nitric acid propagated electrical disturbances down their lengths, causing refractoriness and recovery in their wake, they had thresholds for initiating these travelling pulses, they could be excited or inhibited by electric currents, they exhibited threshold accommodation and oscillatory, rhythmic behavior." (Peter Cariani, "To Evolve an Ear: Epistemological Implications of Gordon Pask's Electrochemical Devices," in *Systems Research* 1993; 10 (3): 22.) The interplay between the iron-wire physical model and the developing theories of the neuron continued well into the 1950's.

19. Jon Bird, Ezequiel Di Paolo, "Gordon Pask and His Maverick Machines," 190.

20. Andrew Pickering, *The Cybernetic Brain* (Chicago: University of Chicago Press, 2010), 337.

21. Gordon Pask, "The Natural History of Networks," in *Self-Organizing Systems*, ed. Marshall C. Yovits and Scott Cameron (New York: Pergamon Press, 1960), 261.

22. Stafford Beer, "A Filigree Friendship," in *Kybernetes*, 30, no. 5–6 (2001): 555. There is undoubtedly much still to be discovered concerning the malleable electrochemical media that Pask and others used. Today's experiments include immersing an analog-VLSI chip in a medium like a ferrous sulphate solution and adaptively building analog iron structures which would interact with the chip; real neurons are grown in tissue culture over chips with many electrodes on their surface. Once the tissue and organ culture techniques are worked out, there is no reason that powerful adaptive devices could be grown via large scale bio-silicon adaptive assemblages.

23. Andrew Pickering, *The Cybernetic Brain*, 7.

24. Pask proposed organizational closure as one of the constitutive conditions for consciousness: "A process is potentially conscious if it is organizationally-closed, informationally open, and if information is transferred across distinctions that are computed as required to permit the execution of the process." (Gordon Pask, "Consciousness," in *Journal of Cybernetics*. 9 (1979): 214.

25. Cybernetic art can be loosely defined as art concerned with the shared circuits within and between the living and the technological. See more in Edward A. Shanken, "Cybernetics and Art: Cultural Convergence in the 1960," in Bruce Clarke and Linda Dalrymple Henderson, eds. *From Energy to Information* (Palo Alto: Stanford University Press, 2002): 155-77. Accessed on January 4, 2016, http://www.artexetra.com/CyberneticsArtCultConv.pdf

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The Algorithmic as Agonistic Agency:
Approaches on Experimental Design, the Politics of Codes, and Post-Anthropocentric Paradoxes in (Media) Cultures.

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Abstract

This paper presents a theoretical discussion, as well as an experimental design approach to the modes in which algorithmic media influences, in a confrontational manner, the configuration of contemporary cultures. Thus, the first section seeks to introduce key media archeological questions, by displaying some aspects of Wolfgang Ernst's and Friedrich Kittler's work. Then, the second section, is devoted to articulate possible connections between the first section and Bruno Latour's perspective on science and technology studies and their relation to art and design. The third section shows how experimental design approaches can constitute the creative argumentation for all the previously discussed issues, by presenting two case studies that have emerged specifically around the questions that sustain this article. Finally, the text closes with a brief discussion about the possibilities the paper's subject matter has to offer as an area for research-creation.

Technical Media and the Agonistic Condition of Culture

The role of technical media within culture —please allow me to speak in general and abstract terms for now — has always been connected, in one way or another, to the structure and nature of culture itself. Nonetheless, nowadays it seems difficult to find a clear dividing line between the spheres of technical media on the one hand, and culture on the other, and thus really noticing what would be such structure and nature. In that sense, it has been the realm of media studies; and more particularly its branch connected to the method known as media archeology; the one in charge of inquiring about the evolution and development of the assemblies between media and culture along history, showing to us how the latter —cultures—, which originally were built around *languages for telling*, are now confronted to the emergence of logical machines, which at the end, have brought a predominance of *languages for counting* [1]. Thus, by witnessing such collision, we also witness the fundamental aspect of media cultures: their agonistic condition.

Undoubtedly, the symbolic nature of written languages has governed the growth and development of the many cultures that populate this vast planet of ours. In our particular position —from the last southern tip of the Americas—, the perpetual influence of European colonization gave us, for example, the epistolar exchange between the Monarchy and local administrations, the Roman legal system, epic poems as *The Araucaniad*, encyclical letters, annals, enciclopedias, and of course —more connected to the local authenticity— the twentieth century South American poetry and novel. Nonetheless, all of these media, so to speak, are heavily structured by the symbolic code of language, and thus it is how the agency of telling has been the sovereign along the maturation of these modern cultures. In that sense, it wouldn't be nonsense to point out that since culture has been mobilized and developed through media, culture itself would be a media code. But let's reserve this last thought for later.

While the *languages of telling* are unquestionably a central object of modern cultures, it is also true that at the same time, we cannot avoid the fact that in many occasions telling also involves counting. The german media theorist, Wolfgang Ernst, reminds to us about the role of annals in medieval European cultures, which combined the task of narrating stories with the act of counting time, by telling and listing the events that took place in a specific period of time; commonly, a year. Hence, annals were indeed media for telling and counting things, and to a some extent, for counting time as well [2]. As Ernst puts it, many European languages reflected this hybrid possibility: "The conjunction between telling stories and counting time is more than just a word game: verbs like *conter*, *contar*, *reccontare*, *erzählen*, and *to tell*, are testimonies to a way of perceiving realities that oscillates between narrative and statistics" [3]. This is particularly compelling for us since in Spanish, *contar* is used nowadays indistinctly for verbal qualitative expression, as well as for verbal quantitative enumeration. Contrary to cultures where this conceptual hybridity actually corresponds to an archaic use of the words in question, it is to be expected that in South America, where annals are still around [4], the double meaning of the verb *contar* remains in common use.

However, in spite of this hybrid meaning, the reader may agree with me on the following: in modern cultures —and I am referring the Latourian approach to modern here [5]—, every meaning was still processed by the symbolic code of *languages of telling*, that is to say; letters, words, sentences, punctuation, grammar, etc. Therefore, a collision, either important or negligible, between the logics of telling and counting still remained. A confrontation between the agencies of telling and counting, or "zählen versus erzählen" [6] as Ernst has put it. But, just as we all are aware of, that processing balance started to change when electronic machines first, and algorithmic machines later, became part of the code for processing the meaning of people's ideas and actions. Then, cities and their infrastructure were one of the first evidences of this shift, where human expression and the narration of stories moved to a new code materialized by telegraph networks, radio waves and antennas, telephone lines, relays, and receivers, and of course, television broadcasting and the sound-image reproducer. Thus, by abandoning the book, so to speak, human knowledge and culture put an end to the monopoly of writing, while at the same time they gave the city a (new) media quality. In the same way, Friedrich Kittler tells us (ironically) in his essay titled *The City is a Medium* [7], how cities can be understood as media, explaining how technological infrastructure and networks grant cities the power to store, transmit, and process diverse kinds of information:

> What to passers-by seems like growth run amok or entropy is technology —that is to say, information. Ever since it has become impossible to survey cities from a cathedral tower or a castle, and ever since walls and fortifications have ceased to contain them, cities have been traversed and connected by a network of innumerable networks, also (and specially) at their margins, points of tangency, and frayed edges. [8]

What is also interesting at this point, is that a *soft* processing system as the *language of telling* —that is to say, writing— led to a hard technical complex to mediate information, and through that, knowledge. Accordingly, it is possible to argue now that culture passed from being a soft system, to be mainly a material one. That is why, I believe, scholars as Kittler have affirmed that there is no software anymore, by considering that at the bottom, contemporary cultures rest over hardware [9]. And at the end, this is also part of the agonistic or rather confrontational condition I mentioned at the beginning of this essay, because the textual intelligences that gave birth to the old modern cultures, are now constantly confronted by the mathematical processing —that is to say, the *language of counting*— of hardware societies. In other words, "[h]uman beings, having created logical machines, have created a discontinuity with their own cultural regime" [10].

An Object-Oriented Culture

In his book *Reassembling the Social: An Introduction to Actor-Network-Theory* [11], the French anthropologist and philosopher, Bruno Latour, affirms that what has been called *the social* does not exist in the terms through which it has been described so far, but alternatively, that what does exist, are networks of constant associations between actors and the collectives they configure. More precisely, Latour says that those networks and collectives are formed by a very diverse nature of actors, which in no case are only human, but rather, human and non-human. This has been particularly interesting for us because invites to reconsider what society is, by understanding that it is not anymore an anthropocentric complex, or more accurately, that it never was; just as Latour argued in an earlier book titled *We Have Never Been Modern* [12], where he sets up the cornerstone of his critique on the epistemic asymmetries that has governed modern cultures. In sum, Latour's thought points out that the networks of associations shaping society and culture are formed —besides humans— by the natural and artificial spheres, and that inside the latter, objects too must be consider as bearers of agency and because of that, also mediators in the ways we humans know the world.

Consequently, it is possible to sustain a media archeological analysis supported by this Latourian view on science and technology studies too, where objects gain a new quality, becoming a key actor of contemporary cultures. Actually, it is based on Latour's concept of *object-oriented democracies*, that I have allowed myself to propose the idea of an object-oriented culture, as a way to initiate a dialogue with the aspects discussed in the previous section, where Ernst's and Kittler's thoughts have been determinant. Thus, when I say hardware societies, I am of course referring to this attention to objects as the bearers of agencies like the *language of counting*. However, the word bearer should not constitute here a way to confuse the role of objects with that of intermediaries, because under our gaze, and as it was said before, objects must be seen only through the symmetrical lens of post-anthropocentric cultures, for thus being able to recognize their condition as actors which mediate in a direct way on the public affairs [13]. This is so, because when objects become active and permanent actors of societies and cultures, they of course participate too of the political issues that concern to us all.

In an essay titled *From Real Politik to Dingpolitik - An Introduction to Making Things Public* [14], Latour argues in favor of reconsidering political and social structures by including objects and things in the center of any contemporary debate. According to his perspective, we must overcome the modern view which considered that every epistemic event was based on *matters of fact*, structuring thus human knowledge through an asymmetrical and anthropocentric judgement of phenomena. On the contrary, says Latour, contemporary times show that the events that are relevant to us all, are configure by a symmetrical participation of actors where the non-human kind plays an irrefutable role in the way our presence in this planet develops. In that sense, the French scholar points out that *Things* are the central element around which societies and cultures assemble, arguing upon the etymological root of the concept, related to the German word *Ding* whose meaning refers

to the *matters of concern* that shape our interests and the modes in which we gather around what is at issue. This discussion is important, because this *matters of concern* —that is to say, things— are configured in material presence as objects; or in more Kittlerian words, as hardware; sustaining what matters and thus gathering people publicly around them. Hence, the *polis* of this hardware society regains its status as the center of the political and ontological debates, specially if one considers that now the artificial sphere —these objects— has its own agenda, so to speak; that agency based on the techno-mathematical intelligence I have called so far the *language for counting* but from now on, I shall call *the algorithmic*.

Following the aforementioned reasoning, another crucial component of this discussion emerges in front of us; while Latour assures that humans and their interests gather around *matters of concern*, he also says that these reunions do not happen thanks to common and shared interests, but all the contrary, because of the concerns that confront and divide us. This is of course a socio-political argument but also an epistemic one, since it relates to the modes we know things, whose materialization, as I have mentioned already, are objets; and these objects —this hardware— are at the same time the media through which we humans know the culture that shapes our world. Thus, I wonder what if this societies of hardware have installed a dual agonistic condition in culture; first, the one suggested by Latour where things and objects gather us around them because of the divergent interests we have for them, while they still behave governed by agencies that are naturally human —that is to say, ruled by *languages for telling*, as it would be the case of a Republic's Constitution—; and secondly, the one belonging to post-anthropocentric times and somehow suggested by Wolfgang Ernst when he says that logical machines oppose humans own cultural regime [15]. In other words, the one where things and objects behave governed by their own agency —that is to say, by *the algorithmic*— and human differences are not processed naturally anymore, but by the new conglomerate of non-human actors that now process what is at issue under their own terms. Hence, two urban and contemporary events can help illustrating this last scenario. On the one hand, Kittler describing traffic light conditioned junctions, saying that through "the endless changes between green, yellow, and red —or 1, 3-state, and 0— all streams of urban traffic (from pedestrian to public transportation) arrive in a digital format that, moreover, a computer somewhere in the city's CPU clocks" [16]. And on the other hand, my own reference to the many traffic lights around the world that in the middle of some demonstration, have ended furiously damaged by human actors.

Paradoxically, just as we all are aware of, most of these objects —this hardware—, as well as the algorithms that make them to act, have been designed by humans. This has constituted enough evidence for many to insist on arguing in favor of the humanistic and anthropocentric gaze regarding these issues, but at the same time, and following an Ernstian thought about the discontinuities of human's cultural regime [17], it has been also our motivation to pursue a critical approach to

the modes these things are designed. Consequently, I think design must be re-situated now as a highly technical cultural practice with strong epistemic impact, whose value resides in its quality as mediator within the issues I have discussed so far in this essay. In that sense, Bruno Latour's article, *A Cautious Prometheus: A few steps toward a philosophy of design (with special attention to Peter Sloterdijk)* [18] offers a very interesting perspective on how every kind of designer should now reconsider her or his activity, as a constant and critical re-design of the *matters of concern* that affect to us all. In a similar path, the German historian of science and media technologies, Wolfgang Schäffner, has also argued that design's scope should be reevaluated in attention to the contemporary scientific revolution whose main catalyzer —either on the technical or media-epistemic aspects— is design [19]. All this is crucial; particularly after taking into account everything that has been discussed in these pages; because it pushes us, in the end, to understand now design as mode to re-configure science and then culture —or in other words, as a cautious and Promethean form of cultural critique.

Approaches from an Experimental Design Perspective

Although the discussion about design's creative-epistemic possibilities has been around for at least eleven years now, there are not many initiatives explicitly dedicated to develop a systematic research around this matter. A few cases I am aware of, are the Royal College of Arts's *Design Interactions* program, which founded by Anthony Dunne, has taken since 2005 a creative and artistic exploration approach to the modes *matters of concern* are shaping contemporary cultures [20][21]. Similarly but more recently, the *Institute of Experimental Design and Media Cultures* at the Academy of Art and Design in Viena, led by Claudia Mareis, describes itself as a practice-led research group inquiring on the intersections of design, media arts, and the humanities, aiming to develop an informed creative analysis on the *things* that configure media cultures [22]. Lastly, in a more epistemic approach, the *Image, Knowledge, Gestaltung - Interdisciplinary Laboratory* at Humboldt University in Berlin —where Wolfgang Schäffner serves as principal investigator and spokesman—, develops an academic research on the design processes of scientific knowledge [23]. However, and despite the apparent lack of formal and widespread attention to this issue, I think that the media arts communities around the world must be seen here as the critical assembly which for decades has developed research-creation on the ways *matters of concern* and its hardware, define what culture is in these post-anthropocentric times. Accordingly, media archeology scholars have explicitly looked to this field to find their creative research counterparts [24], while science and technology academics as Bruno Latour did similarly by founding the *Programme of Experimentation in Arts and Politics* [25], and collaborating with Peter Weibel and ZKM.

Then, it was reasonable for us to follow the same path, by setting up in early 2013 a research-creation group

named *Design and Agonism*, which; paying special attention to media studies, STS, and political sciences; allowed us to pursue a critical inquiry on the modes algorithmic media relates to designed things, and then, on how they together link to agonistic agencies. Thereby, we founded a group whose main project led us to ask first, if *the algorithmic* could influence *matters of concern* and their hardware beyond its own electro-mathematical materialization; and secondly, if that was the case, asking to which extent it would be possible to argue that *the algorithmic* is an agency in the epistemic sense. For doing so, we developed a long bibliographical discussion which to some extent I have presented in the two previous sections; and at the same time, we carried out a creative speculation which at this point has two case studies which have seen the light of prototyping. In the following paragraphs I will briefly present some considerations about them.

The first prototype is called tentatively *Radio-mnemonic Capsule*, and was installed for an entire day on a pedestrian public walk in Santiago, Chile. As its name suggests, it consists of a 2.5 meters high cylindric capsule which can hold one person inside, who can use a periscopic device to watch the urban landscape in 360º, while he or she talks through a radio transmitter to broadcast his or her words to the near surrounding. Outside, six audio pedestals over rails receive and play the radio signal, while passers-by have the chance of hearing the narration and moving the pedestal closer to the capsule (Figures 1, 2 and 3). A relevant aspect here is that the whole situation is loaded with confrontational agencies in advance, since the pedestrian walk points directly to the presidential palace and it was a privileged witness, so to speak, of the coup d'état in 1973. Also, our plan considered to invite people who actually lived those events, to enter into the capsule. Thus, the purpose of this prototype is to see if the *language of narration* is somehow affected by the electro-algorithmic mediation (*zählen* vs *erzählen*), and if that technical mediation plays any kind of role in the agonistic environment that would be at issue.

Fig 1. *Radio-mnemonic Capsule* in Santiago, Chile, January 2016. Wood, fabric, mirror, radios and electronics. Image from the authors's personal archive.

Fig 2. Woman listening to audio pedestal. *Radio-mnemonic Capsule* in Santiago, Chile, January 2016. Wood, fabric, mirror, radios and electronics. Image from the authors's personal archive.

Fig 3. Woman uses optical mechanism at the interior of the capsule. *Radio-mnemonic Capsule* in Santiago, Chile, January 2016. Wood, fabric, mirror, radios and electronics. Image from the authors's personal archive.

The second prototype, named *Nature ex-novo*, consists of a so called book-bound apparatus that relates, on an agonistic manner, to the atlases from the Scientific Naturalism period, which had huge influence in the definition of the natural and political margins of South America's early republics. So, the prototype is a bound hard-case, that holds a set of paper field notes in the middle, as well as two compartments for storing and classifying seeds (Figure 4, 5 and 6). Both sections, while in part recall the cartesian nature of their original references, also seek to subvert that intelligence by adding elements that bring a more symmetrical relation between the natural and artificial spheres. Hence, for example, the field record cards have been redesigned to include more qualitative information, while the compartments incorporate a Voronoi diagram shaped division to hold the seeds just as they are. In sum, this prototype's goal is to ask to which extent the materialization of *matters of concern* —that is to say, objects—, plays an actual political and epistemic role in the configuration of culture.

Fig 4. *Nature ex-novo* prototype in use at the country side near Santiago, Chile. General view, January 2015. Acrylic, 3D printed PLA and paper. Image from Adolfo Alvarez Dumont's personal archive.

Fig 5. *Nature ex-novo* prototype in use at the country side near Santiago, Chile. Detail of seed container, January 2015. Acrylic, 3D printed PLA and paper. Image from Adolfo Alvarez Dumont's personal archive.

Fig 6. *Nature ex-novo* prototype in use at the country side near Santiago, Chile. Detail of field record cards, January 2015. Acrylic, 3D printed PLA and paper. Image from Adolfo Alvarez Dumont's personal archive.

Possibilities

Both of these prototypes have stayed so far in a speculative realm, and any sort of conclusion should wait for further analyses and complementary conceptual and theoretical discussions; which, I hope, will be part of the creative and/or academic work carried out by members of the *Design and Agonism* group in the near future. However, at this point we have wanted to begin this dialogue, where research and creation simultaneously, have helped us to start a critical inquiry on the modes

media and designed things participate in the configuration of post-anthropocentric cultures. In that sense, we are certain that research-creation understood as a method of cultural critique, can help designers, architects, artists, as well as other creative actors, to actively participate of some of the debates that I have wanted to present through these pages. Similarly, this method offers also the opportunity of interacting with the questions that the media archeological field, as well as the science and technology studies have brought into discussion during the last couple of decades. Moreover, I truly believe that research-creation processes as the one made by us, show that experimental design procedures have all the potential to become the material reconfiguration of the theories and principles set up by the aforementioned areas.

Furthermore, this paper does not end with conclusive evidence to prove that *the algorithmic* is in fact an agonistic agency, and of course, this has not been its purpose either. In the end, all the conceptual and theoretical discussion presented in the first part of this essay, allow at this point, only asking if the underlying questions are consistent enough and worth the effort being studied. Thus, in my opinion, the experimental design approach is then a way to physically confront the many modes of existence those questions can take, which of course, relate in a direct way to the impact they may have in the societies and cultures we are embedded to. Taking that into account, and just as it was mentioned above, *the algorithmic as agonistic agency* must be considered not only as valid, but also as an urgent research and creative subject matter.

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'The Familiar': technology-being-with-us

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Abstract

Digital technologies pervade contemporary life, so much so that the boundary between the physical and virtual world has become increasingly blurred as digital technologies are embedded 'seamlessly' into our constructed environment. Consequentially, our awareness of the presence and tangible qualities of computational systems disappears as these technologies merge inseparably with physical reality. This phenomenon is a direct consequence of *ubiquitous computing*. In this paper we investigate how cultural perception influences the ways we understand and approach the application of ubiquitous computing and its related technologies – such as electronic sensors, camera vision and radio frequency identification (RFID) – in creative practice. Through attempting to articulate the conditions that give rise to a distinctively 'Western' apprehension of digital media, this investigation aims to establish a basis from which an alternative interpretation of computational systems might be explored; one that may defamiliarize digital technologies by adopting an 'Eastern' [1] perception of our digital nature as 'technology-being-with-us'.

Familiar (adjective): often encountered or experienced; common [3]

The increasing 'disappearance' of computational technologies into everyday objects has inspired research and development focused on the potential to reconfigure the ways that we, as humans, relate to computers and their associated computational systems. This field of research is known as *ubiquitous computing*. In a ubiquitous computing framework computation is incorporated into the practices of everyday life in ways than do not require users to make a self-conscious effort to adapt their activities in order to accommodate these resulting systems. [4] Researchers in ubiquitous computing seek to distribute computers into our everyday lives in such a way as to render them invisible. This relatively recent condition [2] transforms the ways in which we interact with computer systems as well as where and how we relate to them.

The unifying goal of ubiquitous computing researchers since 1988 can be summarized as making the intersection between humans and computational systems invisible. [5] The ubiquitous quality of digital processes is located not only "everywhere" but also found in "everything" that we use and interact with as part of our daily lives. [6] Ubiquitous computing's potential modality for interaction is based on the idea that within such a computational environment, in which "everywhere" and "everything" converges, interaction can seemingly occur naturally without the user noticing the diverse 'invisible' computational processes being called upon.

The seamless, transparent and invisible incorporation of digital technologies into our everyday objects and environments produces the illusion that digital technology is somehow "phantomlike". [7] This illusion leads us to regard digital technologies as if they were "transparent conduits for immaterial, informational contents" rather than "concrete, material, and present-with-us" elements. [8] Even though ubiquitous computing seeks to blend digital technologies with material environments, this approach risks bringing about a discontinuity between the two domains. By hiding the materiality of digital technologies and instead prioritizing their informational or mediated contents [9] ubiquitous computing reduces our awareness of these digital technologies as material entities enmeshed in our everyday practices.

This brief account of ubiquitous computing is informed by a familiar and very specific narrative. The tendency to regard digital technologies as efficient tools is commonplace – at least as accounted for predominantly in 'the West'. [10] This deference to digital technologies as tools that assist humans and

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[1] We use the term 'Eastern' as shorthand to loosely describe countries in East Asia. Our use is not intended to conflate the complex array of diverse cultural socio-political practices or complex consumption of media experiences in this region into a homogeneous and imaginary 'Oriental lump' but to remind the reader "geopolitically-driven cultural Othering dies hard" [1 see also 2].

[2] The term ubiquitous computing was coined by Mark Weiser circa 1988 whist he was Chief Technologist at Xerox Palo Alto Research Center.

manage their work and domestic activities affects the way in which digital technologies are deployed in our lived environment, along with the promise for how every device will not only be ultimately be connected as part of the *Internet of Things*. [11] These inclinations lead us to believe that digital devices and systems are basically benign, easily consumed and effortlessly upgradable, largely disposable, as well as exceedingly pragmatic and functional.

As counterpoint to this predominant narrative, Bertram Bruce and Maureen Hogan argue that in order to understand the nature of technologically mediated existence, we should look more carefully at how computational systems affect our lives, especially when we cannot see the systems directly. [12] Accordingly: "the more we look at technologies the more technologies [are absorbed] into the background. Despite our attention, we lose sight of the way [technologies] give shape to our daily lives". [13]

The pervasive presence of digital technologies that results from incorporating embedded, contactless digital technologies such as RFID into objects and throughout the constructed environment can lead us to overlook the complex relations that exist between human beings and the contemporary socio-cultural milieu in which we live. The major implication of the technological transformation wrought by ubiquitous computing can be summarized as follows: the direct connection between humans and computational processing is transformed from *obvious* to *oblivious*. By rendering digital technologies transparent and invisible, we take them for granted; and in so doing, we risk becoming oblivious to a sense of 'technology-being-with-us'.

Designers Dunne and Raby argue that an increased understanding of Hertzian space – what they describe as a landscape of electronic products that create "a new, invisible but physical environment" [14] – renders users acutely aware that technology goes beyond the merely visible technological object and encompasses the practices, economies and ideologies encoded into technological artifacts. Illustratively, this notion is particularly apparent in Apple's 'iOS ecology'. In this technological ecosystem, design products such as iPhones, iPods and iPads are material components that we use physically while the operating system that unifies these artifacts is immaterial.

Representing digital technologies as devices or gadgets that efficiently manage our productivity in the workplace and optimize our leisure time is not a new phenomenon. In *Machine in the Garden*, Leo Marx observes that in society, "technologies are habitually represented by 'things' – by their most conspicuous artifactual embodiments". [15] According to Marx, assigning technologies to "the realm of things… distracts attention from the human–socio economic and political relations which largely determine who uses them and for what purposes". [16] This distraction leads to a common belief that technology facilitates a better future for humans when, in reality, it "is matched by our increasing reliance on instrumental standards of judgment, and a

corresponding neglect of moral and political standards, in making judgments about the direction of society". [17][3]

In contemporary society, electronic technologies – and by extension digitally mediated systems – are informed by an uncritical acceptance of what historian Bernard Waites refers to as "American Ideology" or an "ideological legitimation of technology" [19]:

> All problems whether of nature, human nature, or culture, are seen as 'technical' problems capable of rational solution through the accumulation of objective knowledge, in the form of neutral or value-free observations and correlations, and the application of that knowledge in procedures arrived at by trial and error, the value of which is to be judged by how well they fulfill their appointed ends. These ends are ultimately linked with the maximization of society's productivity and the most economic use of its resources, so that technology, in the American Ideology, becomes 'instrumental rationality' incarnate, the tools of technocracy. [20-21]

This sentiment is echoed by Evgeny Morozov's incisive observation that in large part it is the ideological reform agenda of Silicon Valley's "ameliorative experiment" [22] that currently fits "us all into a digital straightjacket by promoting efficiency, transparency, certitude, and perfection" [23] at the risk of losing our capacity for moral judgment in a world of risk adverse cultural institutions. [24]

The manner in which digital technologies are integrated into society is influenced by cultural and sub-cultural imperatives. In large part, it is through specific European and American-centric epistemologies that digital media systems have been predominantly refracted to date. In contemporary Western culture, the specific conditions that render digital technologies transparent and invisible defer our realization that digital technology is *always* with us. Digital technology is frequently considered either in terms of hardware or as software. This dichotomy obscures our perceptual experience of 'technology-being-with-us', making it difficult to maintain an awareness of the intermingled relationships that we have with digital technologies because such a culturally reinforced perception shifts technology from the foreground to the background of our consciousness.

Familiar Unfamiliar

It is important to understand the types of relationships we have with digital technology to appreciate how human-computer interrelationships are dynamically transformed. Notwithstanding the major cultural implications such dynamic transformation heralds, it is

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[3] Evgeny Morozov reminds us that it is Bruno Lator who writes, "[t]he moral law is in our hearts, but it is also in our apparatuses." [18]

paradoxical that as we form increasingly intimate relationships with computational technologies, we become increasingly unaware of their existence. This process of familiarization is exaggerated through the various cultural systems that render these technologies transparent and invisible.

The consequence of these technologies becoming familiarized is that complex relationships between humans and digital technology are no longer consciously foregrounded, as they perhaps once were. In *Steps to an Ecology of Mind,* Gregory Bateson argues that familiarized objects and environments "are sunk into the unconscious levels" to keep our consciousness from focusing on the "pragmatics of particular instances". [25] In short, familiarized objects and environments receive little attention from users. For Bateson, this 'little attention' helps us to forget that our membership in the world is complex. It is a membership in which the "human individual", the "society in which individual lives", and the "ecosystem – the natural biological surroundings of human animals" – are intermingled. [26] In the 'ecosystem' we now inhabit, we frequently take digital technologies for granted by overlooking the complex relationships we form with them and therefore run the risk of losing our sense of 'technology-being-with-us'.

In an attempt to re-foreground digital technology into the human psyche, the process of defamiliarization can be employed to recall an awareness of 'technology-being-with-us'. Literary theorist and scholar Viktor Shklovsky originally developed the concept of defamiliarisation to distinguish between poetic and prosaic languages. [27] Shklovsky argued that the process of defamiliarization – of making the familiar unfamiliar – increases "the difficulty and length of perception because the process of perception is an aesthetic end in itself and must be prolonged". [28] Applications of defamiliarization have been fundamental to the artistic strategies of key Modernist artists such as Rene Magritte and Marcel Duchamp, as well as being a guiding principal of Nam June Paik's aesthetic response to art, media and technology. Defamiliarization enables us to refocus our attention back to a familiar object. In doing so, we are better able to reconsider the particular relationships that the familiar object has within its social milieu and with us. In an era in which HCI design strategy places an emphasis upon making digital technologies transparent for users to accomplish specific tasks more efficiently and economically, defamiliarizing a technology can instead encourage the viewer or user to become more acutely aware of their relationship with technology outside of any predetermined practical or functional usages. If HCI and user-centered design strategies valorize making users less aware of the technology by (over)familiarizing it, the defamiliarization of technology creates the opportunity to reflect on particular cultural activities to help illuminate the interdependent nature of the relationship between technology and human nature – wherein technology is viewed as not merely a tool for us to use but as non-human entities with which we share a fundamental existence.

Interdependency

Understanding our interdependent relationship with technology begins by conceiving technology as an entity that has the capability to construct the social milieu in which we live and changes the ways we think about our existence in the world; and as such, has implications for the very concept of what it is to be a human being. This interdependency is a fundamental characteristic of the relationship between humans and technology. For example, in an examination of technology and culture, historian Bruce Mazlish writes "humans evolved from the other animals [into humanity] through a continuous interaction of tool, physical, and mental-emotional changes". [29] As such, continuous interaction with technology is a critical element in the process of human evolution. While tools and technologies have been the *result* of human imagination and ingenuity, it is *through their use* that we have come to continuously reconstruct ourselves and the world in which we live. In this sense, the world is filled with artificially constructed conditions for our lives.

According to psychologist William Johnston, the artificially constructed conditions of our lives equates to a "third nature" – "the formation of ideology and cultural artifacts which yielded a shift to self-reflective, symbolic thought and agrarianism in humans some 8–40 thousand years ago". [30] Johnston argues that technology plays a major role in the evolution and forming of the third nature and consequently, influences the manner in which we perceive other forms of nature. As humans, we are interdependently involved in the process of creating new technologies that continuously reshape the conditions in which we live. While acting as both *makers* and *users* in this third nature, as biological entities, we also belong to the second nature of emergent life forms. This dual membership in second/third natures implies that as human beings we find ourselves in a continuous process that incorporates our biological body (nature) with manufactured artifacts (culture). In the face of accelerated technological development, the third nature has extended dramatically; to the point that now, any place that is inhabited by human beings can be identified as a constituent part of the third nature.

As a product of this *interdependent* relationship, technology reciprocally shapes and influences our actions and practices. Technology mediates human experience and changes how we perceive the world. For the philosopher Don Ihde technology transforms human experience through "inclinations" that have a powerful cultural variant. [31] Ihde argues that technology mediates our perception and interpretation of reality (the hermeneutic dimension) as well as the manner in which we engage with lived reality (the pragmatic dimension). [32] Ihde contends that there are different types of relations that occur between humans and technology. He

identifies these relations as: "embodied", "hermeneutic", "alterity",[4] and "background" relations. In an embodied relation, we use devices to experience our *lifeworld* that, by default, simultaneously alter and modify our perception of the world; whereas, an hermeneutic relation involves using instruments that must be interpreted to be properly understood (for example, clocks, thermometers, and other technologies with visual displays). Alterity relations occur when technologies appear as the 'other', that is, they possess what might be described as an independence from humans (for example, robots, artificial life and artificial intelligence). Finally, background relations with technology form the context of experience that is seldom raised to a conscious level, as, for example, in the mundane context of a home system using lighting, heating, and cooling systems. [33]

With respect to the type of interdependent relationship we form with digital technology in a ubiquitous computing context, we argue that it is important to foreground the pragmatic – often prosaic or even mundane – dimensions of technological mediations that are often overlooked, not least due to various design factors that render computational systems transparent. These factors include the miniaturization of computer hardware, the immateriality of software and the development of various detection or sensor systems designed to monitor and track human interactions.

Familiar (noun): A demon often said to assume the form of an animal [1]

Interdependence implies that both humans and technology are cooperative partners, and that their relationship is reciprocal. In this respect, human–technological interdependency is analogous to the manner in which traditional Eastern philosophies such as Taoism, Buddhism, and Confucianism seek to harmonize an organic relationship between people and nature. Unlike a Western understanding of interdependency as a background relation (as described by Ihde), [34] a traditional Eastern philosophical understanding of human–technological interdependency is realized overtly and *foregrounded* in everyday cultural activities.

It is common practice in traditional Korean culture to foreground the interdependency between humans and non-humans in all forms of daily activities and routines through cultural expressions designed to signify that we live with 'others'. By example, commemorative rituals in Korea are ancestor-worship ceremonies held at different intervals. In the common annual ancestral rite, *Jeasa* (제사), a single ceremonial meal is prepared in the belief that the ancestral spirits visit the human beings on Earth to eat the food. This event both evokes the

relationship to the ancestors and reinforces the fellowship Koreans have.

The food arrangement in *Jeasa* accords with the philosophy of Yin-Yang and the five elements. The color and shape of the ingredients that comprise the meal match the five elements—green, red, yellow, white and black, and their placement on the table follows the positive–negative balance of Yin-Yang, see Fig. 1. The most important aspect of this rite is that the physical form is designed to remind participants that there is something beyond the physical world—life and death, material and immaterial, body and spirit. Koreans believe that there are spiritual beings beyond the physical world that influence our present condition. It is believed that when the living take good care of the dead, the spirits will provide for the living if they (the living) encounter hardship or face significant problems in their mortal lives.

Fig 1. *Traditional Jeasa ritual in head house of JeonJu Jung Clan*, 2009, copyright National Intangible Heritage Center, Released under Korea Open Government License (KOGL BY).

Non-human agents include nature, animals, and technology, as well as immaterial entities such as the spiritual beings experienced in *Jeasa*. Another common characteristic specific to Korean cultural practices foregrounds various forms of otherwise mundane activities. This occurs as part of the Korean culture's creative strategy to refocus attention on the materiality and immateriality of otherness to evoke a sense of technology-being-with-us.

In casting light on these themes with regards to digital technologies and systems, we argue that specific local cultural and material practices present an alternative lens through which to consider the interrelationships between humans and technology. In traditional Korean culture, the relationship between humans and non-human entities – such as the natural environment, animals and spiritual beings – is reflected through various cultural practices, including culinary art, commemorative rituals and folk painting. These interrelationships are complex and highly nuanced, frequently misinterpreted or simply

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[4] Alterity refers to the radical difference posed to humans as 'others'. Ihde borrows this notion of alterity from the philosopher Emmanuel Levinas to delineate 'how and to what extent do technology become other or, at least, quasi-others'. [35]

dismissed in the West.[5] To illustrate: we can briefly point to *Minhwa* (민화), a specific type of folk painting created by laypeople rather than professional artists. This form of painting was developed in the seventeenth century to reflect on the life of ordinary people and their relationships in the world with other people, animals, everyday objects and the natural landscape, see Fig 2. The main use of *Minhwa* is decorative, and is applied to the adornment of objects such as hand-held folding fans, Byung Pyung (a movable folding wall or screen), and spaces such as a door to a room. *Minhwa* is considered to have a magical dimension. Through *Minhwa*, Koreans possess beneficial virtues such as protecting the owner of a house and their family from an evil force or to help overcome the fear of menacing beings such as a tigers. *Minhwa* reminds Koreans that human beings live with other material and immaterial beings, including spiritual beings (good or bad). Koreans use *Minhwa* as a means to express the beliefs and desires of the virtue of spiritual beings or non-human entities. Without recognizing this strong belief in both the existence of spiritual beings and Koreans people's interdependent relationship with them and other non-human entities, *Minhwa* can all too readily be dismissed as a mere surface, a visual description of the natural world.
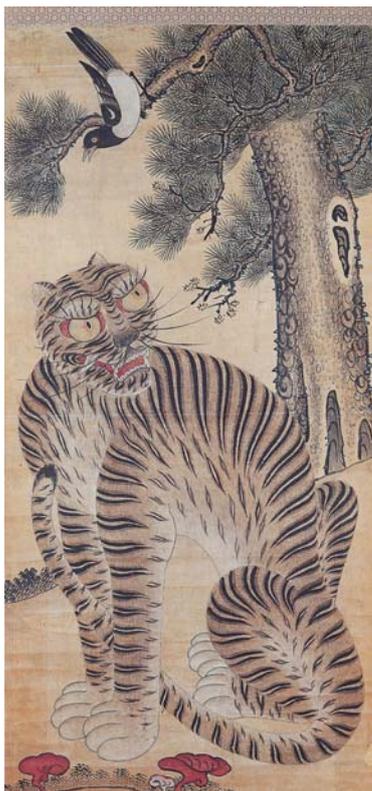
Fig 2. *Tiger and Magpie*, n.d, copyright National Museum of Korea, Korea Open Government License (KOGL BY, NC).

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[5]Japanese author and politician Inazo Nitobe makes a similar claim in his seminal text *Bushido: The Soul of Japan*, written in 1900.

In Japanese culture other distinctive cultural rituals inform the relationships humans have with non-human entities and technologies. For example Deleuze and Parnet remind us that the "arts of Zen, archery, gardening or taking tea, are exercises to make the event surge forth and dazzle on a pure surface". [36] They observe that these activities are designed and staged with the purpose of focusing upon the very mundane action being performed. In doing so, these ritualized activities present opportunities to contemplate the entangled connections that exist as part of our interaction with nature and non-living – often technical – entities such as the bow and arrow, the tree, flower or tea. These cultural practices evoke a sense of interdependence between humans and non-human entities to prompt us to question not only how we use technology but moreover how we *perform, ritualize and enact technologies*.

Translated to contemporary art, the influential work of Nam June Paik exemplifies how the themes considered in this paper are rearticulated into the cultural practice of media art. The distinctive ways in which Paik's work reflected on technology articulates a human–technological "assemblage". [37] By imploring viewers to consider what technology means to our human nature, he emphasized the mediating role of technology. [38] It is important to acknowledge how Paik's articulation of the human–technological assemblage was particularly informed by Korean food culture. According to Paik's wife, Shigeko Kubota, Paik loved traditional Korean food and used to observe that his artworks were similar to Korean *Bibimbap.* [39] *Bibimbap* (비빔밥) is a signature Korean recipe that is infused with the ideology of the world (Yin and Yang and the five elements). The word "*Bibim*(비빔)" literally means "to mix", an important point that will be explored further below. *Bibimbap* is represented as a symbol of the wisdom of the Korean ancestors in pursuit of harmony in nature and social behaviors. *Bibimbap* is a large bowl of rice topped with various vegetables such as bean sprouts, zucchini, squash, thin strips of beef, a fried egg and paprika paste. In its preparation, each topping ingredient is cooked according to its "nature" to sustain its distinctive taste. The overall combination of the various ingredients is selected based on the harmony that embodies the Korean belief that each food ingredient contains the characteristic Yin-Yang, and the five elements. Once prepared, the toppings are mixed together with rice and eaten with a spoon. When all the ingredients are mixed, *Bibimbap* delivers a new flavour; however, it does not do so at the expense of the individual distinctive flavours because the taste of each ingredient is sustained. The art of making *Bibimbap* is to produce a flavour that both closely maintains the flavour of the unique elements but also connects the other elements to simultaneously produce a new flavor, see Fig. 3.

Fig 3. *Jeonju bibimbap*, n.d, copyright the City of Jeonju, Korea, Reprinted with permission.

Paik's approach to video art shared features with this traditional Korean dish by representing the qualities of a "mixed up, convergence and hybridity". [40] For Paik, Bibimbap was a twofold concept. First, it informed his stylistic strategy, and second, it offered an aesthetic language through which he could express his perception of technology, the electronic medium in particular. The uniqueness of Paik's oeuvre is derived from this concept, embodying the manner in which the characteristics of each element could be sustained while simultaneously mixing together each element to create a new form. In works such as *TV Rodin* (1982) *and Exposition of Music – Electronic Television* (1963), Paik mixed familiar yet unrelated components (e.g. television sets, sculptural forms—such as statue of the Buddha and an imitation of Rodin's *The Thinker*—and musical instruments such as the cello and piano) into new combinations that reflect on the relationship between humans and technology. For Paik the humanization of technology was a major theme informing his practice:

> The real implied issue in "art and technology" is not to make another scientific toy, but how to humanize the technology and the electronic medium, which is progressing rapidly—too rapidly. Progress has already outstripped ability to program ... TV Brassiere for Living Sculpture (Charlotte Moorman) is also one sharp example to humanize electronics ... and technology. By using TV as bra ... the most intimate belonging of human being, we will demonstrate the human use of technology, and also stimulate viewers NOT for something mean but stimulate their fantasy to look for the new, imaginative and humanistic ways of using our technology. [41]

Paik's highly distinctive creative methodology is a primary source of inspiration for the contemporary Japanese art movement of *Device Art*, [discussed in 42],

in which computer interaction is characterized by *mitate* – "a method to present and read hidden meanings behind what is shown or written." [43] The concept of *mitate* is also analogous to creative strategies in Korean cultural practices in that both draw on an allusive metaphorical expression to deliver a message. The emphasis on the physicality of technology and this metaphorical manner of interaction that is characteristic of this genre of new media art is similar to humans' attitudes towards physical objects in Korea and Japan.

Conclusion

Our relationship with technology has always been an interdependent one. In contemporary culture, computer hardware, software and computational systems mediate all facets of our lives. As networked systems are integrated thoroughly into the constructed environment, the obvious manifestation of these systems is concealed. In the face of technological development associated with digital media, it is something of a paradox that as we form increasingly intimate relationships with new technologies, we become increasingly unaware of their existence. This phenomenon of familiarization is exaggerated through the various culturally reinforced relationships that render these technologies transparent and invisible. The direct consequence of this familiarization is that complex relationships between humans and digital technology are no longer in the foreground of our conscious perception, as they once were. In this paper, we discussed processes that 'defamiliarize' our complex and intermingled relationship with digital technologies and computational systems. Defamiliarization – making the familiar unfamiliar again – enables us to refocus our attention in such a way that we are better able to identify the particular relationships of the familiar object within a particular social milieu.

As part of this discussion, we explored cultural difference to examine our interdependent relationship with technology through both a 'Western' and an 'Eastern' perspective. In doing so, we raised the proposition that ubiquitous digital media systems be reformulated into culture by adopting a non-Western approach to defamiliarize these media systems. Unlike a Western understanding of interdependency as a background relation, an Eastern understanding of human–technological interdependency is realized overtly and foregrounded in the form of everyday cultural activities. Finally, we discussed how traditional Korean values foreground the interdependency between humans and non-humans in all forms of daily activities and routines through exaggerated expressions designed to signify that we live with 'others'. Encompassing culinary art to commemorative rituals to folk painting, traditional Korean practices such as these exemplify the importance of communality in Korean culture and give rise to distinctive forms of expression. The most important aspect of these cultural practices is that physical artifacts are designed to remind participants of our interdependent relationships with non-living entities by defamiliarizing

and re-articulating familiar objects and environments to remind and re-awaken an appreciation of "technology-being-with-us".

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Expressive Experiments : Art and Particle Physics

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Abstract

In this paper I present recent examples of my art practice which transverses the disciplines of media art and particle physics. As I will discuss, my work engages with both conceptual and material aspects of experimental particle physics, and is in itself an experimental practice. Through the analysis of the works and processes involved in the development of artworks produced at CERN, I will discuss aspects of art / science collaboration.

Epistemic things

The experimental scientist Ian Hacking states that 'Quantum observation necessitates affecting the object [of investigation, and that] we gain an understanding not by looking but by manipulating'. [1] On the subatomic scale, as photons of light have momentum and energy comparable to that of the particles they are being used to study, 'the measurement *necessarily* disturbs the object', [2] and, under certain conditions, actually creates them. I have been peripherally involved with such quantum physics experiments, where the interrelations between the quantum and the macroscopic worlds are quite dynamic, namely through at the CERN Large Hadron Collider (See fig 1.), through the 'art@CMS' collaboration.

The Large Hadron Collider or LHC probes the fundamental nature of the material universe, through the focusing of trillions of electron volts of energy on unimaginably small subatomic particles that are accelerated to almost the speed of light around the twenty seven kilometre accelerator ring. When the particles collide with each other, immense energies are released for an instant of time, which are captured by gargantuan instruments such as the Compact Muon Solenoid detector, or CMS, the most complex detector ever built. This was one of the devices that proved the existence of the Higgs Boson, also known as the "God Particle". This apparatus, weighs in at weighing in at 15,000 tonnes and detecting up to 10 million 'frames' of collision data per second in 3D. This device which took over 10,000 people to design and build, is the most complex scientific detector in the world, and is beyond any single person's knowledge capability. It can be described as an "epistemic object" or "epistemic thing".

Fig 1. *LHC accelerator tunnel*, 2014, Chris Henschke, photograph. Image courtesy of the author.

Unlike objects that have definite forms and uses, epistemic things are, according to a term coined by scientist Hans Rheinberger, 'objects of knowledge [which] appear to have the capacity to unfold indefinitely. [As they] are always in the process of being materially defined, they continually acquire new properties and change the ones they have… [and] can never be fully attained.' [3]

The sociologist Karin Knorr Cetina describes epistemic things, or objects of knowledge, as having a crucial aspect of a 'lack in completeness of being'; although they have material manifestations, they must also be conceived of as 'unfolding structures of absences: as things that continually "explode" and "mutate" into something else.' [4] Such expressive terms indeed describe the high energy collisions occurring in the LHC, where subatomic matter literally explodes into energy, which creates other forms of matter. In a subtle yet direct reference to the LHC, using the appropriate yet obscure technical term 'liquid argon calorimeter' to describe the gigantic detectors at CERN, she states:

> Epistemic objects frequently exist simultaneously in a variety of forms. They have multiple instantiations, which range from figurative, mathematical, and other representations to material realizations. Take the case of a detector in a high-energy physics

experiment. 'It' continually circulates through a collaborating community of physicists in the form of partial simulations and calculations, technical design drawings, artistic renderings, photographs, test materials, prototypes, transparencies, written and verbal reports, and more. These instantiations are always partial in the sense of not fully comprising 'the detector'. [5]

Expanding on the nature of such epistemic things and their relations to the researchers that develop them, Rheinberger states the following:

Epistemic things are … things that let something be desired. They stand for a particular relation to the world: a relation of epistemicity. This relation is exploratory, driven by the desire of finding, not of knowing. Experimenters are specialists in arranging situations in which finding becomes possible. Scientific finding neither obeys the logic of chance nor that of necessity. It obeys a logic of its own, composed of elements of both, and in so doing, undoes the stochastic rigor of the one and the deterministic rigor of the other. It is a game of eventuation, an engagement with the material world that, on the one hand, requires intimacy with the matter at hand, and, on the other, disentanglement, the capacity of rendering strange—of estrangement. I am convinced that the poet's and the artist's activities share the basic feature of this epistemic condition. [6]

The Apparatus

Nature of the Apparatus is an audio-visual artwork, five minutes in duration, I produced during my "art@CMS" collaboration at CERN in 2015. As Rheinberger states, the work seeks to convey experiential, epistemic aspects of the LHC in a way that is both entangled and yet estranged. It is derived from ultra-high definition video I shot with collaborating CMS physicist Dr. Michael Hoch at various locations across CERN, including areas that are usually inaccessible. The locations ranged from old near-abandoned experimental zones, such as a hundred deep metre UA1 shaft, which the CERN scientists refer to as "The Black Hole", to contemporary experiments, such as CMS, also situated 100 metres underground. However, the material that was captured on my video is largely of inert devices - it is not possible for anyone to be on location when the LHC is active, as the radiation levels emanating from the particle collisions would be fatal (although it is not just buried under the ground for this reason, hairdryers and passing trains affect the detector's sensitivities). Thus I experimented with the footage in order to express the implicit energetic aspects of the devices in the footage, in a way that creatively manifested the nature of such experiments.

Fig 2. *Observing the CMS detector*, 2015, Chris Henschke, photograph. Image courtesy of the author.

I manipulated the video footage in a way that uses the "sound" of the accelerator beam energy to affect the spatiotemporal flow of the video. This sound is a transverse electromagnetic vibration of the energy beam in the SPS accelerator, analogous to the way a violin string vibrates. In a unique experiment, collaborating accelerator physicist Ralph Steinhagen energetically 'plucked' the beam, by adding pulses of radio-frequency energy into the accelerator, and recorded the electromagnetic vibrations it made. The fundamental frequency of this transverse wave is about 4000 Hz, within the audible range of human perception, so, with a simple translation of data, the sound of the LHC can be heard, in the same way that an audio signal can be heard when it is attached to a speaker. This energy vibration is used to affect the video by algorithmically mapping (video) time into (screen) space. The source video footage is experimentally manipulated by a custom algorithm in a way that, like streak cameras used in physics experiments, maps slices of the footage across the space of the screen, with the resultant effect that the greater the energy intensity is, the larger the temporal splicing (see Fig. 3). The work is an experiment, as it had to be rendered our outputted to see how the algorithm used the sound to affect the images. The result spatiotemporally compressed and extended the source footage within the space of the output screen. The modulated output audio-visually folds the machine and attendant scientists into a dynamic topology of matter and energy, in a way that could be described as "phenomena", a term used in particle physics experiments.

Fig 3. *Nature of the Apparatus*, 2015, Chris Henschke, still from digital video, 6 mins. Image courtesy of the author.

Founding quantum physicist Niels Bohr developed the term "phenomena" to explain the relationship between apparatuses and objects of investigation in particle physics. For Bohr, the interaction between object and apparatus 'forms an inseparable part of the phenomenon'. [7] As Bohr stated, 'whatever the "true" nature of the electron, the behaviour it exhibits is conditioned by the kinds of experiments we choose to perform'. For example, an experiment designed to look for particles will produce particulate phenomena, whereas a wave experiment will produce wavelike effects. The issue with trying to observe subatomic phenomena that are utterly invisible on the human or macroscopic scale is that such experiments have to produce 'effects substantial enough to be observed and recorded in the laboratory, perhaps in the form of an exposed photographic plate, or in the deflection of a pointer in a voltmeter, or the observation of a track in a cloud chamber'. [8] Bohr states that we are 'constrained by our inability to construct experimental apparatus in anything other than classical dimensions, [thus] we are denied an insight into the 'true' quantum world. What we get instead is the quantum world as reflected in the mirrors of our classical apparatus'. [9] Unlike the classical or macroscopic world, where we can ask definite questions about what things *are*, in the quantum realm, one should ask:

> Does the electron (or any other object) *behave* like a particle or like a wave? That question is answerable, but only if one specifies the experimental arrangement by means of which 'one looks' at the electron. That is what Bohr meant when he said; 'An independent reality in the ordinary [that is, classical] physical sense can … neither be ascribed to the phenomena nor to the agencies of observation'. [10]

As philosopher physicist Karen Barad states, 'apparatuses are not passive observing instruments, on the contrary, they are productive (and part of) phenomena.' [11] Barad points out that Bohr never defined 'what precisely constitutes the limits of the apparatus'. [12] Is it the detector, the computer terminal, the display screen (see Fig. 4), the scientist viewing it, or even the organizations responsible for funding the project?

Fig 4. *Niels Bohr Commemorative Screen, CERN*, 2016, Chris Henschke, photograph. Image courtesy of the author.

Barad argues that when we deal with the boundary between the quantum and classical or macroscopic worlds, the nature of the apparatus becomes an entanglement of matter and meaning. 'it is not merely the case that human concepts are embedded in apparatuses, but rather that apparatuses *are* material / discursive practices… *Hence, apparatuses are boundary making practices.*' [13] But also, as Barad states 'boundaries do not sit still'. The universe and us are not separate, we are in a continual dance of inter-definition. As scientist philosopher Michael Polanyi puts it, 'The knower does not stand apart from the universe, but participates personally within it'. [14]

The media assemblage of the various materials in *The Nature of the Apparatus* can be seen as a manifestation of 'phenomena', or a kind of epistemic object, or even as a 'readymade', in the sense of the term coined by the French mathematician Poincare, the 'grandfather of relativity'. [15] Poincare used the term 'tout fait objects [readymades] to describe 'the epiphanies resulting from a barrage of pre-established ideas'. [16] According to Poincaré's formulation of the nature of human creativity, following an intensive but more or less random input of study, ideas appear to sort themselves out in what he calls the unconscious mind. There follows "tout fait," the illuminating flash of insight.

Expressive Events

According to the new materialist perspective of philosopher Manuel DeLanda, light and sound are forms of illumination and expression applicable not only to us. DeLanda states:

> 'The characteristics [of wavelength components and vibration frequency] allow both light and sound to produce distinctive effects on animal and human brains, effects that may be used for expressive purposes… by human artists. But possession of a nervous system is not necessary to make expressive use of colour or sound. Even humble atoms can interact with light… in a way that literally expresses their identity'. [17]

From a flash of inspiration brought on by the expressive forms created in the CMS detector, I developed *Edge of the Observable* a 12 minute audio-visual artwork (see Fig. 5). The artwork uses visual data from CMS collision events, in a way that amplifies the dynamic and expressive qualities produced, specifically using one of the billions of collisions that occur daily in the CMS detector: event 416497095 of event run 46944. This event in itself has no particular scientific value, but I found it to have unique and compelling formal qualities. The data taken from the collision event is the source material for the artwork; however it is manifested through an experimental installation I developed. Taking the basic setup of a physics experiment, the event is emitted as light from an energy source; it is then modulated through an optical device; and is then captured and recorded by a detection device. Against the popular (mis)conception of experiments being precisely repeatable, I could only get this unique combination to manifest once, suddenly

appearing as as in my detector (also known as a camera viewfinder!). And such uniqueness also occurs in every collision in the LHC – every event is different, each collision producing, in frozen picosecond instants, delicate unique forms, through the particle jets and magnetically guided curve trajectories captured by the detector.

The artwork plays with the concept of the "Golden Event", a term used in particle physics to describe a perfectly captured image of an expression of a rare or important collision event. However, such visual knowledge, manifested through the bubble chamber experiments of the early and mid 20th Century, was largely superseded by the types of numeric and statistical analysis used in modern physics. Physicist Peter Galison describes the tension between these "image and logic traditions":

> Images [captured in bubble chambers] are presented, and defended, as mimetic – they purport to preserve the forms of things as they occur in the world. … Against this mimetic tradition…[is].. the "logic tradition" which has used electronic counters coupled in electronic logic circuits… to make statistical arguments for the existence of a particle or effect. The clash of image and logic traditions [is the clash of the] golden event versus statistical demonstration, the objectivity of passive registration versus the persuasiveness of experimental control, vision versus numbers, and photography versus electronics. [18]

Heralding a kind of renaissance in scientific imaging, experiments such as CMS combine image and logic based analysis, in a 'shift from the pure to the hybrid' experiment and from 'the modern to the postmodern laboratory', where such devices are 'high-tech bricolages' of both bubble chamber and electronic logic devices. [19] These these hybrid detectors contain the 'historical epistemology' of experimental particle physics, where golden events are 'produced by electronics, fished by a computational net out of the ocean of microphysical debris'. [20] But this technologically hybridized gaze can still only penetrate so far – in the heart of each particle collision event recorded at CMS and other contemporary detectors is a small spherical void, known as the vertex of kinetic undetectability, a threshold somewhat like the event horizon of a black hole, which even the most advanced detectors still cannot reach past. This is literally the edge of the observable, and what occurs within this region has to be inferred from the secondary particles produced.

Edge of the Observable incorporates such concepts, and plays with the methods, and results of experimental physics, but is in itself neither science or scientific illustration, rather it critiques the role and nature of images produced in such experiments. The work is a kind of concrete abstraction, existing somewhere between the mimetic (representing an actual specific event) and abstract (expressing formal qualities manifested overall),
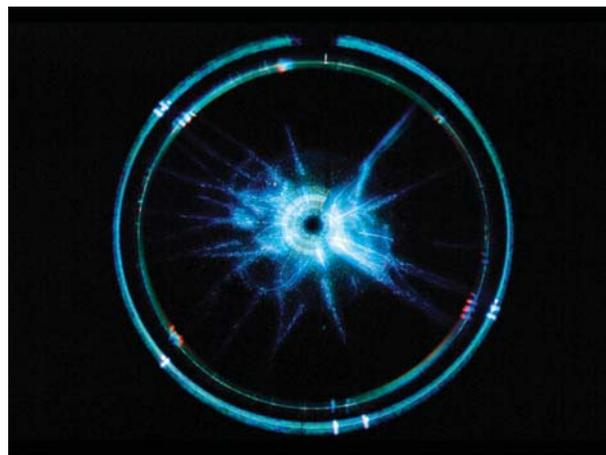
Fig 5. *Edge of the Observable*, 2014, Chris Henschke, still from digital video, 12 mins. Image courtesy of the artist.

akin to the aforementioned struggles which occurred during the development of such detectors. Through my experimental amplification of the visual qualities manifested in the original collision events, the output challenges the physicists' ownership of the forms created in the detectors, seeking to express the dynamics in a way that transcends the realm of the specialist.

During the development of the artwork, I developed a philosophical understanding of the nature of the Higgs Boson, based on my readings of the philosophies of Niels Bohr and Karen Barad, and discussions with the physicists I was collaborating with. When I presented the work at a science talk at the Karlsruhe Institute of Technology, I told the attending physicists (to the bemusement of some) that 'the Higgs Boson does not exist… in this room, cup, and other such normal objects – it only exists in the apparatus that manifests it, i.e. the LHC.' Through my discussion of Bohr's theories of complementarity and phenomena, most of the scientists (some begrudgingly) agreed with me. I have also presented it at other physics events, including the International Conference on High Energy Physics, in Valencia, Spain, (July 1–7, 2014). At the conference, the work was presented in the style of a science information stand, with faux-scientific posters and brochures, under a banner emblazoned with the phrase "Colliding Events: Turn Every Phenomenon into a Golden Event". Displaying the work as a mock science installation opened the way to discussions with scientists attending the conference. Some thought it was some kind of scientific display, and probably would not have been interested had it been explicitly presented as an artwork. I also showed the work at the University of Southampton John Hansard Gallery, as part of the 'Small Infinite' exhibition (August 5–October 20, 2014), which featured cosmology-inspired artworks by late British artist John Latham. Exhibiting the work in such a context provided a resonance between my piece and the other artworks, and yet the relief and familiarity of being in an artspace was offset by the lack of the challenging environment.

Conclusion

Undertaking such an inter-disciplinary practice has its difficulties, none the least being an artist in a realm full of physicists. In such a domain one must resist becoming the awe-struck handmaiden of science, especially when gazing up at the behemoth detectors of CERN, and falling into the trap of artist as scientific 'dabbler or dilettante.' [22] However, artists that work in-situ at such scientific facilities need to know and understand the science involved in order to meaningfully engage with it. Didacticism is sometimes a necessary gateway one must get through, in order to gain a deeper level of connection, which allows critically meaningful dialogue with the collaborating scientists. The fact that it is impossible to understand it all, doesn't imply that you have to be a dilettante or merely engage superficially, that is where collaboration comes in.

Such collaboration is itself a unique and experimental process. This can only develop through actual practical engagement and interaction, which must be nurtured by both parties. Through shared experiences, idiosyncratic heuristics evolve, and a kind of creole or lingo is established. It is through these personal participatory experiences and communications that a form of mutual understanding forms, which, although limited, gets both parties to think about their disciplines in different ways to the everyday. I am dubious about the likelihood that somehow such collaboration will lead to new scientific discoveries, nor should it aim to.

To paraphrase Bohr, from such collaborations, what we get … is the *scientific* world as reflected in the mirrors of our *artistic* apparatus, in a way that turns the scientific apparatus into a tool for art. However, the art is about the apparatus itself, which creates a deeper level of engagement. Through such engagement with scientific concepts and materials, the artist also informs the scientists about contemporary art. In a sense this does lead to new discoveries, in the way scientific concepts, processes and technologies can be used by artists. Developing such applications as a way to engage with the science itself can lead to a more critical relationship. In such collaborations, we can, indeed we must, critically engage with science in its own territory. The physicists I work with agree with this method of critiquing science through creative engagement and exploration (and of course they would, otherwise they wouldn't be working with me).

In conclusion, such collaborative projects have the potential to set the 'pre-conditions for the creation of new intellectual possibilities [which do] more than replicate an image of the knowledge reproduced onto a new subject', [23] akin to setting up an experiment, where the inputs are known but the outcomes are unknown. In the words of the biologist and philosopher Francisco Varela, these collaborations are 'interdisciplinary adventure[s]' where 'the practitioner is taking on a new vocabulary and lingo, other modes of thinking, other sets of procedure...to take bits and pieces from here and there to construct a new assemblage, another kind of aggregation - a collaging from which different, unscripted knowledge effects are squeezed out.' [24]

In my collaboration with CMS physicists Wolfgang Adam and Michael Hoch, the processes described above are fundamental to the construction of a kind of assemblage of science and art, in terms of methods and outcomes. The artworks I have described above form part of such an assemblage, which is still being developed in an exploratory and open-ended manner. To paraphrase Varela and Hacking, through my interdisciplinary adventures at CERN, I collaged together conceptual and experimental bits and pieces, 'not [just] by looking, but by manipulating', manifested in the processes developed and artworks produced. Linking the idea of art as knowledge effect with my collaboration as an experiment that expressively manifests conceptual and material aspects of high energy physics, the body of work produced can itself be seen as an interdisciplinary epistemic thing.

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Transcoding *Nang Talung*:
An Animated Adaptation of Thai Shadow Play

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Abstract

This article explores an animated adaptation from a cultural heritage source. It discusses the source, approaches and technical aspects in my animation – NUNUI (2013). *Nang Talung*, the southern Thai shadow play, offers unique, simple characteristics as a creative resource for Thai animation. The puppet uses jointed parts, which can be animated separately. This study aims to synthesize the ancient and modern by integrating *Nang Talung* folk puppetry with contemporary animation. Following the original source, most of *Nang Talung* animated adaptations relies on conventional stories, plots and the use of dialogues as shown in original performance. I argue that not only similarities, but also differences, are important for the dialogue between the two art forms. This study allows animators to open to change and embrace the other creative possibilities that 'new' media enable. It also offers an animator the opportunity to experiment with *Nang Talung* puppet's movement and to expand its limitations with computer graphics (CG).

Keywords

Nang Talung, shadow puppets, animation, animated adaptation.

Introduction

Thai animators are searching for distinctiveness in their work. This study employs *Nang Talung*, the southern Thai shadow puppetry, as a source for animation. *Nang Talung* is the small puppet form of shadow theatre. It is a traditional performance in the southern regions in Thailand. *Nang Talung* is performed in an open-air area. The puppeteer manipulates the puppets' jointed parts, silhouetted behind a screen. In *Nang Talung*, there is only one puppeteer who is the leader of the troupe. The puppeteer is called Nai Nang, literally master of puppets. The traditional local *Nang Talung* performance is a rare occurence nowadays. I conducted a field trip to the southern region of Thailand and was able to witness an excerpt of a fifteen-minute performance at Suchart Sapsin museum in Nakhon Si Thammarat province. *Nang Talung* storytelling mainly presents four archetypal characters: the hermit (Rue-Si), the main actor (Phra), the main actress (Nang), and folk characters such as Tua Talok or Clowns. The clown character is indispensible to

Nang Talung performance even though only few characters persist nowadays. The most-seen clown characters in modern performance are Nunui and Ai Theng.

Fig 1. A collection of folk puppets at Suchart Sapsin museum in Nakhon Si Thammarat, Thailand. (Source: compiled by this study).

Fig 2. *Nang Talung* shadow play, 2015. Nunui puppet is on the right. Ai Theng is in the middle. Source: https://www.youtube.com/watch?v=CPDrKB3JOHE [Accessed 15 December 2015].

Linda Hutcheon (2006) used the word 'transcoding' for an announced extensive transposition of a specific work(s) in which a shift of medium can occur. [1] For

this study, the transcoding involves a shift of *Nang Talung* shadow puppet theatre to a computer graphics animated film. This article will discuss a process of adaptation – how the theatrical folk art performance (source) is transformed into cinematic form of digital animation (result). Conventionally, animators have focused on similarities between the source and the adaptation. As a result, they use modern media to imitate quality of the folk art. This not only suppresses the 'aura' (Benjamin, 1936) [2] of new media, but the adaptations are also treated as being secondary to the original source. Ironically, they become a replica to the original folk art. Opposed to the traditional approach of a one-directional transformative process from the source to the result, which tends to focus on fidelity to the source, this article highlights a dialogic relation between the source and the result. This emphasizes the act of "(re-) interpretation and then (re-) creation" proposed by Linda Hutcheon (2006, p.8) [3].

Looking through the lens of Avant-Garde adaptation, it not only welcomes the adaptor's interpretation of the original source, but also the appearance of new properties of the new medium. Understanding media helps animators decide what kind of work they want and how much control they can exert. Therefore, the capacity of the new medium was taken into account if this could expand any limitations in the traditional art or the original source. This paper will thus discuss both aesthetic and technical aspect of the animated adaptation from non-literary, shadow puppet performance. 'Transcoding' *Nang Talung* into computer graphics animation involves a process of selection and transformation. I shall investigate this transformation in the animation NUNUI (2013) which includes exploring similarities and differences between the original source and the animated adaptation. In addition to the contribution to the distinctiveness of Thai animation, this article could also serve as a case study in innovation for the sake of preservation.

Related Work

The following examples demonstrate growing interests in integrating the indigenous art with contemporary media. Unruangsi reproduced *Nang Talung* with cinematic narrative in her shadow film *Tale of the Unknown Island* (2010). [4] However, the character movements are limited since the animator chose to maintain original puppet mechanic, where solely the upper part of the puppet figures could be moved. Similarly, Anakule Studio (2014) digitized *Nang Talung* puppets as material culture and heritage objects and used them to produce an interactive game of shadow play. [5] However, the game offers little content and the movements of the interactive puppets are still limited.

Ghani (2011) proposed his Malaysian *Wayang Kulit* puppet in three-dimensional (3D) design. [6] However,

the outcome had its shortcomings in aesthetic features and shadow effects of traditional shadow puppet. In GuanZe Liao's *Journey to the West* (2012), the animators maintained the two-dimensional look of the flat puppets. [7] This aesthetic choice of keeping flatness of the characters is similar to the approach used in NUNUI (2013). However, in Liao's animation, the animator keeps the flat characters on entire 2D backgrounds whereas the flat characters in NUNUI interact with both 2D and 3D environments. This artistic style of combining 2D characters in 3D backgrounds in NUNUI is more similar to that of *Si Lunchai* (2014). [8] However, the animated films from Liao and Rall were adapted from Chinese and Indonesian national folk tales. Consequently, the films heavily rely on verbal narrative. This differs from NUNUI (2013), which is independent from dialogues and narration, and focuses solely on visual-led narrative.

Contemporary Practice

Traditional cut-out puppetry has been revitalized in digital cut-out animation. A variety of digital programs have been offered to simulate the medium. Manovich (2011) pointed out two types of software techniques to simulate the traditional media. The first type is a generative technique, which "offers [a] high-level automation of creative processes" (p.5); the second type comprises low-level automation, which requires a level of manual control from its users (Manovich, 2011). [9] In the animation NUNUI (2013), three basic software programs for multimedia designers: Photoshop, Flash and After Effects were employed to refashion the shadow puppetry, as well as to re-mechanize the movement of *Nang Talung* shadow puppets. Flash was adopted to do an animatic (timed and moving storyboard) for reviewing the rough drawn movement before collaging the cut outs in Photoshop. I did not solely rely on Flash, which could offer an all-in-one solution to cover all the aspects of the animation production. This is because the program cannot support texture elements as much as Photoshop. Moreover, it cannot generate and render lighting as effectively as After Effects. The benefit of using Flash and Photoshop is it gives a feeling of working with traditional or manual processes of animation. According to the program's low-level automation, the interface is simple to learn. This allows animators to focus directly on the artwork without facing many technical problems, as they would occur in high-level automation software such as 3D Max or Maya. In other words, this approach of using low-level automation in software simulation ensures animators a degree of controllability of the aesthetic elements. The downside is the absent function of inverse-kinematics, which is not available in Photoshop program. Therefore, this can consume more time in animating and texturing.

However, the approach is suited to animators who are familiar with a traditional production pipeline.

NUNUI (2013)

The story is about two characters Nunui and Ai Theng who meets on the way whilst searching for their way out.

Fig 3. *NUNUI*, 2013, Chanya Hetayothin, 2D computer - graphics animation.

In NUNUI (2013), I focused solely on the clown characters and adopted Nunui and Ai Theng – the famous puppets which most Nang Talung theatre production have. My interpretative act of adaptation emphasises subjective decision-making rather than solely concern the issue of fidelity. This engages a double intention behind the animated film NUNUI (2013). On one hand, I followed the original design of Nang Talung puppet as closely as possible, which creates a considerable similarity between the original source and the adaptation. On the other hand, not only I challenge and break with tradition in terms of the mechanics of movement and narrative, but I also follow other media's artistic strategies such as those of cinema. Therefore, a dialogue between Nang Talung shadow play and the animated adaptation occurs, creating a distinctiveness in the animation. The dialogic relation between traditional Nang Talung and the animated film is made through the following set of aesthetic elements which comprises: puppet; animation mechanic; lighting and textures; screen, and narrative structure.

4.1 Puppet

The important clown figures – Nunui and Ai Theng – were adopted from Nang Talung. According to its historical background, these puppet figures were derived from a real man (Nawigamune, 2003). [10] In the traditional play, Nunui is Ai Theng's buddy and has the opposite type of character. Regarding his character profile, Nunui is silly, does not catch on to things easily and always follows Ai Theng. Both characters not only have a unique look for viewers who have never seen the southern Thai shadow play, but are used as a referential point to the original shadow play for those aware viewers who know the play, since Nunui and Ai Theng often

feature together in the performance. However, in terms of story content, the relationship between Nunui and Ai Theng was reversed from the original play; in the animated adaptation, they become unknown and strange to each other.

Simplicity is considered to be a distinctive quality of *Nang Talung* clown puppets. This is a reason I have chosen the clown puppets for the animation. The simplicity is also an advantage in animation. This is because animators have to read form and visualize its movement before they animate. Therefore the simpler the forms the animators have, the more easily they can read their movement. With clown characters, I can focus on the character's body movements without spending too much time on decorative elements. Moreover, *Nang Talung* always opens to new designs or ideas regarding contemporary influences. The open-ended design of *Nang Talung* opens up ways to foster creativity and opportunities to exploit the fashions, and social and cultural influences of a particular period. The hybridity between tradition and modernisation in *Nang Talung* comes through the process of adaptation. This not only reflects cultural change, but also gives the southern Thai puppet a distinctive look, separating it from other shadow puppetry in different countries.

4.2 Animation Mechanic: Re-Mechanizing Puppet Form and Movement

The process of re-mechanizing demonstrates how the animation medium can extend the movement capabilities of shadow puppetry. The limitations of movements in Nang Talung have been investigated as follows. The southern Thai shadow puppet only allows the characters freedom of movement above the waist. Therefore, new joints need to be added to augment movability, especially, in the lower parts of the puppets. Thus ankles, knees, legs, wrist and neck joints are created, whereas the joint positions of the shoulder, upper arms and lower arms from the original model are retained.

Fig 4. Scanned puppet - Nunui clown figure, 2013. (Source: compiled by this study).
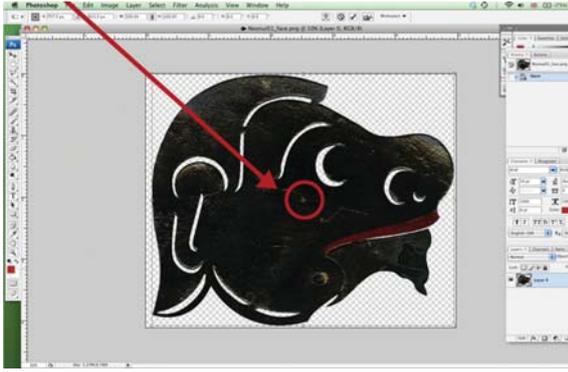
Fig 5. Re-Mechanizing puppet's head, 2013. (Source: compiled by this study).

After re-enginereering, every part of the puppet can be animated. This 'breaking-tradition' approach of extending puppet movements has also been adopted in the animation - Si Lunchai (2014) which allowed the puppets' parts to move freely. In Si Lunchai, the animators maintained the aesthetic of shadow puppetry by portraying a single view of characters and employed a flipping method to present the characters as they turn. However, in NUNUI, I mixed both cut out and conventional 2D approaches. Consequently, the characters were presented in a single view such as side view, but they could also turn around for other views as in conventional 2D animation. This 'turn-around' approach in NUNUI is distinct from the flipping method in the animation Si Lunchai.

Fig 6. NUNUI, 2013, Turn-around model. (Source: compiled by this study).

4.3 Lighting and Textures

Computer-generated lighting by Adobe After Effects was employed in the animation. There is also dilemma in choosing digital media to refashion traditional shadow puppetry. Despite computer graphics' capabilities to light and texture, its digital image still lacks tangibility. Concerning tangibility in CG representation, I had engaged puppet textures in computer graphic production by scanning the texture from a real puppet as an alternative way to maintain tangibility. The tangible texture of the Thai puppet - caused by its hide texture and the use of translucent paint – can offer unique characteristics to the animated characters. In performance, this aesthetic quality is blurred out on the cloth screen once the puppets' shadow is solely presented. Therefore, I chose to highlight this somewhat hidden quality of the puppet's texture besides its shadow in the animated film.

4.4 Screen

Shadow puppetry is an art form where its basic setting of projector, screen and spectator, a social space, shares an affinity with cinema of the Western world. However, despite sharing a basic setting, shadow performance and cinema (projected animation in this case) use the idea of screen differently, as in the following discussion. Our perception towards the cinema screen is as Hanssen noted: "something always exists outside the frame" (2013, p. 143). [11] This differs from the theatrical frame of the shadow play which is more centripetal and, as Hanssen pointed out, "emphasizes the boundaries of action" (2013, p. 143). [12] Therefore, the energy of the shadow play image is rather directed inwards. Moreover, the idea of using screen in shadow puppetry is straightforward and much less complicated than that in animation making which engages cinematography - shots and camera use. The cinematic approach - a moving camera and continuous shots were also adopted in the animation NUNUI. Camera use can also enhance the story's dynamic, for example, when the character – Nunui - tried to find an exit, or when he was chasing another character. This creates a contrast between *Nang Talung* performance and the animated adaptation.

4.5 Narrative Structure

Traditionally, *Nang Talung* represents an eclectic mix which combined rite, folklores, music, jokes, and farce together. The narrative in *Nang Talung* can be categorised into three modes: verse, speech (dialogue), and music. These three modes still persist nowadays. However, the modern puppeteers tend to use speech (dialogue) as a main narrative device. In brief, *Nang Talung* performance relies on the verbal narrative. This narrative approach is challenged in the animation NUNUI. I adopted the Aristotle's mimetic concept which "conceive of narration as the presentation of a spectacle: 'a showing'" (Bordwell, 1985, p.3). [13] All the story and expressions of the characters were shown through gestures and movement. I proposed a different perspective to the popular belief that *Nang Talung* attracts the audience with the folk characters' dialogue, jokes and conversation. Therefore, I discarded all the dialogue and voice-over in the sequence, and instead focused on gestural expression. This contrasts to the related works where the artists in question employed diegesis, the telling of the story by a narrator and using dialogue as the main storytelling device.

In summary, I chose to maintain fidelity in one aspect - the design of the *Nang Talung* clown puppet, whereas I reworked the puppet movements and challenged the original modes of narrative. Moreover, the original source has been utilized with a set of the aesthetic and technical elements of computer graphics medium, as well as film language. This defamiliarizes the original *Nang Talung* for the viewer to a certain degree. For example, the different mechanic movement injected by the animation medium might be unfamiliar to an aware viewer who knows the original performance. However, this defamiliarization encourages the spectators to look at *Nang Talung* in a new way and seek their own interpretation.

Instead of sustaining fidelity to the original source, my interpretive act of adapting allows differences between the source - *Nang Talung* and the animated adaptation dialogue with each other. This, as Bruhn notes, "de-hierarchizes the relation between the primary and the secondary text, the source and the result" (2013, p.83). [14] As a result, NUNUI can be seen alone as a complete animated short film as well as categorized as a *Nang Talung* animated adaptation.

Conclusion

The study signifies the crucial idea that we can take on the cultural material or the art of the past and move beyond it to find a new creative possibility in our own emancipated space. "The role of adapters as creators" (Tsui, 2012, p.58) is implied in this article. [15] This argues against a perceived notion some Thai animators have that tradition can be too outdated, or tradition should be preserved in its original form, as well as that the adaptation is secondary to the original art. The study reinforces the idea that the adaptation should be treated as an original work. I also contend that in order to search for distinctiveness of Thai animation, Thai animators should look to their own roots in art and culture to develop their individuality.

This article has discussed animated adaptations that incorporate indigenous art and traditions. It also helps to cultivate the folk art within the modern context. The theoretical concept of adaptation is put into practice and the outcome – the animated film, NUNUI (2013) - demonstrates originality and some of the creative possibilities for the future. Moreover, the study also reflects how Thai local art could be used to expand animation content and a hybrid between the two art forms can also create distinctiveness for Thai contemporary animation.

Fig 7. Still shots from NUNUI, 2013. For the complete animation, please see https://vimeo.com/68848648 (Source: compiled by this study).

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How the Traditional Chinese Idea of Time and Space Can Be Applied through Digital Moving Images

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Abstract

In this paper, I argue that traditional Chinese thinking and its manner of approaching art can be successfully expanded onto a different platform: digital media art. My research (both in theory and practice) shows how this transformation expands the notions of time and space and forges new interdisciplinary correlations by addressing traditional Chinese culture in four different but interrelated manifestations: the philosophy of Dao, calligraphy, painting and sculpture. As a result, I claim that digital media can shift the notions of time and space from traditional Chinese thinking into contemporary digital art. Conversely, the digital concept of time and space can be interpreted by an analysis of the traditional Chinese philosophy of Dao, as well as a new understanding of 'scroll format' and Chinese digital art has been introduced through my own practice.

Introduction

My digital media artwork series *Dao Gives Birth to One* (2009-2012) will serve here as a case study and practical experimentation project furthering the analysis of how the traditional Chinese concepts of time and space can be applied through digital moving images in a long scroll format (see Figure 1). In this work I attempted to demonstrate that (1) The concept of *Dao*, (2) the function of the scroll as a form. This thesis aims, both theoretically and practically, at providing the reader with a new experience – the perception of the notions of time and space inherent in traditional Chinese thinking – by combining these concepts with digital technology.

Fig 1. Title: *Dao Gives Birth to One (version III);* Video format: Digital; Full HD 1080 x 1920; Exhibition format: (6-12 monitors / projection version); Length: 20 mines looping; Sound: Stereo x 12 channels; Venue: the Hong Kong Museum of Art; Hong Kong, 2010.

The Concept of Dao

My artwork aims to visualize the *cycle* of vigour and vitality [1] of *Dao* in the universe with the assistance of digital media technology – a topic that has not been broached before in relation to the idea of 'play-appreciation' and digital media.

In addressing this issue I first explored the concepts of sheng (生 'gives birth') and yi (一'one') as used in Chapter 42 of *Dao De Jing* and the question how they could be visualized through digital media technology. With reference to the research materials, translations made by different scholars generally reflect their different linguistic perspectives. Thus there are actually different interpretations of *sheng* (生 'gives birth'), including 'to create', 'to give birth'[2], and 'to generate'[3]. In fact, the concept of *sheng* tends to be even more abstract, spiritual and philosophical than any available translations. This led me to question how *sheng* could be reinterpreted and extended through visual representation in this digital era. To answer this question, I referred back to *Dao De Jing* and the ancient Chinese dictionary *Shuowen Jiezi*. According to *Dao De Jing*, yi (一'one') reflects a philosophy of how the universe was created, namely through yi (一'one') and *Dao*. Secondly, the most interesting issue that drew my attention was the

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[1] *Dao* is regarded as the 'primordial natural force' in nature and it contains unlimited 'potentiality' (潛藏力) and power of creation. But there will be an end, inasmuch as life is growing. However, 'the end' suggests the advent of another new life (Chen 2007, p.63).

[2] "The *Dao* (道) gives birth to One. One gives birth to Two. Two gives birth to Three. Three gives birth to all things. All things have their backs to the female and stand facing the male. When male and female combine, all things achieve harmony" (Mitchell, 1988, p. 48).

[3] "The Dao generated One; One generated Two; Two generated Three; Three generated the ten thousand things. The ten thousand things, carrying yin and embracing yang, used the empty vapour to achieve harmony" (Huang 2003, p.76). Huang's version is based on the Silk Texts A and B unearthed from the Han tombs near Changsha, Hunan Province in China in 1973.

Chinese character 一. This is placed as the first word in the first chapter of *Shuowen Jiezi*, which states that the 一 originally created heaven and earth and then generated the whole universe[4]. *yi* (一 'one') thus represents the 'unity' of the universe. And this unity, according to *Dao De Jing*, generates ten thousand things which form their tracks in the universe. Everything (ten thousand things) grows in the beginning and will disappear in the end. This approach has not yet been considered as a visual representation platform using digital media.

The Concept of Long Scroll

I aimed to apply 12 story lines into 12 screens as a storyboarding sequence in order to enact the process in which 'one' could be created / generated into 'ten thousands things' through interaction with human beings as expressed in the texts of Chapter 42 of *Dao De Jing* quoted above. In this endeavour, I first created 12 white digital screens and then inserted my custom-made 'Flying Animated Chinese Character' (FACC), composed from my animated brush strokes. The basic narrative sequence is as follows: The scene in 'screen 1' represents the beginning of the universe. I animated the three-dimensional 'one' as a 'FACC' flying alone in the universe (white virtual space) after serving as a function to divide the universe into heaven and earth (see Figure 2 & 3).
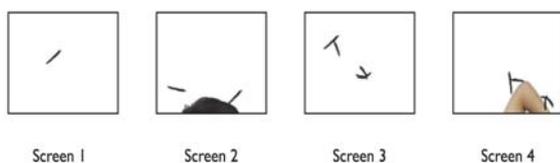
Fig 2. The first three scenes from screen 1 – 4 which indicate how the concept of 'one' is generated to 'two' and 'four' through its interaction with the human. Screen scenario of *Dao Gives Birth to One (version II)*; Hong Kong, 2009 (visualization by the author).

How, then, was 'two' (二, *er*) created ? The answer is that once human beings appeared in this universe, the form of the characters ('form imitation' [象形, *xiang xing*]) was expanded and created through their interaction. Thus 'screen 2' shows how, whenever any part of a human being (such as limb, nose, head) interacts with the 'FACC' 一 (*yi*, 'one'), this 一 will generate another and become 二, because (Chinese) linguistic characters are meaningless without human

involvement[5]. Furthermore, in 'screen 3' and later screens, numerous 'FACC' are generated in such a way that they become brush stocks.

Even though there are a large number of 'flying animated Chinese characters' in the last screen, they move on their own track with a certain system, which simulates our human activities in the chaos of the universe. The last few seconds of 'screen 12' (the last scene of this long scroll) is about everything returning to white (void) again with only one Chinese brush stock left, which implies the system of our human life cycle in this universe.
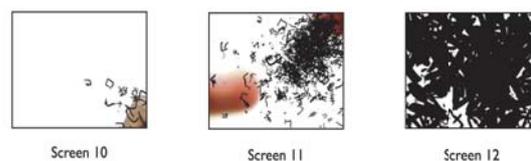
Fig 3. The last three scenes from screen 10 – 12 which indicate how the concept of 'a thousand things in the universe' suggested by *Dao* is transformed through digital visual representation. Screen scenario of *Dao Gives Birth to One (version II)*; Hong Kong, 2009 (visualization by the author).

Furthermore, in *Dao Gives Birth to One* I attempted to transform the 2D plane surface to a 4D virtual space by reinterpreting the concept of void through digital technology, transforming the concept of empty space into a concept of virtual space. Traditionally, the white colour in the pictorial space of Chinese rice paper has been regarded as a *void*[6] — an empty space rather than a colour. Although paper is physically a two-dimensional plane, it is regarded as an infinite space with endless time. When these Chinese characters fly about in that virtual space, one almost has the impression of real beings racing back and forth in the universe. This virtual experience has a 4D sense to it.

I also sought to open a new approach for video and interactive art. I questioned whether a long scroll format video installation could suggest a new direction for digital art in relation to the 'Yellow Box' concept. The result might help solve the problem raised by Professor Boris Groys, who has observed that viewers find it hard to appreciate video work in the exhibition space. In Groys' view

The images go on moving – but the audience also continues to move. One does not remain sitting or standing for any length of time in an exhibition space; rather one retraces one's steps through the space again and again, remains

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[4] The ancient Chinese dictionary *Shuowen Jiezi* 'Explaining Simple* and *Analysing Compound Characters'*, defines 'one' thus: "Unity (一): It is, that starts the Great Begin of the Way is based upon Unity. It divides Heaven and Earth and forms the ten thousand creations" [sic] (*Shuowen Jiezi* 2008).

[5] According to *Shuowen Jiezi*, one of the processes of creating Chinese characters can rest on the features of our bodies or on perceptions of objects from afar.
[6] The concept of *void* in traditional rice paper suggests not only a sense of endless time, but a sense of infinite space as well.

standing in front of a picture for while, moves closer or away from it, looks at it from different perspectives, and so on. (Groys 2008, p. 87)

Groys further argues that the viewer's movement in such an exhibition space cannot be arbitrarily stopped because it is constitutive of the way perception functions within the art system: "An attempt to force a visitor to watch all of the videos or films in the context of a larger exhibition from beginning to end would be doomed to failure from the start – the duration of the average exhibition visit is simply not long enough" (Groys 2008, pp. 87-88). He sees this not as a problem of the length of the video, but of the expectations of the audience: the expectations of the visitor in relation to a video in the exhibition space are totally different from those relevant to the cinema/movie theatre. The visitor to a video installation basically no longer knows what to do. Should he stop and watch the images moving before his eyes as in a movie theatre, or, as in a museum, continue on in the confidence that over time, the moving images will not change as much as seems likely? (Groys 2008, p. 88). We (as artist and viewer) face both problems. In order to solve them in an innovative manner I first created and combined 12 digital video screens together to create a long scroll format. Each video screen displays different kinds of interactive and animated Chinese characters. The detailed method of the video installation is as follows:

I first invited different people to come to my studio to interact with my flying Chinese characters in front of my artwork. In the studio I could shift my focus to different parts of their bodies for the shooting. I then edited all the footage into different lengths and set all of these into the 12 videos as a long scroll screening format, creating 12 video screens with 12 different lengths of running time (see Figure 4).

In fact, the nature of the 12 screens that are indeed not at all seamless as in the format of the traditional long scroll. Those 12 screen do not seep into each other but rather retain their equidistance. Each screen shows how flying Chinese characters interact with humans. The first video lasts 3 minutes; the second lasts 8 minutes; the eighth lasts 21 minutes; and the last video lasts 5 minutes. Because the loop length of each video is different, various narrative combinations are automatically created. Viewers need not worry about the time restriction of the video work, or which part of the videos they have missed, because the video loops run in overlapping phases anyway. In other words, people can come and go freely. They are encouraged to perceive this long scroll video installation from different perspectives, viewing the screens one by one closely or from a long distance; the most important point is that every one has his/her own time to observe and take in the video narration. The free and relaxed atmosphere encourages viewers to enter into the spirit of this video work and merge their minds in the exhibition space as a whole (see Figure 5).

Fig 4. (Details) 12 videos screen with 12 different running times. Screen scenario of *Dao Gives Birth to One (version III)*; Hong Kong, 2010 (visualization by the author).

Fig 5. Visitors sit freely at the exhibition space of *Dao Gives Birth to One (version III);* Venue: the Hong Kong Museum of Art; Hong Kong, 2010.

Chinese-character Writing as a 3D and 4D Experience

Time in Character Writing

The 'Dao' project used digital technology to simulate the reality of Chinese calligraphic characters in terms of *time* and *space*. The first step sought to give viewers a temporal experience by having them visualize the entire process of creating these animated characters as a flying sequence. Traditionally, calligraphy has been a completed work of art that gives the viewer neither a physical nor a temporal experience. In general, therefore, viewers who face a work of calligraphy should try to imagine the process underlying the creation of the characters: for example the characteristics of the first brush stroke, the sequence of brush strokes, and the flow of movement connecting one character to another; this will enhance their appreciation of the work. However, my new approach for the digital era was to invite viewers to 'witness' and 'experience' the whole process of character writing through digital animation sequences.

To better understand this process, let's take a simplified Chinese character, 'horse' (马, *ma*), as an example. I not only animated the motion of the form of 马, but also visualized the character's underlying process of writing through sequenced images (see Figure 6). In other words, the viewer can see how this character was created from the first brush stroke to the final stroke in real time. At this point, the appreciation of Chinese calligraphy is no longer centred on a completed work of art; instead, comprehensive appreciation includes the concept of time, creating a sense of growth and duration, a temporal experience.
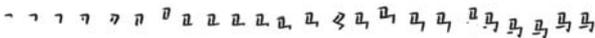
Fig 6. Animation sequence of the writing process from one brush stroke to the final Chinese character 马 (visualization by the author).

Space in Character Writing

The second method that I used to engender a 4D experience of my artwork in viewers involved creating Chinese brush strokes (and characters) through digital technology. In this endeavour I revisualized the characters' three-dimensional forms by using such digital technologies as 3D modelling, interactive programming and video making. I contend that Chinese-character writing contains the seeds of 3D and 4D experience, which become manifest only when a traditional calligrapher controls the volume of ink and the pressure of brushes on a 2-dimensional writing platform[7]. Here, I took the Chinese character for 'mouth' (口, *kou*) as an example of how a flying Chinese character could be visualized through a 360° view (see Figure 7). I designed the flying sequence of this character as a shape that, while in motion, flips from left to right. When the viewer watches this character zooming around in virtual space (void), the character's motion suggests a three-dimensional form, rather than a flattened, 2-dimensional image. When the characters 'mouth' (口, *kou*) and 'horse' (马, *ma*) are flying together, a distinct sense of spatiotemporal experience is engendered.

Fig 7. Animation sequence of a Chinese character 口 as visualized through a 360° view (visualization by the author).

Critique and Comparison

Apart from my own 'animated flying Chinese characters', a number of different styles of digital text artwork have surfaced around the world in the last two decades. Several contemporary artists, such as Camille Utterback (1970-), Romy Achituv (1958-) and Lee Lee Nam (1969-) have applied motion to a text; but this—as opposed to creating a 3D temporal aspect—does not

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[7] According to a visual analysis by the Koiso Design Institute, Nippon Design Center, standard script in the early Tang Dynasty was characterized by the Wan Xizhi movement's emphasis on vertical lift, which was regarded as the most significant aesthetic model in history (*Hidden Principles of East Asian Character Universe* 2006). For example, the character *shu* (書, 'brush writing') shows how the shape of Chinese characters has evolved since the Tang Dynasty from a dynamic flow to a subtle and balanced visual presentation (ibid.). These analyses show that in the early Tang Dynasty some Chinese characters were originally treated as three-dimensional rather than flattened forms. I argue that such three-dimensional forms can be revisualized through digital technology.

typically evoke a spatiotemporal experience. I saw Text Rain (1999) at Utterback's studio in San Francisco in 2006 and Lee's *Korean 8-fold Screen* (2007) at HKART Fair10, Hong Kong, in 2010 (see Figure 7-9).

Text Rain is an interactive installation with falling English letters forming lines of a poem about bodies and language. Participants and viewers can play with those falling letters by gesturing with their bodies. *Korean 8-fold Screen* is a digital video installation with 8 different LCD displays arranged vertically to simulate the appearance of traditional Asian folding screens. These 8 videos show Korean and Chinese textual elements flying from left to right on the screen. However, although the textual elements (whether English, Chinese, or Korean) in these two works of art are animated, they lack literal depth; in other words, the animated textual elements are in motion but their shapes remain flat, on a 2D plane (see Figure 10). This indicates that the artists did not consider connecting the textual elements to viewers' spatiotemporal experience.
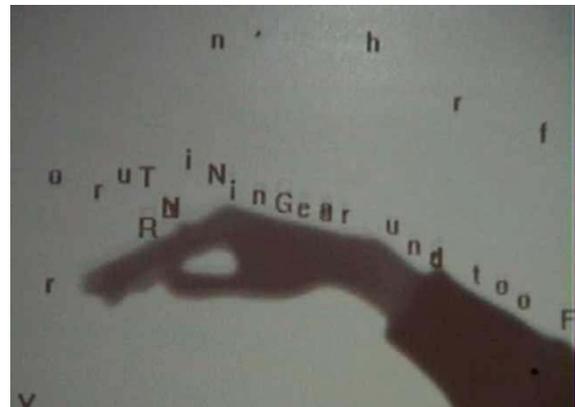
Fig 8. (Video clip) *Text Rain* (1999) by *Camille Utterback & Romy Achituv (United States) (see video: http://camilleutterback.com/projects/text-rain/).*

Fig 9. (Video clip) *Korean 8-fold Screen* (2007) by Lee Lee Nam (Karea)
(see video: http://thecreatorsproject.com/blog/tradition-and-technology-the-korean-folding-screen-goes-high-tech).

In contrast, Chinese characters always have a dimension of *time* and *space*. The perspective of *zi* (字; Chinese characters'), but this seems to be missing from the work of such contemporary artists. In this sense, my 'animated flying Chinese characters' in the '*Dao*' projects show a new approach to viewing time and space

in character writing, with 3D Chinese characters that enable viewers to have an interactive spatiotemporal experience as well.
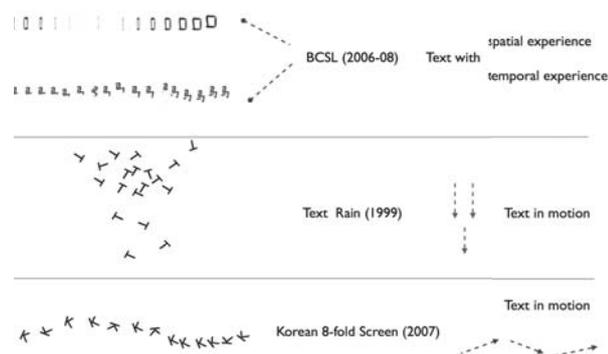
Fig 10. Comparison of '*BCSL*' (2006-2008) */ 'Dao'* project (2009-2012), *Text Rain* (1999), and *Korean 8-fold Screen* (2007) (visualization by the author).

Conclusion

The analysis undertaken in this chapter reflects the limitations of using and exploring *Shu hua* in both 2D and 4D practice today. The practice centres on the format of the scroll as commonly applied in both Chinese *shu* 'brush writing' (calligraphy) and *hua* 'painting'. My paper suggested a new approach to combining *Shu hau* in a long scroll format as a visual representation platform. So I embarked on the project *Dao Gives Birth to One* in order to demonstrate how the traditional concept of handling *time* and *space* could be represented through an interactive video sequence in a long scroll format. The role of the viewer has been shifted from observation (passive role) to participation (active role) or has even assumed part of the artist's role, from where it has become truly interactive. My research has, therefore, demonstrated how the traditional concept of *time* and *space* was applied, and shown a broad spectrum of connections between Chinese art and digital media. The result may open a new way of perceiving concepts of *time* and *space* through shifting the role of the viewer from passivity to activity, and from there to interactivity.

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Alien Aesthetics: Xenofeminism and Nonhuman Animals

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Abstract

The recently published Xenofeminist Manifesto re-fashions accelerationist politics into radical feminism. Arguing for a universalist *xeno*-politics borne out of alienation, xenofeminists see in nature an arch-enemy, aligning with the algorithmical intelligence of technology instead, celebrating artifice and strangeness as the foundation of revolutionary politics to come. In this paper, I argue that nature is but a phantom limb tied to the decaying body of post-Enlightenment modernity. Following the ontological turn in anthropology, I argue that by legitimizing constructed dualisms of nature and technology, xenofeminism fuels the very logic that it seeks to overrun. Enlisting only with nonhumans that it perceives as technological, xenofeminism excludes a number of allies, such as nonhuman animals. Passing beyond the limits of this nature/culture dualism could open xenofeminism up to a full spectrum of nonhuman confederates and lay foundation for speculative aesthetics for all alien subjects.

Introduction

A recent entanglement of feminism and accelerationism, xenofeminism marks the most visible cyber- and techno-oriented insurgence in contemporary feminist theory since Donna Haraway's influential *A Cyborg Manifesto* [1] and Sadie Plant's work with the Cybernetic Culture Research Unit in the 1990s. [2]

Along with the publication of *dea ex machina* (2015) [3], which traces the lineage of feminism(s) that take the machinic state of contemporary existence as their testing ground, xenofeminism aims to reclaim the liberating potential of technology and alienation – a freedom *to* seize technology rather than a freedom *from* it. [4]

On the surface, by aligning their revolution exclusively with the technological dominium, xenofeminism departs from ecofeminism, perhaps feminism's most visible discourse from the 1980s until now, which seeks revolution through reclaiming the connection between women, nonhuman animals, and the environment.

In this paper, I argue that xenofeminism thwarts its own emancipatory potential by relying on the same dualism that informed ecofeminism: that of nature and technology as disperse entities. Grounding the movement into this unchallenged, universalized ontological separation, xenofeminism narrows down the scope of its metamorphic openness and excludes a number of revolutionary allies, such as nonhuman animals. Furthermore, it is only by re-evaluating this unacknowledged ontological predicament that xenofeminism could produce a *xeno*-aesthetics as well as

new forms of subversive subjectivity. Thus, I suggest that an overturning of this ontological axiom creates a foundation for a futurist speculation borne out of alienation, an aesthetic estrangement that cuts across the category of species.

Accelerate! Alienate!

Xenofeminism's prosthetic limbs extend in various directions – its genealogy can be traced back to cyberfeminist collectives such as VNS Matrix - yet rest most firmly in the fertile grounds of accelerationism. Accelerationism is a political movement focused on re-cutting the Left with blades of rationality and technology.

Although radical techno-determinist Nick Land, one of the key members of the Cybernetic Cultures Research Unit at the University of Warwick, was accelerationism's most visible spokesman in the 1990s, xenofeminism rather affiliates itself with "left-accelerationism," best encapsulated by Nick Srnicek and Alex Williams in "#Accerelate: Manifesto for an Accerelationist Politics" (2014). [5]

While global crises are accelerating, they argue, our theoretical capacity has to accelerate along them in order to shake off the post-structuralist "paralysis of political imaginary." [6]

Heavily critical of by-gone nostalgias such as localism and direct action, they propose to seize the neoliberal powers of capital and re-direct them in the interest of social change. To simplify – push capitalism to its limits and it will eventually collapse.

For the xenofeminists – *xeno* denoting "stranger" or alien - alienation inscribed into technological state is the condition of this revolutionary possibility. It was Marx who made alienation a concept central to politics – along with the automatization of production, he argued, the working class had nothing to sell but their labor.[7] Splitting up work into meaningless, minute tasks, the mass production assembly lines generated alienation, estranging the workers from their labor with the aid of technology. For Marx, alienation is the inherent vice of capitalism, preventing men (sic!) from reaching fruition and happiness through work.

Yet, as the accelerationists argue in a neo- or post-Marxist gesture, even Marx had already noticed that the means to capitalism's dissemination were in its own workings. [8]

Xenofeminism also succumbs to this idea, arguing that alienation is the "impetus to generate new worlds" and "the labour of freedom's construction." [9]

Unlike in Marx, however, where alienation is the worker's forced loneliness, in xenofeminism alienation is the perpetual state of estrangement that ensures the fluidity of potentially liberating interactions between technology and society. In xenofeminism, alienation is the relation between humans and the inhuman technology at the expense of "nature," which the Xenofeminist Manifesto proclaims the cause of all injustice: where essentionalized identities – such as 'female' or 'normal' – are produced.

Alienation here has little do to with loneliness or individualism – in fact, xenofeminism celebrates the technologically-enabled communities and platforms of "connection, organization, and skill-sharing" such as the Internet. [10]

The point is not to be isolated – the point is to be *alien*.

Xeno-subjects

A discussion of xenofeminist aesthetics must begin with the very core of the movement – with the alien. *Xeno*-aesthetics should serve the revolutionary plans proclaimed in the manifesto, and if they do, one must ask: who speaks and who is listened to? What kind of subjects are expressing and expressed in xeno-aesthetics? How could we define this xeno-subject that is non-essentialized yet able to form groups and alliances?

Dissatisfied with contemporary feminism's focus on identity and micro-communities, xenofeminists affirmatively insists "on the possibility of large-scale social change for all of our alien kin," [11] a task that they recognize demands large-scale, collective labour that cuts across narrow confines of "natural" identities. [12]

At this point, it is vital to ask who are these *xeno* alienated subjects that enter the space of open-source feminism in the technological age, and whether there should be a place for nonhuman subjects – such as animals - amongst them.

In his review of the recently published accelerationist reader, [13] Simon O'Sullivan identifies the missing component, pointing out that the movement fails to theorize its subjects or methods for the production of new subjectivities. [14]

"Technology isn't inherently progressive," the Xenofeminist Manifesto asserts, and thus must be linked to collective politics necessary to fashion it for the benefit of social emancipation. [15]

Yet can there be a new politics without a subject to carry out the turmoil? While xenofeminism advocates for clever subordination rather than idealistic insubordination, the deposition of capitalism and its exploitative practices still remain the desired outcome.

To complete such a task, O'Sullivan argues, "it will not be enough to take on… a new set of ideas, or put faith solely in technological process – subjectivity has to be *produced* differently." [16]

While Land's accelerationism indeed *is* a politics without a subject – save for the carnivorous, inhuman, algorithmic intelligence – xenofeminism seeks, through its alliance with feminism, an articulation of subjectivity.

In the opening paragraph of the manifesto, xenofeminism presents itself as the continuation of politics of *affinity* instead of *identity* – a response "through coalition" as Haraway calls it. [17]

Yet, unlike Haraway, whose further work extended the cyborg subjectivity to nonhumans such as companion animals, [18] xenofeminism, while portraying itself as a universalist politics that is not of benefit to women exclusively, scales down the mechanisms of affinity to human beings exclusively.

While the manifesto insist on the necessity of claiming technology for the subjects that it perceives as traditionally excluded – "women, queers, and the gender non-conforming" as well as differently abled - in its plea to "cut across race, ability, economic standing, and geopolitical position" it overlooks the category of species. [19]

While xenofeminism makes for a renewed engagement with insurgences of the past (and present), its disregard for nonhuman subjects prevents it from becoming a futuristic gesture that could indeed construct an "emancipatory tactics … scaled up for universal implementation." [20]

Speaking as no-one? Xeno-animals

Following Donna Haraway, Emma Wilson states that scientific knowledge has not as much as collapsed the categories of "human" and "animal" into one but rather rendered both categories meaningless – neither can be placed exclusively in the category of "nature" or "culture." [21]

While the collapse of the human/animal boundary poses challenges to previous constructions of human identity, there has been very little discussion on *how* could technology aid in liberating this polluted, non-essentialized animal subject. Can xenofeminism deliver on its promise of universal liberation for all gendered subjects without attempting to re-structure the predatory relation between technology and nonhuman animals?

There exist multiple reasons why female – and male – nonhuman animals should be woven into the formation of subversive subjectivities as well as the aesthetics bound to it. Given the length of paper, I will focus on farm animals as an example.

First of all, technology created new forms of oppression with regards to farm animals. This short paper cannot afford the space to list all of the procedures performed on female farm animals in industrial farming, yet it must point out that more often than not, these practices are highly sexualized. In the dairy industry, for example, human employees place the cows on what is commonly referred to as "the rape rack" [22] in order to artificially inseminate them by pushing pipettes into their vaginas to deposit the previously collected sperm. [23] Most often, the calf is quickly taken away from its mother and slaughtered. Thus, the patterns of abuse in factory farming are linked not only to specific technological inventions but also to an individual's gendered condition – females, as potential mothers,

would be submitted to different modes of abuse than males.

Secondly, nonhuman animals are the alienated subjects *par excellence* – it is their invisible labor that generates benefits for other groups. In "Animal Capital: Rendering Life in Biopolitical Times," Nicole Shukin describes, from a Marxist perspective, how sourcing labor from the technologically confined bodies of nonhuman animals ties in with the circulation of animals-as-capital. [24] Without theorizing this alienation, as well as the methods for re-appropriating the currently exploitative technology, xenofeminism is not paying attention to all *xeno*-subjects.

Finally, without addressing *all* of alienated, gendered subjects, xenofeminism will be ill-equipped to provide a solution to the crises of capitalism of which Williams and Srnicek list "the breakdown of the planetary climatic system" and "terminal resource depletion" as the most substantial. [25] Xenofeminism shares Williams's and Srnicek's anti- or post-capitalist concerns. "Capital," it claims, "by design only benefits the few" and its technological circumstance currently targets "the world's poor [who are] laboring under abominable conditions." [26]

A great wealth of research has been already amassed on the relation between factory farming, industrial fishing, climate change, and poverty. [27] Thus, reflecting on the relation between technology and nonhuman animals is instrumental in addressing global issues that involve everyone.

To sum up, because xenofeminism obeys the strict division between technology and nature, it automatically relocates "natural" subjects, such as nonhuman animals, to the side of enemy at best and resource at worst. The first step to be taken in the inclusion of nonhuman animals is the demolition of dualisms that separate nature from technology and thus create oppressive hierarchies that mimic patriarchal, Eurocentric, and colonial structures that gave birth to them. Placing itself at this modern partition, xenofeminism cannot speak from a metamorphic, non-essentialized point-of-view of no one in particular that it aims for. [28]

Instead, it speaks from a consolidated and exclusive position of power.

Natural technologies

"Accelerationism is a political heresy," write Robin Mackay and Armen Avanessian. [29] What is heresy if not the very denial of naturalized ontologies, unchallenged norms and axioms?

Donna Haraway captures this rebellious impulse in other words: "Blasphemy protects one from the moral majority within, while still insisting on the need for community." [30]

Xenofeminism also needs long-term collective labor that cuts across identities in order to ripen. To envision a xenofeminist aesthetics is to address the entanglement that forms the movement's political kernel – *xeno*-subjectivity built on the separation of nature and culture. Thus, producing an inclusive, xenofeminist aesthetics

that would be open to all of alien subjects is a two-step process: first, acknowledge the ontology that fuels the production of xenofeminist subjectivity in order to create space for nonhumans. Secondly, fill that space with aesthetic speculation in order to produce new alien subjectivities.

To rise above the partition of nature and technology, we must retort to ontological investigations, which are currently nowhere as thorough as in contemporary anthropology. The essentialist separation of nature and technology is a twin of another, more fundamental divorce – that between nature and culture.

Emerging in the 1980s as a critique of ethnographic politics of representation, the ontological turn contests the once dominant view of different cultures as simply divergent representations of one, objectively existing Nature. [31] It insists that we should rather recognize the existence of *multiple* worlds (ontologies) rather than position the one we were born into as the objective onto which other worlds map.

In Phillipe Descola's categorization, based on years of ethnographic research, there exist four ontologies that delineate the relations between humans and nonhumans: naturalism, animism, totemism, and analogism. [32] Upheld through practice rather than belief, these relations "exist under the form of mental structures, partly innate, partly stemming from the properties of social life." [33]

In naturalism, the ontology that Descola allocates to post-Enlightenment modernity, there exists a strict divide between natural laws and symbolic, cultural, or technological structures. Humans are presumed to be exceptional in that they are the sole possessors of an interiority, their bodies tying them to the nonhuman world only by the virtue of shared physicality.

The engagement with nature as a discursive and geo-located concept is missing from the Xenofeminist Manifesto. "We find," it states "that our normative anti-naturalism has pushed us towards an unflinching ontological naturalism. There is nothing…that cannot be studied scientifically." [34] While this statement reveals an entanglement of two different naturalisms – the first is the colloquial "natural order of things" that punishes all that is perceives an "unnatural," and the second a rationalist philosophy à la John Dewey, it does not localize, explain or engage with the separation of technology and nature through which xenofeminism amasses its accusatory and revolutionary capital alike.

In this way, it departs from its roots in the writing of cyborg feminists such as Haraway, for whom "the historically specific human relations with 'nature' must… be imagined as genuinely social." [35]

In other words, the giveness of nature as the realm beyond technology is the unexamined condition of xenofeminism, one that prevents it from offering a truly inclusive politics for all alienated subjects.

Producing subjectivities: alien aesthetics

How to remedy this ontological partition that leaves nonhuman animals behind as the revolution marches on?

Xenofeminism, hinging on the imagery of cyberpunk, hacktivism, and techno-futurism is a fabulatory exercise of world-building in practice. Defining itself as an "open source software… available for perpetual modification and enhancement" [36] that "seeks to strategically deploy existing technologies to re-engineer the world," [37] xenofeminism ties in with Williams's and Srnicek's proposal that "acceleration [is] navigational… experimental…within a universal space of possibility." [38] Thus, xenofeminist aesthetics should be nothing short of speculative.

So far, there have been only a few explicit engagements with the notion of accelerationist aesthetics. While I argued above that the unaddressed ontological premise interferes with producing a full spectrum of xenofeminist subjects, Steven Shaviro extends the problematic of ontology in accelerationism even further. For Shaviro, aesthetics *is* ontology.

Accelerationist aesthetics, he argues, are spectral, insubstantial, determined in the last instance. "Accelerationism in philosophy," he writes, "offers us, at best, an exacerbated awareness of how we are trapped." [39]

When everything is subsumed under capitalism, accelerationist aesthetics operate from the inside, with no hopes for overturning the system. Instead, they produce safe distance, cruel truth: we have already lost. Accelerationist aesthetics should then allow us the possibility of smiling at other prisoners as we are suspended in an ever-expanding, excessive prison of inhuman forces. Thus, the goal of art nowadays is not to soothe us but rather to confirm that we are not insane: the unease we feel is well-justified.

In his article on geo-political accelerationist aesthetics, Benjamin Bratton notes that "it is not possible to distinguish between what is existential risk and what is an absolute invention, and what is both at once, and mobilize 'positions' accordingly." [40]

In other words, we are now living under conditions that demand a continuous mobilization of speculative resources *as if* our lives depended on it – because they *might*. Although Bratton proposes a planetary, cosmic aesthetics, his arguments could also apply to aesthetics inclusive of nonhuman animals:

> The post-Anthropocene indicates that the organizing work of a "xenogeopolitical aesthetics" (or whatever) can be done only in relation to a mature *alienation* from human history and anthropocentric time and scale. As it foreshadows and foregrounds the eclipse and extinction of Anthropocenic anthropology and corresponding models of governance, it establishes not only that humanism disappears with humans, and vice versa, but that the more elemental genetic machines with which we now co-embody flesh can and will, in time, re-appear and express themselves as unthinkable new animal machines, and with them, New Earths. [41]

In a similar manner, Patricia MacCormack argues that "the *political* role of aesthetics could [be] to catalyze inhuman affective relations that are still to come."[42] What then of xenofeminist aesthetics?

Following Shaviro, I would argue that a shift in ontology would initiate an aesthetic change of gears. Descola's ontologies are not fixed, they escape the boundaries of time, space or identity formations – they are simply descriptions of how humans and nonhumans connect and disconnect on the axes of social practice. Once naturalism is recognized for what is it – one ontology among many – we may begin experimenting with the other three, or maybe even draft a new one.

Descola acknowledges the potential of aesthetics to speculate and travel within ontologies: " art, or certain kinds of reflexive thought, or philosophy, enjoy a certain degree of freedom, which affords the possibility of stepping into different ontologies, divorced from the once in which you were born." [43]

There have already been attempts at entering – through aesthetic practice and philosophical or artistic speculation – to experiment within ontologies in order to re-construct social practice. For example, for Felix Guattari animism, the ontology that Descola defines as the opposite of naturalism, is characteristic of anyone who enters the modality of passion, artistic creation or madness. [44] In Guattari's work, animism is achieved through neurotic phenomena, religious rituals or aesthetic phenomen; a state of estrangement within the self and a sense of community outside of the self. This could be only the beginning of an inclusive xeno-politics to come.

In xenofeminism, nothing is original. There is no original human hiding beneath the layers of avatars and code. To extend xenofeminism to its logical consequences, we perhaps need to start acknowledging that there might be no original animal under the layers of disinfectants, hormones and vaccines, fences and creeps, artificial light cycles, selective breeding and confinement cells. Drawing a politics for the future can only begin when the disappearance of nature is recognized with regards to the nonhuman animal. To mobilize the aesthetics and speculative powers of technology – whether through research, art, design or environmental architecture – in the service of cross-species xeno-subjects would lay groundwork for a truly futurist politics, where the currently unmapped regions of thought and practice could house revolutionary impulses.

Xenofeminism demands: "If nature is unjust, change nature." [45] Perhaps this is not enough – perhaps if nature is unjust, we need to erase it.

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Touch as Techne: Pulse Reading as Interface

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Abstract

This paper introduces *Pulse Project* (2011-2016), a practice-led performance research study that explores an ecology of complex relations between art, humanities, medicine, and technology. In this study, I embody transdisciplinary research practice itself through adopting the role of "acupuncturist-investigator" and acting as an instrument or medium between myself and others and between cultural traditions for understanding and mediating the body and the embodiment of consciousness. Pulse "reading," (readings of the energetic body), algorithmic compositions, case histories and notations of pulses are all used together as methods for exploring the cultural encounter between a creative producer, participants and diverse cultural/informational practices.
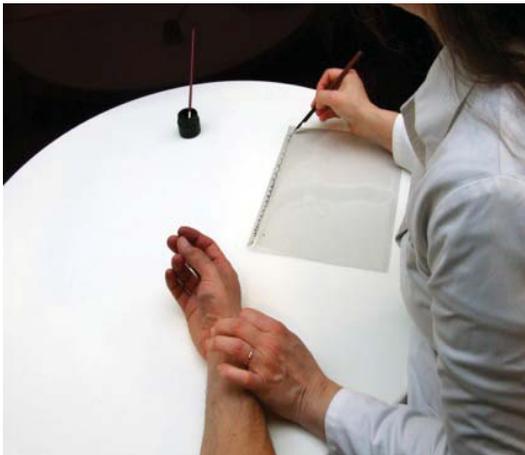
Fig. 1. *Cambridge 1,* 2014, © Michelle Lewis-King, photo document of *Pulse Project Performance* - pulse reading and notating.

Art, Science, Culture and the Body

Pulse Project, an on-going performance and sound study series conducted at various public locations between the years 2011 – 2016. The performance and sound studies draw from my experience and expertise in both the arts and sciences as primary source material. In *Pulse Project*, I embody research practice itself through my performing as an instrument or medium between others and myself, and between cultural traditions for understanding and mediating the body. Drawing upon my expertise as a clinical acupuncturist (with training in biomedicine), I use Chinese medicine and music theories together with SuperCollider (an audio programming language) to compose bespoke algorithmic soundscapes expressive of embodied experience.

These soundscapes are not sonifications of Western principles of circulation or embodiment but offer another perspective to conceive of/listen to the interior spaces of the body-in-being. For example, each participant's pulses are interpreted by using traditional Chinese pulse diagnostics (a complex set of more than twenty-eight waveform images corresponding to embodied mental/physical states of being) and traditional Chinese music theory together with contemporary digital technology as a transdisciplinary and transcultural methods for re-reading and re-mapping the human embodiment and consciousness. Significantly, as *Pulse Project* soundscapes are composed using an aspect of touch that is informed by Chinese medical theory, this study therefore offers an alternate and comparative means for exploring and recording the alchemical nature of embodied being-in-time.

For this reason, the audio works of this study do not represent of the inside of the body from within the Cartesian logic of the *cogito*, but interleaves Chinese medical and philosophical approaches together with Western medicine and philosophy as a means for reconsidering the current discourses that attend the body and embodiment. In resisting the representation of sound in "realistic" (Western) technoscientific terms, this study sonically explores the phenomenal metaphysics of the interior and in-between spaces and processes of the body (according to Chinese medical philosophy) as a means for communicating the more enigmatic aspects of embodied reality than those currently explored by technoscience.

Pulse Project Performance: An Art-Science Case Study

Pulse Project positions the haptic and somatic into play with digital temporality by using intuitive touch in tandem with SuperCollider (a real-time audio synthesis programming language) to create unique soundscapes that materialise and express the invisible and inaudible aspects

of an individual's embodied being. *Pulse Project* adopts touch in this study as a translational instrument of convergence between art and medicine, East and West, past and present, self and other. Each soundscape is composed by using pulse diagnosis as a method to interpret each participant's pulse as a unique set of sound wave images informed by Traditional Chinese Medicine (TCM) pulse diagnostics (as a complex set of more than twenty-eight waveform images corresponding to mental/physical states of being) and also in accordance with traditional Chinese music theory. Significantly, as *Pulse Project* soundscapes are composed using an aspect of touch that is informed by Chinese medical theory, this study therefore offers an alternate and comparative means for exploring and recording the alchemical nature of embodied being-in-time.

As a result, this study generates soundscapes that convey a unique ecology of sonic spaces hidden within the body. These soundscapes are not interpretative of the Western notion of the circulatory system, but instead, draws on early Chinese medical philosophy in order to represent the body/person as a living cosmos pulsating with matter and energy. [1] The architecture of the body according to the Chinese medico-philosophical system is not a separate and discrete entity, but exists as a microcosm in relation to an exogenous multiverse of interdependent material worlds in perpetual motion. This ecological and cosmological model of embodiment is central to this research.

Context for the Study

This research examines the "body" and the "encounter" as fundamental concerns from which my investigations across art and science unfold. The body is conceptualised in this study as an ecological medium that hosts a multiplicity of encounters. Generally speaking, the modern body is a conceptually divided organism not only due to an enduring Cartesian mind/body dualism, [2] but also according to cultural approach. For example, according to Chinese philosophy and medicine, living organisms are metaphysical entities – each a micro-cosmos of continuously transforming inter-relational substances (an organism of immanent emergence). Whereas biomedical (Western) model of the body is still largely based on Cartesian and Augustinian traditions that view the body as a set of mechanical parts to be 'fixed' when they become faulty - or as a fleshy (sinful) organism that is considered inferior to the transcendental capacities of the mind and cognitive thought. [3] These approaches to the body continue to inform and shape the philosophical and medical investigations and debate within Chinese and Euro-American cultures respectively.

From my clinical experience as an artist-acupuncturist, the processes of the medical encounter are uniquely "intra-cultural," i.e., they involve both biomedical and Chinese medical investigation that is at the same time articulated by the warp and weft of inter-personal dynamics. Within this particular form of clinical encounter, the body itself is a multi-dimensional site of countless meetings between thought-practices, alchemical phenomenal processes, personal narratives and self-reflections. In this way, my clinical practice engages in transversal modes of inquiry by continuously creating connections that travel back and forth between early Chinese and modern biomedical concepts, bodily interventions and strategic processes of analysis and treatment for each "patient."

Given the dialectical uniqueness between cultural medical practices of this encounter, this clinical experience is re-imagined and explored as a central premise within this presentation as a means for performing a transversal analysis of emergent body-politics between art, science, technology and society. Transversal analysis is conducted in this research through using transdisciplinary creative research practice as a methodological tool that is able to engage in several interrelating strands of inquiry simultaneously, rather than using methods that observe the more traditional approach of examining a singular subject or pursuing singular object-ontology theories.

Therefore, the body (as research site) and body-politic relationships are examined throughout this paper by inquiring into the complex 'nature' of the body itself - by inquiring, 'What *is* a body?' [1] from both Chinese and Euro-American perspectives. In this way, this research inquires into the *nature* of the body through using the clinical encounter between practitioner and patient as an alembic vessel to test out the art – science relationship through public engagement. By using the clinic as a frame for encountering others as well as other approaches to medical analysis that reorder our understanding of what medical and artistic interventions are and can do, this research inquires into the emergent body-politic of art-science relations by staging events that implicitly ask: "What if art could intervene into the life-and-death determining territories normally occupied by science?" and, "What could science *become* if it embraced the complexity and plurality of (artistic) creativity within its methodological practices?"

Brief Introduction to Chinese Medical Philosophy

The early Chinese notion of the body as a temporal "interface" has a crucial significance for the creation of

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[1]This question is related to Deleuze's famous question, 'What Can a Body Do?' - a question that recalls Baruch de Spinoza's
ŞThis question is related to Deleuze's famous question, 'What Can a Body Do?' - a question that recalls Baruch de Spinoza's statement that: 'We do not even know what a body is capable of.' See: G. Deleuze, What Can a Body Do? In: Expressionism in Philosophy: Spinoza. [4]

my compositions for *Pulse Project*. Central to the pre-modern Chinese conception of the body is that the body is a holistic organism [5] of different interrelated substances and essences that are shaped and mediated by the phenomenological (alchemical) processes of *yīnyáng* and *wǔxíng*.[2] The Chinese observed *yīnyáng wǔxíng* processes to be animate within all forms of being-in-nature - including animals - as a cosmological process. [6] In order for life to be sustained, the (primordial) substances of *yīn* and *yang* - opposite in nature and expression - must maintain a continual process of relative interaction, mutual restraint and interdependence because when *yīn* and *yáng* separate, death occurs. [7]

In addition to the perpetual dynamics of *yīnyáng, wǔxíng* describes the cosmological processes of the five elemental "phases" that are made manifest by the changing of the seasons and the transformations of natural phenomena associated with these seasons, such as: Wood (materialised by the powerful growth and movements of spring), Fire (materialised by the heat and upward expansion of summer), Earth (materialised by the languid abundance of late summer), Metal (materialised by the contracting strictness of the autumn harvest) and Water (materialised by the cooling, sinking and storing capacities of winter).[3] These elemental phases (see Figure 2) are expressed both within the body (i.e., through the organs associated with the types of transformations expressed by a particular element and season) and also exterior to the body, such as the manifestations of seasonal processes, e.g., the condensing and sinking effects that winter cold has on natural phenomena.

Within the body itself, there are vital "substances" that are animated and shaped by both interior and exterior *yīnyáng wǔxíng* processes. These substances are named: *qì, shén, xuè, zàng-fǔ* and *jīng-luò*. Roughly translated, these terms are described as the following: *qì* is the primordial substrate of the cosmos (both interior and exterior to the body), *shén* represents the embodied "spirit" that connects the human/animal mind with the cosmic 'mind,' *xuè* represents blood, *zàng-fǔ* is a term describing the *yīn* and *yáng* organs of the body and *jīng-luò* describe the *yīn* and *yáng* organ-networks of the body[4] (See Figures 2 - 4).

An Introduction to Chinese Medicine and Music Theories

According to the *Huáng Dì nèijīng*, a seminal Chinese

medicine text compiled by unknown authors from as early as the 3rd and 4th century BCE, there are five *yīn*[5] *zàng* organs: the Spleen, Liver, Heart, Lung and Kidneys and
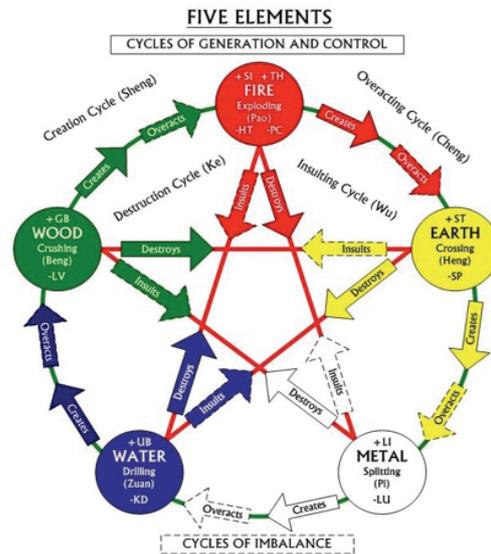
Figure 2: *Five Elements: Cycles of Generation and Control,* 2007, Don Reynolds. [Digital image] Public Domain Attribution. Source: Wikimedia Commons. [6]

six *yáng*[7] *fǔ* organs: the Stomach, Gall-Bladder, Small Intestine, Large Intestine and Bladder. [9] Each of the *zàng* and *fǔ* organs possess an associated energetic network, or 'channel' that runs between the depths of the organ to the outer reaches of the body. [9] The Pericardium, as an organ which encloses the Heart is regarded in Chinese Medicine as the Heart "protector" and is thought of as an extra organ of the Heart *zàng*. So, when we include the extra *yīn* Pericardium organ-network, altogether the *zàng-fǔ* organ-network pairs make a total of six *zàng-fǔ jīngluò (yīnyáng)* pairs and/or twelve *zàng-fǔ jīng-luò* (see Figures 3 - 4).

As it is these twelve channels that elaborate from the six *yīnyáng zàng-fǔ* pairs that are perceived and listened to at the six locations of pulse analysis (and are therefore

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[2] Refer to the Glossary for a definition of these terms.

[3] These elements are capitalised to emphasise their distinctness as Chinese philosophical concepts and are therefore not to be associated with their standard use.

[4] Refer to the Glossary for a definition of these terms.

[5] See the Glossary for this term.

[6] This image demonstrates the inter-relational directions and expressions of the generating (reinforcing) and controlling cycles of the *wǔxíng*. The first cycle travels in a clockwise direction, with the expression and development of each element gaining strength from the elemental phase that precedes it (such as: Earth creates and supports Metal). The "insulting cycle" (represented by the red arrows) is used as a "controlling cycle" in Chinese medicine facilitates one elemental process to control another elemental process from excessive expression or over-development. [8]

[7] See the Glossary for this term.

fundamental to pulse reading), the twelve *zàng-fǔ jīng-luò* form the fundamental structural basis for my graphic notations and audio compositions (this is discussed further the next section).

As mentioned above, each of the *zàng-fǔ* pair networks is also each associated with the phenomenal processes of the following five elements (*wǔxíng*): Fire, Earth, Metal, Water and Wood. For example, the Stomach/Spleen network is associated with Earth, the Lung/Large Intestine network is associated with Metal, the Kidney/Bladder network with Water, the Liver/Gall Bladder network with Wood, the Heart/Small Intestine with Fire, the Triple Heater/Pericardium with "Ministerial" Fire. Also, the *zàng-fǔ* pairs are likewise associated with the fundamental colours of their respective element: Fire is Red, Earth is Yellow, Metal is Silver/White, Water is Indigo/Black and Wood is Green. [8]
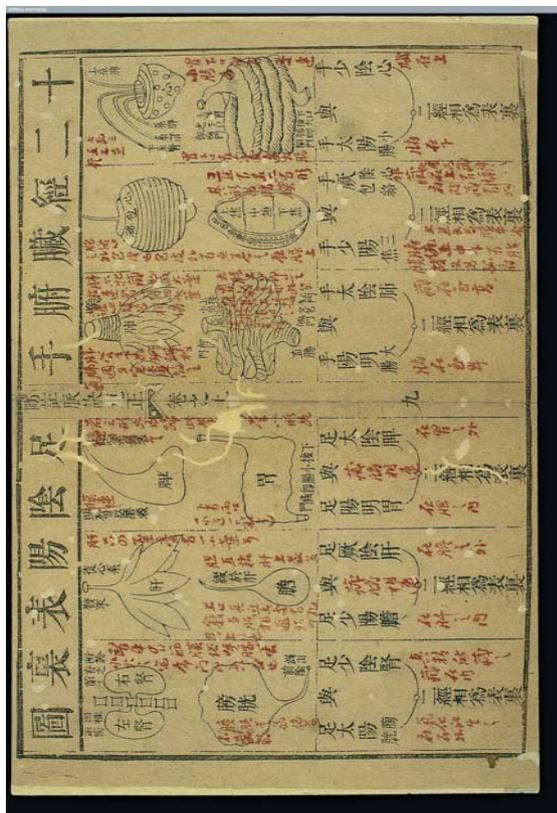
Figure 3*: Interior and Exterior Relationships of the Twelve Channels of the Hand and Feet,* Qing Dynasty 1644-1911. Shen Jing, Woodcut, Creative Commons Attribution. Source: Image Courtesy of the Wellcome Trust Library. [8]

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[8] This image is attributed to have been the work of Shen Jing during the Qing Dynasty. This woodcut illustrates the *yīn* and *yáng* (interior and exterior) relationships between the twelve *zàng-fǔ jīng-luò* (organ-channel network). Starting from the bottom of the illustration: 1. Water - the Kidney (*yīn*) and the

Each element/organ-network is also associated with a fundamental musical tone of the traditional Chinese pentatonic scale: *gōng, shāng, jué, zhǐ, yǔ*. [10] The frequencies used in my audio compositions are therefore calculated using these traditional pentatonic tones, this is discussed further in the section titled, "Soundscape Composition as a Healing Modality" below.
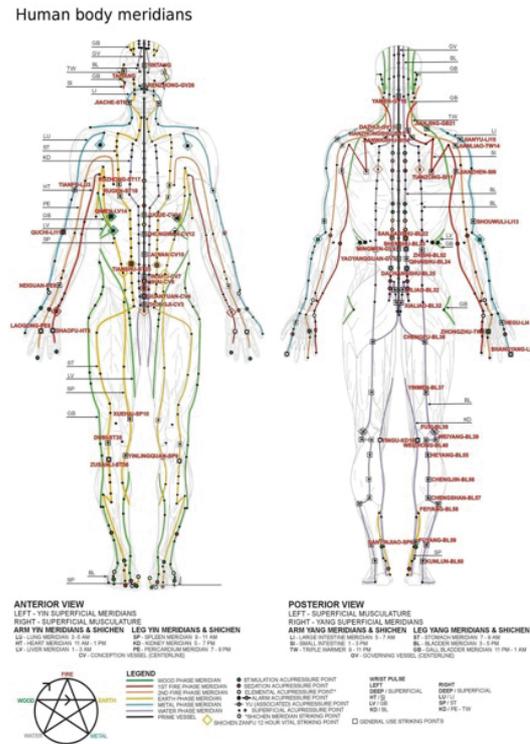
Figure 4: *Human body meridians*, 2010, Author: KVDP, digital image, Creative Commons Attribution-Share Alike 3.0 Unported license, Source: Wikimedia Commons. [9]

Bladder (*yáng*). 2.Wood – the Liver (*yīn*) and the Gall Bladder (*yáng*). 3 Earth - the Spleen (*yīn*) and Stomach *yáng*). 4. Metal - the Lung (*yīn*) and Large Intestine (*yáng*). 5. Ministerial Fire - the Pericardium, which looks like a bees nest (*yīn*), and the Triple Burner (*yáng*). 6. (at the top of the image) Fire - the Heart (*yīn*) and Small Intestine (*yáng*). The text illuminates on how these organs also share a "six-level" system of further inter-correspondence between the organs. For instance, the Lung and Spleen *zàng* are paired to form the *taiyin jīng-luò*, the Stomach and the Large Intestine *fǔ* form the *yangming jīng-luò,* and so on.

[9] This diagram demonstrates a contemporary overview of the twelve *zàng-fǔ* jīng-luò. Each *zàng-fǔ* *jīng-luò* pair is signified by the coloured lines on the body. The *jīng-luò* are: Lung, Large Intestine (blue lines), Stomach, Spleen (yellow lines), Heart, Small Intestine (red lines), Kidneys, Bladder (grey lines), Triple Heater, Pericardium (orange lines), Liver, Gall Bladder (green lines).

Pulse Reading Method

In contrast to simply counting the beats of the radial pulse (as in the West), in Chinese medicine, there are three positions on each wrist to palpate the pulse - making a total of six positions of palpation altogether (refer to Figure 5). From each position (signified by the black dots on wrist in Figure 5), the practitioner registers at least two levels from which the pulse waveform qualities can be felt and are referred to as *superficial* and *deep* (making a total of twelve locations of palpation altogether for the pulse). Each position is also associated with the specific *zàng-fǔ*: the Lungs, Large Intestine, Stomach, Spleen, Heart, Small Intestine and so on. Each *zàng* and *fǔ* position corresponds to a lexicon of pathological and ideal pulse waveform images.

For example, at the middle position on the left wrist (the position of the Liver and Gallbladder *zàng-fǔ* pair), there is a list of corresponding images: "bowstring," "choppy," "replete," "fine," etcetera, and these waveform images (and their amplitude and vibratory quality) reveal the state of health of this *zàng-fǔ jīng-luò* (organ-network). There is more "data" than just the pulse images and vibrations. A practitioner also intuits other sorts of information from touching others, e.g., how they feel about their place in the world, their living situation, an image of inner courageousness or a sense of a person being diminished, etcetera. It is this "artistic" aspect of Chinese pulse diagnosis that this project calls attention to and extends as *Pulse Project* focuses solely on this moment of clinical art as the basis for the performance.
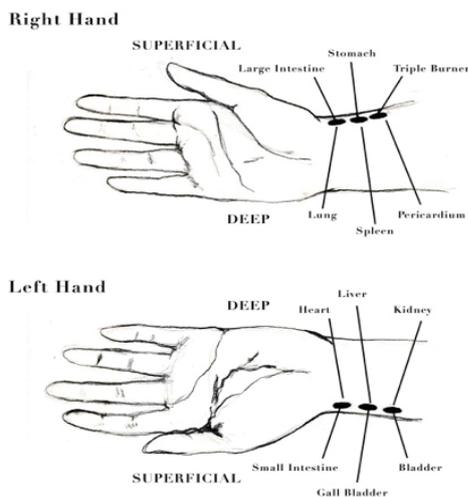
Figure 5: *Chinese Pulse Diagnosis Diagram*, 2013, © Michelle Lewis-King, Digital Illustration.

Soundscape Composition as Healing Modality

My use of audio programming intensifies its focus on listening as the determining factor for composing soundscapes - as I use audio programming to sculpt the dynamics of each sine wave within my compositions. In this way, the embodied (sensory) and intuitive aspects of listening form the primary rationale for my composing soundscapes. It is this act of listening-as-composing itself that is used as a means for characterising the fluid and electric-like nature of the vibrations I feel and intuit within people's pulses into sound. In this context, I conceive of sound in its essence - as a sine wave – thereby generating shaping sine waves by using audio programming arguments as a means for translating the range of waveform sensations that I perceive during the pulse analysis procedure of the performances. In my notations I record the pulse waveforms of the twelve organ-networks felt in each individual's pulse to create a unique soundscape. Figures 6 and 7 demonstrate the pulse wave-forms of the *zàng-fǔ* (reading from top to bottom): Lung, Large Intestine, Stomach, Spleen, Triple Burner, Pericardium, Heart, Small Intestine, Gall Bladder, Liver, Kidneys, Bladder - *R* and *L* indicate overall right and left wave forms.

According to the medical theory of the *Huang Di neijing* (1 BCE), the 'ideal' pitch of each of the *zàng-fǔ*, or the pitch at which the organ network ideally oscillates at and responds best to are as follows:
• Heart/Small Intestine [*Zhǐ* - Fire pitch: 399 Hz]
• Spleen/Stomach [*Gōng* - Earth pitch: 264 Hz]
• Lung/Large Intestine [*Shāng*- Metal pitch: 295 Hz]
• Kidney/Bladder [*Yǔ* - Water pitch: 440 Hz]
• Liver/Gall Bladder [*Jué/Jiao* - Wood pitch: 350 Hz]
[11]
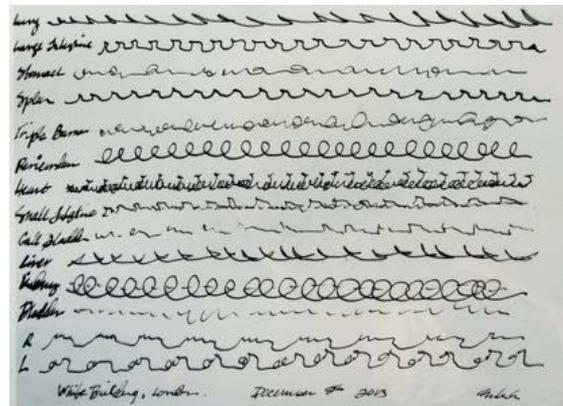
Figure 6: *White Building 4,* 2013, © Michelle Lewis-King, Acetate, ink [A4].
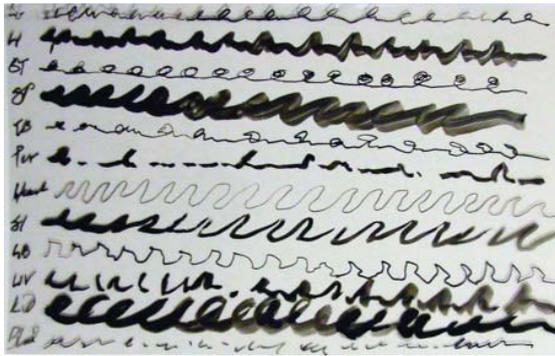
Figure 7: *Cambridge Notation 1,* 2014, © Michelle Lewis-King, Ink Painting on Acetate [A4].

In order to convey the landscape of the body according to Chinese Medicine pulse diagnostics as a soundscape, each pulse waveform from each pulse reading is translated into a composition of sine waveforms modulated to exemplify the signature qualities of the pulse waveforms as recorded in the notations. For example, the Spleen and Stomach waveforms in Figures 6 and 7 correspond to the *gōng* waveform pitch - at the frequency of 264 Hz – and these organs are associated with Earth. According to traditional Chinese medicine and music theories, the 264 Hz pitch/frequency is considered to be the most therapeutic tone/vibration for the Spleen and Stomach (Earth) *zàng-fŭ* network [11] and so each of the twelve pulse waveforms is translated into sound in my audio compositions to both represent and "harmonise" the energy of the specific *zàng-fŭ* networks. My soundscape compositions draw upon my experience as an acupuncturist (therefore it is a form of diagnosis in Chinese medicine) in that I respond to and aim to moderate imbalances felt within participant's pulses. Each of my compositions aim to rebalance the overall "pitches" of the participant's *zàng-fŭ jīng-luò* in order to promote the health and well-being of each participant.

Practice-Based Methodology

Pulse Project uses practice-based research (PBR) in a socially-engaged context (places the private clinic within the public arena) to use artistic research and interpersonal communication to explore current social awareness of art, medicine and technology practices and to co-create a new set of connections and understandings about these practices as a central part of the research processes. To do this, each encounter with research participants creates 'relationscapes' [12]. By using relational touch, tracing and notating the participant's unique pulse rhythms, inter-personal communication, and composing or playing bespoke soundscapes, these PBR methods both draw upon and evidence the co-emergence and co-production of

relational meaning that takes place between researcher and research participant within the performances.

Pulse Project reinterprets the standard uses of case-study consultations and clinical notes as a method for mirroring the clinical encounter in order to: a) question and test what a clinic *is* and can be in public, and, b) open up imaginary and autonomous spaces within the clinical encounter that can be discussed and rearranged via creative communication and production with others.

In this context, using PBR as a method for gathering clinical data can then reflect not only explicit clinical knowledge (i.e., resting heart rate and so on), but also allows for the inclusion of the sensorium of consciousness to become an integral aspect of the clinical production (the outputs of which do not produce a diagnosis but rather artworks *about* the diagnostic process). Consequently, using PBR to abstract the diagnostic process creates a zone intensified 'listening' to another person (and to tacit experience), which at the same time produces a new way to listen to clinical practice itself.

Participant Feedback

In terms of testing whether this project, which touches on converged areas of practice, can be communicated to participants in a clear and cohesive manner that also engages their creative response, the best confirmation of this 'communication' is given by this participant who writes:

"Moreover, not every biological process taking place in our bodies is fully explained and understood even in "sophisticated" western medicine, so maybe searching for the new unconventional methods like you do leads us to understand our own species in a totally different way. Although pulse reading has long history and today it gives us lot of information about functioning some of our internal organs, your method is an amazing way to hear it in a way we never did… from beat to ambient music… it makes me think that my body has not only rhythm but also it's own, unique melody." [10]

This response addresses precisely the reconsideration of the dominant cultural narratives surrounding embodiment that I have endeavoured to reconfigure through my performances and soundscapes and gives an external source of confirmation to the research objectives of this study. Particularly as this participant notes that she

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[10] This text is an excerpt from the 'Participant Feedback Log' within my thesis (where all participant-researcher communication is archived. This particular participant is anonymised on ethical grounds and was given the name 'White-Building 3' in order to identify the individual and to link the feedback commentary with the soundscape produced for that individual. [13]

can hear her body 'in a way [she] never had before' and that her body 'has not only rhythm but its own unique melody,' these statements give substance to the notion that artistic production can offer an 'enriching' experience of the scientific' encounter.

Conclusion

Since human touch bridges oneself with another, the development of a technology of touch [11] based on the model of early Chinese pulse diagnostics is elaborated on in this study as a means for challenging and extending contemporary technoscientific practices. [15] More specifically, the establishment of a technology of touch is investigated in this study as a digital methodology that generates new articulations of an embodied consciousness via sound that runs counter to the trends within "interactive" new media that places its emphasis on the mechanical measurement and mapping of participant's vital signs, such as sonifying data from biosensors, stethoscopes and forms of technology which rely on mathematical calculations as the golden mean for representing the interior of the body and embodiment. [1]

Pulse Project questions aesthetical and ontological axioms that currently underpin contemporary art, medicine and technology by researching these concerns into relation with the concerns of pre-modern Chinese medicine and music theories. Accordingly, this research travels laterally between cultures and practices and calls for a radical change in conceiving of the body in either "Oriental" and "Occidental" terms in order to both reduce ethnocentric ignorance and also to travel beyond the tired bifurcations between mind and body, self and others, the "West" and its Othered cultures.

Furthermore, *Pulse Project* examines the relationship between the arts and sciences from a transcultural perspective that generates a fresh approach to the arts/humanities-science relationship. In using my creative practice together with my scholarship of two forms of medicine (biomedicine and Chinese Medicine), this project offers unique comparisons of expertise and approaches between disciplines, histories and cultural practices from the position of extending expertise from within all of these systems. Finally, being trained in both art and science fields allows me to disrupt the "two cultures" approach still active within humanities and science discourses through dedicated involvement and practical experience in both fields. At the same time, this research also breaks with the ethnocentric limitations of the coherences of "Occident" (the Western self) and "Orient" (the Other as it is "oriented" to the West) by creating a new dialogic imaginary that exists *between* these cultural categories.

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[11] This concept aligns with Elisabeth Hsu's "Towards a science of touch, part I: Chinese pulse diagnostics in early modern Europe." [14]

Glossary

1. *Jingluo* - This translates as the 'meridians' that extend between the zangfu and the exterior of the body. [16]
2. *Shāng diao* scale - an early Chinese pentatonic scale tuning method using the note s*hāng* as the fundamental tone. [10]
3. *Shén* - The central "spirit" or "universal mind" (this is not a Greek-Judeo/Christian concept) that governs the overall processes of the body and also oversees the other four "spirits" of the body - the *Hun* (ethereal soul) , *Po* (corporeal soul) , *Yi* (intuitive intellect), *Zhi* (the will) . The *shén* as an energetic entity is rooted in the body via the connections between the heart-brain-mind and *xue*. [17]
4. *Qì*- Described as an all-pervasive life force, this energetic substance is the basis for Chinese medicine and science. It is the material of transformation itself and the range of transformations could be understood to be as wide as the cosmos itself - traveling from the density of a white dwarf to the briefest emanation of quantum particles. In Chinese medicine, practitioners try to manipulate the flow of this energy to assist healing - based on Chinese Medical principles. [18]
5. *Wǔxíng* - Often called the "five phases" or elements (Earth, Fire, Metal, Water and Wood), this term describes a systematisation of phenomena into five distinct movements or phases – phases that describe the movement and characteristics of the changing seasons of spring, summer and so on. These elements have a specific order and inter-relationship with each other. One element may generate or control another, i.e., winter generates spring, whereas autumn is in contrast to spring. These elemental phenomena can be used to describe the phasic interaction between cosmological entities or between the organs of the body. [19]
6. *Xue* - This substance translates as "blood" and corresponds to the biomedical understanding of blood, but is also conceived of as a yin essence substance that both moves and is moved by *qi*. [16]
7. *Yīn- yáng* - Describes two opposing yet interdependent and interconnected primal forces that are characterised by phenomena that are cyclical or on a spectrum, such as 'day and night,' 'hot and cold,' internal and external,' etcetera. This continually shifting pair of opposites constitutes the fundamental basis for early Chinese philosophy and science. [20]
8. *Zàng-fǔ* - Zàng refers to the five *yīn* organs of the body: Heart/Pericardium, Spleen, Liver, Lung, Kidney. *Fǔ* refers to the six yáng organs: Large Intestine, Small Intestine, Gall Bladder, Urinary Bladder, Stomach, Triple Burner. These *zàng-fǔ* each have an associated channel that extends the energy of the organs along points across the body. As simple definition of the functions of the *zàng-fǔ*: the five *yīn* organs are said to "store" and produce essential fluids, while the six *yáng* organs "transform" essences into production of movements/energy. [21]

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Simondon's Concept of the Image:

At the Junction of the Technological and the Animal

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Abstract

This paper presents an approach to the concept of the image articulated through non-hierarchical modes of being which include the human and the non-human, the technical and the biological, the animate and the inanimate. This approach to the image elaborates on the ideas of French philosopher Gilbert Simondon (1924-1989) who conceives it through an understanding of technical culture that sees no dichotomy between nature and culture and dissolves the rift between the human and the technological, the animal and the machinic. For Simondon, technologies are assemblages between instruments and machines, machines and humans, animals and milieus, invention and experience which produce new hybrid modes of thought, of being, of communicating—of existence which composes through expanded, hybrid beings. These hybrid beings sustain, unite and bring together the actual and the virtual, the human and the non-human, the animate and non-animate as individuations, as machinic assemblages within a multi-phased imagistic process. Like Bergson, Simondon's ideation of the image is non-pictorial, non-visual and steers away from an anthropocentric static conception, so that we can come to express the image as a process of individuation arising at the intersection of the animal and the technological.

Introduction

In the face of the complex, hybrid, expanded reality we find ourselves in—particulary in Art and Technology—the polarised relation between human and machine is no longer tenable, we need a different approach to think the image, one which considers both the natural and the technological milieus. In this perspective, we look to elaborate a concept of the image which goes beyond the anthropocentric scheme and takes into account the process-based, mutable and systemic thinking of a hybrid and expanded world.

We advance that the image occurs within an associative concretization that integrates a hybrid actuality. Here, hybrid refers to the acknowledgement of the simultaneous co-existence of the natural and the artificial in Gilbert Simondon and Jean-Luc Nancy, of the actual and virtual in Gilles Deleuze and Felix Guattari, of the human and non-human in Bruno Latour, and of physical space and cyberspace in Roy Ascott. We bring these questions on the image to the field of Art and Technology at a moment in which we find ourselves constituted by physical and digital dimensions. How can one maintain the division between mental images and concrete images? Between images related to the imaginary, to memory and mental constructs and images related to invention within a technological poetics at the junction of cyberspace and geographical space? How can one maintain the division within technological poetics which builds cyborgs and crosses the animal, human, the vegetal, the micro and nano-biological, and the machinic to create expanded minds and bodies? We speak of informational territories, of cybercities, of cyberspace, telematics, mixed realities, augmented realities, expanded systems, alter-organised systems, ecosystems, artificial life, nano-art, neuro-art, the semantic web, biological software, evolutive hardware, bio-art, the internet of things—notions which bring us to think our existence in a hybrid and expanded way, without invoking spatio-temporal conceptions which are exclusively physical or measurable within closed systems.

We propose a move towards an understanding of technical culture that breaks with the dichotomy of nature and culture and dissolves the rift between the human and the technological, so that what is defined as human nature is already part of a technological system. Technologies are assemblages between instruments and machines, machines and humans, humans and milieus, humans and ideas which produce new hybrid modes of thought, of being, of communicating—of existence which composes through expanded, hybrid beings.

"Thus, we can definitely overcome the traditional anthropocentric concept based on the belief that technics (or biotechnics) must only be developed as an external extension of human organs or in order to widen their physical capabilities (prostheses, tools, etc). The creation of new direct interfaces between human beings and the machinic allows a synthesis of both systems […]. The external relation between human beings and machines becomes a deeper symbiosis between the natural and the artificial". [1]

For Simondon, what is required is a biological and a technological evolution which does not separate nature and technology, where the natural and the artificial constitute the world in a technical culture. "It is necessary that the technical object be known in itself so that the relation of man and machine can be stable and valid: hence, the need for technical culture". [2]

Image and Milieu

Invariably, we like easily cognised ideas as concepts — such as 'field', for example—because we have an intuitive grasp of them based on a certain familiarity that is based on experience. We can look at a farmer's field or a football field, and understand it as a territorial expanse and an activity that takes place on it. Immediately, we see the obvious, implicit division between the surface of the happening and the happening itself. But if we change the scale of our perception, we see that the surface of happening is a changing, mutating site of passage, of synthesis, of being-doing that is difficult to separate from the participants as activities taking place and which are themselves also metamorphosing entities. We no longer speak of the activity as differentiated from the field as location nor from the occupation of the participants. There's no longer a hierarchical distinction of value between the farmer or the players, the plow or the ball, the crops or the grass and consider them equally as participant bodies. More abstractly, the unfolding of the event incorporates actual and virtual participants. It involves forces, intensities and their potentials into an intuitive becoming where the event is guided by an immanent intelligence which orients the creative process and its advance into novelty as invention. The movement of these forces, intensities and potentials does not subscribe to a neatly definable line of causality but is more akin to a turbulent flow of energies, to an unresolvable infinitely complex give and take, to a multiplicity of action and reaction on infinite fronts as imagistic process, whose sum total manifests a resultant direction as becoming.

So that we come to understand the field as a territorialization of forces and intensities constitutive of meta-stable bodies and not one of objects—yet, this field of activity does not happen in space as a temporal unfolding but arises immanently in space-time: it is not space plus time but space-time. The individuated event as an emergent amalgam of territorialities and bodies acquires and expresses its own spacetime within which participants become associated as one in the experiential ecology that involves them. And instead of expressing the processual unfolding of the event as a field, as a flat surface, we consider it as a "more-than a planar surface" which fuses time, space and participants into what Simondon will call in his book, *The Mode of Existence of the Technical Object,* a milieu, an associated milieu.

In French, the term milieu does not only refer to a physical environment or setting, it means "surroundings," or a "medium" as in biology, or "middle" as amidst. The milieu is normally understood as the ensemble of external conditions within which a living being lives and develops or as the assemblage of material objects and physical circumstances which surround and influence an organism. "Milieu" can also be seen as an environment in the widest ecological sense of the term, i.e. as the locus of the dynamic interaction of all the factors and mechanisms that participate in the sustenance of an ecosystem.

The concept of the associated milieu is a useful model to analyze the reciprocal and recurrent co-arising causal relationships that take place between the individual participants and territorialities and the image. The descriptive term "associated" when applied to describe milieu refers to a specific mapping of an ensemble made up of constitutive elements and conditioning environmental modalities which come together to create a concretized individuation through the ongoing exchanges of energy that take place within that specific milieu.

The associated milieu sustains, unites and brings together the actual and the virtual, the human and the non-human, animate and non-animate individuations: it is not a stage upon which a scene unfolds, or a play where only the actors perform, or a canvas upon which the pigments run into each other, or a manuscript where the words follow each other in sequence.

"The milieu is the setting and environment of concretion, of aggregation, where things condition each other in order to form something which in turn, simultaneously, allows these very same things to take form themselves. In other words, the milieu allows for a non-static, dynamic form as an event of images taking-form as experience". [3] This is demonstrated in the artwork *Entremeios* (Between\Milieus), 2014 (Fig. 1). In this interactive video installation produced by LabInter/UFSM the work explores the acts of inhabiting a variety of mediated images/milieus and the movement from one to the other. Generated imagery from various spaces and temporalities hybridise themselves in a singular space and in real time, enabling interactivity between the work and the public.

Fig. 1: *Entremeios* (Between\Milieus), 2014, LabInter, interactive installation. Source: LabInter.

If we consider the animal-milieu relation, the animal constitutes itself in a dynamic geography according to its specific being-doing as movements and forms, thus composing an associated milieu. The animal is not only a subject that acts in the milieu, but the milieu provokes and arouses the subject as a being-doing and which in turn becomes modified by the occupation of the animal; the milieu incites the body into action while the animal is

being simultaneously, reciprocally composed by the milieu—the bee seeks out the flower just as much as the flower rouses and attracts the bee in a simultaneous, reciprocal, interdependent co-arising. These are the qualities of the milieu, of the intensities of beings which seduce and affect sensitive becomings as localised being-doings. As modes of relation, of association, between the qualities of bodies and of milieus, they are states of being, of consciousness, of awareness as a continuum of being. The milieu as constitutive of this continuum of relation allows for the reciprocal conditioning that is non-human or not even not-yet-human, but animate and cognitively different as expressive of its being and of what it can do. Michel Serres poses a very relevant and contemporary question, "How can we forget the elementary, animal relation with the world?" [4] To learn with the animal, to become-animal as Deleuze would say, is to learn through experiences of a non-human body, a body produced in different forms—through the animal, the vegetal, the technological—in a life which affirms itself through the milieu through which it transits and the relations that are woven.

The milieu crosses through individuals, simultaneously existing within them and outside of them like the air which one breathes, or the water that permeates our body, or the earth that nurtures and nourishes us. To think of the milieu is to think of individuation, of the production of the individual proper, its modes of functioning and perceiving, and its pre-established connections and relations. In this way, the milieu is active and defines itself as a source of energies, perceptions and actions. According to Deleuze and Guatarri [5], the notion of the milieu is not unitary: not only does the living thing continually pass from one milieu to another; they are essentially communicating and (in)forming. And here it should be emphasized that milieus communicate not only in the sense of being connected machinically as a matter-forming, but in the sense of exchanging information through the action-reaction dynamic which is constitutive of the production of images. And it is in the way that information is communicated that the different modalities of imagistic process is articulated.

Image: Animal and Technological

Like Bergson, Simondon's ideation of the image is non-pictorial, non-visual and also steers away from an anthropocentric static conception. It is understood as emergent within the associated milieu through a transductive, 4-phased, cyclic process which includes: the motor-image, the perception-image, the mental-image, and the invention-image. [6]

Through these phases, one can modulate the relation between the human, non-human and the milieu and thus eliminate any polarising hierarchical importance between participating elements in the genesis of the image. The image is thus understood as a transient, intermediate processual reality between individual individuations and milieus existing within an evolutive technological

multiplicity. Echoing Bergson, Deleuze [7] points out that we don't perceive things in our mind, we perceive things where they are, in the world. Jean-Luc Nancy [8] points out along the same lines that the image is that which we can distinguish from the background. Thus, within the speculative approach, image is not restricted to the usual visual perception of objects, but is directly related to systems of relationship within the milieu—to experience itself.

Things exist as a polymorphic, evolutive and temporal diversity in a transductive relationship between the co-existent memory-image of the past, the perception-image of the present and the invention-image of the future. The image appears in the directed interaction between participants and the environment they are in: it is not just produced by a subject. Rather, the image produces and develops the subject and allows it to manifest itself as an immanent function of creation while being relatively independent from it. We live in a world of images: they inhabit us while creating our worlds; they actualize us and virtualize us according to different realities.

We understand the image not as an individualized given to be analysed, but as a process of individuation. The genesis of the image is conceived within a systemic, cyclic and processual approach where the cycle is made up of four co-existing phases (Fig. 2):

1) the motor-image
2) the perception-image
3) the mental-image
4) the invention-image
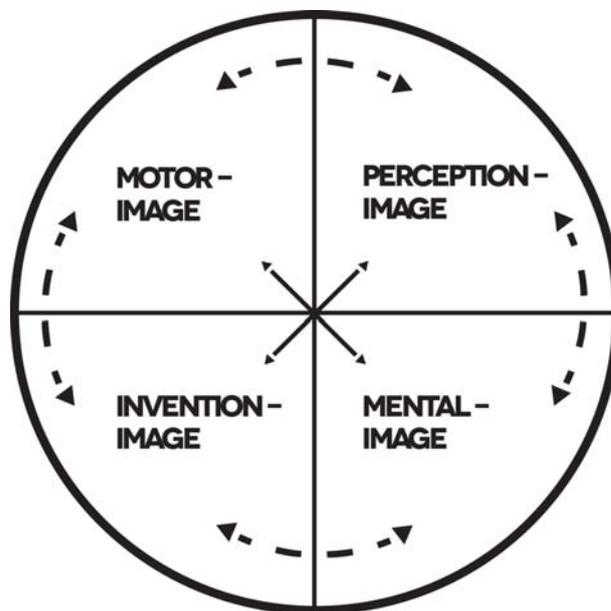
Fig. 2: *The four co-existing phases of the image in Simondon.* Source: Andreia Machado Oliveira.

One important aspect to keep in mind is that the milieu is not a single, homogeneous image. Although the associated milieu can be seen as a unitary subjective imagistic process, the milieu is composed of a

multiplicity of simultaneous subsidiary imagistic processes at different stages of phasic becoming interacting imagistically with each other. The associated milieu is not a pure, singular, homogeneous imagistic phasing but a multiplicity of co-temporal phases interacting with each other. Each type of image is productive of specific results which serve as objective imagistic raw material towards the production of new images. Depending on what they do and how they relate to the type of image being produced, these intermediate imagistic hybrids go by different names: objects, motricity of nervous excitation, signs, symbols… And as will be seen later, these intermediate hybrid images are the hinges that allow the transition from one phase to the next—from one level of informing animation to the next.

With the motor-image, the conditions are created for the adaptation of the living and the non-living elements to the milieu. Through a constant effect of motor activity, the image creates an a priori situation for the future perceptive identification of the object. Motor movement precedes sensory perception so that for the stimulus/response to occur, a high level of organisation is required for the reception of the signs within the milieu. Hence, it is the image that makes the object emerge for the subject, and precedes the object itself. It is the very genetic programming of an organism over its milieu and what determines its animality. [9]

In order to provide examples of the motor-image, we offer situations which refer to adaptations to the milieu—attunements which directly link motricity to instinct. We know that when babies are born, they initially do not recognise the figure of their mothers—instead, there's an indefinite form which satisfies its motor need for suction and food. Only later the infant will have the capacity to recognise the mother figure, the breast object, the nipple, etc.

Activities carried out automatically and unconsciously, that is, without the intermission of conscious thought, go through the various senses—the gustatory, the ocular, the tactile, the olfactory, the synesthetic—to satisfy motor needs brought on by instinct as stimulus, as expressive of our animal nature. Jean-Luc Nancy points out in agreement with Simondon that "the image is not only visual: it is also musical, poetic, even tactile, olfactory or gustatory, kinesthetic and so on". [10] Imagistic process is not only visual but is a motricity produced automatically through the senses functioning together in a pre-human animal response to the reciprocal co-conditioning of the milieu.

In complexifying the motor-image, we can involve issues related to art and technology. We bring forth propositions which put in question the relation between the natural and the artificial, the human and the non-human, the structure of bodies and their actions and connections.

As Latour writes, "Art and nature have merged, folding into one another and forming a continuous sensorium". [11] In the interaction with new technologies, the body expands its motor structures and its physical and mental functions. It acquires others

means of feeling, of perceiving, of acting, and of thinking. For Gianetti, from a post-biological perspective, what currently "makes sense is no longer the freedom of ideas, but the freedom of forms: the freedom to modify and change the body. People assembled by fragments are post-evolutionary experiments". [12]
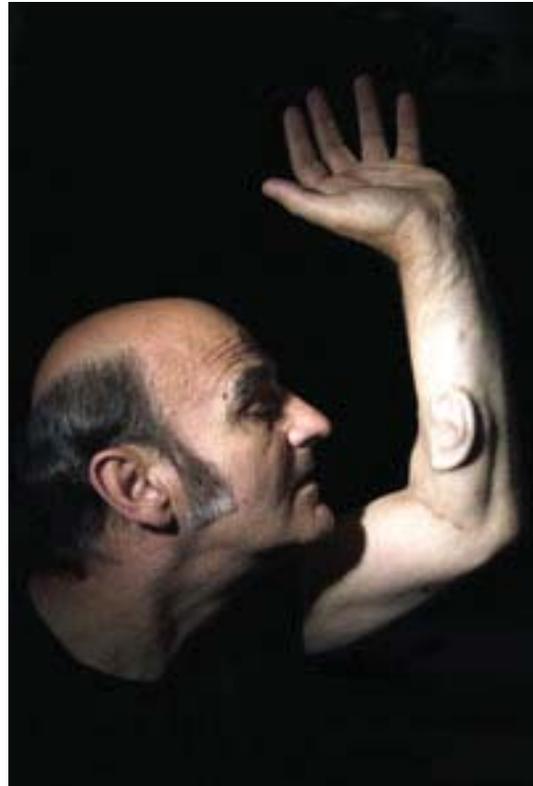
Fig. 3: *Ear on Arm*, 2006, Stelarc, organic material. Source: https://commons.wikimedia.org/wiki/File:Stelarc_Extra_Ear_Ear_on_Arm.jpg

For example, when Stelarc (Fig. 3) implants an ear on his arm, he intends to augment the speed of his body by linking it to the web, thus producing an-other analogic/digital body, a self-imposed evolutionary adaptation. It would be senseless to assert that the digital milieu would reject the body—so that for Simondon, there is a biological and technological evolution, without separating nature and technology. He seeks to attach an artificial extension or prosthesis to the human body to posit that

He seeks the extension of the human body by artificial means, thus positing that our body has become obsolete in face of contemporary technology. In his work *Ear on Arm* (Figure 3) he had a left ear implanted in his left arm to be enhanced in future surgeries with a microphone connected to the internet; this makes the implanted ear an organ with possible public access to other locations, not only to listen but to transmit sounds so that, for example, a person living in New York City can listen in on Stelarc's locale. Even more audaciously, the project can be extended by combining a receiver with

a loudspeaker inside of the mouth; the artist could then answer calls by speaking into the ear on his arm while listening to the received call inside his head. If he keeps his mouth shut he can listen internally, whereas if he opens his mouth, the sound becomes amplified and others can listen in. In this way, the *Ear on Arm* and the amplifier mouth become organs of the internet.

From the motor-images produced by motricity, bodies are able to develop sensorialities in relation to the milieu, which gives rise to the perception-image. As Massumi writes in *Parables of the Virtual* (2002) perception is "real movement, because something has happened: the body has been capacitated. It's been relationally activated". [13]

Imagistic process is not passive or static when it goes by unperceived by the subject; it is differential activity that is constantly emerging and productive. The perception-image enables the interaction of a subject with the world, and the object emerges from the experience as the beginning of a new phasing. But because the milieu is a multiplicity of subordinate individuations at various stages and phasings of becoming, the process is not so linearly straightforward: intermediary images are produced from the imagistic interaction of images in different phases. From the action of signs on the living and the non-living within the associated milieu, a number of responses will result; the images will organise themselves progressively as an effect of difference and repetition within experience. The perception-image evokes an action with the object, based on the perception of the milieu's signs. The object appears through the perception-image of the signs of the milieu which in turn become objects. Perception is not an action of the subject outside and above a milieu which contains objects, but an effect of non-hierarchical systemic relations which include subjects, subsidiary images, objects and milieus, "perception exists between that which perceives and what is perceived" [14]

The perception arises from this relational process between things, making explicit that they are always becoming something in the action of living. A creature's perceptions, whether animal, vegetal, human or technological, "are its actions in their latent states. Perceptions are possible actions". [15] And just as an animal's evolutionary adjustments to ecological imperatives modify their perceptual being, technological devices are evermore altering our perceptions of the milieu, influencing the signs contained within themselves, transforming them, mixing them, incorporating them through the construction of digital milieus and hybrid images in interactive installations, of augmented reality with goggles, tablets, smart phones, etc. As such, the everyday images that we perceive are essentially technological images (analog and digital) which hybridize our experience through imagistic process.

With experience in telematics, Roy Ascott [16] speaks about the faculty of post-biological cyber-perception. Through cyber-perception, we can perceive our capacity to be outside of our bodies or act out a

mental symbiosis with others in fields which can articulate our multiple natures, or a new understanding of non-linear or non-categoreal patterns in rhizomatic assemblages. It proposes a multiplicity of points of view and the impermanence of all perception. An intelligent milieu which responds to our gaze, which sees, hears and reacts to the same extent that we do. It is an art aimed at ridding itself of representation in order to become self-expression and to celebrate the creativity of a distributed consciousness. While inhabiting cyberspace and virtual milieus, the artist becomes concerned with the revelation, with the manifestation of that which until now had never been seen, heard or lived.

Virtual reality artworks such as *Osmose* (1995) by Canadian artist Char Davies, can provide an experience without contiguity with the referent and with other spatio-temporal situations. "Whereas early virtual environments utilised portals that rendered transitions abrupt, in the image world of *Osmose* the observer experiences osmotic transitions from one sphere to the next, seeing one slowly fade before it amalgamates into the next". [17] The viewer enters a state of immersion within the transformations of the digital landscape and experiences sensations of lightness, a lack of gravity, and multidirectional movements. In *Osmose* a virtual reality helmet (in those early days), features of 3D computer graphics and audio that are exploited synesthetically.

Brazilian artist André Parente, in his interactive installation *Figuras na Paisagem* (Figures in a Landscape) (2005), an immersive dispositif called *Visorama* that simulates binoculars, except that it shows digital images of scanned panoramic photographic landscapes as video and audio. Several images and soundscapes are activated simultaneously allowing for the coexistence of various temporalities and spaces.

The mental-image arises in an analogous manner in relation to the world. Afterwards, the motor images and perceptual images are mentally organized and systematized according to an affective-emotional attunement with the external milieu as memorial process. As Simondon states, memories consist of images that have been retained when the situation and the experience no longer exist. [18] To think memory as imagistic process with digital technologies requires that we expand its conception to hybrid or collective memories. We see this hybridity of collective memories at work in the *Selfiecity* project (2014) by Lev Manovich. Together with Dominikus Baur, Jay Chow, Daniel Goddemeyer, Nadav Hochman, Moritz Stefaner, Alise Tifentale, and Mehrdad Yazdani, they have created an interactive web app for discussing the construction of popular photographic self-representation in digital visual culture, for exploring a dataset of 3200 Instagram selfie photos from five global cities: Bangkok, Berlin, Moscow, New York, and Sao Paulo, and for proposing other way of data visualizations. [19]

With the Internet we are faced with collective memory which is fed continuously from data produced in various media and shared by certain modes of data visualizations. And when we speak of nutrition, of

keeping the beast alive by feeding it, are we not harkening back to Aristotle's first divisions of what constitutes animal life? We make this point in passing in that these linguistic constructs are also constitutive of bodies and animate forms, of machinic assemblages which have a life of their own and which produce their own ecologies of thought, of being, of existence which are as animate and full of life as any flesh and blood animal.

Mental images produce collective symbols which when saturated generate invention-images. Symbols are pseudo-objects between the living and the milieu, so that the symbols is an instrument and medium for invention, but not an invention in itself. Language can be understood as an image that is produced in the mental phase, transducted between the motor-image and the invention-image. As Serres writes, "That forgotten, unknown man became a man by speaking, and the word has moulded his flesh, not only his collective flesh of exchanges or perception, use or domination, but also and especially his corporeal flesh". [20] The invention-image produces a spatio-temporal imagistic shift within the environment.

In the video-installation *The House* (2002), Finnish video artist Eija-Liisa Ahtila unfolds the symbol of the house She fabulates the histories contained in the imagery of the house as if the doors and windows float within our unconscious without a boundary between fiction and reality. The house, the artist, the surrounding landscape, the objects, the wind, the animals invent other realities. We are just as fragmented as the house and we come to perceive that there is not only one subjective, historical house, but on the contrary we live within these heterogeneous differences. The image is saturated by a technological montage that plays with the house as a symbol which opens onto other narratives, to other meta-stable triggerings which produce invention.

The invention-image is directly related to the technical and aesthetic invention, where the creative imagination is the ability to invent technical and aesthetic objects from the capacity for symbolization and communication. As Simondon writes, in the very production of the image, "all objects produced by man are image-objects which the imagination concretises". [21] The aesthetic object is an effect of the activity of invention, but mainly it is an opening to unforeseen primitive realities in the sense of an aesthetics of the senses and the return to the primary phases of the image. Thus, the invention-image modifies the conditions of its natural existence. [22] We understand invention as a mode of human and non-human existence which activate fluxes of fields through the action of the future on the present as opening up being to new regimes of images. The installations developed by the SCIArts group were based from the start on the idea of the system: for example, in their *MetaCampo* project (2010) (Fig. 4), the system of the artwork-human-milieu interconnects with what happens inside and outside the gallery. Politics, the economy, traffic in big cities—any smart system including humans can be described as a system that shares similar behaviors or dynamics, and, despite the particularities and scales, maintain similarities in their compositions. The artwork-human-milieu system is inserted into other macro and micro systems, connecting through transductive links.

Fig. 4: *Metacampo*, 2010, SCIArts group. Source: Carlos Donaduzzi/SCIArts group

To emphasize the difference between human and non-human becomes pointless, now that active objects are increasingly taking the place that was once occupied by humans. When we speak about the Internet of Things, Generative or Artificial Intelligence, we need to shift our anthropocentric understanding and make room for objects as animate bodies, as living forms of a different nature.

Thus, Simondon refers to the genesis of the image as a cycle which does not close on a specific phase or on itself. The invention-image is not the end of the cycle but only a phase that is related to the others. "After invention, which is the fourth phase of the becoming of images, the cycle starts anew with a fresh anticipation of the encounter with the object, which in fact can be its production". [23] Yet, we need to keep in mind that individuation is still a complex multiplicity of subsidiary individuations where even if one phase is dominant, all four aspects, i.e. the motor-image, the perception-image, the mental-image and the invention-image, together co-exist as a meta-stable, simultaneous, co-conditioning, and inter-dependant ecology of images. Thus, each individuation has its own singular expression of being, of perception, of thought which is vehicled through the temporality implicit in each phase.

Simondon presents concepts of the image that leave the image open to a process to its own individuation. Understanding the process of individuation directs us towards an ontogenesis of being, of individuals and milieus, of the human and the non-human—towards a genesis of the image concerned with how things become rather than what they are or what their final configuration will be. Thinking in this way can support art research that adjusts itself over time and comes into existence just in the process of construction taking shape. This is a mode of thought which can sustain art research which modifies over time and enters into the raw process of matter taking form.

It is a way to understand experience as a way of individuation and not as personal experience. Parts of the spectator, of the artist which remain in the work, of the work, of the technology enter into the individuation as full participants in the composition of the associated milieu. When it comes to experience, these are not the experiences of individuals but of a process of individuation that does not focus on what "is", but on its emergent becoming. We can refer to this as an ontogenesis that goes beyond the artwork or the human. Thus, we consider that the work, the artist, the spectator and the milieu are a compounded mixt. They compose a multiplicity of individuations within the habitat as they actively incorporate parts of the world in an autopoietic assemblage as an animate becoming-world. We become contaminated by these images and are entrained and drawn into the creative milieu of images by the constant flux, by the rhythm of the milieus, by the mixture of human and non-human elements.

In these hybrid works, we realize that the images never cease being analog so as to become digital—since there is no such dichotomy, since any experience is first analog before becoming digital. One knows, perceives and feels analogically with the body. Even with digital mediation, the body is analog in its manner of responding to life. One does not react or respond to possibility through a binarism of 1's and 0's, but through the multiplicity of analog variations for as Massumi writes, "The analog is process, self-referenced to its own variations". [24] It's not a matter of reducing the digital to a mere tool, but of potential of the digital milieu to find itself in the admission that the analog process is always present. It needs contact with matter—whether it is light, word, sound, so it can roam around the world. "Digital technologies have a connection to the potential and the virtual only through the analog". [25] When images appear on the screen, they are recognized through an analog process, in the same way that we recognize them on a sheet of paper; we tentatively feel for configurations, we invoke the imagination, we back-grid it analogically because "the processing may be digital—but the analog is the process". [26] Even if they are different, the digital requires that it be seen jointly with the analog. It is a mistake to think that the hands were amputated by digital experience. On the contrary, they were expanded by the experience of the entire body.

Within the analog process, the digital expands its possibilities and "the challenge is to think (and act and feel and realize) the co-operation of the digital and the analog, in self-varying continuity". [27] Thus, we can detect in various works the challenge of translating analog experience into the digital, so that one feels more, hears more, and the possibility of exploring haptic and synaesthetic sensations is heightened.

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Occult Computing for Artists: An introduction

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Abstract

The text *A Guest + A Host = A Ghost* once appeared in black print on a green wrapper around a candy given out by Duchamp at an exhibition. This artwork is considered as a point of departure because of its timely connection to theurgical performance and occult computing.

The alarming ability of people and organizations to misappropriate and recolonise wild configurations and marvelous tactics, condensing them into a homogenous version for easy digestion, is not to be overlooked. In this genealogy the act of creating is defined, like most things in the twentieth-first century, by acts of consumption.

The artwork from which this paper transcends epitomizes the notion of a code and cypher key and thus gives insight into the arcane and ubiquitous nature of central technologies existing among us (and their cultural, political and occult substructures). Precisely relating to the manifold of time in which we exist, this small monograph, albeit briefly, both critiques and draws parallels between contemporary computer culture, performance and arcane cultural practices such as; cyphers and their simultaneous concurrence and conflict with present-day modes of expression in contemporary art forms.

Occult computing for artists: an introduction.

The text, A Guest + A Host = A Ghost, by Marcel Duchamp initially appeared in black print on green tinfoil wrapped around chewy caramel candy (see Figure 01). In 1953, Duchamp stood at the entrance of Galerie Nina Dausset, Paris, and handed out this candy at William Copley's opening.[1] Duchamp's *A Guest + A Host = A Ghost* is an obscure work to which very little commentary or explication has been devoted (Gould 2000). The chewy caramel as symbolic object migrates across the dividing line that separates artist and audience. Its consumptive edible form had haptic repercussions for what an art object means. This emphasis on the 'post optical' (Arns 2004) and the paraphernalia associated with haptic chewy caramel with which the artwork exists was executed well before relational aesthetics (about which we will not and simply can not speak anymore about, in case we die of overconsumption).

Duchamp placed an emphasis on the underlying speculative performance of the estranged everyday object in the context of the art gallery space. This concept of the 'hacked' estranged, object (or even more recently, so called, détournement of graphical search engines and various other commercial software - think, tubejaying) has become almost an interminable derivative, recurring as if on repeat command with variation, in almost every contemporary art exhibition since Fountain, the glorious (male) urinal put up for reappraisal by R. MUTT. Woefully forgotten are the complex codes in the titles that accompany these works, bearing numerous meanings and overtones simultaneously in many languages.

Fig 01 A Guest + A Host = A Ghost Marcel Duchamp. The remaining wrapper, black print on green tinfoil once wrapped around a candy. Image: Claire Copley.

Codes are left to distil over centuries, brewing away with potency, an alchemical function, as background process. According to Gould (2000) *A Guest + A Host = A Ghost* is arguably his most profound work with regard to the 'reader'. It inspires contemplation by (remote and local) audiences a deliberately obfuscated work functioning as cypher. The idea of an active 'reader' and therefore 'writer' is especially notable in the processes of consumerism when applied to technology. At the moment, regular unsuspecting computer users are people who are relegated into being 'read' only 'users', denied the ability to participate in less cursory or 'writerly' modes of communication with the digital culture realm. Read/Write exceeds the so called, unparalleled 'freedom'

of typing a status update in standard commercial Read/Only media (think Facebook, Tumblr, Google+ [your chose of social media here]). Barthes extends 'writerly' to have a performative function where the reader is 'no longer a consumer, but a producer of the text' (1974, p. 4). Furthermore, Lawrence Lessig uses the terms 'Read/Write (RW)' and 'Read/Only (RO)' to describe cultural obstacles when it comes to ones access to permissions and rights. The former, Read/Write 'analogy is to the permissions that might attach to a particular file on a computer. If the user has "RW" permissions, then he is allowed to both read the file and make changes to it. If he has "Read/Only" permissions, he is allowed only to read the file' (2008, p. 28). Read/Only he claims is 'less practiced in performance, or amateur creativity, and more comfortable (think: couch) with simple consumption' (2008, p. 28). Repetition of Read/Only tasks makes us seem more like mere scripted robots or instrumental mechanisms than humans. For instance, regular (unsuspecting or uncritical) users of social media outlets could be thought of as guests on a cruise ship, they do not have to think about navigation and are in the meantime exploited and controlled beyond all means within the simple role of they consumer that they endorse. They are regulated and subject to surveillance and must play firmly within all rules. In this way, we can now see how the word consumption has been restored to its root origin, the Latin consumere meaning to squander and waste. It must also be noted that the word consumption was used in the Middle Ages to describe a terminal disease (tuberculosis), something threatening that could literally devour you.

For persons who possess an awareness of technical code, there are alternative user paradigms with enhanced privacy measures, and for those _who know_ there is also the deep web or darknetz/s, which according to Lee Brannon (2014), could very well be like 'Paris in the 1920s'. These darknets are a constructed interchange of forked URL sites and server mirrors; a covert tool for the implementation and dissemination of data across numerous servers, with no one centralised location, for instance the Tor project or Freenet allow such discrete browsing to take place. These spaces are not indexed by commercial search engines therefore it is a place to communicate electronically in relative freedom (depending on technical competency) where one is able to freely enact multiple presences, share and carve up data (returning the modality of the cut-up to its former status as a weapon against consumption).

02 Self Determinism Vs. Being Spoken

Now that we have well and truly set sail in our pirate ship from the relative safety of the cruise vessel into the wild and deep waters of unfathomable darkness, we can breathe in the magic void of the shell (computer terminal) and marvelous mess of codes, constellations, nebulae, interstellar gaps and awesome gullies that can be found in ones computer console. In the console shell you feel a tremendous sense of freedom and awareness. A sense of vertigo arises, perhaps as if you were hanging

from earth upside down on the brink of infinite space. But as a pirate knows, freedom comes with risk and responsibility, and can only exist when you have the ability and sense to acknowledge the rules and then go beyond that to abandon them.

Fig 02 /dev/null Ever wonder where it all goes? #dev/null is a *nix file where unwanted files are redirected – could be understood as a very sophisticated 'trash'[OsX] or 'recycle bin'[windows]. Image: Nancy Mauro-Flude.

Command line computing is an expressive language within a shell console or computer terminal interface where code is executed. An alternative to the Graphical User Interfaces (GUI) widely used in operating systems (OS) such as Windows or Mac based systems (GNU/Linux uses GUI's too but has more of a sophisticated user base that potentially know the command line). Put simply, the in's and out's, codes and install initiations are often problematic to comprehend for someone unacquainted with programming. To entirely reference shell basics, permission groups, types and *nix command line culture per se, would exceed the scope of this small introduction.

Let's take a very brief detour to explicitly define permission types: r – Read w – Write x – Execute. This was touched on about already in regard to Read/Write and Read/Only. Technically these are file permissions and the shell is merely an interface to manipulate them. They are not explicit functions of the shell per se as one can use other languages to manipulate permissions. For instance, potential assignment operators are + (plus) and - (minus); these commands tell an operating system whether to add or remove the specific permissions. As an example, say I have a file named HOST_GUEST_GHOST.txt that currently has the permissions set to _rw_rw_rw, which means that the owner, group and all users have 'Read/Write' permission. The command to change permissions is 'chmod'. So to set a file to permissions on HOST_GUEST_GHOST to simply Read/Only, you would enter this full command line to change permissions:
#chmod 740 HOST_GUEST_GHOST.txt.

Then to check your computation you write:
#ls –lah.

This shows the permission status of the files: #–lah, meaning "list all human" readable files in this directory (this is a more than human realm).

Fig 03 T. Shirt "Go away or I will replace you with a very small shell script". Image: Nancy Mauro-Flude.

A Guest + A Host = A Ghost performs a function with an equation, a cryptic summoning wrapped up in cyphers. The structure of Duchamp's equation *A Guest + A Host = A Ghost* is analogous to the command line and when broken down has three separate components; command, (+) options and (=) parameters. The options flow on from the command, and define the parameters the command should act on.

I will spare the reader too many *nix specifics, and besides, the terminal in which commands execute can also be harsh and cursed at times, not unlike the rough sea, or the raw truth (see figure 05). Instead of being Read/Only, or even, Read/Writerly, there is also a notion of being 'spoken', where one becomes a medium and as such not the measure of ones actions entirely. If we add the conceptual notion of spoken (or re-written), we are also acknowledging there is more than a deterministic control to the measure of our actions at play. Perhaps to be 're-written' or 'spoken' is to surrender oneself to something larger than oneself. This ritualistic form treats the human being not as the full source of the action but rather as an ontological vessel. Put simply, this reveals evidence of other forces at work that could be _jouissant_ or malign, in which code as a parable comes to the fore. As we can see in images 2 or 3, instead of hidden in a candy wrapper these GNU/Linux initiates wear their preferred code on their T-shirt.

03 A Guest + A Host (+ 127.0.0.1 | local host) = Ghost

The artwork A Guest + A Host = A Ghost provides a reflection on what is to be a channel, or a medium for agency, rather than an individual fully in control of ones actions. In the host, guest, ghost and unsuspecting visitor continuum; Duchamp twists the roles of the consumer and producer, sender and receiver, reader and writer by subverting the cultural paradigm of the performer, audience continuum. It is important to note that the candy may at first travel in the pocket of the unsuspecting audience who on entering may grab the candy and place it there for later. In these circumstances the artwork secures remote access while remaining undetected.

The host (Duchamp) invites the (unsuspecting) guest, while an uninvited presence (ghost, or hacker) comes through the 'backdoor'. The back door is in computer science a maintenance or testing tool but also a clandestine entrance, known to an intimate few, perhaps deliberately put in place (by someone for good or for evil/black or white hat) or left by a lazy system administer or unsuspecting user for a hacker to uncover and gain access. The slippage of personhood, from guest to host to ghost, depending on the 'consumption' of the object, and the position of Duchamp as a gatekeeper at the entrance is a thought provoking play on agency and the notion of a cypher. Clearly referencing to the Holy Trinity by obtaining a 'host' during a Catholic ritual of communion, from the priest, one achieves closer contact with the source, the Holy Ghost. *A Guest + A Host = A Ghost* is a formulation of instruction, a simple equation expressed in an intelligible language, which is executed in accordance with logical and conditional patterns. Once interpreted (read) and executed (written), it does not give rise to a definite result, instead the cypher encourages sumptuous play, in its performance of code, that takes pleasure in re-writing the existence of an object of candy as paraphernalia, and the oral gesture of chewing as another way to be spoken.

Another speculation is that perhaps if Duchamp were with us today, is that he might have added a further equation:

A Guest + A Host (+ **127.0.0.1 | local host**) = Ghost.

It is not so outrageous to claim that he may very well be with us now simultaneously speaking through us reading this monograph.

Whatever the case if we for a moment assume that Duchamp is a Dantesque (grey hat) type hacker (the preferred one for this author), in GNU/Linux (*nix) terms, in this equation the artwork extends and channels or pipes (|) the Ghost through 127.0.0.1, also referred to as 'localhost', an IP address. A webserver is a process that requires an IP address and runs on a personal computer. A common saying in hacker culture is 'There's no place like 127.0.0.1' (home)', a play on the chant, 'There is no place like home' (an incantation prayer by Dorothy from Wizard of Oz who, by clicking her heels together three times and repeating these magic words, executes a code –a perfect example of a speech act –and is magically transported home to safety).[2]

04 Performances by Coders

Now we are coasting along the deep and choppy waters, let us consider for a moment the notion of performance as a magical act –in particular the performance by Richard Stallman, the founder of the Free Software Foundation whose alter ego St IGNUcius often manifests at the end of his lectures (see Figure 4). Initially, Stallman pragmatically and fluently relates a

genealogy/nativity-type story about the GNU system, explaining how Linux is one of its kernels, underscoring the fact that the media have locked onto the term Linux but have neglected to acknowledge that the system should instead be called GNU/Linux.[3] The audience is presented with technical facts, evidence and a variety of opinions, which expound how:

GNU is a longstanding project developing and advocating for access to source code and creation of free operating system tools;

Linux, a kernel developed by Linus Torvalds, was the last missing piece; and

There are numerous similarities between Unix and Linux systems but they should not be conflated – for instance, apparently one is required by law to write *nix, instead of UNIX because the latter is trademarked.[4]

Included in Stallman's monologue is a description how Emacs (a programmable lineage of text editors and extensions he has written) became a way of life, bordering on a religion, as well as one of the most powerful computer tools.

Stallman ends this talk by turning his back to the audience, donning a cloak and headdress, and then revolving back to face the crowd as the smiling St IGNUcius. He then begins to sing the free software song:

"Join us now and share the software; You'll be free, hackers, you'll be free. Join us now and share the software; You'll be free, hackers, you'll be free…"[5]

Fig 04 Stallman as St IGNUcius. Photo: Wikimedia commons.

'I am St. IGNUcius of the Church of Emacs and I bless your computer, my child. Long may you run.'~ St. IGNUcius on an AMD64. This text is performed by Richard Stallman, in this mystical act he discusses his accouterments, 'That is no computer disk, that is my halo –but it was a disk platter in a former life. No information is available about what kind of computer it came from or what data was stored on it. However, you can rest assured that no non-free software is readable from it today'.[6]

This dialogical satire of St IGNUcius the performance by Stallman (pictured in Figure 04) usually concludes the serious part of his lecture concerning how the GNU operating system developed by his frustration of not being able to fix his own printer, as he was locked out, unable access to the printer driver code. How GNU, the free operating system tools are typically used together with the Linux kernel but hardly ever acknowledged by the wider community as GNU/Linux, people just say Linux. Further he explains the calamity of how these licensed products have been taken up by some of the very kinds of organisations that lock users into being consumers and have restrictive copyrights about their content and end-products (e.g. multinational companies, the military and the entertainment industries).

Before the current wave of international surveillance scandals, contemporary electronic movements (anonymous, darknets and cypherpunk communities) and related computer sub-cultures had been obscure in popular culture. Accomplished hackers sought anonymity for many personal and political reasons. In general, they avoided celebrity. The recent Snowden global surveillance revelations may have temporarily masked the fact that espionage, surveillance and control is not new, although the scale and depth of its mechanisation is unprecedented.

Forebear, Elizabethan occult magician/polymath John Dee's cypher system of mirrors for remote communication was implemented for the British Naval command, concurrently his purportedly transcendental ability to connect with elementals and ghosts in the ether and his large influence on occult thought is also well documented. Therefore we can see in this small example of how cyphers and their coded implementations fall vertically across genres and time; and hence, how the activities of these obstinate characters and their consequent exposés have been exploited.

Stallman seems to have an alter ego, not just as seen in his transformation into St IGNUcius, but also in the very manner he conducts himself; wearing no shoes in formal university settings and surrounded by a entourage of Eastern European women who sell Free Software Foundation merchandise and give away propaganda stickers. Stallman imbues his words and actions with an authority all of his own, transforming himself into an agent provocateur working outside (some) conventions. The romantic performance of the heroic outsider artist or rebel figure relates to many free culture advocates, such as WikiLeaks' main representative Julian Assange. For instance, Assange is now a common household name even though his site itself runs on the anonymising Tor network [a.k.a darknetz]. We see magazines like Rolling Stone featuring articles on hackers as if they are the new genre of rock star.[7]

For the purposes of this introduction, the important components are the performance of code, the hacker, and how these slot into the advocation of a free

software code base which functions as a dynamic open repository (perhaps even a deep vault) for people (who know how) to extend upon it.[8] Barbara Maria Stafford reflects upon the recurrent idea of the 'digital magoi' and their ability to be 'in direct contact with code' (Stafford 2008). Also, the research of Florian Cramer argues that 'Information as a code that executes into political action and into utopia existed before the Free Software movement. It was central to…the original 1614 Rosicrucian manifesto Fama Fraternitatis' (1998, p. 51). We can draw similarities between the occultism, the free software movement and the philosophers of the reformation who were protesting—among other things—the authority of the priestly hierarchy as the sole interface to God, and who demanded that everybody be able to read the bible (source code) in order to establish their own relationship with *Him*.

05 User insisted too much, dying badly

Authorship and acknowledgement of prior or existing art is not new, but has been brought to prominence through the twentieth century corporatization of techné (creative industries). Thanks to that the upper middle class are now even able to purchase hardcore from online band merch, dissidence from the tattoo parlor, activism from Greenpeace and feminism via Chanel.[9] However it is the discussion of where people draw the line in acknowledging technical contributions to an artwork that is the pertinent topic, for instance, designers or artists who never acknowledge the coders' contribution. In principle, the tools of free software remove the stern barrier between software users and developers (Read/Only) as the software's source code is made available for users to modify and extend. It delightfully and undoubtedly becomes exposed to idiosyncratic configurations in a process often termed 'forking' (in version control systems such as GIThub, a shared code repository). But it is vital to share not only the source of the concept and/or code, but also the genealogies, histories, traditions and philosophies that play out in this collaborative field.

The ramifications of the free software movement for me as an artist is that I'm able to both acknowledge, build on and respect another person's work. This is not to say that I ruthlessly mine my lover, mentor's (…place intimate role here) deep thoughts and show them in an exhibition premise at a much later date, or that I overtly discuss on social media the considerations of someone else, as if my own. To instead acknowledge that one is influenced throws individual authorship into high relief.

Of Stallman's GNU Manifesto, Aymeric Mansoux writes 'Looking at the text itself, we can see that the tone and the writing style used by Stallman make the GNU Manifesto closer to an art manifesto, than to yet another programmer's rant or technical guideline' (Mansoux 2011). The way in which the 'legal system has had to deal with collaboration in its management of difference within the aesthetic and information economy is suggestive of a path applicable to other new and

immaterial forms of production', in which Mansoux's text My Lawyer is an Artist (2011) articulates a concise position for the artistic decision to choose an alternative to standard copyright and licenses for artwork.

The individual that gave his or her name to a discovery did not create or discover it all ex nihilo; rather, he or she was the one who brought together many separate streams. Source code contributes to a larger body of knowledge for people to acknowledge, extend and tweak to their personal disposition; the beauty of it is that it allows for complexity.
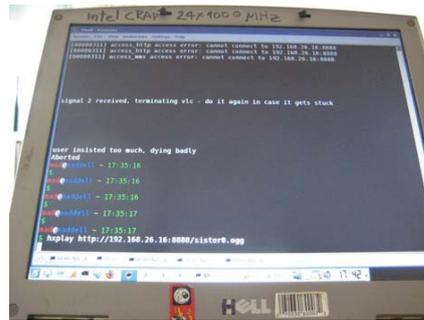
Fig. 05 A typical computer console. IMAGE: Nancy Mauro-Flude.

If we wormhole back in time to the publication of the first 'How To' manuals, or 'machine books', the necessity for idiosyncratic custom builds was discussed in the seventeenth century. Jan Lazardzig highlights how these early 'how to' manuals, or 'machine books' emphasise the Readerly/Writerly activities of the machines, quoting the ingenuous engineer Heinrich Zeising, for the general social body:

'…emphasizing and explaining the technical apparatus. This pointing gesture…collapses the role of the viewer in the picture with that of the viewer in front of the picture: 'I hope to please every refined person who looks carefully at these machines and reads their principles and properties. The gentle reader is truly considered… the most blissful person since he can benefit from these inventions for his own purpose with ease and free from worries' (Lazardzig 2008, p.158).

Here we see how the seventeenth century engineer Zeising thinks it is worthwhile to have a Read/Write mode. That is, to able to acknowledge, and then copy, an invention and in so doing, gain an understanding of how its creator thought and felt, while always bringing in one's own idiosyncrasies and vision, in the understanding that all these efforts are related and have a larger common purpose.

As artists, programmers and/or users in a networked community with we are always faced with our own necessary processes of self-discovery, which, for regular users of computers, should also entail finding out how operating systems work, and how to discover a computer's internal system, language and power. What is truly of deeper interest to me are the ongoing connections with the occult.

Although these propositions are radical, in practice Free Software and Open Source are not entirely progressive movements, as always, there is social stratification of class, gender and race to navigate. Jaron Lanier contends that: 'Even though the open-source movement has a stinging counter cultural rhetoric, it has in practice been a conservative force' (2010, p. 125). While Lanier's point may be accurate, he neglects to take into account how the movement's innovation has flourished elsewhere as a social and economic process. The GNU/Linux Free Software Foundation campaigns for computer users' freedom to cooperate and control their own computing conduct. There is an argument that open source software principles of 'freedom of information' and 'universal interoperability of systems' (open standards) are more valued than the principle of 'knowledge sharing' passionately emphasised by the Free Software Foundation. The former includes the latter, but the latter inevitably does not include the former. With its eclectic combination of earnestness and missionary zeal, Stallman's Saint IGNUcius's act is a radical manifestation of this philosophical connection between performance and occult, of technocentrism and the often-intangible nature of software development.

The dilemma is not that it is proprietary software (closed to the source) being used to program the computer (some proprietary applications are open source and cost money) it is rather an ethical, and arguably, a spiritual issue. When the source code is both copyrighted and closed, a problematic situation arises; the user may be unable to modify the software to his or her needs or acknowledge the source. We need to be in direct contact with the source code, lest we may die of thirst. We are not the measure of our actions, not entirely, so in the end it depends on how one would prefer to be 'spoken' by mercantile forces or by something quenching, vast and incomprehensible. It is unfortunate that many of us have lost an inner sense of the mystical (which lies outside of the consumer standard). Perhaps artists today must first restore their sense of the spiritual, for without that nothing matters anyhow.

References

1. F. Naumann, *Marcel Duchamp, L'Art à l'Ere de la Reproduction Mécanisée*, reproduction #191. (Editions Hazan, Paris, 1999), 179.
2. For instance, this subculture shows many of their favourite codes via t-shirts fashion featuring witty idioms as shown on the *ThinkGeek Merchandise* site, viewed 18 December 2013. ff<http://www.thinkgeek.com/product/5d6a/>.
3. L. Frank Baum's 1900 novel and MGM's 1939 motion picture *Wizard of Oz* starring Judy Garland.
4. I attended Stallman's Lecture 'Free Software in Ethics and in Practice' at Stanley Burbury Theatre, University of Tasmania, on September 30th, 2010.
5. For an account of the genealogy of the Unix machine and its offspring of *nix derivatives see Hardie, M (2007). I am required by Law to write *nix, instead of UNIX as Selkirk, C writes '…I used the term "*nix" to denote Unix, or more precisely Unix-like operating systems, this is due to the fact that "Unix" is a trademark, and as such cannot be used in this way. However, as the operating systems we are discussing owe their historical roots to AT&T's "Unix", we will describe them generically as "*nix" ' (2004).
5. Richard Stallman website, viewed 12 December 2013, < http://www.gnu.org/music/free-software-song.html>.
6. Richard Stallman website, St IGNUcius, Viewed 12 December 2013, <http://stallman.org/saint.html>.
7. This is quite diverse and one could claim in fact the 'Hacker' is the new celebrity which can be comprehended seen in diverse Mass Media coverage from respected computer magazine Wired, or popular culture arbiter Rolling Stone, to more vernacular publications for instance Mirror UK. See Quinn Norton, (2012); Rich, N 2010, 'The American Wikileaks Hacker: Jacob Appelbaum fights repressive regimes around the world - including his own', in *Rolling Stone'*, 15 December 2010, viewed December 2 2013, <http://www.rollingstone.com/culture/news/meet-the-american-hacker-behind-wikileaks-20101201>, Pisa, N 2013, 'Julian Assange dubbed Rockstar of the Year by Italy's Rolling Stone', *Daily Mail* 2010, viewed January 10 2013, <http://www.dailymail.co.uk/news/article-1338566/Julian-Assange-dubbed-Rockstar-Year-Italys-Rolling-Stone.html#ixzz2h6Hx47yv>.
8. Richard Stallman states 'Some people don't realize that Saint IGNUcius is Saint IGNUcius's way of not taking himself too seriously. Therefore, Warning: taking the Church of Emacs (or any church) too seriously may be hazardous to your health.' Viewed 10 September 2013, <http://stallman.org/saint.html>.

Using Expressive Musical Robots: Working with an Ensemble of New Mechatronic Instruments

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Abstract

This paper presents the first qualitative user study focusing on composers' experiences in working with musical robots. Increasingly complicated mechatronic musical instruments have resulted in an increasing number of expressive affordances exposed to users. As the mechatronic instruments grow more complicated, they potentially become more difficult to use, necessitating some form of mapping scheme. This paper seeks to evaluate the mapping schemes employed by a number of parametrically-rich musical robots (including a two mechatronic chordophones, a mechatronic harmonium, and a high degree-of-freedom mechatronic drum player). The user study's findings indicate that multiple mappings must be made available for each instrument, allowing for both rapid compositional prototyping and for finer-grained control over musical nuance of these electronic artworks.

Introduction

Recent years have seen the emergence of increasingly complicated musical robots. Such mechatronic/electronic artworks expose more expressive parameters to composers, allowing them to explore new composition techniques, timbres, and other nuances that would have been impossible with earlier systems. New challenges emerge as the systems increase in complexity: the parametrically-rich instruments run the risk of presenting users with a confusing array of options, allowing for precise control but potentially unintuitive mapping schemes.

This challenge of making a parametrically-dense device into an expressive instrument is not limited to musical robots. Dobrian and Koppelman, in [1], describe the dilemma facing designers of new musical instruments and interfaces: "It is one thing to create a controller with simple mappings that even a novice can use with satisfying results without training... but it is quite another to develop an instrument that provides maximal control, diversity, and efficiency, in order to best enable expression by a skilled user."
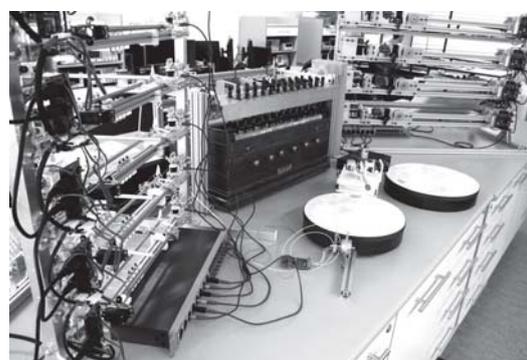
Fig 1. The ensemble of mechatronic instruments employed in the user study. Instruments, clockwise from upper right: Mechbass, Nudge, Swivel 2, Kri*taanjli*

In recent years, the authors have created an ensemble of musical robots equipped with relatively high degrees of freedom. Such degrees of freedom allow for precise control over musical outcomes but, as mentioned, can prove time-consuming to work with in a compositional or improvisational setting. A key focus of the work presented in this paper is to explore the effectiveness of the parametric mapping schemes chosen for the authors' instruments. To this end, a user study has been conducted to examine users' interactions with the mappings: questions were asked of the users regarding their opinions and experiences with the mapping schemes. Additionally, the user study examined the differences in users' perceived expressive control over two similar musical robotic systems equipped with different levels of mapping abstraction.

In addition to exploring the effectiveness of the mapping schemes employed in the authors' ensemble of musical robots, the user study was intended to gain insight into what musical robot parameters users felt most afforded expressive use. With knowledge of what parameters were deemed most expressively interesting by the users involved in the user study, future expressive

mechatronic instruments may be equipped with these parameters.

This paper begins with an overview of related works, focusing on other notable musical robots that demonstrate innovative means of expressive control. After reviewing related works, the ensemble of robots employed in the user study (shown in Figure 1) is introduced. Next, the design and coordination of the user study are presented, followed by an exposition of the user study's findings. The article closes with an extensive conclusions section, detailing the musical and engineering implications of the user study's findings.

As the first formalized user study of composition and use of musical robots, this paper seeks to establish a trend in the musical robotics literature away from papers limited to technical details and quantitative characterizations and toward a paradigm of collaboration with composers and musicians. The community of mechatronic instrument builders will benefit from close interactions and iterative workflows wherein end users are part of the cycle of research and development.

Related Works

Before conducting the research detailed in this paper, a number of prior mechatronic instrument ensembles were reviewed, allowing the authors to gain insight into existing mapping schemes and means of composing for arrays of robotic instruments. Additionally, prior evaluations of musical robots were examined; findings are reported below.

Notable Musical Robot Ensembles

While there are many notable examples of individual musical robots (such as those presented in [2], [3]), and [4]), there are fewer examples of collected ensembles of mechatronic instruments intended for compositional, improvisational, and installation use.

One of the earliest ensembles of mechatronic instruments is that of the Logos Foundation [5]. Founded by Godfried-Willem Raes, the Logos Foundation consists of an array of numerous mechatronic instruments. An examination of the compositional use of the robots in the Logos Foundation played a key role in the design of the user study presented in this paper. Musical roboticist Eric Singer is a more recent innovator in musical robotic ensembles [6]; Singer's use of the robots as a cohesive ensemble was an inspiration to the authors of this paper. Finally, co-author Ajay Kapur's KarmetiK Machine Orchestra [7] ensemble served as a predecessor to the ensemble presented below.

Notably, many of the aforementioned ensembles consist largely of relatively low-degree-of-freedom instruments. The relative simplicity of individual instruments greatly simplifies the act of interfacing with them. As noted in Section 1, an increase in available "expressive" parameters results in an increase in complexity of use, making such systems benefit from careful consideration of mapping schemes and, as presented below, user studies.

Evaluations of Musical Robots

A number of quantitative evaluations and characterisations of musical robots have appeared in the literature. Such quantitative analyses allow other roboticists to study the performance of an instrument. Further, they allow composers to understand the capabilities of an instrument prior to using it, permitting some degree of offline composition to occur. The quantitative evaluations typically contain details about subassembly performance, including drum strike rate, portamento speed, and other metrics. Kapur's percussion system evaluation [8], along with Richard Vindriis's chordophone evaluations [9] and Jason Long's percussion system overview [10] are examples of such quantitative research. Additionally, Weinberg includes some quantitative performance data in his documentation [11].

While such quantitative data forms an important part of any evaluation and characterization of a mechatronic instrument, the authors feel that a musical robot should benefit from qualitative evaluations as well. Such qualitative evaluations are best conducted in the form of a user study such as the one presented below.

The Robotic Instruments

The authors' musical mechatronic ensemble consists of a number of instruments, each designed with the intention of providing more parameters and degrees of freedom than is typical of similar mechatronic instruments. An understanding of the functionality and behavior of these instruments is helpful when reviewing the user study's findings. The following subsections detail the instruments and the means by which each parameter may be controlled.

MechBass

Built by collaborator James McVay, MechBass (shown in Figure 2 and detailed in [12]) is a modular 4-stringed mechatronic chordophone equipped with bass guitar ings. Eric Singer's GuitarBot was a key inspiration for MechBass, which was built with the intention of allowing more parameters for expressive control than GuitarBot. Each of the four single-string modules on MechBass is equipped with a stepper motor-based linear positioning subassembly that slides a clamping mechanism along the string's length. The clamp's
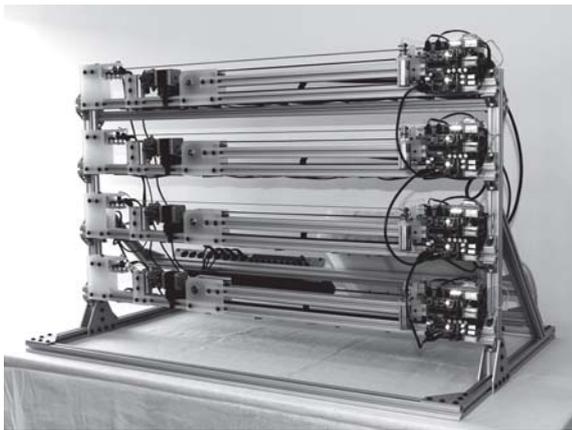
Fig 2. The four string modules of MechBass.

position affects the vibratory length of the module's string. After the clamp is positioned, a rotary pickwheel spins, bringing one of its picks into contact with the string. The pick intensity may be adjusted by raising and lowering the pickwheel with a motorized cam. The string's vibrations are then transduced with an attached optical pickup and are ready for further signal processing and amplification.

MechBass features a high-level mapping scheme, allowing simple commands to result in multiple actuator actions. Upon receipt of a MIDI NoteOn message, the string clamping mechanism is positioned according to the MIDI message's pitch. After the string is clamped, the pickwheel is raised to a height corresponding to the message's velocity, at which point the pickwheel rotates and excites the string. Upon receipt of a MIDI NoteOff message, the module's damper presses against the string and the clamp releases the string. While other instruments in the ensemble feature a more one-to-one mapping scheme, MechBass's one-to-many scheme was chosen to allow for rapid musical prototyping. This scheme is compared against "lower-level" scheme of the Swivel 2 system in Section 5.

Swivel 2

Swivel 2, shown in Figure 3, is a mechatronic chordophone consisting of six string-playing modules equipped with guitar strings. Each module is equipped with a microcontroller configured to respond to MIDI commands. Described in more detail in [13], every Swivel 2 module features a rotary pitch-shifting mechanism, allowing for rapid note transitions and portamento events. The pitch-shifting mechanism is rotated by a servomotor in a plane parallel to the string and may be clamped against the string by a second servomotor. Two more servomotors are used for string picking and damping.
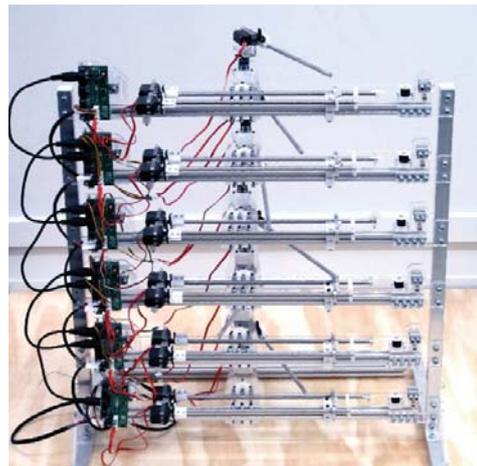
Fig 3. Swivel 2, equipped with six string-playing modules.

While MechBass uses a high-level one-to-many mapping scheme, a one-to-one mapping scheme is used on Swivel 2. Each actuator is configured to respond to a different MIDI control change (CC) message (outlined in detail in [13]), allowing composers to use the 7-bit resolution of the actuators' CC messages to achieve relatively fine-grained user-defined control over the actuators. A key goal of the user study presented below is to evaluate the compositional implications of a parametrically-rich mechatronic instrument (such as Swivel 2) equipped with a "low-level" scheme against one equipped with a "high-level" scheme (such as MechBass). User study responses to this issue may then be used to dictate future mechatronic chordophone mapping schemes.

Kritaanjli

In addition to the mechatronic chordophones described above, the authors' ensemble of musical robots includes Kritaanjli, a mechatronically-augmented harmonium. Kritaanjli (shown in Figure 4 and described in detail in [14]) consists of a human-playable harmonium coupled to a mechatronic assembly. The harmonium used in Kritaanjli is a small reed organ with a hand-pumped bellows. The mechatronic assembly consists of an array of solenoid actuators and a bellows-pumping mechanism as well as communications and control electronics.

Kritaanjli is equipped with a microcontroller programmed with HIDUINO [15], allowing the actuators to respond to incoming MIDI messages sent from a host over USB. As a keyboard instrument, Kritaanjli's solenoid key playing array maps relatively well to the piano roll MIDI sequencing paradigm common in digital audio workstations. Each solenoid responds to a NoteOn MIDI message whose pitch corresponds to the harmonium's keyboard pitch. Controlling the harmonium's bellows required a less obvious MIDI mapping: the bellows pumping motor responds to a MIDI CC value that sets the motor's rotational velocity.

Fig 4. Kritaanjli, a mechatronically-augmented harmonium.

Kritannjli was included in the user study to resolve questions regarding the ease of use of the bellows pumping speed parameters (and whether a higher-level mapping scheme would be of use). It was hoped that responses to these questions could provide guidance in future decisions about user control schemes for keyboard-based mechatronic instruments.

Nudge

The final instrument in the ensemble of musical robots is Nudge, a mechatronic drum player. Nudge, shown in Fig- ure 5 and detailed in [16], is a solenoid-powered drum beater capable of rotating and changing the at-rest height of its drum. The decision to include the rotating base and variable at-rest height was made in order to expose additional parameters to composers. The rotary turntable allows the solenoid drum beater to be rotated through an arc, striking multiple positions on one or more drums. The variable at- rest height consists of a servo-operated cam that changes the height to which the drumstick returns after a strike event. This allows the drumstick to be used for very rapid playing events (if the at-rest height is close to the drum head) or slower, more powerful strikes (if the at-rest height is further from the drum head).

Similarly to Swivel 2 (discussed in Section 3.2), Nudge features a one-to-one mapping scheme. In this scheme, each actuator has an accompanying MIDI parameter, allowing users to manually fine-tune the performance of the drum with the use of any MIDI output device. While it shares a one-to-one mapping scheme with Swivel 2, Nudge contains far fewer parameters. In the course of the user study, the question as to whether a one-to-one scheme is more appropriate for a lower-degree-of-freedom system than for a higher-degree-of-freedom system (such as Swivel 2) was raised and is discussed below, in Section 5.

Fig 5. Nudge, a mechatronic drum beater.

User Study Design

The first step in gaining qualitative use input on the mechatronic instruments presented in Section 3 was to identify the "target audience" for the instruments. From such a sampling frame, representative members could be selected for participation in user-based research. To determine the target users, an informal survey of the demographic makeups of three prior mechatronic instrument ensembles was conducted: of the KarmetiK Machine Orchestra's seven founding members, all were familiar with electronic music composition tools such as DAW software and MIDI interfaces [7]. Similarly, the seven founding members of Ensemble Robot possess music and engineering experience1. Finally, each of the eight "composer, programmer" musicians currently involved in the longstanding Logos Foundation's Man and Machine robot ensemble have experience with electroacoustic and synthetic composition techniques in addition to their work with the Foundation's mechatronic instruments. While much future work could focus upon simplifying the process by which those unfamiliar with such techniques may interface with mechatronic instruments, it was decided that users with similar backgrounds to those in the aforementioned ensembles would be invited to participate in the user study.

After choosing to invite eight musicians familiar with electroacoustic composition techniques to evaluate the mechatronic instruments, the number of users to involve in the study was decided. A purposive sampling technique was used: eight participants familiar with the aforementioned compositional and musicianship techniques were invited to evaluate the robots. Such purposeful sampling techniques were deemed acceptable given the skillset desired for participants.

The survey is divided into nine steps intended to follow a user's progress from first connection to the robots' communications buses through to the use of the robots' parameters. In the first step, study participants are asked a number of questions relating to their prior experience with the technology employed in the user study. Participants are then asked to connect to the robots from a client computer; after doing so, they are asked a number of questions regarding the connection process. Once connected to the robots (as shown in Figure 6),

participants are asked to use the Ableton Live DAW to instruct Nudge to strike a drum. After gaining some familiarity with the means by which the instruments are addressed with the DAW, study participants are invited to create a melody and pattern with the instruments, using all available parameters (which are provided to them via printed documentation). After creating a melody and pattern, they are instructed to answer a number of questions about their experiences with the expressive parameters. Finally, a number of general questions about the robot ensemble are asked to participants. Through these survey questions, the overarching questions that motivated the user study may be addressed: users experiences with the robots and their opinions on the role of one-to-one versus one-to-many parametric mappings with musical robots, as well as the robot parameters that electroacoustic musicians find inspiring and expressive.

Interfacing technology and music software with which all study participants were familiar are used for the user study. As conducted, study participants addressed the robots with a MacBook Pro laptop running Ableton Live 9 DAW soft- ware. Highlighted findings from the user study are presented in the following section. See Appendix C in [17] for verbatim user study responses.

User Study Findings

This section presents the findings of the user study, first highlighting the robots' expressivity and ease of use and then presenting the participants discussions of the robots' most expressive parameters.

Expressivity and Ease of Use

The debate between ease of use and parametric richness is an old one in the literature of new musical interface design. While researcher Perry Cook argues in favor of simplicity and ease of use [18], Sile O'Modhrain in [19] presents the case for more open-ended control of interfaces: "...a designer may also wish to leave room in their design for a skilled player to explore the 'corners' of an instrument's sound space, much as a skilled violinist can exploit extended playing technique that expands the range of bowing and fingering gestures."

While this debate about ease of use versus access to an instrument's "corners" centers on digital input interfaces, the question of expressivity can be applied similarly to mechatronic instruments. To go toward answering this question as applied to musical robots, study participants were asked to interface first with MechBass, whose one-to-many parametric mapping allows for rapid note-playing events. After interfacing with MechBass, participants were asked to use Swivel 2, whose one-to-one mapping allows for independent control over note pitch, damping, pressure on the string, and picking.

After playing both instruments, study participants were invited to compare their experiences, being asked

whether "... Swivel 2 [would] have been easier to use if it was more like MechBass," and whether "Swivel 2 [would have been] as 'expressive' if it was more like MechBass." While users found MechBass easier to use, with two users describing it as "very responsive," many agreed that Swivel afforded more expressive control. One user felt that Swivel 2 would be "easier to get going quickly but less expressive" if configured more like MechBass. A second user's comments were similar, sawing that Swivel 2 would be "easier to use, but not as expressive."

To address this dichotomy between MechBass and Swivel 2, one user suggested implementing multiple mappings for each instrument: "I like the level of control in Swivel, but I also like the ease of MechBass. Implement a hybrid..." Another participant advocated for different modes for different composition styles, arguing that Swivel 2 "would benefit from condensed commands" but that "both ways of controlling it would aid different composition techniques."

Some users proposed a second way of addressing the problem of expressivity versus compositional ease-of-use for mechatronic instruments, pointing to the development of new input devices to allow for users to more quickly interface with robotic instruments. One participant noted that the DAW served as an adequate interface for offline composition, but would have preferred a "MIDI keyboard" for Kritaanjli or a "custom-designed interface" for Swivel 2. Workers in the field of musical robotics have noted this need. While Ajay Kapur and others have pioneered such input techniques (as described in [20]), there remains a need for custom software and hardware interfaces for parametrically-rich instruments such as those presented in this paper.

Based on the findings from the user study, one form of mapping that can enhance both ease of use and musical expressivity is that of self-tuning for chordophones and other instruments. To determine whether to develop a self-tuning system, study participants were asked whether "Swivel 2 would be easier to use if it had the ability to tune itself." Such self-tuning is similar to the other mapping schemes discussed above, taking in a user's input and mapping it to a related output value. Many participants indicated that the ability for a robot to self-tune would increase not only the instrument's ease of use but also its expressivity: one user mentioned that such self-tuning would make playing "Western scales [and] temperment" easier, while expressing interest in the addition of non-western tuning schemes to the instrument, stating that "some JI [just intonation] tunings would be interesting." Further, users expressed a desire for additional pitch feedback when using Swivel 2. This interest among participants in the study led to the development of a self-tuning scheme for Swivel 2, presented in [21].

Expressive Parameters

Another goal of the user study was to gain insight into what kinds of parameters users found to be expressive. Such insight will help to ensure that these parameters are made available on future mechatronic instruments (and, if possible, added to existent instruments).

Many study participants equated continuous control with expressivity: parameters capable of being adjusted through a continuous range of values (rather than those only able to be switched on or off) were named by participants as the instruments' most expressive. One user of Swivel 2 noted that the continuous parameters of "balance and pitch-bend were particularly fun to manipulate." A second user indicated that the instruments' ability to adjust their output velocities was "most expressive," stating that "velocity control through all of the instruments seems to be one of the most important [parameters]. This [keeps] them from sounding monotonous and allows for more nuanced interaction between the instruments." Additionally, one user stated that "all of the dynamic controls" were the most expressive parts of the instruments: "Because these parameters provide a user with full control over the instrument, [they allow for] a variety of timbral results."

Study participants' preferences for pseudo-continuous parameters over those capable only of what one user described as highly quantized "step"-style modulation goes toward validating the design goals of the instruments included in the study's ensemble: parametrically-rich instruments with many degrees of expression-affording freedom. Where many previous percussion systems allow for only a single degree of continuous control, Nudge allows for continuous control over strike actuation length, actuation intensity, and drumstick position. Similarly, Swivel 2 allows not only for continuously-adjustable portamento events, but also for continuously variable damper and pitch-shifter pressure. Kritaanjli and MechBass allow for adjustable output dynamics through variable pumping speed and adjustable pickwheel height, respectively.

Conclusions

An examination of the findings of the user study allow for a number of conclusions to be drawn. These findings can be retroactively applied to the instruments included in this study's featured ensemble of mechatronic instruments or applied to future mechatronic instruments.

Many participants in the user study indicated a desire to use dedicated purpose-built human-to-robot interfaces for interacting with the mechatronic instruments. Such interfaces (including the eSitar used by Ajay Kapur and Curtis Bahn [7]) have been developed in part for use with lower- degrees-of-freedom instruments; the findings of this user study reveal a need for related interfaces for the parametrically-rich instruments likely to appear in greater numbers in future years.

In addition to indicating a desire among users for dedicated interfaces, the user study revealed participants' desires for multiple mappings on mechatronic instruments. For certain contexts, these mappings can be configured to allow one-to-one mappings for precision "low-level" control of the instruments' actuators. In other contexts, however, higher-level "one-to-many" mappings should be developed for rapid sketching of musical ideas. While such multiple mapping schemes should prove simple to implement (either on the instrument's firmware or through the use of an abstraction scheme on the composer's personal computer), a need is seen to go one step further: the high-level and low-level schemes should ideally be easily accessible from one another, allowing a composer to "sketch" at a high level before switching to lower-level controls for further nuance.

Finally, study findings showed that users preferred the instruments' parameter ranges to be restricted to values resulting in musically-sensible output events. On Nudge, for example, the turntable's default mapping allows the drumstick to be rotated past the edges of the drum used in the user study. This setting was chosen to allow for easy deployment of larger (or multiple) percussive objects. However, users found it easy to unintentionally rotate the drumstick beyond the drumhead; restricting this range to immediately-relevant values could reduce confusion among non-expert users. In response to these findings, the robots' workspace limits have been configured to allow for easy MIDI-defined reconfigurability. Such on-the-fly constraint definition could allow for composition or composer-specific functionality of a particular mechatronic instrument.

While the findings of this user study support the argument that increasing a mechatronic instrument's parametric density results in an increase in its expressivity, it also shows that the act of interfacing with musical robots becomes more complicated as the robots become more parametrically rich. It appears that Nudge was about as parametrically- dense as users found workable; denser instruments (such as Swivel 2 or MechBass) require some form of streamlining to the user experience. Ignoring this need for streamlining the user experience on very high-degree-of-freedom mechatronic instruments appears to result in an overly-low level composition experience, requiring users to spend much time manipulating relatively insignificant parameters. The steps already taken to simplify the means of interfacing with the robots (including the development of one-to-many mappings for MechBass) met with favorable responses from participants.

In short, any future work on expressive musical robots should be undertaken with this study's findings in mind: at least as much effort should be spent on the development of interfaces for complicated musical robots as on the instruments' mechanisms themselves.

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Starcraft II and Chinese Scroll Painting: Narrative Ideas for RTS Computer Games

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Abstract

Real Time Strategy (RTS) computer games have established themselves as highly successful Esports, however their capacity for single-player storytelling remains underdeveloped. In the case of Blizzard Entertainment's *Starcraft II: Wings of Liberty* (2010), the storytelling of the game was widely criticized for an over-reliance on filmic animated sequences that were structurally disconnected from the actual gameplay. We describe *Starcraft II* in relation to the RTS game genre and present its structural similarities to Chinese scroll painting. We present a selection of narrative strategies from within the Chinese landscape scroll, including cartographic narratives of the journey, poetic metaphors in transmedial landscapes and landscapes of geopolitical conquest. By analysing RTS games in terms of scroll painting, we seek to provide designers of RTS games with a set of narrative strategies that are more structurally congruent than the filmic animated sequences, and therefore encourage the creation of more innovate and coherent narrative structures for single-player RTS games. Our paper concludes with a thought experiment for how the game map of *Starcraft II* might be redesigned by incorporating narrative structures from Chinese scroll painting.

Introduction

This paper describes Real Time Strategy (RTS) games as having more in common with scroll paintings than they do with films in order to offer a new range of storytelling techniques for this popular game genre. Narrative storytelling in RTS games has been a frequent object of criticism. These criticisms commonly cite a conflict between filmic narrative techniques and isometric gameplay. Previous studies have established structural connections between RTS and Chinese scroll paintings. This paper examines Chinese scroll paintings to ask how their narrative structures might replace the use of film-based storytelling techniques in RTS games. The commercial success of Blizzard Entertainment's *Starcraft* franchise is largely due to the popularity of the game as a multiplayer competition and an Esport. The 2010 release of *Starcraft II: Wings of Liberty* was praised for its enhancements in gameplay, but criticized broadly for the execution of its single player narrative. Throughout the history of RTS games, filmic 'cut-scenes' provided a standard technique for driving plot developments. Our paper has selected a number of criticisms of *Starcraft II* as illustrations of the structural mismatch between isometric RTS gameplay and first-person perspective character-based narratives. By taking advantage of the connections between isometric RTS

games and Chinese landscape scrolls, we propose that Chinese scrolls could provide a series of innovative and structurally congruent storytelling techniques that could be abstracted and applied within RTS games. We provide a brief typology of the Chinese landscape scroll, considering cartographic landscapes, the transmedial poetic landscape, structured architectural scrolls and the geopolitical scrolls that depict the journeys of the Kangxi Emperor. By situating these narrative techniques within the language of game studies, we conclude this paper with a thought experiment for how scroll-inspired strategies might be used as a basis to redesign the narrative experience of *Starcraft II.*

Real Time Strategy Games (RTS)

In this section, we define the game genre of isometric Real Time Strategy in reference to its spatial configuration and mode of interaction. We argue that its structure is inherently incompatible with a character-driven, filmic story, and requires the development of an independent theory of visuality. [1] We use this incompatibility to introduce and contextualise the criticism that was levelled at the narrative execution of *Starcraft II*. [2]

The game genre of RTS emerged in the late 1980s, and is now typified by titles such as *Warcraft* (Blizzard Entertainment, 1994 - present)*, Command & Conquer* (EA, 1995 - present) and *Starcraft* (Blizzard Entertainment, 1998 - present). [3] The genre focuses on large-scale battles between opposing players, where large numbers of units are directed across a map from an isometric, zoomed-out camera. The RTS game genre utilises a free-roaming camera system, where the player can manually navigate to any part of the map, independent of their avatars. Their ability to survey the exact content of the landscape, however, depends on the presence of friendly allied units to reveal terrain otherwise masked by the 'fog of war'. The decoupling of camera and avatar is a key difference between RTS and other games that use a similar camera viewpoint, where the camera is tied directly to the movement of the avatar, which the player controls. For example, in the isometric structure of the *Diablo* series (Blizzard, 1996 - present), the camera is tied to the avatar, and can be considered as an extension of the avatar [4]. Conversely, in RTS and

other strategy simulations such as *Sim City* (EA, 1989 - present), the decoupled camera allows the player the omniscience required to plan and command. [5] Both RTS games and city-building games place strong emphasis on construction and supply systems played out in a real-time environment, the focus on warfare distinguishes the RTS genre.

Our paper presents the RTS game *Starcraft II: Wings of Liberty* as a case study for our argument concerning structure and narrative between RTS and scroll painting. The game is a sequel released within Blizzard Entertainment's broader *Starcraft* franchise, and is popular both as a competitive Esport as well as a single-player narrative work. The first game in the series was released to critical acclaim in 1998, and the sequel was released in 2010. [6] Despite being well received as a graphical and mechanical improvement on the 1998 original, *Starcraft II* was widely criticised for weaving a narrative of cliché and generic character tropes. [7] Rather than focusing on *what* the narrative presented, our paper will concentrate on the criticisms of *how* the narrative was told. We will illustrate why the execution and method of delivery for this narrative was structurally incompatible with RTS gameplay to add value to our suggestion that innovative storytelling techniques can be developed within the existing structure of RTS maps. It is important to note that these strategies are not intended to be applied to the multiplayer or Esports function of *Starcraft* or RTS. In this paper we are looking specifically at the link between isometric RTS and structurally analogous modes of storytelling.

Fig 1. *Starcraft II: Wings of Liberty,* 2010, Blizzard Entertainment.

The existing narrative of *Starcraft II: Wings of Liberty* is told using a combination of radio-style inserted dialogue, in-game animations (visually similar to the isometric gameplay), and cinematic cut-scenes that imitate film in their perspective and visual composition. The use of cinematic animations reflects the uneasy relationship between computer games and film when it comes to storytelling, which is especially evident in ludology/narratology discourse. [8] Using Günzel's

conception of the 'image-space' and the 'space-image' for conventional images in media and video games (or other works that allow the user to manipulate the camera), the conflict between the cut-scenes and gameplay of *Starcraft* can be described as arising from an attempt to use images presented in 'image-space' within a context that requires the 'space-image'. [9] Using to Günzel's definition, a conflict is created in *Starcraft II* by removing the control of the camera from the player and implementing an entirely different visual language. In this light, the contrast in *Starcraft II* between the personal, cinematic sequences during cut-scenes, and the omniscient isometric detachment during gameplay is unmistakable. The contrast means that the player is constantly reminded of the real world. This interrupts the game and allows for self-reflection, which is something that Whitson et. al also advise against when seeking to create an immersive game experience. [10] Furthermore, the player's ability to survey the game map, independently from their avatars creates a detachment, where any single unit is generally one of many, which further undermines any sense of attachment or empathy the player should feel for an individual unit. [11] In RTS games, units are mass produced and expendable, so long as the player can still progress towards overall victory. This function does not encourage the player to form emotional attachments to individual units. This detachment typifies the criticism of *Starcraft II: Wings of Liberty* and that of the RTS storytelling in general, where the impersonal nature of gameplay is routinely, and inappropriately, coupled to a narrative that depends on a small cast of individual characters – the exact opposite of the anonymous characters that exist within the gameplay. [12] Players of *Starcraft II: Wings of Liberty* criticised the emotional connection they were expected to have to individual game characters, and complained that this undermined their narrative experience within the game. [13] We argue that this problem is caused by the custom within RTS games for creating personal stories around individual characters that rely on filmic methods of presentation. Our analysis of the structural history of isometric gameplay and its ancestral connections to Chinese scroll painting will open up a wide set of narrative strategies which could be exploited by the RTS genre to replace the disjunctive use of filmic storytelling in isometric games.

Isometric and Oblique Projection

To form an initial bridge between isometric RTS games and Chinese scroll painting, we will outline the technical distinctions and historical connections between isometric projection (commonly found in RTS games) and oblique projection (commonly found in Chinese scroll painting). These commonalities will form the starting point for our thought experiment to redesign *Starcraft II* game maps based on ideas from Chinese scroll painting.

Jan Krikke presents isometric and oblique drawing as forms of 'parallel projection'. They do not include a vanishing point, and parallel lines on physical objects remain parallel in their graphic representation (see Figure 2). [14] The Chinese scroll was intended to be unrolled from right to left, viewing approximately one metre at a time, so that the viewer could experience a seamless transition of scenes and images. Krikke describes this as "a kinetic medium, based on the synthesis of space and time" that stands in contrast to the European optical perspective, which "depicted a frozen moment in time." Krikke identifies oblique projection as a temporal space, and describes it as a non-hierarchical space due to its lack of scaling between near and distant objects. [15] In other words, human figures in the foreground and background, or at any point along the scroll remain essentially the same size, and therefore there is less hierarchy of importance between individuals, as compared to a perspectival image where figures in the background are of both diminished scale, and diminished narrative importance within the image.

Fig 2. *Spring Morning in the Han Palace*, Ming Dynasty, Qiu Ying, section of a hand scroll, ink and colours on silk, National Palace Museum, Taipei.

Isometric projection was invented as a graphic technique in England by William Farish in 1822. It uses a similar projection of parallel lines to that used in oblique projection, and has the similar result - figures remain a constant size, and the space is endlessly extendable along any axis of the image, without any warping or need to return to a common vanishing point. Krikke speculated that the invention of isometrics in England could have been influenced by the importation of oblique projection to Europe by Jesuit monks in the 17th century. [16] Due to the lack of perspectival diminution of scale tied to spatial recession, isometrics allowed mechanical drawings to communicate 3D form as well as to display accurate measurements, and the historical use of isometrics expanded in the West from industrial design, into architecture, and other aspects of visual culture. Krikke points out that the eventual use of isometrics in early computer graphics was a pragmatic solution to representing three dimensional space, because the lack of scaling kept processing requirements to a minimum, and

interactive spaces could be created using sprites that did not require complex changes in scale to facilitate a coherent depiction of movement. [17]
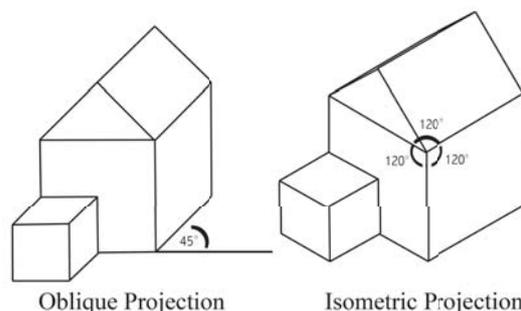
Fig 3. *Oblique and isometric projection*, 2015, illustration by the authors.

Bernadette Flynn identifies the importance of scroll painting for discussing the interactive function of scrolling and isometrics in computer games, and proposed that these spatial devices, ancestral to certain computer games, could be used to locate the cultural significance of particular modes of spatial interaction in games. [18] Our paper would like to take this parallel one step further. By using Krikke and Flynn's analyses to connect isometric RTS with Chinese scroll painting, we wish to explore what narrative structures exist within Chinese scroll paintings, and how they might be implemented in the redesigning of the single player RTS experience.

Chinese Hand scrolls

To expand the connection between the Chinese scroll and isometric RTS games, we present a brief typology of the scroll to demonstrate the wealth of cultural and narrative devices potentially available to RTS game design. We have focused specifically on the hand scroll landscape (that which unrolls along the x axis) because this presents the closest structural analogue to RTS as identified by Krikke and Flynn. We have therefore excluded the album leaf and the hanging scroll formats. The hand scroll appears across a number of genres in Chinese painting. In this section we isolate four narrative functions within Chinese scroll painting: the landscape as a cartographic description of traversable geography, a calligraphic representation of metaphoric landscapes imagined in poetry, a structured architectural representation of Chinese Imperial society, and a landscape of journey and geopolitics.

Hu Bangbo describes a Song dynasty hand scroll that displays qualities of both a landscape painting and a cartographic map. *Ten Thousand Li Along the Yangzi River* (artist unknown) was historically classified as an artwork within the Qing dynasty imperial

collection, however its cartographic accuracy in representing and naming the specific landforms and their traversable pathways in Sichuan was a highly uncharacteristic feature for a landscape painting. Hu Bangbo therefore situates it as a hybrid landscape, or "art as map". [19] This designation is useful for two reasons. First, it reveals how cartographic landscapes in Chinese painting can communicate highly specific information relative distances between sites and how to find the way from A to B. Second, this borderline art/map scroll connects us to the fact that non-cartographic landscapes in Chinese painting usually had little or no relationship to actual places at all, and were to be read as metaphoric landscapes.

Fig 4. *Imitating Zhao Bosu's Illustration of the Latter Red Cliff,* Ming Dynasty, Wen Zhengming, section of a hand scroll, ink and colours on silk, National Palace Museum.

A more conventional artistic use of the hand scroll landscape is Wen Zhenming's *Imitating Zhao Bosu's Latter Ode on Red Cliff* (Ming dynasty) (Figure 4). This painting depicts a landscape based on a Song dynasty poem written by Zhao Bosu. [20] The poem recounts a melancholic night on the Yangtze River, where the drunken poet exclaims his existential struggle on a cliff's edge, and finds solace through his hallucinations of the Taoist sages. Like the poem, Wen Zhengming's landscape refers to, but does not specifically depict the Yangtze River. The artist represented the rocks and mountains using the blue and green style of the Tang dynasty, thereby weaving an additional layer of cultural lineage into the landscape scroll. [21] In this case, we have a landscape scroll, based on a poem, with a suggested connection to an actual place, and a heavy reliance on previous iconographic traditions to create layers of meaning.

Qiu Ying's *Spring Morning in the Han Palace* (Ming dynasty) (Figure 2) uses strict ruled line oblique projection to create an architectural environment that represents the Han Imperial court. Within the geometry of this architectural scroll, Gloria Eslinger and Maura Zephier identify numerous representations of gender politics in the Ming dynasty. The concubines, courtesans and eunuchs that comprised Imperial court life generate a tension that is regulated by the highly structured and repetitious oblique architectural environment of this hand scroll. [22]

The series of hand scrolls, collectively referred to as *The Southern Tour of the Kangxi Emperor* (Figure 5) was painted by a team of artists headed by Wang Hui (1632 - 1717). Commissioned to document the Kangxi

Emperor's Southern Inspection tour, they depict the imperial journey through Southern China, the civic life of the cities, as well as the Emperor's observation of Confucian rites (an important symbol to the literati of Southern China). [23] James Elkins describes Qing dynasty painting as presenting a complex amalgam of historical styles. [24] This work has an overt cartographic structure that depicts the specific landmarks of the Kangxi Southern Inspection Tour. The stylistic depiction of trees and mountains draws heavily on what Lothar Ledderose described as the repetitive modular lexicon Chinese landscape painting (including the same blue and green mountains as used by Wen Zhengming). [25] This scroll can also be read as a geopolitical historical document. [26] The management of the waterways of Southern China was vital to maintaining Imperial authority over Southern China, due to their importance as a trade routes and their vulnerability to flooding. After the overthrow of the Ming dynasty by the Manchus, supervision of the canals and levee systems in the South was of vital importance. [27] The Kangxi Emperor undertook six southern inspections, and it is argued that the symbolic importance of such tours resonates to the modern day, with Deng Xiaoping's 1992 'tour inspection of the south (nanxun)'. [28]

Fig 5. *The 'Southern Tour' of the Kangxi Emperor,* Ming Dynasty, Wang Hui, Detail of hand scroll on silk, Palace Museum, Beijing

From this very brief typology of the narrative structures available within Chinese scroll painting, we have summarised four examples: the landscape as a traversable map, the landscape as a metaphorical poetic space, an architectural space for containing social relations, and the landscape as a geopolitical journey. Krikke and Flynn have provided a structural entry point for comparing scroll painting and RTS games. We will now expand on this connection to discuss how some of these narrative ideas from scroll painting might be applied to the design of *Starcraft II,* in order to replace the language of film, as more structurally compatible approaches for narrative development.

Discussion

Through the examples provided in this paper, we have created a functional context within which we can now exchange ideas between RTS games and Chinese scroll

painting. The inspiration for this exchange was the criticisms of narrative construction within *Starcraft II*, coupled with the links made by Flynn and Krikke to the rich narrative potential of Chinese scroll painting. We would like to conclude this paper by speculating upon how *Starcraft II* could innovate narrative strategies inspired by Chinese scroll painting. Before speculating on how scroll painting might be applied to the level design of *Starcraft II*, we will situate our thought experiment within a broader discussion more familiar to computer game studies.

Henry Jenkins introduces the term 'spatiality' to suggest how narrative might be approached in computer games. Jenkins argues that spatiality, rather than filmic storytelling, is a more suitable narrative approach for games, where exploration takes precedent over plot development. [29] He argues that whilst the future of games will have no single answer for narrative development, game designers and critics would be well served to consider a broader set of cultural reference points when speculating on what directions this future might take. Olli Leino points out that the problem with the term 'spatiality' is that in a computer game, topography breaks down into topology, and that the spatial environment of the computer game is entirely dependent on how certain features exist in a hierarchy of importance for the player. Leino suggests the term 'playable world' be used such that the topological hierarchy of the game environment is not lost in a discussion of what is simply 'spatial'. [30] Dovey and Kennedy elaborate on Jenkins' suggestion, and write that 'enacted' or 'embedded' narratives can be built on the players navigation through environments and obstacles, whose resistance to the player define the imperatives of the game, and that these obstacles can be the building blocks of narrative experience. [31] Therefore, to talk of spatiality as a narrative device within gaming requires the clarification that spatial exploration is only significant to the player if it is vital to the condition and imperatives of the game. Given this clarification, we feel it is appropriate to offer our paper as a response Jenkins' initial suggestion that we turn to other narrative media for critical inspiration.

As previously noted, the criticism of *Starcraft II* was its disjunctive use of first-person perspective cut-scenes interspersed between discrete game maps, to deliver plot developments. Our thought experiment for redesigning the single player experience of *Starcraft II* removes the cinematic cut-scenes that intersperse game levels, and places the entire single player campaign within one single landscape 'mega-map', within which the player is responsible for a travelling army. This addresses the criticism that the use of first-person cinematics as a narrative tool is disruptive and immersion-breaking, and allows us to open up the structure of the game to various embedded narrative approaches. Using Jenkin's terminology of micronarratives [32], battles with enemy armies would punctate the player's journey, challenge

the command of territory, and amalgamate to form major narrative moments. Extended bottlenecks, stretched supply lines and open plains vulnerable to attack would offer a rich variety of landscape tools for narrative construction. As resources depleted, the player would be forced to push deeper into the unexplored landscape. With the treacherous landscape and suitably strong enemy armies, the player would have to balance advance and retreat, the possible abandonment of forces and settlements, and the repeated need to rebuild new bases and raise new armies. A major implication of having an entire campaign take place in a single map is the issue of expendability. Presently in *Starcraft II* and other RTS games with a similar mission based structure, the sequential nature of missions allow for hero units or important story characters to be inconspicuously and non-diegetically resurrected between missions without breaking the player's suspension of disbelief. In our suggested model, this would have to change as the breaks between missions have been removed, pushing significant events, such as deaths, towards a higher level of permanency. This could provide a space for the organic development of the player's units as they acquire more kills over time, which in turn would allow stronger hero units to emerge through gameplay, rather than be arbitrarily assigned through their association with cut-scenes and predefined story. We speculate that players would place greater value on these evolved hero units simply from having spent more time and effort with them, which in turn might make the player more likely to form some kind of emotional connection. The 'mega-map' landscape would not have been possible in the early days of RTS games, however with contemporary processing power, such ideas can now be supported. For the remainder of this paper, we have generated three specific design suggestions within the framework of the 'mega-map', inspired by devices from scroll painting. Our thought experiment does not advocate for specific narrative arcs (this is the territory of *Starcraft* lore), instead we offer techniques and structures that could be implemented as embedded narrative devices within the playable world.

The Blue/Green Mountains of Wen Zhengming

Wen Zhengming's use of the archaic blue/green colouration in repainting the poetic journey of Su Dong Po implies a method whereby a landscape can be re-inscribed with cultural content over and over, and can be viewed as an accumulation of layered meanings and significance. We suggest the construction of a landscape map that must be traversed and backtracked over multiple times. Through the allocation of resources, the presence of hostile threats and the use of cartographical bottlenecks, the player can be forced to return to areas they have previously inhabited or areas that have seen previous conflict. Bases and structures, either abandoned or destroyed, can be returned to, and destroyed units will remain in the map. The player will be forced to re-engage continually with the landscape and re-inscribe its

significance, rather than simply conquer it and leave it behind. The blue/green mountains imply that the landscape is never new, instead it is layered with the inhabitation of the past. By making this part of the player experience, architectural ruins will not be inert scenic elements, but they will be remnants of their actual historical connection with the game map which, under our thought experiment, they must inhabit for the entire duration of the *Starcraft II* campaign.

The Imperial Court of Qiu Ying (The Architecture of Social Relations)

By creating sections of the game maps that are dominated by restricted architectural spaces, we can limit which units the player can use in a section of the game map (as exists in select *Starcraft II* maps at present). By effecting this transition from landscape environments to urban architectural spaces, we will force the player to reconsider the hierarchy and value assigned to their units. Inspired by the way in which Qui Ying uses the architectural scroll to articulate the gender tensions within the Imperial Court, we also suggest that the value hierarchy of *Starcraft II* units further exploit the assignation of gender within unit types. When the values of units are redefined by their ability to navigate different architectural environments, the specific units that the player must use within this restricted space can restructure the narrative character of their army.

The Southern Inspection Tour

In *Starcraft II* there exists the ability to use harvested resources to summon re-enforcements, currently referred to as 'mercenaries' within the narrative of the game. These units (such as the War Pigs or the Sons of Korhal) currently drop from the sky and assist the player. Inspired by the geopolitical qualities of the Southern Inspection Tour scroll, we suggest that the player can have the opportunity to politically woo potential allies within the game map. The player can prove their worth to potential NPC allies via their ability to construct buildings for them or to protect them from other hostile NPCs. The metaphor of controlling the flooding Yangtze as a demonstration of the right to rule could be implemented here, whereby the player enacts a means of hazard reduction against environmental or NPC threats, and in return, is granted control of a new allied army. Similarly, if their hazard reduction measures fail, the right to rule might be jeopardised, and the ally might rebel and either abandon the player, or become hostile. This embedded narrative would allow territory, resources, diplomacy and military power to form narrative arcs that could be designed into the game map.

McKenzie Wark argues that in *Civilization III* (Firaxis Games, 2001), the storyline of the game is subsumed by the interaction between the allegory of the algorithm (the way that the gamespace must be played becomes the story). [33] Alexander Galloway refers to *Starcraft* as a game where the algorithmic differences between the different races (Terran, Zerg and Protoss) force the player to develop a new form of balance and flow. According to Galloway, *Starcraft* is defined by its different modes of being within the landscape, the most marked difference being that between the army and the swarm. [34] Our thought experiment seeks to allow the design of *Starcraft II* to better realise its mode of being, and its potential for providing a deep narrative experience for the single player. By looking back to scroll painting as a structural precedent for RTS gaming, we have sought to practically expand the narrative language of *Starcraft II* by enacting the insights of current computer game theory.

Conclusion

This paper was written in response to an enjoyment of the single player experience of *Starcraft II* and the criticisms from the player community regarding the disjunctive relationship between isometric gameplay and filmic animated sequences and cut-scenes. We took advantage of the existing relationship between RTS games and Chinese scroll painting outlined by Krikke and Flynn to investigate how narrative strategies within scroll painting might be incorporated into the redesign of the single player experience of *Starcraft II*. By removing the first-person animated sequences and situating the entire player campaign within a single 'mega-map' landscape, we opened up a situation where extended immersion and extended time spent with the same units can form the basis for narrative development. By isolating a small number of strategies – the re-inscribed landscape, the architecture of social relations and the geopolitical journey scroll, we connected these narrative approaches to an existing discussion within game studies. The application of these approaches within our thought experiment seeks to provide an alternative language to film, which might allow for a more successful narrative experience to be created within the format of single player RTS games, such as *Starcraft II*.

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Arcade Videogame Interface Aesthetics

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Abstract

This paper examines the aesthetic and connective properties of arcade videogame interfaces. It considers the arcade videogame interface as a communicative and creative link that extends beyond play orientated input and feedback mechanisms. With the correct emulation and homebrew tools, videogame platforms that were originally designed as consumer only devices become malleable forms that can be interfaced at artist and developer levels, allowing previously closed hardware and software systems to function as reconfigurable digital materials.

Communication within constraints

Videogame interfaces ideally create a symbiotic connection between the participant human(s) and the computer that are participating in a digitally centered game experience. While an interface is not the game itself, for example a chess game may have a text-based interface, it does fundamentally affect how the game is experienced. [1]

This experience encompasses the complete aesthetic design of the overall product, visually, physically, sonically, and communicatively. Technically the host platform will impose a set of affordances and constraints for the videogame designer, who presents the results of working within these parameters to the end user. These factors include graphics resolution, sound bitrate, processor speed, and the nature of input devices. The physical styling of the hardware device's form factor also bears influence on its game experience, whether used as a portable, domestic space based, or public situated play experience.

The communicative aspect of the interface is critical, as the player must understand the machine, and vice versa. This is summed up succinctly in Chris Crawford's definition of interaction as "an iterative process of listening, thinking, and speaking between two or more actors". [2]

For example, after a player inserts their coin into a videogame at an amusement arcade, they are presented with a text prompt through the machines visual interface to select either single player or two-player mode. To articulate back their choice of single player mode, the player selects the button labeled '1'. An audible chime from the speakers and a change in the visual interface that affirm the chosen option are then relayed back to the human as sonic and visual feedback by the computer. Without this feedback, there is a disjoint in the communication, and as a result the interface is rendered defective.

The constraints that govern the flow of this dialog affect the viewpoints of both the human and machine participants. From the meatspace occupant's point of view, how the computer communicates is limited by its processing power, the fidelity level of its graphics and sonic capabilities, alongside any other feedback mechanism available to it. From its own vantage point the computer perceives an incomplete composite of human sensory faculties via the limited input means assigned to it. If the digital organism's senses are augmented through the addition of extra sensors, for example the ability to detect gestural movement, this subhuman composite evolves closer to resembling the complete human being. This hobbled interpretation of the human in the eyes of the computer based on it's restricted sensor capacities provides a view of an leveled relationship between both parties, comparable to how humans may interpret a suprahuman machine intelligence when it emerges.

A videogame's communicative anatomy comprises of two elements, input and feedback. The input side is most commonly associated with the controller-centric perspective of game interfaces. This view encompasses manual controllers such as the keyboard or joystick, alongside glass based gestural interfaces, in addition to freeform gestural interfaces, for example, Nintendo's *Wii* Controller and Microsoft's *Kinect*. These can be seen as consumer level game interfaces. The game developer interacts with the host technology at a more raw and visceral level, where the inner workings of the computing system are exposed and directly addressed through code.

Feedback forms the second component of the transmission loop. This feedback is most commonly delivered through visual, auditory, or tactile means. The harnessing of the olfactory senses as feedback targets for digitally originated feedback in videogaming has yet to reach consumer level. In game design the vibrating 'rumble' feature of game controllers is common method used to enhance immersion by adding the extra tactile dimension of haptic feedback. For example, The Playstation 2 version of Sony's *Rez* (2001) uses a

dedicated tactile feedback called the *trance vibrator* unit to provide feedback accompanying its psychedelic visuals.

In terms of visual feedback, the Graphical User Interface adds a layer above the 'developer only' interface of the command line. This further abstracts human interaction directly with the metal of the computer.

The term GUI is typically used to describe a point and click style operating system interface, but in the videogame context the graphical interface is not limited to mouse control. A visual interface is delivered mainly through the screen, but also can refer to other visual augmentations to a videogaming system, such as the flashing lights on the *APB* arcade cabinet (Atari, 1987). In *APB* the player drives a police car and must arrest a set quota of criminals and traffic law violators on each level. The player must also collect doughnuts to increase their high score. Whenever the player is in pursuit of a perpetrator's vehicle, the siren lights on the cabinet activate, adding to the games immersion.

Galloway cites Vilém who described the screen as "a two dimension plane with meaning embedded in it or delivered through it" [3] This meaning can be textual, image based, both abstract and figurative. Galloway also uses the term of the intraface to describe the ether that holds together the various layers of the visual interface, the interplay of static and diegetic (or dynamic) interface elements.

Static game interface elements are those that cannot be interacted with directly, that exist to solely provide visual feedback. For example, in the game *Asteroids* (1979), the static interface elements are the current score and the number of lives remaining. Dynamic or diegetic interface elements are feedback elements that are incorporated into the game environment itself. In the *Grand Theft Auto* series, damage that is visually manifested on the player's vehicle provides dynamic feedback to the user on how effective a driver they are, rather than relying on a numeric value.

The division between screen based visual interfaces and the manual interface of the hardware controller has become less distinct since touchscreen technology became a viable part of modern consumer electronics. The screen has become a new form of tangible surface, despite its limited tangible feedback capabilities. The ability to reach deep into the screen physically in commercial video games, in a reverse of *Videodrome*'s signature hallucinogenic sequence, can only be done through virtual rather than physical augmentation of the visual display. The glass barrier ensures that games presently remain solid to physical touch, rendering the play field only malleable through extension into the digital space visually through a digital embodiment, or sonically via three-dimensional sound.

While remaining intuitive and clear, a game interface must engender a sense of challenge. This level of difficulty is dependent on the audience as well as the host platform. A casual gamer indulging in a five-minute game on their smartphone requires simple, intuitive controls. On the opposite end of the spectrum are those who thrive from the intrinsic challenge of mastering a complex experience, taking satisfaction in mastering a task that requires more rote learning than intuition. Take for example the text mode visual overload of *Dwarf Fortress*, where the player must invest months to master the game control system, memorising a considerable number of keyboard shortcuts while navigating and understanding a myriad of statistic packed status screens.

As technical advances bring the digital closer and closer to analogue realism, the digital has already bled through into analogue culture. This essay is intended as an introduction to the area of videogame interface aesthetics, reflecting on how the link between people and low fidelity videogame technology has manifested through the pixel art, chiptune, retro gaming, and media art.

Building an interface for play

One of the earliest documented participatory videogames, and interfacing of the general public with computers as a mode of leisure took place in 1958 at Brookhaven National Laboratory, a nuclear research facility in Suffolk County, Long Island. William Higinbotham, a nuclear physicist who had worked on the Manhattan project, and afterwards became a campaigner for nuclear non-proliferation, led the team that built *Tennis for Two*, an interactive exhibit intended for public engagement. "I knew from past visitor's days that people were not much interested in static exhibits, so for that year I came up with an idea for a hands-on display, a video tennis game". [4]

Housed at the display for BNL's Instrumentation Division, *Tennis for Two* used a circular 5 inch diameter oscilloscope screen as a visual display. Auditory feedback was provided through a basic sound effect that is heard when the ball is batted. The use of an oscilloscope as *Tennis for Two*'s graphical display unit enforced a monochromatic, stripped down line drawn aesthetic, that can be seen taken in a more intricate form to the z-axis in *Battlezone* (1980), and *Vib Ribbon* (1999).

Brookhaven National Laboratory's mainframe computers were imposing machines that filled entire rooms. From the general public's point of view, the fact that these new and largely technologies were housed at a nuclear research facility during the cold war added to their ominous nature. Indeed the computer used was an analog computer, programmed laboriously through punch cards. It was a machine built by computer scientists for computer scientists.

By building *Tennis for Two*, Higinbotham introduced play to early human computer interaction, easing any misgivings felt by humans interacting with a new technology for the first time. A vital characteristic of a gaming interface is that it establishes a

communicative link between player and machine, which can be measured through user engagement. The successful dialog accomplished by Higgenbotham's team was made evident by the long lines of people who waited in line to play the game during the 1958 BNL visitor's day. However, Higgenbotham didn't seek to commercialise his invention, and Tennis for Two remained largely unknown until 1985 when Nintendo cited Bayer's *Tennis for Two* as the original tennis videogame in response to been sued by Magnavox.

Videogame interface anatomy

Tennis for Two is important in the early lineage of video gaming as it set out the basic template for a two-player arcade game interface. The game's two manual controllers were built using industrial potentiometer knobs for onscreen paddle movement alongside a serve button, each of which was encased in stainless steel boxes connected via cables to the computer. Alongside the laboratory oscilloscope and the bulk of the analog computer, the physical visage of the machine is very much representative of the cold war military industrial complex that is was born from. Its gameplay mechanic and dual controller physical interface, alongside the audio and visual feedback elements were later echoed by Ralph Bayer's *TV Game System* (1966). Bayer's invention was later commercialised for the mass market as the *Magnavox Odyssey* (1972).

In 1985 Japanese game manufacturer Nintendo manufactured and sold their own videogame tennis system, and were sued for patent infringement by Magnavox. Nintendo responded by calling Higinbotham as a witness, arguing that *Tennis for Two* was the original tennis video game. The judge ruled that the since the oscilloscope display was not receiving a standard video signal, it therefore could not be considered a 'videogame'. At the time, a mixture of naivety and legal obfuscation was enough to ensure this minor technicality exempted Tennis for Two from falling under the definition of videogame. However, signal transfer technologies for video display continue to evolve, from the analog radio frequency cable to the binary datastream of digital and internet based television. Despite the judge's ruling in the Mangnavox Vs Nintendo case, the *Tennis for Two* computer was indeed sending instructions to the oscilloscope, and although it did not meet the same technical specifications as a televisual video signal sent to standard nineteen seventies cathode ray tube television set, it nonetheless defined and updated the visual display on the unit.

Atari's *Pong* (1971) took the TV tennis concept and translated it to the amusement arcades, it also (predictably) resulted in Atari been sued for copyright infringement by Magnavox. It was also the second commercially sold coin-operated arcade videogame. The first of which was *Computer Space* (1971), which was also produced by Nolan Bushnell before starting Atari. Similar to Pong it was a close copy of an existing game, a lab experiment called *Spacewar!* that originated in

1962 at Massachusetts Institute of Technology as a tech demo and experiment for the DEC PDP-1 computer. The extravagant molded fibreglass body of the cabinet reinforced the science fiction scenario of the game, even making an appearance in the film *Soylent Green* (1973) as a futuristic home fixture. Despite high production values, *Computer Space* failed to translate to the public space. It's control console and onscreen display elements did not communicate their function clearly to the user, and the game demanded more time to learn than a single play would allow. *Computer Space* had an interface that preformed all of its functions correctly from an engineer's point of view, there was a button for each action required of the player. Unfortunately, the visual mapping of the buttons and the lack of a pre existing visual language for videogames that the layperson could connect with, lead to *Computer Space* failing commercially.

By contrast, the zen like simplicity of the *Pong* interface ensured it's success. Pong's arcade cabinet design is minimal with clean typography, the wooden veneer body and stainless steel control panel striking a balance between the industrial and 1970s home decor. A single line of instructions that reads 'Avoid missing ball for high score' was placed on the front of each cabinet between the two rotating potentiometer controllers. The mapping of the physical controllers to their respective onscreen paddles is made obvious to the player, while turning each knob clockwise or anti-clockwise generated an immediate and appropriate response, changing the vertical position of the player's onscreen paddle. Simple audible tones accompany the sound of hitting the ball, and also missing the ball. The ball itself isn't round, but square, the beginnings of the pixel aesthetic. Pong sold heavily, generating more royalties for Magnavox than the *Odyssey* console had.

Looking inside of a *Pong* cabinet we see the interface construction laid bare. The circuit board hangs attached to the side of the cabinet, with wires reaching outwards to the television monitor, controls, power supply, and coin mechanism. It is unembellished and utilitarian, a nod back towards the industrial feel of BNL's *Tennis for Two*. The outward face of the game presents a polished visage in comparison to the exposed raw components that power it. In effect the cabinet front is a boundary both physically and visually, separating the player from the electromechanical and computational processes that power the interactive game experience. This view behind the curtain is denied to the general public, with only the game technicians and the arcade owner making contact with the core mechanics of the system. While the developer uses machine code writes directly to the metal, here the coin-op owner or technician physically views and interacts with the machine circuitry.

Following on from the *Pong* arcade game was the home television console version of *Pong*, which in turn inspired further copies and adaptations of the TV tennis concept. A simple and refined game interface had kickstarted both the home and arcade videogame

markets. This new form of digital engagement would influence the formation of creative and cultural movements in the digital and analog spaces, bringing computer technology from the science laboratory to the domestic space, while influencing thought on speculative scenarios involving the merging of both domains.

The emulator as interface

The original *Pong* arcade machines are now in museums and private collections. If a visitor to the Computerspeilmuseum in Berlin wants to play *Pong* they need to arrive at a set time where they will be allowed to play the delicate artefact with supervisor assistance. For someone who doesn't have access to the original Pong hardware, the next best option for experiencing the original game is through an emulator. An emulator is a piece of software or hardware that recreates a computer system through a different computing platform. For example, the Commodore 64 home computer can be recreated in software form on a modern Apple Macintosh using the emulator *VirtualC64*.

Most classic videogame consoles and home computers exist in emulated form, which are usually created by enthusiasts without any official backing from the original machine creators. Legal difficulties do exist, and to circumvent these issues most emulators are distributed without core proprietary code. Users are typically asked to sign a disclaimer stating that they are going to fill the gap by legally extracting the code from the rom chips or system disks of their own working machine. Yet in practice most users will simply conduct a web search to find the missing files for free through a less than legal source.

Pong is one of the few anomalies in videogame emulation since it wasn't actually programmed but 'built' electronically as an analogue circuit. In regular emulation, the original program code is 'dumped' as a rom file taken direct from the original game circuitry in the case of a cartridge or arcade PCB system, or extracted from the original tape or disc. This program rom is then loaded into an emulator for the chosen classic system, just as an original disk or cartridge is loaded into the original hardware. Recreating an analogue videogame through code is directly comparable to the creation of virtual analogue synthesizers, where the circuit and the voltage flow through its components are modeled through code. *DICE* is one such program that simulates the original *Pong* arcade games on a home computer.

Modern pixels are too square

It is necessary to archive and preserve digital culture that has not already been committed to the online space. Physical machines and data storage mediums are not impervious to time and wear. Bitrot, the phenomena of magnetic storage mediums losing vital sectors of their information due to degradation of their physical makeup, proves that the digital world is not impervious to the

environmental forces of the analogue world. However, recreating a classic arcade game on a modern computer works to the extent that an ebook can recreate a print book. Using an original tangible controller with an emulator through a custom adaptor, for example the Atari 2600 paddle control with the Atari 2600 emulator *Stella*, can closer approximate the original experience of using 2600 as it was originally played.

The kindle ebook reader provides an immaculate paper white screen, and the ability to store many books in a compact physical form. Subjectively this can be interpreted as convenience at the expense of character. A paper based book takes up more room, it can be easily torn and the paper fades and changing colour over time. Whether or not these weaknesses of paper books are seen as a hindrance or welcome quirk, they remain a part of the experience of interacting with that medium. Similarly, when a game intended for original viewing through a cathode ray tube based screen is viewed on the immaculate high resolution of a modern computing system, convenience is added, but also part of the original medium's essence is lost.

Admittedly, CRT screens are inconvenient on several levels. Compared to flatscreen monitors, they are bulky in size and weight, and their low resolution makes it difficult to focus on smaller details onscreen. Additionally, the scanline interlace flickering of tube base video screens can induce eyestrain. Also when using an analog signal, if a lower quality video connection cable is used that doesn't separate the red, green, and blue component video signals, the image becomes less defined.

Game designers have positively and creatively harnessed these imposed constraints and colourations. An example of this in effect is shown in the transparent waterfall graphics in *Sonic The Hedgehog* on the Sega Megadrive, made possible by blurring two shades of light grey into a semi-opaque effect. When viewed through an emulator without CRT simulation the effect is lost. [5]

In comparison to Sega's Megadrive, the Atari 2600 was extremely limited in it's visual display options, and was originally designed to display only two player objects on screen at once, in addition to 'bullets'. A machine engineered to play Pong derivatives. To overcome the system's limited sprite display capabilities, programmers relied on the ghosting effect of CRT phosphor and the human eyes persistence of vision. By switching images on and off quickly onscreen, it was possible to create the effect of multiple characters onscreen.

In 2009 a team of developers from Georgia Tech developed a software filter for the *Stella* emulator that simulates a cathode ray tube screen. [5] The parameters of the CRT effect can be adjusted to change the images curvature and blur, distorting the outputted video signal to the viewer's own requirements. This destructive yet aesthetically enhancing form of image filtering can be paralleled to the glitch art movement. If bitrot is the random encroaching of analog

environmental variables into the digital world, then the creation of distortion and glitches is a deliberate unsettling of the predictability of digital code execution.

Emulation, the ROM hack, and vintage platform enhancements

Aside from recreating the features of a vintage computing platform, many emulators add extra functionality that serve to expand the recreated platform beyond it's original uses, making direct to metal processes open to the consumer that in turn enable them as creators. *NESticle* version x.xx (1998) by Bloodlust Software emulates the Nintendo NES system. [6] When a .NES rom file is loaded into the emulator it can be viewed in tile mode. Tile mode displays the component graphical elements of the loaded game rom, alongside the HEX values for their assigned memory locations and other binary variables such as their colour palette. If the rom file for *Super Mario Bros.* is loaded and the tile view is enabled, it is possible to locate the graphic tiles that are used to compose the sprite for the game's main character, Mario, and redraw his appearance using the emulator's built in image editing tools. The edited rom file, known as a rom hack, can then be saved and ran as a normal game. It is also possible to take a hacked rom image and transfer it to a physical rom chip, allowing the modified code to run on the original system hardware.

Through *NESticle* and other rom hacking tools, it is possible to edit and experiment with the visual interfaces and control systems of classic video games. Some rom hacks are purely functional and address existing issues in the game, for example, making a Japanese language only game accessible to a wider audience by replacing the original dialog with English language substitutions. Other rom hacks go down a more conceptual route; *Super Mario Clouds* [7] by Cory Archangel is a seminal example of the rom hack as media art. *Super Mario Clouds* is a rom hack of the game *Super Mario Bros.* (1985), reducing the game down to a minimal level, where all visual interface elements are rendered invisible, apart from the sky and clouds.

The early home computer systems such as the Commodore 64 presented the command line of the BASIC programming language as their initial start up interface, encouraging users to creatively code for their machines, however the game consoles were intended solely as playback devices. Emulators recreate this core software interface, but also expand on it.

In the cases of Nintendo and Sega, only licensed developers were permitted to develop for their systems. Another factor that made creating for these platforms so exclusive was that specialist development systems were required for the task, which were not on sale to the general public. In addition, the game cartridges for console systems were developed strictly under license from Nintendo or Sega, although bootleg cartridges and pirate 'backup' copy devices existed on the grey market.

As with the emulator scene, modern development systems for classic videogame hardware are made by enthusiasts with detailed and often self-taught

knowledge of the software and hardware architecture of the original platforms. These software interfaces provide access to previously inaccessible aspects of the console platform, and ease the development process for the classic computer systems. For example, *VirtualC64* presents a series of advanced debug options that allow a programmer to examine and modify a game as it is running.

Complimentary to software emulation and homebrew development kits, vintage gaming hardware is augmented into the modern age through the addition of third party peripherals. These devices add functionality such as USB file storage, network connectivity, and high definition enhanced audio and visual output. The HD output options contradict the aesthetic ideal of the CRT software filter, showing that the phosphor blur is a nostalgic as much as aesthetic preference.

Emulators and homebrew software development kits, alongside modern hardware additions for classic videogame systems ensure the continued survival of vintage computer gaming platforms. Authenticity is a prized attribute in emulation, whether exemplified as the fuzzy RF visuals on a tube based television set approximated in *Stella*, or the unseen but consciously valued process of analog circuitry simulation in the *DICE Pong* recreation. In these instances, the interface effects of platform constraints are embraced, but expanded beyond when necessary for creative purposes.

Homebrew videogame music interfaces

In 1989, Nintendo released the Game Boy portable gaming console. Designed by Gunpei Yokoi, it was an evolutionary step beyond Nintendo's Game and Watch series of LCD based portable games, a videogame equivalent of the Sony Walkman, allowing access to a library of interactive games on the go. The system's most basic revision, the Model DMG Game Boy (Dot Matrix) is equipped with four sound channels (two pulse waves, a 4-bit wave channel capable of playing samples, and a noise channel).

Apart from the nostalgic view, there are several reasons that the Game Boy, and low fidelity computer music sound has been embraced by modern musicians. One is the appeal of working within constraints rather than navigating a bewildering interface of feature bloats in modern music software. Another factor is that the Game Boy provides an affordable alternative to pricey electronic music equipment. Finally, the sound from Nintendo Game Boy has a raw, unfiltered edge. This primitive level of sound synthesis is immediately associated with vintage videogames, and has been adopted into the high-end systems that it rebels against.

Visually it can display four colours onscreen simultaneously, and is controlled through a simple four way directional pad alongside four action buttons. While the visual display was improved in clarity over a series of system revisions up to the Game Boy Color (1998), the basic control and audio system remained the same. For over twenty years, the system has endured as a pop

culture motif to the point that custom cases are available for high-end smart phones that camouflage them into the likeness of the original Game Boy.

Inevitably the Game Boy has become a popular machine for homebrew software and hardware development, and has received wider embracement as a musical instrument. Although Nintendo has produced it's own music creation programmes, for example the *Trippy-H* sequencer included with the Game Boy Camera, the platform's abilities as a music creation tool have been pushed largely due to the efforts of the homebrew development community. The two most prolific of these creative tools are *Little Sound DJ*, also know as *LSDJ*, and *Nanoloop*.

Little Sound DJ and *Nanoloop* are not endorsed by Nintendo, although Nintendo seemingly tolerates their existence since no legal threats have been made against the application developers. In order to use *LSDJ* or *Nanoloop* with an original Game Boy console, the user must first obtain a grey market 'backup' cartridge, and then transfer the downloaded rom image from their computer to the cartridge. These cartridges have the advantage of allowing the user to save their compositions onto their computer for backup purposes, as well as allowing them to playback and interchange music sequences between Game Boy software emulations and the original hardware.

The first cartridge versions of *Nanoloop* were released by German art student Oliver Wittchow in 1999. *Nanoloop* transforms the Game Boy into a music composition and performance instrument, but instead presents the user with a minimal, graphical based interface. This visual interface is based upon a 4 x 4 grid of squares, the user interacts with these shapes using the directional pad and control buttons, tweaking the sound parameters of each of these steps in the loop. Changes made to a square's properties are reflected visually as well as sonically, and the overall interface feel is more exploratory than *LSDJ*. A fine level of control detail is compromised through the graphical interface while improving accessibility.

In 2001 Stockholm based Johan Kotlinski released the first cartridge version of *Little Sound DJ*. As with any rom image, the program can also be used on other portable gaming systems and computers through emulation software, although the creator cautions "Keep in mind that sound emulation can never be 100%, mostly because the low-grade hardware used in Game Boys adds some characteristic noise". [8] Indeed, the original DMG model is the preferred device for live performance and recording of gameboy based tunes.

Little Sound DJ uses a tracker based interface, maximising the level of granular control that the composer has of the Game Boy's music architecture, while fitting comfortably within the visual confines of the platform's 160 x 120 pixel resolution and 4 colour pallet. This level of miniaturisation is made possible through the numeric shorthand of the hexadecimal number system, allowing values above 99 to fit within a two-character space. Navigation is accomplished through

the systems four way directional pad and four buttons, although custom peripherals allow further manual control options of the application's sound parameters. The learning curve associated with LSDJ is steep in comparison to its nearest rival Nanoloop, but perseverance in mastering the text heavy interface opens up a high level of granularity and control.

Both *LSDJ* and *Nanoloop* are further augmented through hardware hacks, modifications, and custom peripherals. These mods enhance and expand the Game Boy's hardware interface by adding features such as professional level audio out jacks, backlit screens for improved visibility, and MIDI interfacing to enable the connection of music control devices. The LED hack is an aesthetically as well as functionality motivated mod. It provides useful visual feedback, flashing in synchronisation with the current BPM rate of the device, while enhancing the visual appearance of the Game Boy in when used for playing music live.

In 2003 chiptune music received a boost of mainstream press recognition when Malcolm McClaren, the manager of Sex Pistols, who had been around at the inception of the Punk and Hip Hop subcultures, was interviewed about his involvement with New York's burgeoning chiptune scene. McClaren waxed lyrical about this 'new' subculture in interviews with *Wired*, and *The Guardian*. However his attachment to this scene was soon questioned online through an open letter by GW3M, a member of the Micromusic forum.

"Whilst micromusic.net welcomes interest from the music industry we feel that Malcolm's statements have been at least inaccurate, certainly without acknowledgement of the 25 years of chip music history, and possibly even using ideas and concepts taken from us." [9]

It is indeed important to note that chiptune music didn't begin in the early twenty first century, nor is it confined to the Nintendo platform. Chiptune music has existed as long as the hardware to create it has existed, just existing under different names. The originators include computer game soundtrack composers like Martin Galway and Jonathan Dunne, renowned for their work written for the Commodore 64 SID chip. Music composition on vintage computing platforms has also been pushed on since the early days by game hackers who removed copy protection from commercial video games, then redistributed cracked versions incorporating their own signature theme tunes and 'greetz' to their hacking cohorts in the introduction. The level of technical proficiency needed to compose on a Commodore 64 in the mid-1980s was considerable:

"To have a clearer picture we have to add that those times there were no music composer programs yet. Their tracks were composed as an assembly language program, they mixed sounds "by hand" and coded all filters effects themselves. One can imagine the patience and experience it needed" [10].

The game hacking scene is closely linked to the demo scene. Demos are audiovisual presentations where teams of coders, artists, and musicians work together to

produce the most technically and aesthetically impressive presentation possible within the constraints of their host vintage platform. For demos that use modern hardware, the restrictions are imposed, for example the 64-kilobyte memory limit imposed for the Breakpoint 2010 demo contest.

What links the aforementioned three videogame music subcultures, and separates them from the artists using *LSDJ* and *Nanoloop*, are the interface methods employed to create their music. The early computer game musicians, demo coders, and hack intro / hacktro creators all had programming knowledge at their disposal, either individually or as part of a team. The new generation of chiptune music makers benefit from constantly evolving interfaces harnessed to established and deeply explored creative mediums, allowing content creation, while negating the necessity to interface with the platform at developer level.

Interface aesthetics and authenticity

In 2012, Disney released the videogame culture inspired movie *Wreck-It Ralph*. The film centers around Ralph, an antagonist character in fictional classic era arcade game *Fix-It Felix*. Ralph is a non-player controlled character, a feature of the game's dynamic interface. He travels outside of his normal environment across multiple videogame platforms and genres on a quest to find his true self. In an opening scene, the arcade cabinet for *Fix-It Felix Jr.* is shown in an amusement arcade, alongside actual historic cabinets such as *Pong*.

This manufactured association with videogame history is reinforced in the physical space by Disney's creation of a limited number of *Fix-It Felix Jr.* arcade coin-ops. These cabinets provide an experience that simulates the early 1980s arcade videogame, including tactile arcade microswitch controls, an authentic CRT screen with imperfect blurry scanlines, limited audio resolution, and even the character building battle damage of a game presented as a 30 year old museum piece.

Through the manifestation of an interactive artefact, the movie narrative is anchored concretely in our physical universe. The *Fix-It Felix Jr.* cabinet is an emulation of a game that never existed, successfully employing the functionally superfluous, but aesthetically authentic constraints of classic videogame interface aesthetics to enhance the credibility of its claimed vintage. The interface is not the actual game, but it undoubtedly affects how the game is experienced.

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Connecting Indigenous Cultures to Design Pedagogy

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Abstract

To move beyond the homogeny currently extant in design, Alain Findeli posits design should broaden its scope of inquiry. I will argue that to facilitate this shift and enable more culturally expressive design solutions, Indigenous symbols and visual spatial strategies should be acknowledged within design pedagogy. This study introduces the Pasifika ideologies of *Ta-Vā* (time and space) and *teu le vā* (sacred connections) to illustrate the relevance and opportunity afforded design when Indigenous ideologies and aesthetics are purposefully imbued. Although the use of the term 'savage' infers a level of hegemony, Owen Jones was one of the first to ratify culture within design when he stated, "The eye of the savage accustomed only to look upon Nature's harmonies, would readily enter into the perception of the true balance both of form and colour." [1] To illustrate the relevance of Indigenous ideology design students at Victoria University, investigate individual cultural legacies to identify and validate their heritage within design. Having acknowledged these sacred connections the students employ both analogue and digital media to parallel Modernist principles alongside Indigenous markings of time in space in which geometry is used to create the common goal, beauty from chaos.

Connecting the Dots

Drawing attention to cultural diversity within twenty-first century aestheic education is well established in the manifestos of many tertiary graduate attributes and professional standards for accreditation. Contemporary design curricula dominated by Eurocentric ideals, constantly acknowledges the value of non-Western social, cultural, and creative practice. [2] Institutes prom-ise to graduate globally competent citizens able to work in international settings, adapt to diverse cultural demands, communicate across boundaries and be aware of global issues. Adding that; "graduates with disciplinary expertise in concert with a background in globalization, international affairs, and cultural diversity will have a higher standing as they enter the twenty-first century workforce." [3] These promises sound convincing. Yet, I suggest there is still much to be done to entice, retain and graduate students that will advance the laudable skills and knowledge offered to design pedagogy from within Indigenous cultures.

Unlike traditional art and craft, design as a discipline developed well after the colonial period in the mid twentieth century. As such, design research has tended to disregard Indigenous culture as having little to offer the disciplines. This has left design pedagogy dominated by a model that privileges Western influences. An increased demand for diversity within design education and practice has called for a re-evaluation of this Eurocentric stance. In support of a shift away from the apparent homogeny, design theorist Alain Findeli posits, twenty first century design should further, "open up the scope of inquiry." [4] This paper asserts that to facilitate this shift beyond the current paradigm and to enable more collective and culturally expressive design solutions, Indigenous symbols and visual-spatial strategies should be acknowledged within the pedagogical structures practiced. This study aims to show that the inclusion of Indigenous tenets, specifically those of the Pacific region known as Moana, within contemporary design pedagogy is not as much of a cultural stretch for aesthetic education as one might perceive. I will argue that visual references to culture, understood by reformists in the nineteenth century to be visually excessive, specific to few and therefore not universal, were not unequivocally removed from aesthetic education. They, if not yet celebrated as having contributed to the roots of the modernist pedagogy, certainly demonstrated, and continue to implement comparable ideologies that suggest a lineage within the aesthetic language instigated by the reformists and used in the development of the universal visual language by design modernists. I will assert that Indigenous visual spatial languages should be considered as tacit as their Western counterparts are to design education. This research will exemplar course work prepared for use in the first year design curriculum that has incorporated Indigenous symbolism and narratives in collaboration with the Tongan ideologies of *Ta-Vā* (time and space) and *teu le vā* (sacred connections). This work illustrates the relevance, opportunity and expansion of visual expression Indigenous culture can offer design thinking and practice. The following abridged historic overview of ornament acts as the platform for for the student to progress their understanding from. From the boarders of ancient Greek temples, pottery markings of the Lapita people, various religious iconographies, the carvings on the rafters in Māori *whare*, the lashings of the Samoa *fale*, to the embellishment atop New York's Chrysler Building, ornament is expressive. Ornament speaks to us and speaks about us through its own figurative and rhythmic languages.[5]

As an article of culture, ornament is as important as it is misundestood and misused. Whether regarded as essential enhancement, fundamental cultural expression or immoral adornment, ornament has always been a consideration in the making of forms, storytelling and the expression of symbolic and pragmatic meanings visually.

To clarify the backdrop that incited the removal of any cultural referencing within what is currently taught as the modernist aesthetic language, an abbreviated review of what ornament and adornment were perceived to be and why such visual expressions fell from favour is required. Aesthetic education celebrated the formal embellishments of Vitruvius (c. 90 - c. 20 BCE) in the first century AD, Leon Battista Alberti (1404 - 1472) in the fifteenth century and the decades that ensued where ornament flourished in both theory and practice to the late nineteenth century where the extravagant use of ornament within industrialised production caused it, along with cultural, religious and historic visual references to be considered obsessive and to be scrutinised as such. Reacting to the denunciation of excess and wastefulness of the Rococo, the horrors of emergent mass-production and an economical social divide that flamed discontent, the reputation of ornament and visual expression bore a substantial weight in the social reformations led by John Ruskin (1819 - 1900), Owen Jones (1809 -1874) and associates. As part of the Reformist's legacy and as a well-constructed trajectory to these ideals, early twentieth century architects and designers began to question the uses of ornament. Austrian architect and follower of the Vienna Secession, Adolf Loos (1870-1933) scorned ornament, labelling it degenerate and no less than a crime. [6] Loos defamation, in which he cited expressions of indigeneity as counteractive to the evolution of a modern culture devoid of primitive ornament was one of the earlier and most fanatical outbursts that initiated the turning point in which the study of ornament began to be eliminated from the curricula of art and architecture. [7] Polemic as many of the arguments were, the success of the nineteenth century aesthetic reformations gained traction. Throughout the late nineteenth and the early twentieth century Ruskin and Jones' ideals were imbued in an education that sought a less elitist approach to aesthetic understanding and use than Loos with the emergence of a more egalitarian and universal approach. The reformists although paralleling Loos in the trajectory toward reductive graphic codes, offered an understanding to the use of aesthetic languages that class, status or Loos for that matter, could not own or define. The historical trail that followed was filled with

as much politics, diplomacy, economics, war, peace personalities, jealousy, duplicity, success and demise as any efficacious work of fiction let alone historic non-fiction could promise.

To begin, I will summate educational theorist Friedrich Froebel's (1782–1852) instigation of aesthetic education that armed Ruskin and Jones and then enabled the development of modernist design pedagogies. Building on these I will elucidate how these holistic, and abstractive theories were further cultivated by Johannes Itten (1888–1967) and Lázsló Moholy-Nagy (1895- 1946) within the German design academy, the Bauhaus (1919- 1933) and then as part of their later endeavours in the United States. This study will reveal, a hidden connection between Froebel's theory, Ruskin's and Jones' manifestoes, the Bauhaus, and Indigenous Pasifika and Māori visual spatial languages. The efforts made by Froebel and the Bauhäusler, have been accredited, with fashioning the bedrock of a modernist aesthetic education. Additionally, Jones extensively documented the abstracted graphics, flat patterning and ornamentation of many cultures whose aesthetic strategies became highly visible, albeit without recognition, in modernist work. These ideals continue to be widespread within Western design pedagogy and practices today with, quite quixotically, no mention of the Indigenous visual spatial strategies that pre-existed the industrial reformation and that also clearly demonstrate numerous and distinct similarities to the reformists ideals. These holistic strategies and rationalised reductive visual expressions were established well before Froebel, Ruskin, Jones or Loos noted their own discontent with the irrational, excessive and visually meaningless aesthetic work that they sought to banish. Using the ideals of *Ta-Vā* and *teu le vā* championed by Tongan academic Hūfanga 'Okusitino Māhina in his Theory of Reality this research will draw analogies between Indigenous visual-spatial strategies and those of Froebel and the Bauhaus and elucidate not only the relevance but the opportunity Indigenous culture holds for contemporary design thinking and practice. By paralleling the historical trajectories of both, the uses of reductive graphic codes and the holistic ideologies as espoused by Froebel and the Bauhaus with those embedded in Māhina's theory this study will not only expose the historical connections but also the congruence between the ideals imbued in *Ta-Vā, teu le vā,* and contemporary design education. I posit that the acknowledgement and inclusion of Indigenous culture should not be considered an interesting historic or cultural deviation but as a visual spatial language deeply rooted and highly relevant to the enrichment of

Fig 1. *Examples of Froebel's Gifts*, Circa 1850, Norman Brosterman, Inventing Kindergarten, Norman Brosterman.

Fig 2. *Lapita markings*, 3200-2700 AD, Patrick Vinton Kirch, The Lapita Peoples: Ancestors of the Oceanic World, Wiley Global.

design education, theory and practice.

As a keen observer of nature and humanity Froebel's beliefs were akin to many Indigenous peoples. Both approached the transfer of knowledge from a biological and a spiritual perspective. Froebel believed that what separates humankind from other life forms is the ability to alter our environment. His philosophy embraced all things in nature as connected. Froebel's work expressed interrelationships between the living and the innate, again replicating Indigenous ideologies. Importantly, Froebel's work honoured the relationships and connections held in the space between nature, people and things. It was upon holistic, sensory, spatial and social ideals that Froebel built his pedagogy and introduced, perhaps more correctly, re-introduced, to the new world, the values of nurturing and respecting the individual and acknowledging their progressive contributions within a larger collective, be that family, community or the environment. His approach, although instigated as early childhood education has been credited with having had a direct, "influence in the history of architecture and all plastic arts beyond any predictable proportion." [8] It is well established that Froebel's teachings influenced the creative process and social ideologies of inspirational Bauhaus founder Walter Gropius (1883-1969), his studio masters Johannes Itten (1888–1967) Paul Klee (1879-1940), Wassily Kandinsky (1866–1944), Lázsló Moholy-Nagy (1888–1967), Swiss architect, Charles-Édouard Jeanneret, known to all as Le Corbusier, (1833-1965) and prominent American architects and designers Frank Lloyd Wright (1867-1959), Buckminster Fuller (1895-1983) and Charles Eames (1907–1978), to name only the grandfathers of the Western aesthetic influence and instigators of its subsequent embedding in design education. Froebel's Gifts, as his teaching tools are known, introduced a reductive graphic code based on a sparse grammar of straight lines, diagonals and curves to express the abstracted essence of form and space. The Gifts encouraged physical experimentation with scale, balance, unity, perception, connection and divisibility. The Gifts shifted successively from simple to complex and two-dimensional to three dimensional, moving through point, line and plane to create inter- connected relationships with nature. It is worth noting, that similar simple grammars and codified instructions for use can also be found in the dentate stamping on the pottery produced by the Lapita peoples dating as far back as 1500BC. [9] The Lapita peoples are the common ancestor of the Polynesians, Micronesians and Austronesians-speaking Melanesians who colonized the islands of the Pacific, including New Zealand. This observation, I would assert illuminates the first correlation I make between traditional
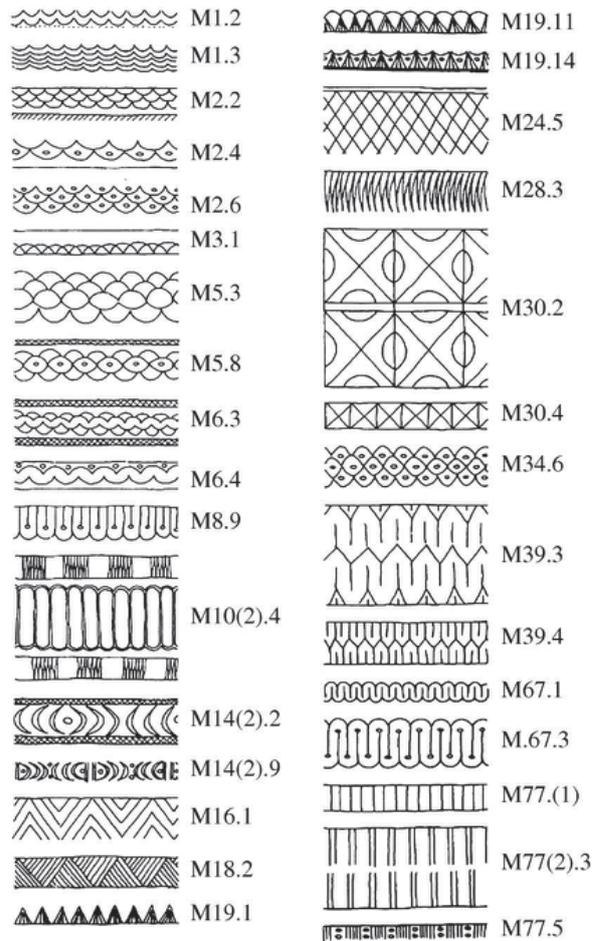
Fig 3. *Savage Tribes Plate*, 1857 Ornament of Grammar, Creative Commons.

Fig 4. *Gunta Stölzl*, 1928 Bauhaus Weaving Workshop, Creative Commons.

Indigenous practices and what ironically aesthetic education refers to as the inception of the modernist approach. [Figs 1 and 2] Jones, unlike Loos who had remained elitist in his aesthetic endeavours, would also look toward numerous ancient and Indigenous, although foully referred to as 'savage' cultures, for much of his inspiration when developing bold new theories on geometry and visual abstraction. [Fig.3] Less than half a century later, French reformist and inspiration to both Itten, and his Bauhaus colleagues, Eugene Grasset, (1845-1917) also looked to Indigenous culture and asserted similar beliefs in reductive graphic codes and chronological connections. [Fig 4] Grasset stated; "The return to the primitive sources of simple geometry is a certain guarantee of the soundness of our method." [10]

Froebel also reasoned the existence of connections within space and the importance of nurturing these connections by employing spinning to show how form is perceived to change when treated differently within space. Within this experiment Froebel had described appearance and illustrated perception. As a summation of this exercise, Froebel

historian, Norman Brosterman described this exercise as, "a straightforward demonstration of cosmic mutuality and universal interconnectedness that even a child could understand." [11] Contrasting the Western paradigm of space as a separator, the ideals embedded in the Pasifika constructs of *Ta-Vā* and *teu le vā*, like Froebel's, also place an emphasis on connectivity. Importantly, this offers the second indication of how the connections offered within Indigenous visual–spatial strategies intersects with aesthetic education. Froebel's exercises expressed, as do *Ta-Vā* and *teu le vā*, immaterial connections, sensory perception and shared understanding; all intangible yet present. As part of this ideology, *vā* is expressed in Hawaiian and Māori cultures as *wā*. Samoan born academic and author Albert Wendt explains the symbiotic relationships and relative space between entities. He explains that through nurturing and respect, they grow and change over time. [12] "*Vā* is the space between, the in-betweenness, not empty space, not space that separates but, space that relates, that *vā* holds separate entities together in the Unity-in-All, the space that is context, giving meaning
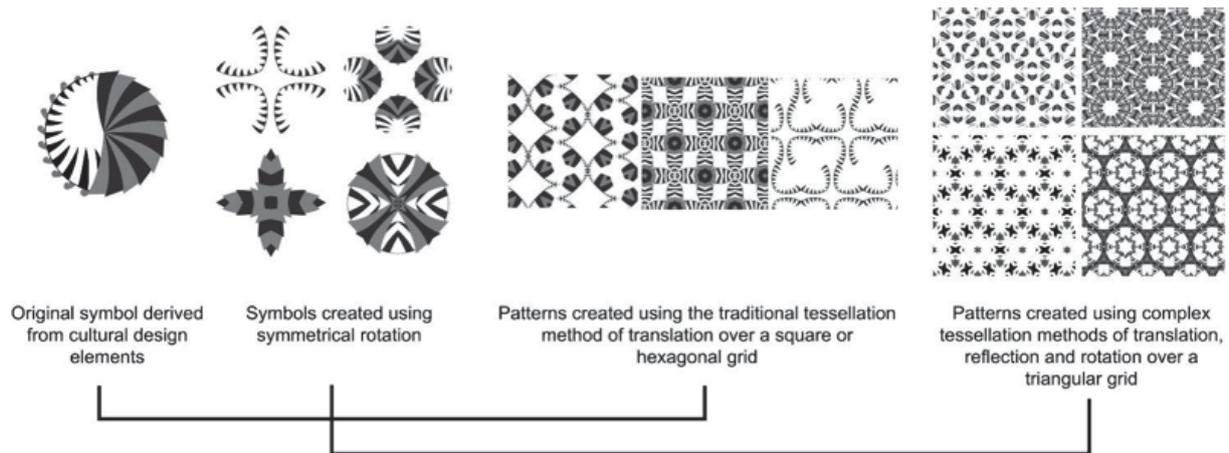
Fig 5. *Diagram from course work*, 2015, N. O'Sullivan.

to things." [13] Following on from Froebel's educational reforms and motivated by twentieth century industrialization, Itten and Moholy-Nagy, as two of the most influential Bauhaus masters, shaped a preliminary year *(Vorkurs)* pedagogy. Much of which continues to be central within modernist educational approaches still delivered within Western, and many non-Western, aesthetic programmes. Important to this research is the recognition of the ideals that were embedded in Bauhaus pedagogy but not the aesthetic model that emerged to be known, and dominate the aesthetic landscape, as the Bauhaus Style. Itten's *Vorkurs,* understood to be the backbone of Bauhaus pedagogy laid a pathway for individual exploration and analysis of one's self, nature and the world of artistic creativity within the guidelines of a collective. [14] This was done to produce not a common result or style, as wrongly interpreted within mid-twentieth century American architectural and design education, but a shared and universal understanding. Itten's tenets, like *Ta-Vā* and *teu le vā* had offered students the ability to see, synthesize emotion and senses, and expressively articulate the essence of form and space. Itten explained, "Walls with windows and doors form the house, but the emptiness in them establishes the essence of the house. Fundamentally, the material conceals utility; the immaterial establishes essence. The essence of a material is its effect on space, the immaterial. Space is the material of the immaterial." [15]

Post Moholy-Nagy's emigration in 1933 from the Bauhaus to the United States due to Nazi pressure, his ideals were further challenged within design pedagogy as he attempted to disseminate Bauhaus tenets at the New Bauhaus in Chicago. At this time Bauhaus founder, Walter Gropius, (1883–1969) now teaching at Harvard Graduate School of Design, highlighted

Moholy-Nagy's new conception of space saying it, "opened design considerations to the problems of the fourth dimension and a modern conception of space" [16] Moholy-Nagy himself wrote: "Today spatial design is an interweaving of shapes; shapes which are ordered into certain well defined, if invisible, space relations; which represent the fluctuating play of tension and force." [17] When the relevance of Moholy-Nagy's ethical, environmental and socially responsible doctrines were brought into question by politically motivated industrialists Moholy-Nagy retorted, "the artist's work is not measured by the moral and intellectual influence which it exerts in a lifetime but in a lifetime of generations." [18] Peder Anker states that, "Moholy- Nagy believed the future held the possibility of a new harmony between humans and their earthly environment if forms of design followed biological functions." [19] For the most part, American industrialists of this period sought immediacy and profit and therefore, Moholy-Nagy's ideology fell predominatey on deaf ears. Although never compared before, I would suggest a correlation between the canons of Moholy-Nagy and Māhina's Theory of Reality, *Ta-Vā*. Māhina charges current political and economic trends for the loss of, "mutually holistic, symbiotic human-environmental relationships." [20] Findeli observed of Moholy-Nagy that the "key to our age is to be able to see everything in relationship." [21] I suggest that Māhina's *Ta-Vā,* time and space theory sits very comfortably alongside Moholy-Nagy's 1947 work, *Vision in Motion* and reveals further correlations to Froebel, Itten and the Bauhaus.

What remains of the Bauhaus pedagogy post the American translation is the reductive code, material-explorations and the desire to unite creative practice with technologies, predominantly for financial reward. I posit that what has been diminished within

Itten and Moholy-Nagy's teachings are the holistic applications, and the environmental concerns that connected design to the past, the present and the future, known within Pacific Island cultures as *teu le vā*, sacred connections. Within *Ta-Vā* these honoured connections are considered enduring legacies that are left through experience and importantly, hold the counterpoints from which the path forward is negotiated. *Ta-Vā*, as Māhina explains, allows experience and memory to influence the future by negotiating it in the present. He advocates, "People are thought to walk forward into the past and walk backward into the future, both taking place in the present, where the past and the future are constantly mediated in the ever-transforming present." [22]

As a tether to space and time the use of *teu le vā* as a form of respect is also considered essential to Froebel and the Bauhaüsler. Evolving from Itten's *Vorkurs* faculty were seen not as instructors but as guides in a student's quest towards a unity of head, heart and hands. [23] Wendt also outlines *teu le vā* as Froebel and the Bauhaüsler had, considering the nourishment, cherishing and caring of the connections between the head, heart and hands as imperative to the creative process. Froebel's practitioners were referred to as kindergarteners, the gardeners of children. Froebel also privileged an understanding of connectivity through group work in which shared responsibility for motivation, collaboration and aesthetic sensibilities was addressed. Simple geometric patterns were developed by and for the group from two dimensional designs on a gridded surface into three dimensional forms, "wherein, each individual is there on account of the whole and the whole on account of the individual." [24] By asking his students to see, analyze, connect, disconnect, interlock, weave, abstract, construct, and deconstruct simple forms, Froebel challenged the manipulation and juxtaposition of multiple entities. The tasks although quite manifold, acknowledge that change and development are progressions; "the last one; therefore was brought about and prepared by the former." [25] Following on from this Grasset asserted; "to innovate is to preserve by modifying." [26] Expanding from a predominantly Pasifika comparison to European constructs, Amiria Henare explains that within Māori ideology *taonga*, also contrasts the Western (excluding the Bauhaus) concept of space as separation. Henare stated that, "in the Māori world people and things have close relations that collapse spatial and temporal boundaries." [27] Both Indigenous strategies and the tenets of Itten and Moholy-Nagy aim to ensure the relationships formed between entities, teacher and learner, artefact and artist or

object and environment are; reflected upon, respected and communicated appropriately. By acknowledging the space, the relationship in-between, the two entities can be expressed for example, as a dependance, independence, tension, ease, balance, imbalance, symmetry or asymmetry.

The nexus between Froebel, Itten, Moholy-Nagy and current design thinking to concepts such as *Tā-Vā* and *teu le vā* is the appreciation of what space offers both physically, emotionally and perceptively. By addressing the diversity that characterizes the space between current design pedagogical practice and the vehicles of meaning embedded in Indigenous cultures, new agency can emerge and ensure, that future uses of aesthetic language do not become constricted. In order to augment the value diversity offers within design there is a need for a more engagement with Indigenous culture. Again, with a focus on the cultural agency of the Pacific Islands, I reference Pasifika poet Albert Wendt; "I belong to Oceania- or at least I am rooted in a fertile portion of it. So vast, so fabulously varied a scatter of islands, nations, cultures, mythologies and myths, so dazzling a creature, Oceania deserves more than an attempt at mundane fact; only the imagination in free flight can hope, if not to contain her, to grasp some of her shape, plumage and pain." [28]

In response to the diversity present in New Zealand design education I have developed project work for students to gain both an understanding and an appreciation for culturally inspired visual-spatial languages. Using Bauhaus, Wendt and Māhina's understanding that the immaterial space between living and/or inanimate forms holds a tangible connection, the design challenge asks students to think critically about their individual and collective connections to culture, spirituality and creativity. This project encourages students to consider what they intend to visually express or reveal about themselves and their individual connection to a cultural collective. Using *Ta-Vā* and *teu le vā* the students identify and visually express both tangible and intangible connections to the past, present and the future. The student actively investigates the historic or traditional meanings and methods attached to the symbolism or strategies they have identified in order to find relevant methods of expression in a contemporary context. As Moholy-Nagy, Wendt and Māhina have all asserted the space in-between holds connections and encourages relationships. Using simple elements and forms of the reductive aesthetic codes that I have asserted bind Indigenous visual spatial languages to the modernist aesthetic, the students are asked
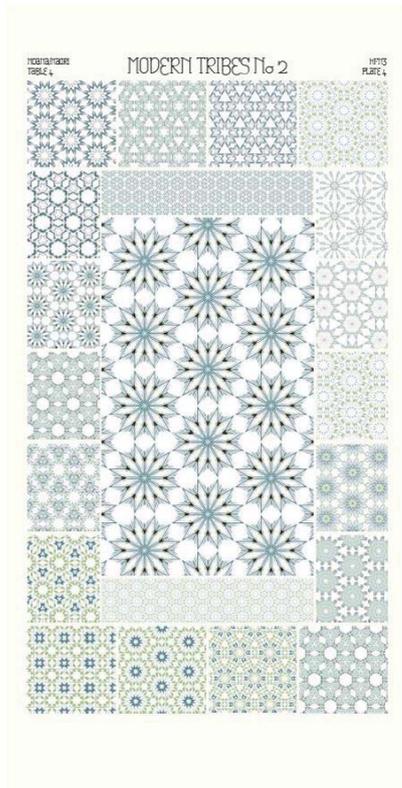
Fig 6. *Modern Tribes Moana/Maori Plate 4,* 2015, Nan O'Sullivan, printed poster.
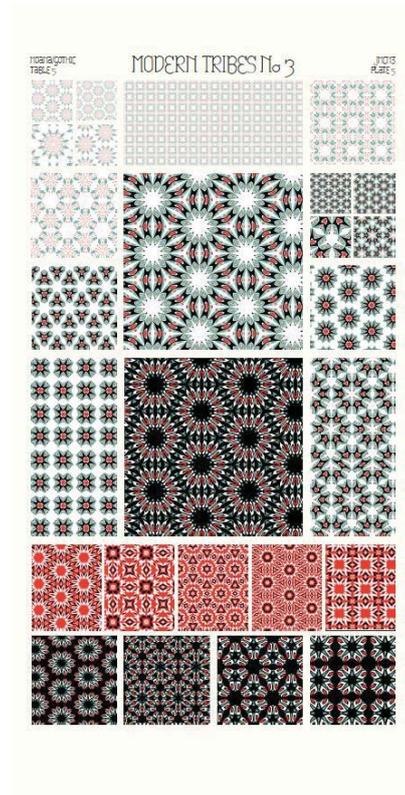
Fig 7. *Modern Tribes Moana/Gothic Plate 5,* 2015, Nan O'Sullivan, printed poster.
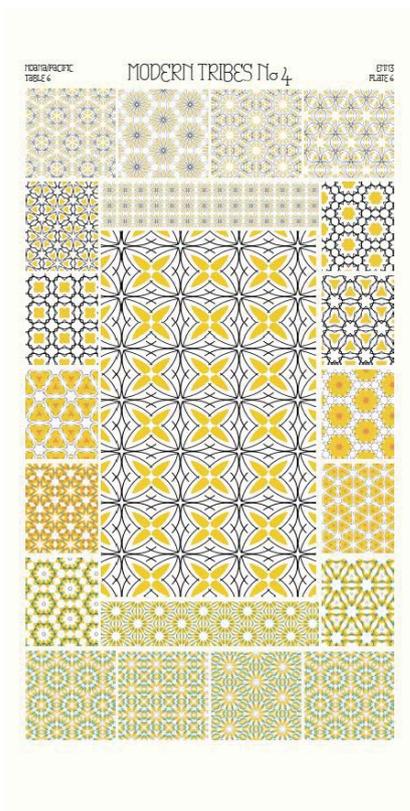
Fig 8. *ModernTribes Moana/Pacifika Plate 6,* 2015, Nan O'Sullivan, printed poster.
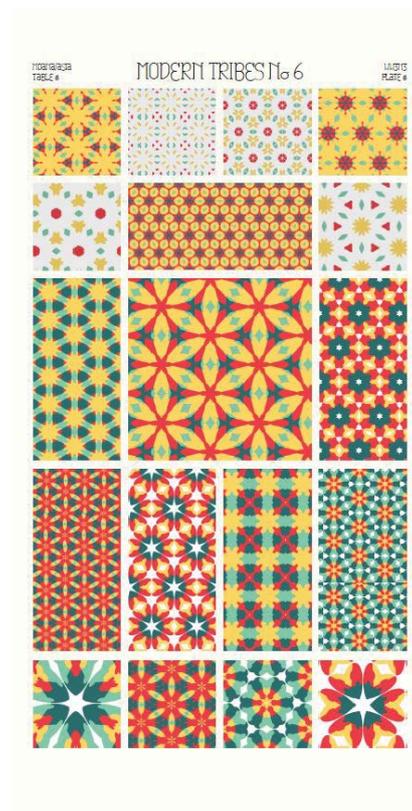
Fig 9. *Modern Tribes Moana/Asia Plate 8,* 2015, Nan O'Sullivan, printed poster.

to apply an understanding of *Ta- Vā* and *teu le vā* in order to visually characterise the connection they have to their cultural heritage. Using the family tree concept of structural formations inherent in family genealogies, the tethering extant in the design process of iteration is elucidated. Using visual narratives and specific visual strategies taken from Indigenous practices students iterate and integrate graphic representations of their cultural heritage and visually express their emotional connection to it.

Although the use of the term 'savage' suggests a certain hegemony, Owen Jones, as a fore-father to modernism, was one of the first to ratify culture within design when he stated, "The eye of the savage accustomed only to look upon Natures' harmonies, would readily enter into the perception of the true balance both of form and colour; in point of fact we find that it so, that in the savage ornament the true balance of both is always maintained." [29] With an appreciation that people and cultures arrange time and space in multiple and diverse ways students investigate Pasifika practices where time and space are marked in a symmetrical fashion using repetition and symmetry to give rise to beauty. The students, inspired by Indigenous or ethnic narratives design symbols that resonate with their understandings of their own cultural heritage. The symbols are designed referencing historic culture and represent Indigenous narratives that identify and reflect what ethnicity, culture, or cultures a student may feel tethered to. Using a combination of drawing, generic software and more complex custom tessellation and pattern generating software the students continue to grow their understanding of connections through iteration. [Fig 5] To develop the visual narratives further the students employ strategies of repetition, rotation, symmetry and asymmetry that are common to both the Pasifika regions and are fundamental to the software engaged with. The results have been collated in the collective format synonymous with Owen Jones' seminal tribal and societal depictions in the and are catalogued on plates that are representative of both Moana and the specific cultural strategies the student has used to develop their visual identity and subsequent pattern iterations from. Figures 6-9 are part of a series of works that graphically represent the cultural cacophony that makes up the first year cohort within our school.

As argued the connectivity between the Indigenous visual spatial strategies of *Ta-Vā* and *teu le vā* and the ideals of the Bauhaüsler is extant and if not yet acknowledged as evident, a comparison of Māhina's proposal is mirrored in Raleigh's assertion of the Bauhaus' success. "Few have so successfully

drawn from their past, merged with their present, and anticipated the future. To scan the philosophic past that resulted in as significant an educational movement as that represented by the Bauhaus may possibly have a use now." [30] I would posit that over half a century after Raleigh's plea design is still in need of a pedagogy that engenders a design approach based on the quality and diversity of spatial relationships. I have further argued that the acknowledgement, inclusion and reflection of Indigenous culture should be considered as essential to initiate a shift away from the current homogeny apparent with design expression. By identifying intersections between Indigenous spatial strategies and the holistic pedagogy intended by Froebel, Itten and Moholy-Nagy I have established a space to demonstrate this compatibility. By engaging with graphic and ideological meanings embedded in in Indigenous visual-spatial languages and strategies in combination with acknowledging their meaningful relevance and contribution the assimilation of Indigenous culture within contemporary design education can be realised. In doing so, the attrition of more diverse and globally proficient design graduates is affirmed but as importantly these graduates will not only value, they will be able to reveal, using an enriched visual-spatial vocabulary, the perpetual connectivity held in the space between humans and nature, humans and objects and humans with humans. As a Froebel alumni and a kindred spirit to Moholy-Nagy, and I would hope Māhina had they ever met, Buckminster Fuller asserted "Space is irrelevant. There is no space there are only relationships." [31]

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Intimate Technologies: The Ethics of Simulated Relationships

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Abstract

This paper considers the complex relationship between ethics and social technologies. It is particularly concerned with what it means to be intimate or share ideas of intimacy with robots and avatars. Looking to the world of theatre and situating our ethical framework within two specific plays we are able to examine new technological narratives that inspire critical reflection on our current and future relationships, sexual taboos and ethical practices. It also poses the question of the role of the arts in preparing society for dramatic technological and social shifts that challenge what we might think of current ideas of what it means to be human and values that have troubled debates between the biological and the artificial. Such shifts are not gender, or diversity free and we recognize that ethical aspects of technology are always person-dependent, culture-dependent and situation-dependent [1]. Within ethics, discussions of privacy and identity move to the foreground of our discussions.

Situating Ethics in Technological Futures

Science fiction has often been used as a medium for understanding the emotional and ethical conditions of new and developing technologies [2]. Furthermore, robots and avatars are a recurrent theme in the science fiction landscape, Famous examples such as William Gibson's *Neuromancer* (1984) and Neal Stevenson's *Snow Crash* (1992) define the avatar and have inspired cybernetic dreams and the languaging of techno-spiritual transcendence [3]. Fritz Lang's *Metropolis* (1927) defined much of our aesthetics around robotics and Isaac Asimov's *I, Robot* has become a touchstone when discussing themes of robotics and Artificial Intelligence (henceforth AI) and still informs some of the policy and ethical guidelines around robotics sixty-five years after its original publication in 1950 [4]. In the 21st century, films like Spike Jonze's *Her* (2013), Alex Garland's *Ex Machina* (2015) as well as the recent hit television drama *Humans* (2015, Channel 4, UK) push the conflict with and negotiation of technology in our lives to legitimately change the way we comprehend what it means to be human. For example, in *Humans* Anita is a robot who has sex with the father of the family that has bought her, and in *Ex Machina* the characters want to have sex with Ava, the humanlike robot whose intelligence is inherently humanlike. Ava inspires very human feelings: lust, adoration and empathy from the men.

It is this correlation between the technological or even biological superiority of AI fictions in *I, Robot*, *Humans* or *Ex Machina* that drive us to redefine the technological other. The technological creature in these cases is used to simulate our own very human, existential questions, which allow us to view them as models for reflecting on humanity as an outsider. Taken altogether, what we're seeing is both the horror at techno-infiltration coupled with a deep disgust at how much we seem to like it. The fact is people already fall in love with fictional characters, even though there is no chance to meet and interact with them. Like social networking and the email capabilities of the Internet revolution, robots and avatars are progressively surrounding us in our professional lives as well as our professional sphere.

Robots are already taking care of our elderly and children and there are few studies that consider the ethical implications of such care in the long term. Sherry Turkle is an exception. She has been a key theorist in the developing field of social robotics for over 40 years. As a professor of social science and psychology she maintains a profound interest in the inner working of the human mind. This includes the way that modelling the human mind on technology and technology on human interaction is affecting psychological theory and changing not just our engagement with technology but with each other [5]. Through monitoring the relationships people form with robots over a series of clinical trials, Turkle warns that the immersiveness of these relationships and the subsequent downgrading of the human will allow strong attachments to be formed that may replace other forms of human interaction, creating the illusion of companionship. She cites specific examples such as PARO[1] a therapeutic robot for the elderly, and AIBO, Tamagotchi and Furby as children's toys that stretch and re-form our definitions of authenticity, life and companionship. As Rosalind Picard has noted "The greater the freedom of a machine, the more it will need moral standards"[6].

In addition to Turkle's cautions about how humans live in a technological environment, other theorists, such as Becker, Crutzen and Duffy have examined the socio-

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[1] http://www.parorobots.com/

technical aspects of human-computer interaction, others like Veruggio and Operto have opened up the question of ethics in interdisciplinary discourse in the field of applied ethics in robotics and the issues surrounding humankind and autonomous machines. Their paper in the International Review of Information Ethics (2006) offers a comprehensive view on current discourses, focusing on how far can we go to embody ethics in a robot? Is it right to talk about "emotions" and "personality" of robots and the anthropomorphization of machines? [7]

In chapter 3 of *Anarchy, State and Utopia* (1974) Robert Nozick introduces *Moral Constraints and the State* [8]. From a political philosophy perspective he opens up a range of questions surrounding morality and how the state in one form or another may deal with the issues of developing a good moral framework within their specific political systems. In this section he introduces two key ideas that are useful when examining our developing relationships with robots and avatars. Firstly touching upon the ethics of animal-human interaction; Are there "any limits to what we may do to animals? [And] have animals the moral status of mere *objects*" (pp.35). He debates the fact that some higher animals should be given more weight but concedes that it is difficult to define *which* animals are higher and *how* one might measure this. He also begins to break down some of the defined boundaries between humans and animals and discusses how violence, pleasure and pain in relation to these begin to blur the boundaries and moral conditions. He claims that "once they exist, animals too may have certain claims to certain treatment" (pp 39). Might this not be the case for robots too, that once they exist – we give them our form, eye tracking, AI or other empathy inducing features – that we may begin to categorise higher forms of robots that have gained an ethically ambiguous status within our society? In *Do Androids Dream of Electric Sheep* (1968) Philip K. Dick presents this debate through both human and animal robots, within a society that has clear moral guides that states that empathy can be tested for and measured as the key feature that defines the treatment and status of electronic and non-electronic humans and the authenticity of animals and practises of care. This puts into dialogue notions of the Posthuman and the ethical application of non-anthropocentric thinking [9] into conversation with debates on robotics.

In the same chapter Nozick introduces the concept of the Experience Machine as a thought experiment. This experiment asks if there was a machine that could not only simulate but convincingly "stimulate your brain so that you would think and feel that you were writing a great novel, or making a friend, or reading an interesting book," would we plug in? In Nozick's existential argument he states that there is a difference between wanting to *do* certain things and simply having the *experience of them*. He claims that it is not only experience that we value as human beings and plugging in would rob us, not only of our identity as a particular kind of person, but also our ability to have an impact in

the world. He then develops the argument further by asking if we adapt the experience machine to a transformative machine and through this we could transform into whatever kind of person we would like to be, while still being us, would we plug in? And beyond this if we then created a results machine that would allow us to additionally make a difference to the world, would we plug in? Nozick asserts that we should not be looking for the right formula or condition that would make plugging in a valid option for we cannot stimulate from within the brain the authenticity "to live (an active verb) ourselves" (pp.45). When considering the role and policing of avatars in line with developments into full body immersion [10], we must once again consider whether in specific cases Nozick's condition of plugging in may become more attractive or even more moral when society denies us the possibility to live as ourselves. This may be particularly pertinent in the case of sexual perversions but more broadly this may apply to anyone who feel unaccepted by those who socially define them. Plugging in may become not only tempting but a refuge from society, a better way for someone to live themselves (as Nozick suggests), even if they are aware that it is virtual. This is something to consider in the case of *The Nether* play discussed within the following section.

The above examples give an insight into how avatars and social robotics have challenged some of the most fundamental and personal understandings of the way we form and sustain relationships. We believe it is important to look beyond generalising views of technology and consider a couple of situated examples that complicate current utopian or dystopian views on technological intimacy.

Ethics, Performance & Technology: Body Narratives that support Moral Ambiguity

The main focus of this section is to discuss and pull out key strands from two current plays that were performed in Edinburgh and London in 2015; *Spilikin: A Love Story* [11] and *The Nether* [12]. These plays both deal specifically with technology, ethics and the body. This is achieved by the actors performing narratives of near future robotic and avatar-based scenarios. Audiences are forced to examine current and future ethical practices around complex issues such as: dementia, robotics, care, virtual reality (simulation), paedophilia, cooperate ethical protocol and the formation of emotional relationships with technological 'others'. In other words, how we understand the emerging and future technologies surrounding us - particularly how (sexual) companion robots and the policing of cybersex will affect us and the society in which we live.

Emotional and sexual relationships between humans and robots are the concern of Matthias Scheutz (2012) who has clearly identified dangers that robots, specifically designed for eliciting human emotions and feelings, could lead to emotional dependency or even harm. He discusses several experiments are discussed

that show that humans are affected by a robot's presence in a way "that is usually only caused by the presence of another human." (p. 210). However, in the case of human-robot interaction, the emotional bonds are unidirectional and could be exploited [13] whilst David Levy looks at future robot prostitutes. Men pay (mostly) women for sex in the 'real world' and Levy considers the ethics of robot prostitution and speaks of "the knowledge that what is taking place is nothing 'worse' than a form of masturbation" (p. 228) [14].

Blay Whitby (2012) directly addresses Levy when he considers how social isolation might drive people to robots for love and affection. Whitby says, "peaceful, even loving, interaction among humans is a moral good in itself", and "we should distrust the motives of those who wish to introduce technology in a way that tends to substitute for interaction between humans." (p. 238). He therefore suggests that robot lovers and caregivers are political as well as ethical topics, rather than providing simply technological solutions to the challenges of the modern world [15].

Socially, imagining how to befriend the robot or avatar allows a re-examination of how contemporary societies value and police, either socially or legally, the actions of individuals and groups. Cognitively it also makes us re-evaluate how we understand ourselves, one another and our relationships with the outside world, which are opened up to be reframed in the context of the robot or avatar companion [5]. The moral ambiguity of *Spilikin: A Love Story* and *The Nether* is also important. Neither play takes a position of what is right, although it may be said that both plays begin with a situation where personal morals rather than societal consensus around technology can easily be applied. *Spilikin* focuses on a robot caring for an elderly woman with Alzheimer's and *The Nether deals with childlike avatars that perform sexual and sadistic activities for paying customers.*

The Nether begins with the interrogation of Mr Sims aka 'Papa' whose Hideaway is a virtual world in the Nether. As the play develops we see that the customers who use the Hideaway become so addicted to it that they may be tempted to abandon real life altogether, getting themselves hooked up onto life support machines and "crossing over" to spend all their time in the virtual world where it is now possible to experience such sensations as taste, smell and sex. But in the outside world, the Nether's own policing unit are keeping an eye on things and the tough female investigator Morris has brought in the owner of The Hideaway where punters, retaining their anonymity by adopting avatars, are able to have sex with virtual children. The Hideaway is one of the darkest corners of *The Nether*, a paedophile's paradise created by a Mr Sims who provides his guests with the perfect getaway for them to explore the most extreme part of these darkest fantasies - the abuse and murder of children.

Fig 1. The Nether, 2015, Stills of the play showing the offline setting of the interrogation of Mr Sims aka Papa by Detective Morris. Image sourced from: http://www.thenetherplay.com/

As you delve deeper into this play it brings up a range of important questions about simulation, intention and what actually categorises sex or violence online [16]. Such as: If you create an avatar and your avatar is a serial paedophile, is that a crime? And more specifically, is a virtual paedophile as real a threat as a non-virtual one, if there are no actual children involved? Might, on the other hand, the virtual space be used as an option to live out paedophilic and sadistic fantasies in order to prevent them from being carried out in other ways? This is what the main character Mr Sims suggests, stating that he made The Hideaway in order that "users may experience their fantasies in a non-judgmental environment without committing actual harm." Morris however is unwilling to accept this answer and questions whether living out these fantasies could be a way of testing the boundaries of extremity, claiming that the cases of paedophilia reported have become more sadistic. Mr Sims motives are also questionable when one considers the fact that The Hideaway is at its heart a business that will no longer accept you when you cannot pay. The play also brings up a range of contemporary debates around the definition of real and virtual, particularly when the interrogation forces the characters to face a physical act which replicas, in its exact aesthetic and physical detail, the sex and violence of their virtual world. It makes the audience question what constitutes life, death and identity online, including the personal representation of intimate emotions such as love and loss in social virtual worlds and online games [17] [18].

Spilikin: A Love Story is a play that was performed during the 2015 Edinburgh Fringe Festival[2] and is going on a national tour in the UK in 2016. The play is a collaboration between Pipeline Theatre company and Engineered Arts, whose RoboThespian was the instigator of this script. The story focuses on the past and present of a woman with Alzheimer's who lives with a robot, left to her by her dead husband. Through a collection of

conversations with the robot the audience is drawn into her story and is able to share her vulnerabilities and the progression of her dementia in circumstances where she is more or less aware of her husbands death. The robot aids her in reliving her original meeting and developing relationship with her husband in the past. Throughout the play although the robot's physical appearance, projected face and mechanical body does not change, the widow Sally is able to express a range of emotions towards him. She engages with the robot in some instances as her husband who she cares for by covering him with a blanket and giving him his glasses, while at other times he is the target of her confusion and resentment, seeing the robot as an annoyance that she has to endure until her husband comes home from his conference.

This story focuses on current issues of robotics and care, particularly the integration of robots into care of the elderly [5] [19]. But the story is able to draw us into this debate in a deeper and more personal way by showing us 1) the uncomfortable relationship Sally has to the only other real person who comes to see her in the play, a technologist who fixes the robot and knew her husband 2) the fact that her husband knew he may inherit a disease that caused his father to die young and was through this experience already predisposed to thinking about the future and the relationship he may come to have with the mechanical robotic structures that he is always shown to be tinkering with in the past 3) the relationship she shared with her husband in the past and her admiration of his work with robotics, it is clear that her husband's identity is strongly embodied by his passion for robotics and thus the robot can be seen as a fitting tribute to his memory 4) the fact that her husband made the robot specifically for her and that this is clearly an act of care and love on his part. It is an individual robot for her who sings with her, confirms that she can call him her husband and acts as a memory aid for her 5) the materiality of the robot itself, as a being on stage – including the mechanical sounds and lights that are not trying to emulate the gestures, movement or looks of her husband.

Fig 2. Spilikin: A Love Story, 2015, Stills of the play showing Sally's emotions of love and fear towards the robot. Images sourced from: http://www.pipelinetheatre.com/gallery1.html

The breaking down of wide speculative scenarios, in which ethics are taken from a collective perspective of what is better for society into an individual story, shows that ethics need to be situated in order to be evaluated. Obviously this play does not suggest that robots should be companions for every Alzheimer's sufferer but it offers a touching and intimate portrayal of a woman who is for the majority of time able to take comfit in the simulation of her past (memories) and her companion (a robot). Engineered Arts' director Will Jackson also states that this was one of the main aims of the play: the examination of "the ethical, moral and philosophical ramifications of artificial intelligence and robots with human-like characteristics... This play isn't about presenting one side or another, but about exploring the issue in a nuanced, critical, human-centric way." [20]

In a similar way, *The Nether* projects some of our deepest social fears with the aim of interrogating technology, projection and simulation. This play takes a theme that has strong currents in public opinion and the media, the issue of paedophilia. Many reviewers and commentators [3] noted that *The Nether* is part procedural police thriller and part evocation of the murky world of the Internet. Some specific questions that were addressed within these reviews were: How do you write a play about the ethics of online existence? How do you stage a virtual world? How do you police the entire Internet? And how much of this part of our world do we know about? This is what *The Nether* does. It questions what are the boundaries of immersion, when does play become real, what role do corporations have in policing their networks and how does the materiality of the

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[3] See: http://www.telegraph.co.uk/culture/theatre/theatre-reviews/10991160/The-Nether-Royal-Court-review-haunting.html, http://www.theguardian.com/stage/2014/jul/27/the-nether-royal-court-observer-review, http://www.independent.co.uk/arts-entertainment/theatre-dance/reviews/the-nether-royal-court-theatre-review-deeply-disturbing-and-provocative-9629576.html, http://www.ft.com/cms/s/2/aef5965e-13e0-11e4-8485-00144feabdc0.html, http://www.huffingtonpost.co.uk/victoria-sadler/nether-royal-court-theatre_b_5634521.html, http://www.timeout.com/london/theatre/the-nether accessed 1/12/15

Nether, as opposed to the flat projections used within the real world detective scenes (see Fig 1), help to enforce our view that the Nether is as real as any other environment.

Fig 3. The Nether, 2015, Stills of the play showing Papa and Iris having a picnic in The Hideaway inside The Nether. Image sourced from: http://www.thenetherplay.com/

The Nether is compelling and seductive partly because of what the stage designer Es Devlin does, for both the Royal Court Theatre and it's transfer to the West End stage in London, is to make the online world a magical reality. There are beautiful sunlit poplar trees, a quaint Victorian styled, 19th-century house with elks' heads on the walls and a jovial proprietor and host called Papa, who offers a beautiful virtual girl for the delectation of his paying guests. After they have had sex with her they are invited to slay her with an axe.

Whilst the plays we cite focus predominantly on the elderly, Holloway and Valentine's research into the way in which young people engage with the Internet offers a useful example of what robots might look like beyond heteronormativity [21] They found that anonymity online allows "users to construct 'alternative' identities, positioning themselves differently in online space than off-line space" - identities that are both played with and at times abandoned. This anonymity offers control, flexibility, as well as "time to think about what they want to say and how they want to represent themselves." Despite this, they also found that the off- and online worlds of children are not utterly disconnected, but rather "mutually constituted". Nonetheless, legal and policy questions also arise, on which there has been little attention to date [22]. The first issue concerns not only the moral, but also the legal status and identity of the robot. Notably, and perhaps taking a cue from Asimov [23], some countries have begun to develop codes of ethics for robots [24]. The robot's status will in turn influence how other areas of the law might apply or develop. What about issues of consent? Might a sex robot be the instrument by which a sexual offence is committed by a human perpetrator? Can it be considered

fungible property, which can be permissibly sold or impermissibly stolen? And, finally, privacy questions also arise: For example, what data can the robot legitimately collect and distribute? [25]

These questions are what the two plays are probing. In *The Nether* the heterosexual and elderly men cannot distinguish between the worlds they inhabit. Pretence and belief are inverted in a magically seductive world but one in which the detective Morris argues that a crime is a crime in whichever reality is it committed, although Sims reminds her that she herself is drawn to the Nether in her sexual past, questioning why sex with a simulated child is different to sex with a simulated centaur or demon – why Morris was "ashamed […] at the idea of having sex with an *image.*" This leads Morris to question the usefulness of the body in the future and whether the Nether gives us the opportunity to "design the way that we *exist.*" She also slips into the seduction and magic of the Hideaway herself, falling for the simulated child Iris while undercover. Whereas in *Spilikin* – Sally, the elderly widow – can not always tell reality from memory or imagined simulation due to her Alzheimer's and is thus able to take comfit in a being which does not question her understanding of reality. In both plays the questions of acceptance and social policing of norms are as much up for debate as the embedded ethical questions surrounding technology and the implementation of intimate technologies. Technologies are never politically, socially or cognitively neutral [26]. Technology can augment or challenge established assumptions that can be made in understanding the world around us [27] but are we ready to change with it?

Arts, Culture & Complexity: how can we broaden the debate on technology and ethics

This section focuses on the impact of the arts and arts research can have in widening cultural understanding of robotics and virtual reality, including the role of the avatar, through participatory and personal engagement in installations, workshops, exhibitions and plays. These art forms have the ability to provide people with engaging and meaningful encounters with new and emerging technology that may shape their perceptions beyond some of the classical aesthetic or behavioral tropes used within mainstream science fiction.

Prendergast in her paper *Utopian Performatives and the Social Imaginary: Toward a New Philosophy of Drama/Theater Education* [28] argues that theatre can be a powerful tool to explore and play with notions of Utopia and Dystopia in a shared space. Theatre gives us the possibility to experience our darkest fears and deepest desires in an intimate and shared space. It is this closeness, the proximity to the actors, and staging that makes this experience so immersive. The use of technology within the theatre space e.g. the projections used in *The Nether* and the live RoboThesbian in *Spilikin* provide an element of enchantment [29] to these experiences that further emphasises their dramatology and critical reflections on simulation and humanity.

The Nether also hosted a series of post-play public debates that aimed to gage the audience's developing views and opinions after their experiences of the play. At the Duke of York's Theatre, London on the 10th March 2015, Susie Hargreaves (Chief Executive of the charity, Internet Watch Foundation) and Jamie Bartlett (Author of *The Dark Net* and director at the UK think tank Demos) discussed the subject of policing the Internet. About 30 people were in the audience on that evening to engage with Bartlett. The dark net was the main focus of his talk as Bartlett has immersed himself in a disturbing journey through the furthest recesses of the Internet where users and payments are untraceable and anything is possible. On the other hand, Hargreaves was able to shine some light on the political lobbying which has got Google to donate £1m to the Internet Watch Foundation in 2013 to support its work on child sex abuse. Out of the abyss of the dark net comes a debate about ethical technologies and ethics, in relation to a public debate around intimacy (or sex) with robots and avatars, which is part of a campaign that reflects human principles of dignity, mutuality and freedom.

Installations, arts based research and exhibitions can also be powerful tools in testing public readiness and perceptions of new technology particularly in respect of how audiences and participants think about their own bodies. As they are not necessarily narrative-based they offer visceral ways to alter our predispositions about the relationships we may build with new technologies. In 1995 Anne Balsamo noted in her book *Technologies of the Gendered Body: Reading Cyborg women* [30], that the process of "reading the body," the body in high-tech is as gendered as ever but Jones and Arning state that "today [the body] and its visceral surroundings are studded with earphones, zooming in psychopharmaceuticals, extended with prostheses, dazzled by odourless tastes and tasteless odours, transported by new media, and buzzing with ideas" [31].

This has prompted several art projects, exploring these bodied experiences, among them Anna Dumitriu and Alex May have been collaborating with Professor Kerstin Dautenhahn and Dr Michael L Walters from the Adaptive Systems Research Group (The University of Hertfordshire,UK) to investigate the social robotics that they make. Dumitriu and May's work focuses on raising public debate around the ethical issues in contemporary robotics and led to the development of a serious of provocative heads for humanoid robots. The interactive robot head is the ultimate in personal robotics. It can take on the appearance of any user to provide a potentially comforting sense of recognition and familiarity, as can aid users in every aspect of their lives. The "Familiar" head uses a Microsoft Kinect to take features from visitors faces and combining them with features from their friends and family's faces based on their proximity to the robot. As you approach, it turns to you and begins to change. The robot tells you "I like your face" or "I love you". Of course this can also lead to a feeling of discomfort known in robotics as "the uncanny valley"

[32] (Mori, 1970[4]), where users feel a sense of repulsion as robots become very humanlike (in this case very like themselves and their companions) but stopping short of being wholly human. The depth camera in the Kinect can be used to measure this effect in operation by recording how visitors approach the robot. It looks most like the person that it sees most in order to promote bonding, a kind of intimacy that some visitors found unnerving as they experienced the work shown at FutureFest, London in March 2015.

Two further projects are relevant here, *The Blind Robot* and *me and my shadow*. These projects, commissioned and produced by UK design collective body>data>space, do challenge our current social consensus of what a robot or an avatar is and how we may engage with them in the future. They deal with a more nuanced approach to technological intimacy – less fantastical then science fiction and less corporate then products built for the market.

These two installations are of two programmes of work, Robots and Avatars [5] and MADE, directed by body>data>space, and created with the support of the EU Cultural Programme, NESTA and others. A series of installations, exhibitions, workshops, and reports that act as a portal for developing a cross section of dialogue between the public, the technology industry and academic partners. The art works also become instigators for a range of debates about technology, including the development of a series of reports that chart new protocols of Behaviors and Ethics [33].

Fig 4. The Blind Robot, Louis Philippe Demers, Touch and Interactive Robotics (2012 – 2014). Image sourced from: http://www.robotsandavatars.net/exhibition/jurys_selection/commissions/the-blind-robot/

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[4] Masahiro Mori, Professor at the Tokyo Institute of Technology, wrote an essay on how he envisioned people's reactions to robots that looked and acted almost human. In particular, he hypothesized that a person's response to a humanlike robot would abruptly shift from empathy to revulsion as it approached, but failed to attain, a lifelike appearance. This descent into eeriness is known as the uncanny valley. It first appeared in an obscure Japanese journal called Energy in 1970. More recently, however, the concept of the uncanny valley has rapidly attracted interest in robotics and other scientific circles as well as in popular culture. Some researchers have explored its implications for human-robot interaction

[5] http://www.robotsandavatars.net/

The Blind Robot[6] is a robot that communicates predominantly through touch. Demers states that this work is about the development of "degrees of human engagement when a social robot intimately touches a person. This work originated from a recently known cultural artifact, the robotic arm, which has been transformed [in this art work] from a cold high-precision tool into a fragile, imprecise, sensual and emotionally loaded agent" [34]. The idea of linking the robot to the very human disability of blindness also helps with this aim as it evokes vulnerability on behalf of the robot and gives the touch a higher status that helps to create a level of trust and intimacy between human and robot.

Fig 5. me and my shadow, Joseph Hyde, Phil Tew, Ghislaine Boddington, MADE (Mobility for Digital Arts in Europe)(2007 – 2013). Image sourced from: http://www.bodydataspace.net/projects/meandmyshadow/mams-made-commissioning/

me and my shadow[7] is an immersive installation that engages us through focusing on the body and movement in an aesthetically fluid virtual space rather then acting within a specific identity or scenario, as in *The Nether*. It is this centralizing of the body with the interaction that creates a poetic link to the metaphorical concept of the shadow, that is able to transform our

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[6] Blind Robot was commissioned by Robots and Avatars, a co-operation project between body>data>space (London, UK), KIBLA (Maribor/Slovenia) and AltArt (Cluj Napoca/Romania) with the support of the Culture Programme of the European Union (2007-2013). UK partners - FACT Liverpool (Foundation for Arts and Creative Technology) and National Theatre (London). Supported using public funding by the Arts Council of England. Robots and Avatars was originally conceived and produced by body>data>space with partners NESTA in 2009. Blind Robot premiered in Kibla, Maribor as part of Maribor 2012: European Capital of Culture from 5th to 30th October 2012.

[7] me and my shadow was commissioned by MADE, a co-operation project between centre des arts d'Enghien-les-Bains (Paris, France), body>data>space (London, UK), Transcultures (Mons, Belgium) and boDig (Istanbul, Turkey), with the support of the Culture Programme of the European Union (2007-2013). UK partners - body>data>space and National Theatre (London) in association with Bath Spa University. Supported using public funding by the Arts Council of England. Connecting real-time audiences between London, Paris, Brussels and Istanbul, me and my shadow premiered at the National Theatre from 10 – 26 June 2012 during the Olympic celebrations.

perception of disembodied technical immersion into an extension of our own body's experiences. There is an intimate connection formed between the movement and the display that challenges our understanding of what it is to be intimate with technology.

Closing Statements

Within this paper we seek to widen the definition of intimacy in relation to ideas of technological intimacy. Whilst we have considered the role of theatre in exploring specific issues we would argue that the arts in general have a key role to play in bridging of the divide between the biological and the artificial.

By taking on the ethical debates that relate to developing new social norms and political understandings of simulation and robotics, through the arts, we consider how ambiguous narratives can help us to think through complex problems. This gives us more personal experiences challenging the boundaries of how intimacy is expressed within society.

Through this paper we would assert that the arts have a key role to play in the future development of technologies and technological narratives for public engagement.

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"This is a techno-necklace from my great grandmother":
Animism-Inspired Design Guidelines for Digitally Ensouled Jewellery

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Abstract

Technology-enhanced jewelleries capable of collecting bio-data are rapidly establishing a presence in the market. Yet there is limited focus on applying core values of traditional jewellery in the making process. In this research, we were inspired by the theory of animism, and investigated the concepts of techno-animism and digital ensoulment of jewellery. By going back to the roots of jewellery design, we investigate the cultural and social importance of the jewellery components and making techniques and propose a set of guidelines that consider data collection as a fundamental component of the creation process. Our findings are based on two research based jewellery-making workshops, along with a technology review and our guidelines aim to provide a set of accessible and actionable suggestions for the design of future technology-enhanced jewellery.

Introduction

What is observed in the latest wave of technological tools to appear in the global market, is an exponential rise in the number of wearable accessories which can gather and analyse bio-data from the user. As these technological accessories attempt to digitally "ensoul" information – store bio-data inside the physical object – we form an analogy with animistic practices in the sense of attributing a spirit (anima) to inanimate objects and categorize the process as a form of techno-animism. Even though the idea that we are living in a techno-animist world is not something new – theorists from a number of disciplines such as Laurel, Erik Davis, Alfred Gell, Betti Marenko- have discussed variations of this concept extensively in their work [18, 3, 9, 10, 19] there was never a correlation, to our knowledge, between design methodologies and creation techniques rooted in animist principles – and our contemporary designers and makers working on the current generation of techno-animist wearable accessories.

Our contribution is in the field of jewellery making and animism, particularly in the practices itself of

'ensoulement.' Whereas 'ensoulement' of things and objects in animist societies is often carried out ceremonially, underlying cultural etiquettes and cosmological worldviews, the process of "data ensoulment" by technological tools such as digital jewellery is approached from a perspective reflecting consumerist principles. It is not so much cultural narrative and design process of the tech tool itself in its entirety which is given special significance but its internal memory card and the information saved within it: photos, videos, documents, notes and passwords. Emerging technologies currently available in the market that gather bio-data such as the 'Fitbit' fitness products and 'Jawbone' bracelets are indicative of this trend [16, 32]. These digital wearables, as with most products that follow technological breakthroughs, place emphasis primarily on product design intended for mass production – and not on their perennial use. They are designed to be functional only for very short period of time, perhaps a few years. Moreover they show little concern to core values of traditional jewellery design, which is the focus of our investigation.

In this research, we attempted to re-ground the field by firstly investigating the roots of "data ensoulment" in jewellery and to create a methodology of creating technology enhanced wearable accessories, based on the knowledge of the past. We believe that our research can positively contribute towards the maturity of the practice and to the much needed shift towards a greater balance between core values of craftsmanship from one end, and cutting edge technology on the other, so that they integrate and inform each other in a unified practice. This paper delineates the results of the first part of our research, a dialogue and a workshop with traditional craft jewellery designers, to produce a set of guidelines to drive further our research. 22 designers, ranging from undergraduate students to experienced designers, were

invited to create jewellery that "evolve" over the course of time, depending on the data collected from the wearer. The designers were interviewed and invited to talk about their design methodology and thinking process. The results were then used to produce a set of guidelines, which were subsequently contextualized by findings taken from public research.

This research builds further on the work of pioneers in the field such as Jayne Wallace and her collaborators who conducted extensive work on over the years on the concept of "digital jewellery" [36, 37, 38] and how they can be used as a communication device. We also acknowledge the work done by Yulia Silina and Hamed Haddadi who created a very detailed and comprehensive survey of current "ensouled jewellery" that are currently in the market [31]. This work differentiates itself by concentrating specifically on shape changing, evolving jewellery. The aim of research is twofold. Firstly, to invite the disciplines working in this field to start re-thinking their approach on the process of ensoulment of technological tools which collect bio-data and secondly to produce a set of easily accessible and actionable guidelines for designers and engineers currently working towards shape-shifting wearable accessories.

In the next section, we will shortly discuss our theoretical grounding, exploring the theories of animism within the discipline of social anthropology. Following up, an outline of existing products and research on digital jewellery will be presented. We will then introduce our workshop process and data collection method. The following section is our main contribution, the presentation of our 10 guidelines supported by the empirical evidences from the workshops. We will further discussed the current wearable technologies and their future usage in digital ensouled jewellery. Finally, the paper concludes by an overview of the author's future plans and the technologies they are currently investigating.

Theories of Animism

Encountered in societies around the world animism is the worldview whereby non-human entities, non-organic objects, cultural artefacts and natural formations are embedded with a spiritual essence and retain a capacity to assume personhood and engage in direct dialogue with humans. The process itself of ensoulment can be spontaneous or performed ceremonially. Amongst Amerindian people for example objects are believed to be endowed with the capacity to attract individuals with whom they come into casual contact, while other objects can only become animated through intimate association. Some objects in-turn may be perceived as a source of sorcery or to be endowed with important fertilising powers which increase with the passage of time and with their transmission from generation to generation [28]. In a volume of collected essays titled "The Occult life of

things" the authors identify three domains regarding the role of material objects in Amerindian Societies. (A) Their manifested "subjective life" (B) their social life, that is how humans and objects interrelate and (C) their historicity. [27]

Animism is not absent from the west despite positivist and objectivist discourses – a characteristic of the modern world and Western thought–which insists on the interior differences between humans and non-humans (as well as natural objects) in that only humans possess a meaningful sense of selfhood, whether individual (mind, language, capacity of symbolism) or collective [12]. Santos Granero offers several example of objects treated as if ensouled within the west, from Paganinis violin, to wedding dresses passed down from mothers to their daughters, to cell phones with important data. [28] Objects, artefacts or tools with significance that goes beyond the metaphorical, but touches upon the spiritual. Santos Granero presents the case of Barack Obama who was sworn in as US president using not one but two bibles. The one was the bible used by Abraham Lincoln and the other was the bible used by Martin Luther King because, as Barack Obama explained there was a "connection" between "the sacrifices of these two men" and himself getting elected.

Anthropologist writing on animism since the postmodern turn in 1980's have considered animism as a relational notion regarding human-environmental relationships [2] with things and objects in a landscape retaining capacity for 'secondary agency'. Strathern proposes the concept of the 'dividual' as opposed to "individual" to describe members in animists societies, which denotes 'a person constituted by relationships [20], material objects included." In her work Strathern draws from Gibsons's Ecological Approach to Visual Perception and his affordance theory where the landscape is not only perceived as spatial and morphological relationships, but filled with latent possibilities for action (*affordance*). "The perceiving of an affordance is" wrote Gibson "a process of perceiving a value-rich ecological object. Any substance, any surface, any layout has some affordance for benefit or injury to someone. Physics may be value-free, but ecology is not." [15] A stone affords to be sited upon, to be used as a table, as a door holder, to be thrown against a wall. If it's small enough it can be used as a bead on a jewellery, and in recent years, embedded with technologies collecting bio-data.

In recent theories on animism, led by Viveiros de Castro [34], authors call for an ontological reorientation of our theoretical framework that resonates with the natives' point of view. Producing animist accounts premised on non-animist assumptions, these authors argue, will only produce contradictory results. Cartesian metaphysics and concepts such as Nature Vs Culture – characterising the Western Intellectual Tradition– are not capable of analysing the relational ontology of animism or grasp an animist universe where such distinctions are

absent [33, 34, 26, 28, 4, 12] "This approach " writes Holdbraad "gives logical priority to the task of conceptualization: what kind of thing must 'things' and 'spirits' be if statements such as 'things are spirits' are to make sense as more than just bizarre oxymorons?" [12]

Whereas symbolism and cultural metaphor are implicit in the relational approach which advances the ideas of multiculturalism, intersubjectivity and one nature, an animist worldview from an ontological framework is multinatural, perspectival and uni-cultural. Spirits, entities in dreams, rivers, trees, insects, cultural artefacts, animals and humans co-exist symmetrically in one experiential reality as 'persons' clothed with a particular form (nature) and who act according to the perspective accorded by that form in a cosmological performance of alliances amidst warfare [33,34]. Engaging with animism thus becomes an existential ontology which, following Tim Ingold, sets to "recover that original openness to the world in which the people whom we (that is, western-trained ethnologists) call animist find the meaning of life" [12]. Tim Ingold fuses together ecology and phenomenology to argue that societal culture is in many respects the weaving together of material objects in a process of "emerging involvement" within the "lifeworld" and that life itself is woven together by a web of movements. [13]

It is within this theoretical narrative where we place our research for digital jewellery identifying the creative process that needs to be followed in order to induce meaning and the sentiments of craftsmanship to the maker and the wearer.

Wearables and Fashion

During the last twenty years, research into technology enhanced jewellery was primarily conducted by technology companies like IBM and Nokia [30]. Most of the commercial available wearables currently fall under the *Wellness and Sports & Fitness* market sectors [6] and these objects focus around the idea of telling the wearer something about their bodily state. Researchers, such as Wallace and Seymour, argue towards the potential computational jewellery however they stress the importance to move away from products that look too much like gadgets [20, 29]. Jayne Wallace did extensive research in the field of "digital jewellery" and she describes her work as an exploration of the potential of jewellery, digital technologies and design artefacts within meaningful spaces in people's lives [5]. In her work, which is both physical and conceptual has laid out the foundation for both design and theory of technology embedded jewellery, primarily investigating the development of digital artefacts and design methods that explore intimate contexts of human experience. [38] Building on the hypothesis that "*If an object embodies elements of personal significance for an individual, attachment with that object may occur. Attachment*

through form and function will lead to an enduring relationship between individual and object" [37] Wallace developed three research strands: The exploration of significance and attachment of a jewellery piece through (a) personal use (b) personal symbolism and (c) through the unique communication afforded by the digital function of the jewellery. Both the hypothesis and the research directions exemplify the commonalities between the literature and the principles of Animism.

Yulia Silina, in her paper "New Directions in Jewellery" has done an extensive survey, examining 187 jewellery-like devices that are either already available on the market or at various stages of development and research [30]. In their discussion, they state that "although jewellers understand the market, consumers and historical context of adornment and jewellery use, until recently they were able to create simple on/off devices, missing out on the potential of computational technology. On the other hand engineers and to some extend product designers, often misunderstood the core requirements surrounding fashionable technology" (ibid). Recently however, they are happy to notice an increase in collaboration between engineers and jewellers and they has been an increase in aesthetical and technological pieces evident in pieces such as *Misfit Swarosky Shine*, *Cuff* [31] and *FibBit Tory Burch* [32]. Unlike traditional jewellery pieces, Yulia noted that the majority of the current jewellery-like devices use material which are "but a poor shadow" of precious metals, gemstones, woods and shells They then continue to identify products such as *Purple* [24] and *Looksee* [18] that clearly demonstrate that its well worth looking at producing pieces through the eyes of a jeweller (ibid). It is also very interesting to note that they identify the immerse potential of color/odor/temperature and shape shifting material to the new dimension and communication they can offer to technology enhanced jewellery.

A final related discussion point, raised by Yulia, is the one regarding interaction modalities. In order to move away from what we call "gadgets", makers are now attempting to conceal screens and LEDs. This opens up unexplored avenues of novel modalities and this is exactly where our research falls under.

Our approach towards the guidelines

The investigation began with an extensive literature review on technologically enhanced jewellery design methodologies (presented in the previous section) and technological trends (presented in a subsequent section) in both the academic and the commercial sectors, followed by two design workshops.

In the beginning, we compiled a questionnaire, which was sent to 22 designers (12 undergraduate students and 10 experienced designers, averagely aging 33.5 years-old, and 19 are females), aimed to get an insight into

their background and skills, current work methodologies, past experience with technology and their interest to experiment with new methods and techniques. These questions were partially shaped by the three research strands identified by Wallace and discussed in the previous section. . In order to enhance creative spontaneity and freshness we intentionally looked for designers with no extensive experience with technology, as we wanted to avoid bringing in their past methodologies in the creative process.

Subsequently, the designers were asked to attend a full day workshop where they would have to complete a brief by creating prototype designs. As there were a large number of participants, two workshops were organized at two university labs in two days. The designers were introduced to current trends in digital jewellery design and subsequently presented with the workshop brief. The designers had one full day to complete the work and present their prototypes by the end of the day. They had the creative freedom to use any kind of materials they wished. At the end of each workshop, there was a presentation session and a discussion and the whole day was documented through video recordings.

Here we present an outline of the brief:

This research envisions the creation of jewellery that evolve (change characteristics such as shape and color) over the course of time, depending on the data it collects from its wearer. Our aim is to create pieces of jewellery that become personalized over a period of time thus creating a deeper emotional connection with its owner.
The speculative material you are meant to use, will be infused with a technology that will be able to "en-soul" the bio data of its wearer. It will be able to understand a persons' mood, attributes and emotional state (happiness, sadness, excitement, fear, anger) and gradually evolve to reflect the person's life.

As each piece will be slowly changing, no two pieces will be the same. At its final form, the jewellery will by a visualization of certain character traits of an individual and because of this we hope the jewellery will acquire an even greater emotional value and be able to transcend generations.

Guidelines for Digitally "Ensouled" Jewellery

The following guidelines were prepared by drawing from the literature review, our grounding theory on Animism, and the 2 workshops. The guidelines are separated into two types – Type A Guidelines which should apply to all types of "ensouled" jewellery and Type B Guidelines – Which offer possibilities of different variations.

Reviewing core Animism principles, we can see that objects: act as a representation of past events (addressed in our guidelines 2, 3, 9, 10), carry social status (addressed in guideline 9 and 10) and that the manner which with they are worn (address in guideline 4). We

can also see that there is a great importance in the act of making them (address in guideline 6) and at the moment where they are passed over from one generation to the next (address in guidelines 5 and 6). Furthermore, Tim Ingold, talking about the "lifeworld" it's almost as he is predicting the fusion of the real and the virtual worlds in our contemporary society and the importance it will play in the development of emotions and the self (guideline 7). Finally, by looking at the work of Wallace and Yulia, it is clear to say that the most common pitfall of technology enhanced jewellery is their look and feel. Most of the guidelines are pushing towards traditional jewellery design but this is addressed directly in guidelines 1, 6, 8, 9 and 10.

Type A: General guidelines

1. Aesthetic Qualities
"Current technology jewellery forgets the importance of tradition and nostalgia, and even though I usually stay away from traditional designs, in this case I think it's important to go back to the basics."

Jewellery pieces should adhere to classic jewellery design principles.

Strategies for designers:
• Consider attractiveness and aesthetics of traditional jewellery pieces. Designers should pay special attention to craftsmanship and quality of materials.
• Aesthetic values should be considered by designing for different user groups and offering a choice of diverse material qualities – for example precious or non-precious materials to meet customer satisfaction.

2. Reflecting feelings (or data) on the Jewellery piece
Create a *code* that translates the data into different configurations, adhering to aesthetic qualities of your target market.

Fig. 1 and Fig. 2 show two examples where happiness creates more elongated shape, sadness creates compress, confidence creates smooth surface, and shy for rough surface, and anxiety for ripple.

(a)   *(b)*
Fig. 1: (a) Clay Prototype, 2015, Kelly Santer. (b) Clay Prototype, 2015, Lukas Grewenig

Strategies for Designers:
- Consider a variety of shapes and/ or colours that are distinguishable by different types of emotions (or data).
- Distinguish individual emotions derived from different occurrences through a variety of shapes and/ or colours so that they can be identified.

3. Transparency of Feelings to the outside world

It is evident from the research that not all designers want to create jewellery that make the feelings of the wearers transparent to everyone. A method needs to be identified that "protects" the wearer from feeling over exposed.

Strategies for Designers:
- Consider finding ways to personalize the meaning to the owner. One way to do this could be to have a modular design that allows different configurations.
- Consider a form that allows you to conceal and reveal personal qualities within individual jewellery pieces, like a pendant, bracelet or ring. Not only to think about the placement, but also take into account colour and texture as a means to conceal and reveal.

As shown in Fig.2, Krsitna stated "*Outside is pretty and beautiful, inside it has green spikes, reflecting the real emotion.*"

Fig. 2: Clay Prototype, 2015, Kristina Sutcliffee

4. Contact with the Skin

Jewellery should have direct contact with the skin, as this creates a much more intimate relationship with the object.

Strategies for designers:
- Consider bangles, necklaces and rings.
- Biodata can be more easily connected when there is contact with the skin.

5. Pass down generations

With the sketch illustrated in Fig.3, Annette said "*the family is like rings in tree junk, in different colors to represent period in life*".

Fig. 3: Sketch Prototype, 2015, Annette Holmgaard Laugesen

Ancestral knowledge can be accumulated and then re-mapped when passed down a generation.

Strategies for Designers:
- Clearly differentiate where one generation begins and where it ends.
- Differentiating between generations could be one way to build up layers of evolution of the piece.
- Slow down the shape shifting process.
- Changes should occur over a number of years.

6. Involve the owner in the making process

The owner should feel part of the making process of the piece. This offers greatest personalization and expresses individuality. Fig.4 shows an example of the rings breaking apart based on the wearer's life event.

Strategies for Designers:
- Single jewellery breaks and into more pieces, creating multiple individual heirlooms.
- Single jewellery breaks/fractures and re-assembles in different configurations.

Fig. 4: Clay Prototype, 2015, Philip Palmen

7. Collect information from the virtual self

Emotions are expressed in more than one realm with the virtual self – realized through online interactions and social networks – being equally important as physical interactions.
Strategies for designers:
- Consider the possibility to also collect emotional data from social networks.
- Use online data as a way to filter bio data (e.g. identify what caused spikes in emotions).

Type B - Guidelines for Variations:

8. Modular Designs

Through the use of a modular system (pieces of jewellery made to allow user customization) wearers have the flexibility to choose from a range of custom-generated components.

Strategies for designers:
• Offer pieces which be worn alone or as part of a set.
• Each piece should evolve in a different manner to allow differentiation.
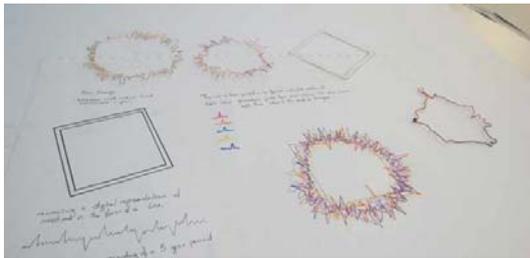
Fig.5: Sketch Prototype, 2015, Joanna Garner

Joanna sketched a set of bracelets where each represents wearer's emotion in each day, as shown in Fig.5. She says, "You could choose which ones you want to wear depending on your mood – You can choose to wear the ones that were generated in a happy day of your life or a sad one."

9. Social Status

By demonstrating a literal depiction of emotions or circumstances, the designer creates pieces that elevate the social status of the wearer, as shown in Fig. 6.

Strategies for Designers:
• Consider the use of demonstrating emotions in a literal (1 to 1 mapping) to create pieces that demonstrate pure characteristics – i.e. honesty, courage

Fig.6: Clay Prototype, 2015, Mirka Janeckova

"A piece of jewellery can be viewed like a diary of your life." Says Mirka

10. Negative Emotions

Research reveals that in some occurrences, people would like to disclose attributes, which are perceived as not being positive (such as fear, pain and frustration). Fig. 7 shows one example sculpture that reflects the anger.

Strategies for Designers:
• Turn negative emotions into powerful shapes.
• Consider the use of segmental structures, which can grow freely in a variety of different directions to create spectacular forms.
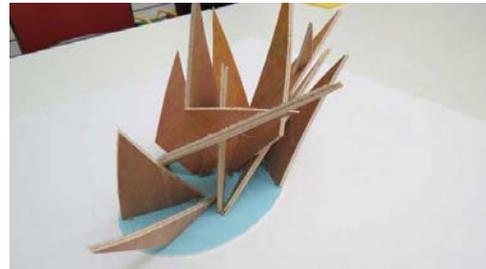
Fig.7: Wood Prototype, 2015, Annette Holmgaard Laugesen

Annette states,"What if the jewellery turns beautiful when negative emotions happen?"

Insights on Technology

While most of emerging wearable technologies have been overlooking rich emotional associations of jewellery [38], we envision that, underlining animist, or rather techno-animist principle the future of digital jewellery, "ensouled" though technologies,will re-emphasize core values such asreflecting social and emotional states. In this section, we will review and discuss the existing wearable technologies, and provide our vision on how the future technology could support the design and manufacturing of digital jewellery as transgenerational life reflection, i.e. ensoulment.

Viewing past experiences

As animism revealed that inanimate objects were often painted in various colors as the reflection of ensoulment, existing digital garment and jewellery have widely adapted color as their main output channel, and this was also reflected in our workshops that colors were used to indicate emotions.

LED is the most popular visual components embedded in fashion items and controlled by digital personal information [1, 7, 32]. Although LED lights were currently common due to its low cost, its emissive nature leads to the reduction of ubiquity [39]. On the other hand, non-emissive display technologies that have recently emerged, such as *e-ink* [8] and *thermochromic paint* [21], are currently being applied in digital garment design. Although the thermochromics ink is currently limited by the size of the controlling system and the variety of the colors, it is predictable that this technology

can be embedded into tiny jewellery with future manufacturing technology that could minimize the size of the system. E-ink is one more mature technology has been applied in tablets and current research explores its application in wearables, such as bracelet [6] and shoes [35].

In summary, non-emissive display technology would be more preferred for the digitally-ensouled jewellery in the future, as the surface could be dyed or painted with e-ink or thermochromic ink, and controlled by the minimized technology inside.

Shaping past experiences

While color has been widely adapted in digital fashion design, our workshops revealed that the colors in one piece of jewellery were rarely designed to evolve through generations, but rather being utilized as indicators and associated with particular emotions/activities (guideline 2). Instead, similar to the ancient ensouled statues which were often either manually crafted or naturally weathered into various shapes, the 3D information of the jewellery (e.g. shape, layout, and surface texture) were preferred by our workshop participants for reflecting the accumulated information of the wearer. A few participants commented that when the wearer touches it, he/she can feel the shape and the surface, and empathize the past (guideline 4).

The shape evolvement of the digital jewellery is highly related to the research in shape-changing interface. Hiroshi Ishii envisioned Radical Atoms [14], which "takes a leap beyond tangible interfaces by assuming a hypothetical generation of materials that can change form and appearance dynamically" based on on digital information. Under this vision, Yao et al. [41] invented bioLogic, a new shape-changing interface using bacillus subtilis cells that can be actuated by different humidity. The demonstrated application in wearables suggested the possible adoption by the digital ensouled jewellery in our vision. What's more, thin pieces of shape-memory alloy (SMA) have been well adapted in flexible materials, such as fabric and paper, to trigger shape-changing effects in handicraft [42]. Yang et al. [40] invented the 3D printing technique with shape memory polymer, which can be used in wider usage of personal fabrication for digitally-ensouled jewellery in the future.

Collecting past experiences

While the traditional ensouled objects were often crafted manually in the beginning and naturally worn through generations, we envision that the digital "ensouled" jewellery could update itself automatically through sensing the daily life of the wearer. Two types of the input channels were observed in our workshops: actively accumulating the wearer's physiological information;

and passively receiving life events from the wearer's digital profile, such as social media.

The most obvious signs of emotional arousal involve changes in the activity of the visceral motor (autonomic) system [25]. As jewellery, such as ring, necklace, bangle, and bracelet, are directly contacted to the human skin (guideline 4), the galvanic skin response (GSR) [11] and the heart/pulse rate [23] can be used to reflect the emotional states of the wearer. The optical-reflection-based pulse sensor has been widely available, and can be integrated into various wearables, such as bracelet and bangle, necklace, and earring.

While emotional states could be directly retrieved from the on-body physiological sensor, more specific life events can insterted by the wearer, e.g. through social network. One common comment from the workshop is that "the wearer would like the privilege to decide which emotion/life event to be reflected from the worn jewellery". Thus, manual input of emotions/events provides a controllable method for digital "ensouled" jewellery. This design suggestion can be supported by a recent development from Google "Project Jacquard"[22], which created a woven material that contains integrated conductive threads that enables the wearer to interact with cloth through touching.

In addition, although most participants proposed real-time update on the digital-ensouled jewellery, a few designers stated the importance of "updating"/"ensouling" the jewellery offline, concerning the issue of privacy leaking. We envision that in the future, there would be a charging station for the wearer to update his/her jewellery which would be made of advanced smart materials.

Discussion & Conclusion

This paper describes our findings in the first part of our research towards the creation of digital ensouled jewellery. We presented a set of guidelines for "ensouled" jewellery that have emerged from our workshops. We hope, by making these guidelines available to jewellery designers and engineers working in the field, it would encourage the disciplines to start re-thinking their approach. Our approach is based on the principle of Animism, a belief that goes back thousands of years, and it is still deeply rooted in certain societies around the world. We believe that animistic principles are inherently part of the majority of the population and through our literature we have demonstrated that they are still relevant to the western world.

Building upon these principles, we conducted two workshops with 22 traditional jewellery designers in order to investigate and document their design methodology in the creation of ensouled jewellery. The workshops revealed that designers desired the technology to be an integral part of the jewellery however not the dominant aspect. In today's society we

became accustomed to receive immediate feedback, and we often associate technological progress with faster results. Jewellery pieces, however, can be symbols of status, knowledge and believes – elements that might take a lifetime to develop. Our workshop findings suggested that there is a need to dis-associate "ensouled" jewellery from the notion of immediate feedback and instead ensure the wearers that the evolution will happen organically and over time, similar to the way a coral grows in the sea. This shift will ensure that wearers will put equal emphasis to all aspects of the piece, just like when they look at non-"ensouled" jewellery, and technology will be just one more aspect they would need to consider.

Based on these workshop findings, we derived 10 design guidelines for designing digital ensouled jewellery that could reflect the wearer's life and be passed through generations. Our future plans is to develop a prototype of the technology and we invite jewellery designers to apply our guidelines in their work. This will help us better understand how the guidelines work in practice, and provide insights about how they need to be developed further. We anticipate the need to occasionally revisit the guidelines, especially as material technologies continue to evolve.

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On-line Film Circulation in China: The Case of Youku Tudou As a Creative Corporate Soft Power Champion.

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Abstract

Since China's entry in the World Trade Organisation (WTO) in 2001, the development of Chinese start-ups has been explosive. Their representation worldwide has also been notable with such examples as Alibaba or Youku Tudou (YT). A lot of these start-ups have been tightly connected with the expansion into the media sector. During this recent political-economic transition, the media has been used as a soft power vehicle (ruanshili), both internationally and domestically. This makes it a key strategic sector for the Chinese Communist Party (CCP) to control and shape.

Through the case of YT, this paper addresses the following questions: Before and post WTO entry, how has China been managing its political-economic series of transformations to create the current media context? In that context, how is the Chinese government shaping the evolution of its media system towards the creation of national brands and on-line creative champions such as YT? To which extent, is this influencing China's soft power agenda abroad? What does it tell us about the changing relationship of the Chinese government and its creative industries in regards to Intellectual Property (IP)? Is it a step forward to identify and nurture emerging local film talent?

Introduction

From 2001, when China joined the World Trade Organisation (WTO) to further develop its economy and open it internationally, the media sector in China has become an increasingly powerful economic tool, which now lies at the intersection of political power and economic development. When studying China's contemporary media landscape it is essential to look at the country's broader political-economic context. Since the Mao era and particularly during the Communist Revolution (1949) and the Cultural Revolution (1966-1976), the media has been considered as a powerful political and ideological tool. [1]

The Chinese media is a contributor to political and economic stability as it generates jobs, it is a source of entertainment, and it has become a significant source of revenue for the country. In 2012, television and film alone generated over US$15 billion in China, while in 2014, China's total box office reached close to US$4.8 billion, a 36% increase year on year. [2][3] In parallel, Alibaba Group, one of the largest Internet platforms in the world, has recently purchased the totality of Youku

Tudou [优酷土豆] (YT), an online film circulation platform, in which it already held 18.6%, for US$3.6 billion and a total estimated deal of US$4.2 billion.[4][5] This follows Alibaba's plans to expand in the film and creative industries sector since 2013. To that extent, the term creative industries will be used throughout the length of this paper. Although the use of cultural and creative industries is important in the Chinese context, where the terms "creative industries" and "cultural industries" have been used with different connotations (for example "creative" in Shanghai, and "cultural" for more conservative reasons in Beijing). [6] The emphasis of this work is to demonstrate the use of online companies as branded businesses to promote soft power abroad, with arguably a limited emphasis on cultural capital - although it might sometimes be coined as such as part of the promotion of cultural identity by the Beijing-based government.

During the recent political-economic transition of China, the media has also been used as a "soft power" vehicle (ruanshili), both internationally and domestically. [7][8] This makes it a key strategic sector for the Chinese Communist Party (CCP) to control and shape (Chinese media is to this date attached to the Department of Propaganda). This control strategy had already started during the Mao era, from 1949, when the media was totally controlled by the government and officially termed "propaganda." [9][10][11] This approach to media control has constantly evolved and it has been adapted throughout the years with the economic reforms of the late 1970s, after the Tiananmen Square incident of 1989 and after the WTO accession. Over this period, the media has been closely related to political forces and increasingly connected to the economy. With the economic reforms implemented over the past thirty five years, the media in China has also evolved in its structure and its approach. The Chinese economy has increasingly been integrated internationally. Therefore, in this paper, the term soft power will mainly relate to the political agenda of China and its influence abroad by promoting its online brands internationally, while controlling and shaping the media sector domestically.

This research aims to answer the following questions: Before and post WTO entry, how has China been

managing its political-economic series of transformations to create the current media context? In that context, how is the Chinese government shaping the evolution of its media system towards the creation of national brands and creative champions such as YT? To which extent, is this influencing China's soft power agenda abroad? What does it tell us about the political economic characteristics of the power in place and its changing relationship with Intellectual Property (IP)?

This paper addresses the recent political-economic media transformations and processes of change in China from a historical perspective. This historical process will be analysed both in political and economic terms. Although this research does not position itself strictly speaking in the field of political economy but rather in the field of the creative industries, it is important to understand the key political-economic transformation mechanisms that took place in China pre and post WTO accession. These changes were initiated and implemented over a rather long period of time (more than six decades), so the core of the analysis will focus mostly on the period immediately preceding and following the entry of China at the WTO. This study is presented in three parts; 1) an overview of the key political-economic developments and transformations of China before its WTO entry and after, which have been leading to the current state of play in the local media landscape, 2) a case study of YT which reflects these changes. This case study will look at Youku and Tudou as separate entities first while 3) the third part will investigate the nature of the YT merger just before the Alibaba take over announcement. The case study of YT is central to this research, as it describes the creation and the development of one of the key champions promoted by the Chinese government as a microcosm the forces operating at large and the emergence of a creative corporate soft power model with Chinese characteristics.

1. China's political economic changes and the definition of a new media context with Chinese characteristics:

Control and reforms in a changing global landscape

With an estimated population of 1.3bn people, China has gone through a succession of political and economic changes since the 1950s. These transitions have taken over sixty-years to be implemented and can be differentiated into seven key steps occurring before and after Mao's period of rule. Most of the economic reforms led by Deng Xiaoping, from the late 1970s, have been incremental and were the work of a planned political economy and its various adaptations. [12]

Reforms in economics and politics have manifested across all sectors, sometimes outside of the five-year plan framework. The pace of economic reforms has been

cautious and adaptive. Most changes in Chinese economic and social structure appear to have followed this approach, including developments in the media sector. [13] Similarly, Rabiger demonstrates that a documentary represents a slice of society. [14] This suggests that the government's strategic decisions and its representations have deeply influenced the development of the media sector. This sector can be considered a 'microcosm' of the political forces at play. [15] Politically, successive governments were slowly selected and introduced to bring about reforms as smoothly as possible while maintaining the legitimacy of the Party. This reflects the priority of the Chinese government, to provide the stability of society to one of the largest populations on earth. [16]

To put things into perspective, prior to the 1950s the Chinese government had to focus on providing food and basic commodities to a large population and maintain economic growth. According to some, these have been the most notable achievements of the Party and also key features of its legitimacy. [17][18] The resulting, current Chinese political-economic system has been developed over decades and been studied by both academics and practitioners. Some claim that the Chinese system now in place is still fundamentally Communist, [19] while others debate whether it is now effectively a capitalist system. [20] The consensus is that China's system has developed into a dual system and I will apply the term 'hybrid', a more nuanced categorisation that takes account of, and critiques, the Chinese government's officially sanctioned term to describe its system as "Socialist with Chinese characteristics." [21] Since this term is quite vague, it leaves room for interpretation of the intent of the Chinese government, and of how the current political economic system can be defined. My view is that the current system is dynamic. It reflects the existence of a Communist political system that coexists with, and controls, a market economy that is adapting to both external and internal forces.

China's Communist political system and the market economy have developed conjunctly and they contribute to the stability of the Chinese society which is subject to tensions and challenges that the government has to tackle, such as the ageing population, the one child policy and its demographic consequences, environmental issues and corruption. Of equal importance is the promotion of a national cultural identity inside China and abroad, which is commonly called "soft power" and which is greatly facilitated by the media industries which is why, one could argue, the media is closely watched. [22] To that extent, the government has revived some traditional cultural elements such as Confucianism. [23] This trend is accompanied by a tendency of the government to create unity in China through the fostering of a nationalistic sentiment or even "neo-nationalism" whilst reinventing and exporting its culture abroad after the void left by the cultural revolution. [24]

However, promoting nationalism could easily backfire against the controlling power and the Party is increasingly developing inner and outer soft power to rally its masses and the international communities to its way of thinking [25][26] - Neo-nationalism has already led to recent and sometimes violent anti-foreign incidents against the USA, Japan or France for instance.

After the Tiananmen Square incident (1989) and subsequent WTO entry, the government became increasingly aware of its international representation and the need to diffuse a positive image of China abroad as well as domestically. The sole use of internal propaganda was no longer an adequate tool. Through soft power, directed both inwards and outwards, the government would have more chances to maintain the country's social harmony and political stability. In this context, in 2004 Jiang Zemin initiated the "Three Represents" theory to promote Chinese culture and identity. [27]

The theory was both intended for the Chinese Communist Party's (CCP) own cadres and for Chinese citizens, trying to rally them to a traditional Chinese cultural identity, which disappeared with the Cultural Revolution less than forty years earlier. "Three Represents" was also directed to other nations through the entry of China in the WTO as a soft power tool to try to restore the image of China abroad. It was also used as a means to limit the cultural influence of other countries such as the USA in China by promoting China's own cultural characteristics as being strong and resilient. [28] Additionally, the "Three Represents" theory has paved the way for more soft power slogans with the Hu Jintao's "Harmonious Society" and Xi Jinping's "Chinese Dream." [29]

Soft power agenda: the emergence of creative champions

The promotion of China's culture is central to the way that the creative and media industries have developed post-WTO entry. Chinese media industries are subject to both economic imperatives and above this, tight political agenda and rules. Tensions around the latter are particularly vivid in the eyes of the Chinese government because of the perceived potential for politics to be negatively disrupted as a result of technological forces, especially the Internet, at least as seen in other parts of the world. [30] In principle, the shift to develop culture allows for a greater freedom of speech and a free flow of critical and creative ideas. In the context of potentially disrupting media, how has the government responded and adapted its soft power agenda?

The Chinese government has maintained tight control over its own creative industries, particularly film content. Arguably, the government is the key engine of development of media in the People's Republic of China (PRC). This is evidenced by how the government has shaped all aspects of the media through the issuance of licenses, the imposition of censorship, and the enforcement of quotas for foreign productions to protect its own creative industries and cultural identity. The

building of China's great firewall over more than twenty years is emblematic of this control. It is not only content that has been kept out of China, online foreign media companies have been prevented from setting up business within Mainland China whereas Chinese investments have allowed China to exert some influence on several Hollywood studios, notably through the Wanda group that purchased US-based AMC Theatres in May 2012. [31] It seems that the global IP agenda pushed on to China (mostly by the USA), may not have been that disruptive after all, as it has been harnessed by the Chinese government, through its national champion brands although not without controversies. This has contributed to expand its soft power abroad while the country's economy is further integrated globally. [32]

Although the term champion is not officially sanctioned by the Chinese government, this paper sheds light on how companies such as Youku Tudou are used as brands or champions to promote the Chinese political-economic soft power internationally. The Chinese government has allowed corporations such as Youku Tudou (YT) to expand beyond China's borders. This strategy has been economically supported by transnational investments (FDIs) and substantially from Chinese companies' Initial Public Offerings (IPOs) taking place abroad from the late 90s to the early 2000s. [33] Therefore, the Chinese government seems to have facilitated the emergence and the development of selected digital creative and cultural champions such as YT.

2. Youku Tudou as microcosm of the key forces operating at large

The transition of China from a planned economy to a market economy particularly after China's entry in the WTO in 2001 can be studied through an analysis of YT. The way YT has developed demonstrates China's ongoing tight political control over the media and its concurrent support of Chinese businesses, brands and their use in China's strategies of soft power abroad. YT also illustrates the technological transition of film circulation from being viewed on TV sets to online and simultaneously the rationalisation of the Chinese media sector, which is moving away from piracy and formalising by adopting legitimate practices where copyrights have an increasingly central role.

YT integrates two websites that used to be pirate platforms and are now legitimate online platforms listed on the New York stock exchange (NYSE). Born from a recent merger, YT has become one of the largest legitimate online video provider in China and the second largest worldwide after YouTube, according to Alexa rankings. YT's market share was around 35.5% of the entire Chinese online film-viewing market and it provided films for close to 400 million Chinese users per month in 2012-2013 and now to over 500 million. [34] [35] Although both Youku and Tudou used to infringe copyrights, they now seem to have formalised their

activities and made a transition towards an IP-centred business model. This merged legitimate platform diffuses local, regional, national and foreign content for which it now purchases the rights. Following the success of YT's model and its competitors' the sector has been instrumental in reducing physical and even online piracy by placing IP at the centre of their business model.

This model also facilitates the monitoring and control over the type of content, which circulates online with economic and political implications. Economically, advertising is more targeted and therefore more effective. Audiences can be channeled through these platforms in hundreds of millions which allows for large viewer bases that the US or European markets cannot match. Politically, although this is outside of the focus of this paper, it is relevant to acknowledge that these online champions can be used as surveillance platforms from which the government can control the dissemination of content and ideas. It has managed to migrate local audiences in "controlled spaces." [36] YT also serves the political purpose of expanding China's soft power abroad as a growing brand name and a successful business. With the planned future integration to Alibaba Group, it will undoubtedly help promote further the group's brand name and operations both locally and abroad.

To understand this process, I will analyse YT's as two separate entities before their merger and then observe their key synergies as a single entity.

Youku: Prime content and IP emphasis

The development of Youku has been led by Victor Koo, a Stanford graduate and former President of Sohu , who initially raised finance to create Youku (优酷) through his own fund (1Verge) in 2006. Youku went through several steps before being finally licensed by the government to offer films online legitimately and to produce its own content in a similar way to Netflix. Originally, Youku hosted mostly User Generated Content (UGC) much as YouTube does in the West. It also featured local and foreign pirated content. But Youku's path followed a different trajectory from its Western counterpart: as early as 2009, 70% of Youku's content had become professional and 30% was semi-professional or amateur. [37] The particularity of Youku is that, since the start, it has authorised its users to upload material irrespective of length. This feature was particularly problematic in the early development of Youku, when entire feature films were uploaded on the website and violated copyrights. Youku progressively came into agreements with over 1,500 producers and distributors from the film and TV industries to provide professional content to their viewers. The following study of Youku shows how this transition from being a pirate platform to becoming a legitimate business has taken place.

The year 2009 was pivotal for Youku, since it coincided with vast censorship and anti-piracy operations initiated by the Chinese government. During this anti-piracy campaign, the Chinese Film Bureau shut down hundreds of pirate websites and requested that online film-viewing platforms apply for a license, forcing hundreds of websites to close down including the foreign competitor, YouTube, which was blocked in China. [38] As a result, only a handful of local websites such as Ku6, PPS, iQiYi and YT were able to provide online film circulation to the wider Chinese audience. It allowed Youku and its most legitimate local competitors to gain market shares in the online video sector to the detriment of other platforms, which were screening exclusively pirated content. By January 2010, Youku became the number one Chinese online video provider after the website successfully managed to win over 50% of the online video market, in terms of time spent. [39][40] It also forced viewers to migrate from other pirate platforms and foreign competitors to the remaining local players (about 10 in total), therefore growing their audience and concentrating the sector.

Without a license, online video companies could not continue their business. SARFT's new license became a compulsory element for all the video-sharing companies: for example, BitTorrent file-sharing company BTChina was shut down by the authorities for not being able to secure a license. In the eyes of the Chinese government, the license system would help tackle pirate websites and at the same time formalise the online video-sharing sector, keep foreign platforms at bay, and retain control over the sector's concentration. The license, in effect, gave power to the licensees to legitimately cooperate with TV stations, video production companies and to air their content after purchasing the appropriate rights. It also significantly limited the chances of new players entering the sector as they would have to obtain a license before running their video-sharing business. [41] This move contributed further in the migration of viewers from TV to PC and online viewing contexts.

This government initiative was timed for implementation just before the Initial Public Offering (IPO) of Youku on the NYSE in 2010. It is widely accepted that the crackdown on foreign sites could have also been motivated by a wish to promote Youku along with other Chinese companies that were seeking funding. In 2009, China represented 45% of the entire IPO volume in the US with a record high of 183 ventures launched on the stockmarket. [42] As a reference point, China sold over US$50 billion worth of shares compared to US$24 billion for the USA that year. 2010 was also a good year with the capitalisation of 22 Chinese companies on the NYSE including Youku, Bona Film Group and ChinaCache. Without YouTube and other foreign rival companies on the Chinese market, the perceived value of Chinese brands, such as Youku's would increase their chances to attract capital and enhance their business prospects. [43]

However, the success of Youku cannot solely be attributed to the wide-reaching government operations of 2009, which targeted a large number of pirate and foreign Internet platforms; it is also the result of a distinctive, well-designed and implemented business model within a very competitive context. A large proportion of Youku's revenues had been derived from advertising - quite similar to YouTube - and to a very small extent, from subscriptions and pay-per-view (PPV), although these revenue streams have recently been increasing which also contributed to fuel both the cost of local and foreign content. Before the merger, programming accounted for almost 30% of Youku's costs. [44][45]

When Youku was first launched, some of its content infringed copyrights and most feature films uploaded on the website were broadcast without a license. From January 2010, Youku set up a digital system to minimise the issue of pirated content and progressively proceeded to systematically take down pirate material. These measures coincided with the Joint US-China Commission on Commerce and Trade (JCCT), which addressed issues of piracy in China in October 2009. During the commission, Chinese representatives officially acknowledged the negative effects of piracy on the US creative industries and reassured the US trade representatives that the Chinese government would "impose maximum administrative penalties on Internet infringers." [46]
Youku also took restrictive measures on pirated content just a few months ahead of its IPO announcement at the New York Stock Exchange (NYSE), which indicates that the company intended to legitimise its business in order to attract foreign capital. In an effort to integrate with the global IP regulations, it complied with the international IPR framework and made it a central part of its business model. Youku also allowed the Chinese government to monitor its platform and to decide on what content may be inappropriate and should be removed.

This example shows that a combination of technological, global, legal, economic and political forces have largely shaped the online Chinese media sector. This marks a transition within the Chinese film-viewing sector from being exclusively centred on pirate activities to becoming a legitimate enterprise. It also shows the increasingly central role of IP in China, driven both by transnational and local political forces. This IP centric corporate approach, characteristic of Hollywood, [47][48] makes IP an integrated feature of online players that serves both political and economic agendas in China.

The creation and formalisation of Tudou

While Tudou was created before Youku and represents an important component of YT, it was Youku that effectively purchased Tudou and drove the merger. On 15th April 2005, one year before the creation of Youku, Shanghai-based Tudou (土豆网 or TŭdòuWǎng) was

officially launched by co-founders Gary Wang and Marc Van Der Chrijs. Tudou initially started as a blog hosting website, a few months later, they developed a video-hosting platform, similar in concept and features to YouTube. Before the merger, Tudou had already built a large viewer-base and enables access via mobile telephone technologies, which turned the merger with Youku into a significant opportunity: a brand new hybrid model using both Netflix and Youtube's key features to circulate content across multiple platforms.

In the summer of 2007, Tudou had the fastest Internet growth in China; the number of video clips viewed per week increased from 131 million to 360 million with an average of 40 million visitors per month. [49] Tudou started working on wireless and mobile video technologies as early as September 2007 in collaboration with Intel. As a direct result of its focus on mobile technology, by August 2011, Tudou had close to 15.5 million mobile subscribers on China Mobile alone making it one of the largest mobile operators in China. [50]

Similarly to Youku, state intervention was instrumental in Tudou's transition from a pirate platform to a legitimate online business, but transnational political-economic pressures also contributed to these transformations.

In that sense, Tudou did not try to advertise itself as a challenger of YouTube prior to its IPO, mainly because it was originally used mostly to screen pirated content. For example, in 2007 on TVLinks, a UK website acting as a linkfinder, many US mainstream films were directly connected to Youku, Tudou, and 56.com websites, where the copyrighted content could be accessed for free and sometimes even featured Chinese subtitles. With an estimated 2,000 films infringing copyrights and a traffic ranked 214 on Alexa with 40% of US-based users, Tudou became a significant East-West pirate gateway, which represented a major threat for the right holders in Europe and particularly in the USA. Not only was the US film industry struggling to penetrate the Chinese market with the quotas and censorship restrictions, which prevented access to the large potentially lucrative Chinese market, but they were also running the risk of seeing their own domestic market getting eroded by these Chinese websites. [51]

Despite several attempts from the industry to target the end viewers, very little could be done legally against users watching films in streaming mode, since it was made available by a foreign server. The only way to counter such pirate activity was to shut down the infringing websites which, outside China, required a lengthy and costly legal action. [52] Therefore, it became a priority for the US film industry to lobby internationally to reduce the negative impact of the Chinese websites on their own markets and to formalise

the Chinese sector, for instance during the JCCT and through WTO claims.

To that extent, some commentators have suggested that China has been much more willing than the USA to implement trade and trade-related international agreements and that this willingness to be seen to play by the book can also be considered as a political soft power strategy. [53][54] However, it was also widely suggested that these transnational forces had exercised effectively less influence as what was initially perceived. The government and the media sector itself were largely responsible for the shaping of the online video industries into a legitimate and formalised business. [55]

The US film industry's lobbying efforts cannot be disregarded as contributing factors to the formalisation of the online film-viewing sector in China, but it can be argued that the media sector started regulating itself by bringing more cases to court. In 2009, Tudou was sued by one of its rivals, Joy, and 80 right holders for infringing copyrights on some of their content. [56] Youku and Tudou also sued each other ahead of their merger in regards to copyright infringement issues. [57] In one instance, Tudou was fined for a total of RMB50,000 (US$8,000 equivalent) for screening a Chinese film, Hao Ning's *Crazy Stone* [*Feng kuang de shitou*] (2006), without purchasing the rights from NuCom, an online rival platform. [58][59] As it has been for Youku, the year 2010 was key for Tudou in terms of negotiating a transition from being a platform which operated largely in the informal economy, to becoming a legitimate platform, which operated in the formal economy. From 2010, Tudou posted official guidelines regarding piracy and rules against copyright infringement on its website to raise its users' awareness about piracy. [60]

In 2010, Tudou started to purchase the rights to legitimate and professional film and TV series content. Similarly to Youku, Tudou acquired exclusive film content from Hollywood right holders, which cost the company millions of dollars in licensing fees. The purchase of the rights coincided with both the JCCT and Tudou's own IPO (on NASDAQ). While state intervention placed more emphasis on IP, it also increased government control over the online video sector and contributed largely to shape the existing online media landscape towards an IP controlled corporate model.

3. The Youku Tudou Merger: Economies of scale, IP creation, and sector concentration

Price of content and economies of scale

At the time Youku and Tudou announced their merger on 12th March 2012, Youku was ranked by Alexa 10th and Tudou 13th in China, which translated respectively as 49th and 65th worldwide. [61] After the merger took

effect in August 2012, the resulting online-video group was the largest in China, with a value of over US$1 billion, which made it the largest Internet deal in China at the time. [62]

This merger had enormous potential in terms of converging platforms, leading to cost reductions in bandwidth, content acquisitions and increased advertising revenues. Although the two brands remained distinct, the cumulative viewer base of YT made it one of the Internet pioneers in China and abroad. The timing of the merger was expected to take advantage of regulatory changes that would allow online video platforms to strengthen their position within the Chinese media sector and enable them to compete against state television. To that extent, the merger between SARFT and GAPP into SAPPRFT in March 2013 would facilitate this strategy.

The merger was also allied to agendas of the media sector and the government, specifically to identify and promote local IP and film talent, to produce films for its local market and to export them as soft power.

One of the key factors for the merger were the losses that both Youku and Tudou had consistently incurred over the years. Despite rising revenues and a joint market penetration of 75% on average in 2011 and 2012, both Youku and Tudou remained unprofitable businesses. [63] Combined losses persisted after the merger, reaching US$34.54 million (RMB219 million) in the third quarter of 2013 and US$55 million (RMB348 million) in the third quarter of 2015. [64][65] These losses were attributed to the rising costs for Internet bandwidth, mobile video services and the significantly heightened cost for purchasing copyrighted content. Even though the merger helped rationalise these costs, they still represented a significant expense.

At the end of December 2012, just a few months after the merger, YT's portal offered a selection of 4,500 films, 2,700 TV series and more than 900 variety shows. The content could either be streamed for free (with advertising) or accessed with paid subscriptions or PPV. This acquisition strategy, implemented over the course of several years, was a fundamental departure from Youku and Tudou's initial business model, and that of most online film-viewing platforms (pirate or legal), including YouTube, which relied almost entirely on advertising revenues. Some of the YT licensed US Hollywood studio productions included *The Vampire Diaries* (2009-2011), *The Walking Dead* (2010), or *Mad Men* (2007), *Schindler's List* (1993), *The Mummy* (1999), *Being John Malkovich* (1999), *The Big Lebowski* (1998), and *Jurassic Park* (1993). [66][67][68][69][70][71][72][73][74][75][76] In that sense, YT developed a new hybrid model for China, which positioned itself between YouTube's and Netflix's business models and tried to take advantage of both worlds: attracting high volumes of viewers through its social network activities and then selling them premium content.

The increasing demand for premium content via the Chinese online platforms and TV channels continued to drive the prices of content up and simultaneously raised the importance of copyright and IP in the media landscape. The transition towards a model that also included subscription and PPV revenue streams was a new concept in China for an audience that, up to then, had mostly benefited from free entertainment and media content. [77][78] However, audiences adopted the new model relatively fast: by November 2012, YT had 2 million paying viewers who could either opt for a RMB15 (US$2.50) monthly membership (subscription fee) or a RMB5 (80c) fee per film on average for PPV services. [79] Gary Wang, former CEO of Tudou, claimed that viewers were starting to "get used to paying for content." [80] But to make this strategy viable, online platforms would need to keep securing exclusive access to quality content whose price kept increasing.

In the short term, purchasing rights from regional players such as TVB has helped YT keep their content related costs under control. Various analysts have commented on the fact that the YT merger allows the group to reduce the copyrighted content costs through economies of scale by exchanging and cross-releasing content. [81][82] Compared with online platforms located in other parts of the world, Chinese online video providers such as YT could also take advantage of the lack of structure regarding the distribution windows in China. Until after the merger of SARFT and GAPP in 2013, the Chinese digital release windows had been enjoying more flexible domestic regulations in regards to quotas and censorship than the Chinese theatrical window. When it comes to online film-viewing in China, online video providers also operate on one of the most populated single territories: a potential audience of over 500 million Internet film-viewers, a market for which YT had a dominant market share. [83][84] However, this translates both into higher bandwidth and IP costs.

The importance of creating IP

The increasing price of content had not simply resulted in the integration of copyright and IPR in the online platforms' business models, but it had also prompted new tactics, particularly from YT. As part of its goal to reduce the cost of purchasing content, YT had started to emphasize the production of its own original content to simultaneously reduce content acquisition costs in the short-term and to become less reliant on it in the long-term. Both Youku and Tudou had initiated the production of their own content prior to 2012. For instance, Youku financed and produced *Hip Hop Office Quartet* (2011), which had more than 100 million online viewers in 2011. [85] This trend seems to have intensified after the merger. In 2013, five of the Youku Tudou's produced shows were in the top 10 of the group's most viewed content. This decision to produce and promote content made financial sense for YT since, in most cases, in-house production significantly reduced

the costs associated with content acquisition, given that an in-house feature film can be produced for as little as RMB1 million (c. US$167,000). [86] Following the same strategy, YT renamed its production house 'Heyi'.

After the merger, Tudou and Youku's websites still existed independently with a certain level of brand fragmentation, which in time could have created a brand identification and validation issues. While Tudou and Youku and remained complementary, the group renamed its operations Heyi (literally meaning 'unify') to promote the production of its own content with a common brand. [87] In that regard, the company tried to regroup its distinct target audiences: Tudou.com had positioned itself in the 'fashion' and 'youth' target while Youku was more of a 'mainstream' online-video provider. [88] In 2013, Heyi started to coproduce prime content with global companies such as Canal+. Heyi coproduced *Outcast* (2014) with Nicolas Cage for an estimated budget of US$25 million. [89][90]

The group also chose to turn toward pro-sumer video creators through its 'New Revenue Sharing Program' launched in June 2013. The program gave young talented video creators the opportunity to be paid for producing high quality UGC, sometimes in the range of US$3,500 to US$10,000 per month. The operation has been successful so far and YT has entered agreements with c. 600 selected partners. [91] The decision of YT to screen a blend of exclusive mainstream films, regional and in-house productions, along with pro-sumer content allowed the group to control the cost of its acquisitions, while simultaneously ensuring that it still operated legitimately, continued to attract large online audiences, and even own and manage the rights of its own original content.

Since 2008, Tudou has organised the Tudou Video Festival, an online independent film festival to attract and build loyalty with young urban audiences. In 2013, for the festival's 6th edition, the website registered 18,000 entries (almost twice as many as Sundance) and had 230 million online viewers. The festival also moved across several cities and screens films during events at various locations including Beijing, Shanghai and Guangzhou. [92] The festival started collaborating with Sundance from 2011 and acts as a large catalyst to identify and nurture local emerging talents. [93][94] Some of the participants have been able to find their audience and reached up to 1 billion viewers. [95] YT also finances original content from local filmmakers, separately from the festival, sometimes propelling them to fame while knitting a long-term working relationship with them and retaining the copyright of their work. Besides becoming a central part of the online creative corporations, IP seems to be combined with the promotion of emerging talent as a vehicle of soft power both locally and abroad.

Product placement and advertising standards

The new directions taken by YT in terms of content production have not only allowed the group to reduce its cost of purchasing content, it has also contributed to increase its advertising revenues and to build a distinctive and unique social and corporate image. Large corporations such as General Motors started advertising on Tudou before the merger and sometimes contributed financially to produce original content for the Chinese market such as *Miss Puff* (2011) an online animation series that targets the young female audience. [96] In this Beijing-based animation, one of the protagonists owns a GMC car, which was a good product placement opportunity for the car manufacturer. Additionally, YT has been competing domestically for audiences and advertising revenues against national and provincial television networks, which are usually quite fragmented. The most popular TV shows typically capture 2-3% of the national audience so there is scope for YT to build larger audiences than the local or national TV networks. [97]

The Chinese TV network is still state-owned and suffers from significant levels of bureaucracy, which YT tends to be free from as a private enterprise mostly co-financed by US and Chinese transnational capital. Government restrictions have also led young Chinese to migrate from their TV to online platforms to access Western and on-demand content. [98] When online regulations come into place and allow online-viewing channels to compete directly with the television networks, it is expected that an even larger part of the audience will move online. YT has another advantage compared to the local TV networks: on Youku's website there is about one minute of advertising per hour, compared with 12 minutes on Chinese TV, which gives YT considerable space to operate and increase its advertising revenues.

Appealing to the advertisers and providing them with a good service seems to have been at the core of both Youku's and Tudou's strategies even before the merger. In 2010, Youku was the first online-video website in China to use third party auditing of all its videos. Youku partnered with CR-Nielsen, a Chinese joint venture between Nielsen and ChinaRank, to systematically and independently monitor the ads and transfer the data directly to the relevant advertisers. [99] Based on transparency, credibility combined with its IPO, gave Youku a distinct advantage in attracting advertisers to its platform. It was also part of the group strategy in negotiating its transition from a pirate platform to a legitimate business. At the same time, Youku did not simply look to comply with State-led and transnational IPR regulations, but it positioned itself as a pioneer company that demanded urgent standardisation of ad-tracking criteria, for ad effectiveness, and for transparent ad-tracking systems to be implemented. [100]

In a similar way, Tudou challenged the Silicon Valley-based Alexa ranking criteria as a set of data, which can sometimes be inexact and potentially misleading. In particular, Tudou challenged the concept of the 'click' largely promoted by Silicon Valley-based dot-coms, which may have lost some of its initial significance, and instead focused on new criteria such as time spent on the website, unique visitors, and user "stickiness." [101] YT has been challenging Internet practices both at home and abroad in order to reshape a fast changing online landscape for what appears to be better practices, but first and foremost to remain a market leader and a Chinese creative champion spreading soft power abroad. This series of tactics should now serve the overarching Alibaba brand after the takeover is complete. Beyond the transition of YT from a pirate platform to a legitimate business, which values the concept of copyright, these changes also illustrate the transformation of the company's original business culture. YT and Heyi have essentially developed a corporatist, IP centric business model and culture, similar to Hollywood, which also operates as a soft power vehicle for China.

Consolidation of the online creative champions

The political-economic agenda of the media industries (traditional and online) and that of the government are to create corporate brands primarily as soft power expansion political tools internationally and, to some degree, as a way to attract additional revenue streams from both local and foreign markets. This strategy is more effectively applied if there are only a handful of Chinese players to promote internationally and it makes the sector easier for the government to control. This has meant that the film and particularly the online sectors have had to consolidate rapidly.

The concentration of the online sector is exemplified by the recent takeovers of PPS and Iqiyi by Tencent, Youku and Tudou's merger, and more recently with Alibaba's purchase of a 18.6% stake in YT in 2014 and the successful offer to purchase the remaining control of the company in October this year. [102][103] These series of consolidations seems to show the government's intention of increasing its supervisory role over the online economy. The rationalisation of the sector is reflected at a political level and coincides with the merger of official departments, for instance GAPP and SARFT merged into SAPPRFT in 2013.

The government has regulated and controlled the sector to balance the number of companies operating in it. It has avoided situations of monopolies and at the same time it has consolidated the ecosystem so that the champion brands can economically survive in it. Supporting online brands and creative champions while avoiding monopolies comes from the imperative to create more jobs, and develop the sector in a sustainable and harmonious fashion. These measures also have an underlying political motivation as they make the sector easier to control. Additionally, they make it easier to promote and diffuse a handful of strong emergent brand names from China and to spread their soft power

globally. This corporate framework also contributes to identify and promote local emerging talent online. This could be a long-term soft power strategy if these talents are nurtured and grow as creative ambassadors.

Conclusions

Since the beginning of the Chinese reforms, particularly in the 70s and after the WTO accession in 2001, macro political-economic transformations have influenced the evolution of the media sector in China. This is particularly true of the online media sector which has gone through successive phases of formalisation and rationalisation with an increasing emphasis on the corporate development of IP and talent.

The sector has received a lot of attention worldwide, with successive IPOs, and posed new challenges to both Hollywood and the Silicon Valley companies. Local talent, Chinese standards and brands have been promoted in a corporate fashion that shows a different business culture emerging within China. The series of carefully planned strategic changes and tactics of adaptation by the Chinese government also mirror the growing trend of corporate culture.

After the promotion of Confucianism and national pride, could China's next move be described as a development towards a corporatist system whereby emerging creative talent could be identified, selected and nurtured by the corporate political-economic systems in place?

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FileLife: Kurenniemi and the Question of Living Archives

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Abstract

In the age of social media, notions of life and memory are transformed. This paper investigates how the Media Art Group Constant have refashioned the archive of the Finnish engineer and artist Erkki Kurenniemi, who set out to create an archive of his own life for a possible artificial life resurrection in the future. Constant explores modes of life and mediation in their experimental digital archive project. The paper investigates how this this project illuminates the future of archives and social memory through a dialogue with media archaeology, format theory and Actor-Network-Theory.

The New Order

Digital archives transform the order of power and knowledge. Media archaeologists like Wolfgang Ernst have argued that with the advent of codes and computer algorithms as the new *arché* or command system of knowledge, we have to reload Michel Foucault's archaeology of knowledge for a new age. We need to look into how computation and digital files have intervened in the rules governing knowledge. This is where Constant's intervention into the archival remains of Erkki Kurenniemi is exemplary. They do not simply open up the holdings of an archive (what it says and shows), but try to engage with the codes and algorithms or the *arché* itself of the archive, with what constrains the sayable and visible in a digital age. Furthermore, they make accessible this archival infrastructure for their user as a new mode of *sharing* the archive. They focus on the new dynamics or life of some of the smallest items of prosthetic memory, codes and files, on how files are constructed, can be transformed and how they connect to other files. These series of operations seem to lay the ground for new ways of conceptualizing social memory, provoking a set of questions, which may benefit from insights concerning the life and agency of objects in Actor-Network Theory as well as the philosophical and media-theoretical investigation of the concept of life presented in the work of Eugene Thacker.

After Kurenniemi fell severly ill in 2005, he gave most of the collected material from his active life as an artist and a self-archiving protagonist since the 1970s to the Central Art Archive of Finland's National Gallery of Art in 2006, where it is being catalogued and digitized. In 2012, a smaller portion of this was handed over to the art and media group Constant. If Kurenniemi believed in files becoming life, Constant uses the same files to investigate the life of files. As this is the first major computational 'intervention' into this archive, their efforts will be my focus.

Constant (with Nicolas Malevé and Michael Murtaugh as principal investigators) were commissioned by the group KURATOR (led by Joasia Krysa), Kiasma and Documenta 13 to create a prototype of an online archive of the Kurenniemi files. The material they were given can be considered a sample. It consists of almost all the pictures, some of the cassette diaries, a few home videos and transcripts of the most recent diaries (including the digital files from the Newton MessagePad) from around the mid-1990s and up until 2005; totaling one terabyte of information. Kurenniemi's early musical compositions, his experimental films and his gadget and ephemera were not included in the samples.

To understand the complexity at play in the Kurenniemi files and in Constant's work on the files, we have to look at what has happened to the file more generally in the 20th Century. The transformation of the file from being the official record of a political and administrative system to becoming itself a governing entity in a computational network, is actually a revolution with huge ramifications. Not only does it mobilize the file itself; both conceptually and practically the very notion of an archive and its functions (recordkeeping, storage, cancelling, manipulation, destruction, distribution, search and access) undergoes drastic changes.

Files are the stuff that archives deal with. As Cornelia Vismann has shown in her history of the archival 'file', the file has been there ever since the beginning of the modern archive. 'For the administration of the Western world, a life without files, without any recording, a life *off the record*, is simply unthinkable', Vismann demonstrates. Historically files were 'the administrative underbelly of the law and its representation', and from there they proceed to 'trellised, inaccessible chanceries,' Vismann writes. Essentially, files and archives were difficult to access. But with the turn to digital society a significant change occurs in the operationality of files. 'The appearance of files as stylized pictograms or icons on computer screens indicates the end of the epoch of files,' Vismann maintains. This is a bold statement. However, files in a computer are no longer simply files documenting the commands and

protocols of a political system, but are now themselves carriers of algorithms, the new commands and protocols of a computer system. As Vismann writes, today 'files and their techniques organize the very architecture of digital machines […] they ensure access to all internal operations by controlling both instructions and data, as well as their addresses.' [1] The files are no longer simply the static record of the actions of an administration, but have themselves become an integral component of a world of algorithms and codes which carry out a complex series of operations as well as *suturing* them into visibility and remediating them into pictographs looking like old media (a 'document' on a 'desktop' etc.). The operations that control their visibility are, just like the old files, inaccessible to most users. Their operations work in the hidden abode of computational systems, and their operations are so manifold that most users are happy if they can avoid dealing with it.

The Sociality of Files

Constant use open source software to interact with the Kurenniemi-files, *and* they document, step-by-step, the codes they use. In this way they both rely on and foreground a dynamic memory network of shared codes. Their focus on the potential for constant sharing and reworking directs our attention to a different concept of social memory when such processes constitute the materiality of both our 'objects' and 'frameworks' of memory. Early on in their Kurenniemi-online log-book Constant writes:

> When starting an archive project, one reveals the sociality inherent in the documents. All items in an archive are shared objects. They are produced in a transaction, through collaboration with instruments (pen, paper, camera, recorder, etc), software agents (programs, algorithms) and people. [2]

The world of new media is constructed through models of sharing and enclosure. Constant's approach demonstrates an underlying politics of sharing which implicitly critiques most social media web 2.0 platforms, since they tend to hide and copyright their algorithms.

As Eric von Hippel has shown, the internet and its culture has become a new ground for collaborative innovation. He calls it 'democratizing innovation', and the development of open source software is a key example of 'user-centered innovation systems' which 'supplant product development carried out by manufacturers'. [3] Constant is part of this turn to user-centered innovation based on openness. Codes are developed and shared in teams, and this sharing is expressed as collaborations between human and nonhuman capacities. Algorithms give instructions as to how a certain feature is supposed to interact with

other types of software and so on. Files *make* new connections and links. Computer files operate precisely by always 'assembling new allies', to paraphrase Latour. The very definition of 'open source code' is that it is meant to be implemented in new media in such a way as to be open for further elaboration and manipulation. It assembles allies (and foes) by default.

The development of free and open-source software (FOSS) is a form of collaborative innovation which aligns itself nicely to the way files work. Computer files *work* by collaborating with other files in series. These collaborations involve several layers of transactions on a synchronic and diachronic axis. Diachronically they rely on forms (such as open source software and algorithms) that has been tested and tried out in a series of earlier innovations, collaborations and practices; synchronically they communicate and collaborate with other programs and instructions to execute their tasks. Constant applies the knowledge of FOSS communities on archives. They work on other arenas than most such communities, and thus extend their practices of sharing further than most FOSS communities. They move from 'sharing in' (sharing in a restricted community of experts) to 'sharing out' (sharing with a larger public) to even 'sharing across' (having the non-experts comment and intervene in their practices). Let us look more precisely into how they organize their acts of sharing within an archive context.

Constant is committed to several acts of sharing. They want to share Kurenniemi's files. Forging accessibility is something most state archives and national libraries in the Western world do (unlike many private archives), and such archives and libraries (unlike private book repositories like Google Books) are committed to free and open access to their search and metadata standards. However, while libraries, for instance, try to enter the digital age without radically changing their system of metadata standardizations, FOSS communities like Constant openly applies their knowledge of how metadata regimes are implemented in digital files in new ways, and how they co-evolve with other ICT standards relating to formats, files and protocols. Constant want to share this new infrastructure of archives and files. They do this in a critical way, and the story behind their alternative approach in this particular case is curious.

Due to the often sexually explicit content of some of Kurenniemi's video and image files, much of the material is 'unshareable', because of privacy rights, despite Kurenniemi's own desire to share. These restrictions forced Constant to invent new ways of presenting the material. Even if some of the images are unsharable *as* images, that is, on the level of 'cultural material' (the visible layer of data), they are still 'sharable' as 'techno-mathematical material' (the data underneath the visible layer). They open up the

files to affordances the law could not imagine. Indeed, their algorithmic approach allows them to share what would otherwise be unsharable due to legal restrictions. The legal restrictions release a playful retake on the archive. Constant addresses the files so as to activate dormant affordances enabling them to assemble new connections and allies through interactivity and sharing. The source codes organizing their archive are not only free and open, sharable in themselves, but make objects 'not for distribution' sharable. Their 'active archive' is an experiment in sharing. In their view, the entire Kurenniemi archive-body is a source code to be shared.

> In this essay, we take the archive-body to be an exemplar of an active archive, not as fixed materials or a mere collection of objects but something more like source code that is modifiable and shareable. [4]

They follow the hacker ethics. Their online archive does not share files in the way most online archives do ('click to open'); the want to share the digital infrastructure of the archive itself. They operate in between an experimental archive and a git hub (an archive for shareable software).

Navigation through their archive is difficult. It does not have one single interface, but several entries and few overviews, and is more like a hypertext with a plethora of samples, links and extended blog commentaries resembling a lab log or a research paper in progress. Their layout brings out associations to an anti-immersive Brechtian web-editor promoting *Verfremdung* and reflection, rather than classification, overview, and easy availability. They resist the merchandization of a collection. They address the potential construction of an online archive rather than the finished product, and finally, their commitment to the politics of sharing turns archiving into an ethical issue way beyond the Kurenniemi holdings. Nevertheless, it is all done in the spirit of Kurenniemi who was himself committed to the hacker ethos of the 1970s.

Essentially, Constant opens up a single file in its multiplicity. They activate the file's data, codes, histories, fixed and potential connections as well as its possible transformations. This involves at least three different *forms* of sharing:

> 1) They share the files. This is done by opening up the other side of the file to access the data governing its affordances and metadata; this enables them to legally share information about a file that would otherwise be legally unsharable.
> 2) They share the knowledge of sharing. This is their most elaborated mode of sharing and involves several operations: they use free and open source software (FOSS) to

access and read the files; they call it 'seeing through the lens of algorithms ', and they manipulate FOSS for their own purpose and share their code amendments with their user so that he or she can activate them elsewhere.
> 3) They share the knowledge of their users. This is in some of their samples done by inviting the user to interact with the files by tagging them on the fly.

Furthermore, these processes of sharing add new data to the archive, and become part of it. The archive, here, is an evolving and dynamic entity without closure. Below we will examine how these modes of sharing are specific to a digital age and how they challenges our long standing understanding of social memory as related to the way things are shared in a society.

Sharing and Social Memory

What happens to social memory in a time of altered connections between humans and technologies? Today memory needs to be rethought in relation to a more general politics of life. The proliferation of discourses that view technologically mediated life as a self-constituting entity are understood, by many critics, as a key symptom of a new form of biopower. If the new emphasis on life issues is at times taken to indicate the return of 'real bodies' and 'real materiality' – a new metaphysics of presence – It is more precise to say that the new biopower is premised on revised conceptions of the body as well as of materiality. There is, for instance, a tendency to see an extension of life principles and biological functions in the realm of digital technologies. Eugene Thacker writes, 'the major problem concerning life has to do not with its definition … but with the very *plasticity* of life, [as] a shape-shifting quality.' [5]

Such renegotiation of the question of life is a key feature of computing history. In its early stages, computer science suggested that intelligence (in Turing's version) and memory (in von Neumann's version) were not exclusive to humans and could be reconstructed in a computer. Now, Thacker explains:

> The very concept of life itself begins to dissolve and dissipate, while still remaining in use and in circulation. What if life is not assumed to reach its pinnacle in human life? What if life is only incidentally, and not fundamentally, an anthropocentric phenomenon? And what if life actually has very little to do with the presumed self-evident nature of the living? [6]

Such insights are fueled by phenomena such as biocomputing and the development of biosynaptic computer chips and are becoming part of standard medicine. Thacker uses the term biomedia to discuss

the 'technical recontextualization of biological components and processes'. The body is reconceptualized as 'compiled' through modes of information processing, modeling, data extraction, and *in silico* simulation. Kurenniemi prefigures such 'compilations'.

Both Kurenniemi and Constant imply that life can express itself through a series of materialities and media. Indeed, there are many possible ontologies of life today, and they also recall Thacker's notion of a 'superlative life' which exists at different stages in history going back to certain ancient vitalist positions where life is seen as 'that which flows or pours forth'. Here life is 'distributive, pervasive, and outflowing'. Life is 'at once everywhere and nowhere, a pure excess and generosity, and yet in itself not any one, single, individual instance of life'. Aspects of this notion reappear in biomedia practices that resituate life in relation to media. Here, life relies no longer on the 'wet lab' but the 'dry lab'; biology is done '*in silico*'. Life expands into media technologies and their specific features and affordances: 'If the encoding process carried patterns of relationships across material substrates, then the recoding process will extend the functionality of those encoded or translated data in ways that are specific to the medium.' This implies that 'the generosity of life is itself irreducible and unlimited, though the particular manifestations of life may in and of themselves be constrained.'

Kurenniemi's work may be a symptom of the general questioning of 'life' identified by Thacker, but it is important to distinguish between Kurenniemi's ideas and other visions of technologically aided afterlife. On the one hand there are ideas about biological afterlife secured through various forms of cryonics; on the other ideas about afterlife secured through information technologies and artificial intelligence. Kurenniemi clearly belongs to the latter strain, as seen in his technical conception of the material body: 'Man is a machine. A machine produced by evolution. I find it impossible to think that for mere nostalgic reasons, such a slime-based system would be preserved', he says in an interview. [7] Yet the specificity of his project resides less in such body/machines vision, than in his emphasis on life as memory – seeing the personal archive as a point of departure for the potentially continued life of an autonomous entity. Essentially, he believed in the future's computers ability to turn the remains of a personal archive into some kind of consciousness. He seems less interested in the emerging field of bioinformatics where both the biological (genes) and the computational (codes) are conceived of as informational structures.

In the latter part of his active life, Kurenniemi took increasingly interest in an ecological perspective in which flesh-based life on earth is viewed as detrimental to the environment. He believed that artificial forms of consciousness could be stacked in

small balls and sent to outer space: cultural heritage would be salvaged in the sense that these balls of consciousness could enjoy the Earth's past as some kind of digital entertainment in outer space. He also discusses the politics of cloning and how certain democratic freedoms can be sustained in a posthuman artificial world of clones and extraterrestrials. In this respect he was several decades ahead of many of his compatriots who have only recently started working on what they call the constitutional rights of extraterrestrials.

Constant's online version of Kurenniemi's life is severed from any direct association with the extraterrestrial aspect of his afterlife. They do not talk about consciousness or artificial intelligence. Their horizon of operationality belongs to the Internet-culture. Unlike Constant, Kurenniemi was prevented from experiencing the way in which digital networks have turned life into a series of interconnected events. In the transition from early computing to Internet-culture, 'life' is extended in a variety of ways and associated with the ongoing researches in biocomputing. While Turing and von Neumann was interested in computational explanations of human-centered attributes such as intelligence, learning, or memory, biocomputing focuses on molecular processes. At this level, 'life' is both nonhuman and intelligent. Life is both an automatic process and an intelligent process in the way it relies on heritage, memory and interaction with its environment. It is informational and networked. Modern biology represents in other words a shift in the human-computer relation from an emphasis on mind (and cognition) to an emphasis on 'life' as articulated in complex networks. Thus, in the 'PC era', computing is seen as nonconscious, distributed, and a parallel to 'life' rather than to mind, cognition and intelligence. Constant foregrounds this trajectory by capitalizing on the inherent life of files, their dynamic sociality. In their work, Kurenniemi's life becomes extended as a networked entity. He is shared, distributed and transformed by a network of users and producers. This development is allied to the social turn within computation, and it also comes with a catch. As Jose van Dijck writes, making the web social actually means making 'sociality technical' – a development that some would see as another instance of the instrumentalization of social relations. Constant is aware of this and endeavors to project an alternative to a homogenizing sociality by instantiating Kurenniemi's 'life' through a hacker ethos based on the use open source code. How does this transform the concept of social memory?

Archives and collections have always been part of cultural memory, but as archives become digital, they become more dynamic and potentially more like *social* memory. No longer relatively stable storage systems, archives increasingly figure as dynamic living system, constantly transformed and updated, constantly the object of mergers with new

informational clusters and programs. The work of Constant is focused on bringing out the living, or social dynamic in the technological infrastructure of digital archives. Their microscopic work on the life of files in a world of shared data show how the presence of a file, the file in question, does not simply testify to a unique singularity, but to a multiplicity of historic and potential actions. The file is so to speak the 'undead of information', an 'enduring ephemerality'. [8] It is always the result of undead layers of *action at a distance* in both the past and in the future.

After Gabriel Tarde we can investigate how social memory works in a deeper more pre-cognitive way. Memory is whatever creates some form of association or connectivity. Such associations are not found 'in' society, but constitute the social link as such, and may be mapped by tracing movements of imitation and invention. [9] The impact of the newspaper in the 19th century made Tarde speak of imitation as a form of 'action at a distance' – a perspective that has only become more relevant with the introduction of electronic media technologies. Influence 'at a distance' works in, through and around our connected lives, our *filelives*. Constant shows how such dynamics of imitation and invention are capacitated and exploited through digital technologies, generating new connections along the complex pathways of 'living' files. The politics of sharing advocated by Constant shows not only how Kurenniemi's memory files always already existed in connected, disassembled and reassembled cartographies of socio-technical memory arrangements, but also that such arrangements are always battlefields. Algorithms and codes are not neutral tools that neatly implement whatever is given to them – they constitute a transformative field of constant renegotiations and reconnections.

Constant's politics of sharing shows how what differentiates one memory assemblage from another is to a large extent a question concerning different ways of assembling the sociality of files. Their three modes of sharing – sharing the file, sharing the knowledge of sharing and sharing the knowledge of their users – is an approach to memory which underscores the active involvement in the new technological infrastructure of memory events. The new technologies do not represent a dead repository or a neutral tool for memory, they are rather a living systems where memory itself becomes a mode of action. As we have seen, software is not simply mathematics, but a consolidation of long traditions of knowledge, memory, habits and techniques of ordering and remembering. As they are implemented in shareware (FOSS), memory becomes action. Constant foregrounds the *eventness* of memory by entering the operations going on both inside and outside the files. These are operations that make the files speak and remember, work, connect and transform themselves. They do not see the archival

document or file as a single static entity, an image or a text, to be preserved and classified in a static dead repository according to its unique singularity; they activate the file in its living multiplicity, and bring out its networked condition through events of associations and connections where a single file no longer simply represents an image but a series of complex arrangements and operations (DCFs, JPEGs, RGBs and a series of FOSS) each with their own controversies, that can be readdressed directly by well-targeted algorithmic operations.

Kurenniemi wanted his life archive experiment to become a template for mankind. He did not know how it would be remembered or continued, but he devoted much of his intellectual life at projecting the ways and means of doing it. Interestingly, several of the Kurenniemi videos used in Mika Taanila's documentary film, shows, Kurenniemi talking about his life archive at parties and among friends. He opened up his archive and shared his ideas whenever he got a chance – and recorded his sharing. In this way, Kurenniemi's archive was social, improvisational and reflexive from the start. The files contain a self-reflexivity which projects a series of possible future trajectories. Constant's probes into the archive add further trajectories. They do not monumentalize Kurenniemi into an object to be commemorated, but open the files to a multiplicity that demonstrates the dynamic sociality of the file as well as their ability to produce future memories. Constant's living archive is a precarious territory in the sense that the emergence and withdrawal of networked *filelife* depends on a distinct politics of sharing.

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Ulysses Pact: Metagenomic Entanglements

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Abstract

This paper aims at presenting and discussing the work 'Ulysses Pact' (2016) produced by the author – a bioart interactive sound installation that metaphorically evokes the ancient myth of Ulysses (Odysseus) and the pact he made with his crew as they approached the Sirens. The reference to the myth is a dramatic invitation to reflect on the constitution of our viscerally chaotic plurisystemic selves – myriads of Complex Adaptive Systems' (CAS) conglomerates, resembling a noisy metropolis build up of *microbiomic* conversations. As it is envisaged by the author, in an isolated wall at one of the ISEA 2016 collective exhibition venues, one individual a time is challenged to have a seat in an object that resembles an old restraint apparatus – a reference to the Benjamin Rush's (1749-1813) 'tranquilizer chair' designed for psychiatric patients, to which a circuit of sensors and piezoelectric generators is integrated. Seduced by its own curiosity, or by the apparatus' weirdness itself, this individual will find her/himself immersed in a vibrational whole body experience. Starting from a personal interest in investigating potential links between schizophrenia and the human microbiota, in 'Ulysses Pact' the author dedicated to the production of a sonification project using raw data from a study where the 'composition, taxonomy and functional diversity of the oropharynx microbiome in individuals with schizophrenia and controls' was investigated. 'Ulysses Pact' is the first emergence of a new series of works produced by the author as an attempt to investigate plurisystemic conversations within our body from a cross scalar perspective considering the phenomena of quantum entanglement as the main communicational strategy that allows to understand our bodies as CAFFS - Complex Affective Systems (a term coined by the author) and consciousness as an emergence from this self organizing structure.

Plurisystemic Selves

"In general, we may ask, why has not everything a soul, since everything either is an element, or is formed out of one or several or all of the elements? Each must certainly know one or several or all." [1]

We were just informed that [2], from the 100 trillion cells the human body contains only one in ten of those cells approximately is actually human. These Complex Adaptive Systems (CAS) we understand and recognize as 'individuals' can be seen, from a microscopic point of view, as a plurisystemic structure that shows some integrity and emerges from subtle cross scalar informational processes. This understanding is essential when we propose to consider a continuity between the body cells and the microbiome of a given organism. Systems that can be described as having a characteristic that couples with its adaptive qualities – affectiveness.

From this perspective they can be understood as Complex Affective System (CAFFS) – a term coined by the author to describe and discuss certain Complex Adaptive Systems (CAS) focusing on affectiveness as the main bond between the systems' elements, the bond that is responsible for its integrity.

Fig 1. *Ulysses Pact,* 2016, Clarissa Ribeiro, bioart interactive sound installation, 3D model produced by the author evidencing the intimidating weirdness of the apparatus (image by the author)

This aspect of system's interconnectedness and the ability its elements have of nonlocal communicating can be linked to the phenomena of quantum entanglement. In fact, far from a reductionist understanding of our organism as strategically isolated from the environment, running a unified genetic program that encapsulates ancestor's informational history and dictates all the development steps and metamorphosis from mammalian sperm-egg interaction to death, we can actually picture ourselves as something resembling a metropolis build up of *microbiomic* conversations. As in any Complex Adaptive System (CAS), the relations between the microscopic sub-systems are so instable, transitory, easily disturbed by different noise sources, that the AI (Artificial Intelligence) challenge (the long term cybernetics' goal) to design an equivalent of a human mind in its plenitude sounds more like a childhood dream, as reductionist as Heron of Alexandria's [3], automata or miracles (thaumata).

All Watched Over by Organic Post-Humans

It was just recently that, for the first time in science history, a consortium of researchers organized by the

U.S. National Institutes of Health (NIH) Common Fund, Data Analysis and Coordination Center (DACC), got involved in the challenge of mapping the normal microbial composition of healthy humans supporting the Human Microbiome Project (HMP). According to the researchers "the aim of the HMP is to characterize microbial communities found at multiple human body sites and to look for correlations between changes in the microbiome and human health." [2], The consortium clarifies that, "[…] the majority of microbial species present in the human body have never been isolated, cultured or sequenced, mainly due to the inability to reproduce necessary growth conditions in the laboratories." [2]

The HMP is using 16S rRNA and metagenomic sequencing to characterize the complexity of the human microbiome collecting tissues from 15 body sites in men and 18 body sites in women – what complements sequencing and analysis of reference genomes isolate from human body sites and, according to the team, "[…] generating unprecedented amounts of data about the complexity of the human microbiome, and providing a baseline for further research into the impacts of the microbiome on human health and disease." [2] The researchers consortium collected up to three samples from each volunteer at sites such as the mouth, nose, skin (two behind each ear and each inner elbow), and lower intestine (stool), and three vaginal sites in women.

Conventional sequencing is based on a culture of identical cells as a source of DNA. Back in the 1990s, the early metagenomics studies revealed that there are probably large groups of microorganisms in numerous environments that cannot be cultured and consequently cannot be sequenced. These early studies focused on 16S ribosomal RNA sequences revealed that cultivation based methods find less than 1% of the actual existing microbiome in a sample, showing that the huge majority of microorganisms had previously gone unnoticed by previous sequencing methods. This for a long time unnoticed eclectic microbial population that is in fact a majority in what we consider a human body, can be considered a key knowledge and the starting point of born strategies that can essentially conduct our species to the point we can call ourselves post-humans – not by coupling with artificial prosthesis or nano robots but by mastering ways of managing, altering, engineering our natural microbiomes.

This population of micro-organisms within our body secretes a large number of neurochemicals, including dopamine, serotonin, and gamma-aminobutyric acid (GABA) – the same chemicals our neurons use to communicate and that regulates mood. Recent experiments has examined the possible immunomodulatory effects of probiotic supplementation in chronic schizophrenia patients, based on the fact that probiotics – taken as beneficial micro-organisms –, modulate the immune response of the host by affecting the composition of gut microbiota. Several probiotic species have been tested in series of experiments for health benefits, including the gram-positive anaerobic genres Lactobacillus and Bifidobacterium. According to Jakub Tomasik and his collaborators, these experiments "[...] have shown beneficial effects on systemic inflammatory cytokine levels, neurotransmitter and neurotrophic factor production, intestinal permeability, and oxidative stress in animal models." [4], Tomasik explains that in humans, oral administration of probiotics is known to restore normal inflammatory status, increase systemic antioxidant capacity, change the activity of brain regions responsible for processing of emotion and sensation, and reduce anxiety. In addition, improved brain function after probiotic supplementation has been attributed to the gut–brain axis – "[...] multiple ways of communication between bacteria inhabiting the human intestine and the central nervous system. For example, probiotic microorganisms interact with the innate immune system, affecting secretion of pro- and anti-inflammatory." [4]

An Overabundant Perception

"[…] what we subjectively term efficacious volition is certainly bound to the persistence of exceptional fluctuations affecting the physical systems which we term organisms and their surroundings, including both the appearance of these fluctuations and their destruction under the pressure of the environment." [5]

In a paper published in Schizophrenia Bulletin, Vol. 29, No. 3, 2003, Doctors Louis Sass and Josef Parnasin propose to characterize schizophrenia as a self-disorder or, an ipseity (Latin word for 'self' or 'itself') disturbance that has, according to the researchers, two fundamental and complementary aspects or components. The one that brings to the scene one of the most fascinating aspects of schizophrenia is hyperreflexivity, referring to forms of "[…] exaggerated self-consciousness in which a subject or agent experiences itself, or what would normally be inhabited as an aspect or feature of itself, as a kind of external object." [6] The peculiarity of schizophrenia as a state of consciousness potentially emerging from gut-brain psychobiome integrations is that it can lead to an augmented perception of the plurisystemic nature of the self and its integration with the surroundings that is evidently terrifying and destabilizing.

In the above quoted work, the researchers mention a valuable first-person descriptions of schizophrenic 'negative symptoms' – the autobiographical descriptions of the writer Antonin Artaud [7] where he describes a consciousness invaded by experiences of the body-subject where the hyperreflexive awareness leads to a sense of 'shifting vertigo, a sort of oblique bewilderment' [7]. According to Osborne Wiggins and Michael Schwartz, Artaud can be seen as one of the rare examples of individuals that, "[…] with the onset of schizophrenia is liberated from the structures and norms that powerfully govern normal human experience." [8] Nevertheless, the researchers

were not focusing on examine "[…] the creativity that may – albeit rarely – issue from schizophrenic mental life" [9], focusing on analyzing the more common forms of schizophrenia that brings "[…] severe suffering and hardship without the compensation of greater originality." [8]

To discuss 'A Phenomenological Anthropology of Schizophrenia in its Beginnings: The overwhelming Complexity of Reality', the authors recall different pioneering works on philosophical anthropology as the one of Max Scheles [10] claiming that human beings are inherently 'world-open', and posterior correlated approaches as the one of Arnold Gehlen, according to whom "Human beings are exposed to an excess of stimulation towards which they remain world-open" [11], specifying that these stimuli "[…] may be either internal or external ones; i.e., they may issue from within the individual's body or mind, for example, in inner urges or thoughts ,or they may consist of sensory data coming from the external world." [8] The reduction of the complexity of internal and external stimuli consists in the achievement of automatic syntheses. During the early stages of schizophrenia, this mechanism is broken and it is observed a weakening of the automatic synthesis and, as a resultant, an overabundance of perceived stimuli. In a report of patient diagnosed with schizophrenia published by James Chapman, defending that the clinical data presented in his studies support the view that schizophrenia is an organic psychosis, the weakening of the automatic synthesis becomes intriguingly evident – "What I'm worried about is that I might get myself so controlled that I will cease to be a person. I find it difficult to cope with these situations that get out of control and I can't differentiate myself from other people when this comes on." [12]

Metastable Equilibriums

"We have just seen life destroy or create metastable equilibriums in the same way that a hydraulic engineer drains a mountain lake or dams a torrent. Indeed, an entire network of distribution of negative entropy is represented by a living organism, and also by the evolutionary line which has produced it. How could this extremely complex network, whose very existence represents a negative entropy, have been created at the expense of the natural tendency towards dissipation of energy?" [5]

The microbiome of schizophrenia patients has not yet been extensively investigated, as attested by reviews run by several research groups as showed in a paper where Dinan, Borre and Cryan [13] explore the view that the genomic analysis of schizophrenia to date has been far too limited, and fails to capture the true genomic diversity of the human body. Nevertheless, several studies as the one presented by Severance, Yolken and Eaton [14], show consistent investigations on how autoimmunity, gastrointestinal (GI) disorders and schizophrenia have been associated with one another for a long time.

Considering the challenge of conceiving an installation that invites the audience for an immersive reflection on how subtle is the equilibrium that gives our body integrity and how sensitive to internal and external cross scalar informational processes this adaptive organization could be, the author searched for studies where a possible interconnection between our microbiome and schizophrenia was considered.

The intention was to integrate available raw data from metagenomic sequence analysis, from studies were the above mentioned connections between microbiome and schizophrenia was investigated, in the design of a semi-material apparatus that was to be the core of the art work.

The selected study from where the raw data was selected proposes that "the oropharyngeal microbiome may be associated with or contribute to an altered immune state consistent with findings in schizophrenia" [15] The strategy of the team was to "characterize the schizophrenia microbiome by interrogating the oropharyngeal microbiome structure regarding its taxonomic and functional diversity" [15], focusing on the complete microbiome that means to include virus, bacteria and fungi populations. This study just recently published, is an open access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, reproduction and adaptation in any medium and for any purpose provided that it is properly attributed. To make raw data for unrestricted use has been a common posture adopted by several research projects involving metagenomic sequencing, being the Human Microbiome Project (HMP) an important source for further explorations.

Working in a sonification project integrating available raw data from this study, it was possible to compose a sound that brings to the surface microbiome landscapes from patients diagnosed with schizophrenia. The data resultant from metagenomic sequence analysis allows investigating differentiations between the microbiome composition of control group and patients diagnosed with schizophrenia metaphorically exploring the idea of accessing somehow our plurisystemic intimacy.

How about getting immersed in a vibrational bath where our whole sensory system is reached by a sound designed to allow metaphorically navigating the microbiomic landscape of patients diagnosed with schizophrenia? Can it have the effect of a placebo-sound, giving the impression of affecting temporarily our mental equilibrium? How permeable are our vibrational structure to this sound? Can the information related to the perception of this sound be instantaneously shared in a subatomic level through all the cells that constitutes our body, including the microbiome ones?

Quantum information theory [16] deals with four main topics that are united by a common recurring theme that is the interpretation and applications of the Von Neumann entropy. First of all, it deals with

'Transmission of classical information over quantum channels'. Secondly, it deals with 'The tradeoff between acquisition of information about a quantum state and disturbance of the state. Additionally, it deals with 'Quantifying quantum entanglement' (where Von Neumann entropy plays a central role) and 'Transmission of quantum information over quantum channels.'

According to John Preskill, Professor of Theoretical Physics at the California Institute of Technology (Caltech), […] the deep ways that quantum information differs from classical information involve the properties, implications, and uses of quantum entanglement." [17] It means that, in the subatomic world of quantum mechanics, as Preskill attests, "[…] if A and B are entangled, a measurement of A is performed and a particular outcome is known to have been obtained, then the density matrix of B does change." [17] Considering the perspective of a Quantum Information Theory, an intriguing issue comes up that is related to the questions we are pointing here when considering the ways our body actual cells and our microbiome communicate – How then does the quantum state manage to travel from A to B? According to John Preskill, "[…] we can hardly say that the two classical bits that were transmitted carried this information – the bits were random. So we are tempted to say that the shared entangled pair made the teleportation possible." [17] A and B has to be capable of nonlocal communicating.

So, considering our actual body cells are quantum entangled with the microbiome ones and, beyond using nervous systems as a communicational channel, the information is non-locally shared through this plurisystemic structure – the 'microbiome-body cells' can be considered a CAFFS – a Complex Affective System, producing our fuzzy logic and instable consciousness as an emergence from its cross scalar instantaneous conversations.

Ulysses Pact: Microbiomic Sirens

"The faculties of the mind have been called, very happily, internal senses. They resemble the external senses in being innate, and depending wholly upon bodily impressions to produce their specific operations." [18]

The work 'Ulysses Pact: Metagenomic Entanglements' is a bioart interactive sound installation that metaphorically evokes the ancient myth of Ulysses (Odysseus) and the pact he made with his crew as they approached the Sirens. According to the myth, as the hero wanted to hear the Sirens' chant, although he knew that doing so would render one incapable of rational thought, Ulysses put wax in his men's ears so that they could not hear the Sirens and had them tie him to the mast of the ship so that he could not jump into the sea. Upon hearing the Sirens' chant, Ulysses was driven temporarily insane and struggled with all of his might to break free so that he might join the Sirens, which would have meant his death.
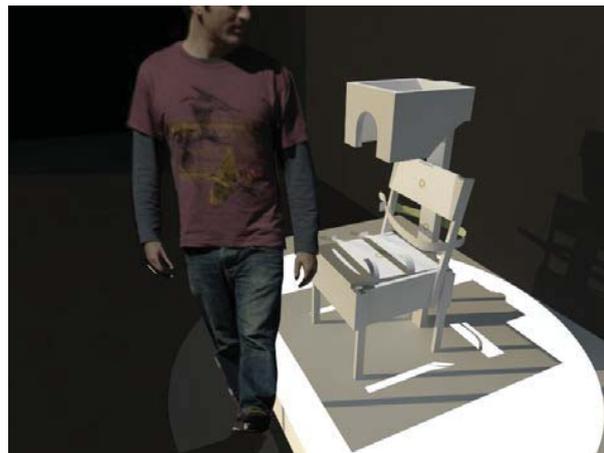
Fig 2. *Ulysses Pact,* 2016, Clarissa Ribeiro, bioart interactive sound installation, 3D model produced by the author evidencing the intimidating weirdness of the apparatus (image by the author)

In a possible conceptual link to Psychiatry, mental health advance directive, are sometimes referred to as Ulysses Pacts – contracts designed to override a present request from a legally competent patient in favor of a past request made by that patient. An example of when Ulysses Pact is invoked is when patients diagnosed with schizophrenia stop taking their medication at perceived remission times. Nevertheless, according to Puran, "Ulysses contracts also raise a number of ethical questions, including the nature of patient autonomy, competency and how to handle refusal of treatment." [19]

Considering that voice hearing is often seen as a prime symptom of psychosis and that auditory hallucinations is considered a first rank symptom of the specific psychosis of schizophrenia, to recall the ancient myth of the sirens is an artifice to build a conceptual bridge that can possibly allow for a reflection on how consciousness emerges from plurisystemic conversations involving our innate cells and our microbiome. According to Flavie Waters, "[…] it has been estimated that approximately 75% of people with schizophrenia experience auditory hallucinations." [20] Can we somehow hear the microbiome's voices embedded in our thoughts, in what we identify as consciousness?

In 'Ulysses Pact', the reference to the ancient myth is a dramatic invitation to reflect on the constitution of our viscerally chaotic plurisystemic selves – myriads of Complex Adaptive Systems' (CAS) conglomerates, resembling a noisy metropolis build up of *microbiomic* conversations. As it is envisaged by the author, in an isolated wall at the one of ISEA 2016 collective exhibition venue, one individual a time is challenged to have a seat in an restraint apparatus – an adaptation of Benjamin Rush (1749-1813) 'tranquilizer chair' designed for psychiatric patients as a strategy to calm down his patients. A few centuries ago it was common to use restrictive techniques and apparatuses to calm down psychiatric patients that could be submitted

to tough treatment including restraint bags, strapped chairs and could be placed in an isolation box or cages. The Rush belief that "[…] mental diseases were caused by irritation of the blood vessels in the brain […]" [21], that leaded him to design the 'tranquilizer chair' is used here as a metaphor for the conception of the material part of what can be considered a semi-material apparatus – becoming the installation an artifice to access cross scalar realities within our bodies.
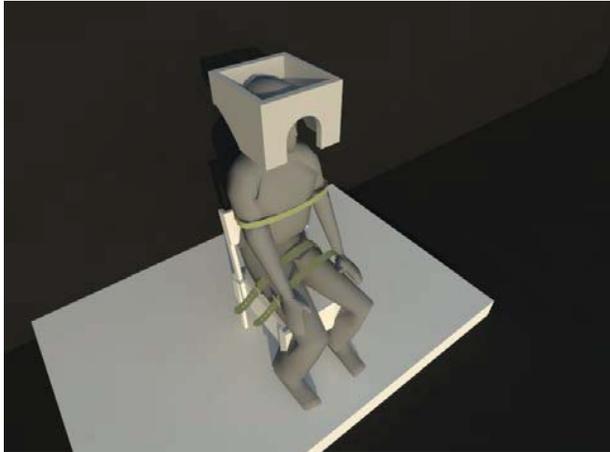
Fig 3. *Ulysses Pact,* 2016, Clarissa Ribeiro, bioart interactive sound installation, 3D model produced by the author showing a person joining the whole body vibrational experience. (image by the author)

After having a seat in the chair at the gallery, the individual finds her/himself immersed in a vibrational whole body experience unleashed by the subtlety of an input – a transducers installed in the region referent to the neck that can capture heart beats by reading differences in blood density just by having the emitter's light reflected by the visitor's skin surface. In correspondence to the brain intestines communication circuit, piezoelectric generators are installed along the restrictive chair's body and the reading of the heart-beat transducers processed by an Arduino and Processing interrelated code designed by the author, makes the sonified microbiome landscape to be played louder or softly depending on the visitor's state of relaxation or excitement. Ulyssses Pact invites the audience for an intimate restrictive sound experience – a metaphorical meeting our own potentially schizoid sirens.
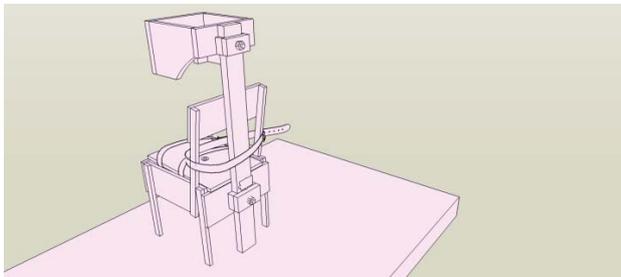
Fig 4. *Ulysses Pact,* 2016, Clarissa Ribeiro, bioart interactive sound installation, 3D model produced by the author showing the apparatus' structure (image by the author)

Starting from a personal interest in investigating potential links between schizophrenia and the human microbiota, in 'Ulysses Pact' the author dedicated to the production of a sonification project using raw data from metagenomic sequencing analyses.

The study from which the author used selected raw data to produce the sonification project that integrates the installation "[…] aim to characterize the schizophrenia microbiome by interrogating the oropharyngeal microbiome structure regarding its taxonomic and functional diversity" [15], contributing to understanding the relationship between microbiome diversity and schizophrenia.
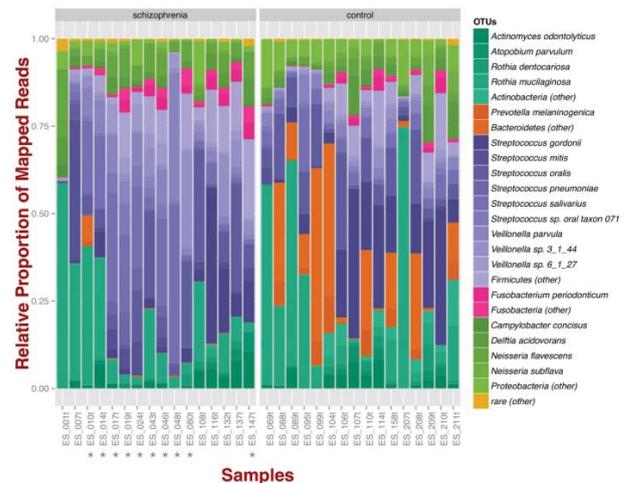
Fig 5. Oropharyngeal microbial composition at phylum and species levels exhibits different patterns for schizophrenia and control samples [15].

As reported by the team of researchers, the oropharynx microbiome was selected due to the fact it is easily accessible by non-invasive techniques. Individuals with schizophrenia were recruited from psychiatric treatment programs at a large psychiatric health system and community psychiatric programs in central Maryland. The study found out "High-level differences were evident at both the phylum and genus levels, with Proteobacteria, Firmicutes, Bacteroidetes, and Actinobacteria dominating both schizophrenia patients and controls, and Ascomycota being more abundant in schizophrenia patients than controls." [15] Data showing these specific differentiations consist the raw material used by the author for the sonification project.

Sonification strategies were used to allow the perception of microbiome variations in the dataset from a single database table, altering different components of the sound initially generated using Audacity 2.1.1 – a free, open source, cross-platform software for sound editing and recording. As more representative specific phylum and species are considering the oropharyngeal microbial composition, the strategy was to produce equivalent increase in pitch, amplitude and tempo.

Final Considerations

Ulysses Pact: Metagenomic Entanglements is the first emergence of a new series of works produced by the author as an attempt to investigate plurysystemic conversations within our body from a cross scalar perspective, considering the phenomena of quantum entanglement as the main communicational strategy that allows to understand our bodies as CAFFS – Complex Affective and consciousness as an emergence from this self organizing structure.

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Building Like Animals:
Using Autonomous Robots to Search, Evaluate and Build

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Abstract

Typical architectural design is reliant on prescriptive top-down decisions that seek efficiency through simplification. Erection of designs produced in this way depends on specially prepared construction sites and access routes. Such building procedures are destructive and cannot gracefully integrate with existing ecosystems. By contrast, this paper is motivated by the desire to assimilate newly built artificial structures with pre-existing dynamic, amorphous, highly variable and fragile sites. As one of the possible approaches to this challenge, this paper discusses the prospects offered by the utilization of intelligent robots. This discussion relies on an empirical study of autonomous robots that outlines the capabilities necessary for such construction.

Architecture of Change

Typical architectural designs rely on static conditions: given briefs, regulated construction sites and industrial materials. They depend on expert predictions and expert control. And yet, there is a growing recognition that the power of design expertise in finding solutions is fundamentally limited. "All buildings are predictions. All predictions are wrong." [1] Appreciation of this condition has led to the emergence of approaches that seek to embrace and facilitate change, including, for example designing for disassembly and reuse, open buildings, systemic design, service design or holistic approaches to sustainability.

Animal Architecture

The space of this short article does not allow a detailed discussion of animal architecture. However, some of its important characteristics are suggestive as ways of thinking about holistic architectural design and the types of systems that could support it.

Animals construct architecture as a way of extending their control, catching prey at greater distances using spider webs or building mounds to influence interior climatic conditions. Such structures can be seen as extensions of animals' organisms. They actively modify the surrounding environment, sometimes dramatically. These modifications construct ecological niches for the builders, in competition with others. At the same time, animal-made structures create opportunities for exploitation by other forms of life, sometimes leading to complex symbiotic dependencies. Importantly, animal architecture has to be considered as states within extended evolutionary sequences that also result in particular biomechanics, behaviors, ways to reproduce, procedures for raising progeny, tactics of socialization and so on. Thus, structures produced by animals are locally and temporarily satisfactory solutions that are continuously changing in response to the changing circumstances. As compromises framed by multiple moving targets, these solutions are always sub-optimal. They cannot serve as optimal models for narrow and well-defined tasks, where they can be outcompeted by deterministic artificial systems. However, biologically inspired solutions can be useful in situations where designed systems need to be adaptable, rather than optimal. Evolved life excels at survival. Correspondingly, designed systems with capabilities for long-term autonomy may prove beneficial in situations where human capabilities are limited or direct access by humans is not possible. Beyond extraterrestrial environments and capillary vessels, that are already navigated by autonomous robots, such situations might include environments characterized by large, complex and long-term processes such as those of ecosystems or cities.

Architectural Robotics

Robotics is a growing area of interest in architecture. At the moment, the attention of the field is on industrial robotic arms that are attractive because they are common and comparatively cheap. [2] These devices belong to the subfield of manufacturing automation, or industrial robots. As such, they are intended for environments with existing manufacturing processes, control mechanisms, quality requirements and automation measures. In this context, their purpose is to benefit from financial opportunities that might be available through reduction of waste, improvement of quality, decrease of downtime and so on. Current speculative research in architecture strives to develop software and hardware modifications that can redirect such robots towards operations on bespoke tasks that are common in architectural design.

Autonomous Robots in Dynamic Environments

Beyond automation, robots can be seen as devices that act as programmable replacements for humans but are physically situated intelligent agents within hybrid socio-technical ecologies, capable of more or less independent sensing, analysis, decision taking and action. [3] Here, "[a]n agent is anything that can be viewed as perceiving its environment through sensors and acting upon that environment through actuators." [4]

The purpose of such agents is not in replacing people but in being better, at least in some aspects, than biological systems, projecting human capabilities into inaccessible environments or enabling otherwise impossible tasks. Robotic agents can achieve these goals not because of their superior intelligence but through a combination of characteristics common to machines: they can operate continuously and for long periods, maintain speed and precision, cope with large volumes of data, etc.

The difference between automation and autonomy can be seen as the contrast between – on one hand – better tools (extension of human arms, tools with "long handles" such as drones, tools moving in bounded regions, not dissimilar to automatic weaving, such as manufacturing robots) and – on the other hand – adaptive, unsupervised agents, such as mobile robots.

Automation is the use of tools for the execution of precise, repetitive actions in well-understood environments. Such environments are treated as controlled, closed worlds and are modelled with confidence, on the presumption that it is possible to build a model that can capture all that is relevant for a set of given operations. Automation robots are common in factories because certain operations on production lines can be specified as such closed worlds. However, some worlds – such as typical architectural environments – are not closed. Where models of such worlds are made, they are complex and incomplete. In such cases, comprehensive preplanning of actions is not feasible or desirable. Instead, sensing and analytic capabilities can be employed for adaptation in response to feedback. Mobile robots operating in open worlds have to understand their environment and thus require intelligence.

In general, the vision of an intelligent independent robot is as yet unfulfilled, especially in the commercial domain. At the moment, most of such robots are employed within small subsets of their possible applications, limiting their potential contribution. However, knowledge accumulated by robotics coupled with the ongoing democratization of coding and mechatronics opens new opportunities as it becomes easier to prototype autonomous systems for new domains.

Related Work

In architecture, interest in autonomy, typically in construction, has a long history. [5] This paper suggests that some of the ideas generated during that journey can be productively revisited with the current tools. Some of the recent related work focuses on the applications of adaptation or emergence, without specifically considering the use of robotic devices. The use of practical robotic experiments to test these approaches is still rare. [6]

In engineering, one existing example includes implementations of bottom-up construction behaviors. [7] Another explores prototypes for intelligent interaction with unknown environments. [8]

More broadly, the 'autonomic computing' initiative is of relevance to the present discussion. [9] Its attempts to develop self-maintaining systems have similar goals but fall outside of the scope of this paper.

Experimental Setup

Architectural engagement with the field of robotics, especially with robots as intelligent agents, requires the establishment of new collaborations, protocols, practices and skills. Considering the role of architects in construction, Kieran and Timberlake argue that to retain relevance they have to act as managers of intelligence and "the overseers of the exchange of information". [10]

Seeking to illuminate the capabilities needed for such overseeing, this research engages in an empirical investigation of robots. It accepts that rich interplay with the surrounding environments and multiple types of co-present agents constitute necessary conditions for intelligence. Given this, the work discussed below investigates which components and methods are required and how they can be coordinated.

The scenario presented in this paper explores construction from objects that can be found on a site, for example rubble left after an earthquake or items collected for recycling. It was presumed that a site containing such materials is initially unknown and partially inaccessible. This type of challenge requires 1) a capability to execute actions in the physical world; 2) an ability to plan actions, such as the use of resources; and 3) a capacity for real-time reasoning based on perception. The experimental setup involves a miniature robotic system that autonomously maps its environment and uses found materials to build shelter-like structures according to high-level criteria specified by humans. Based on a "real but contrived" design, the results of this experiment contribute to the challenge of understanding which capabilities are required for intelligent physical interactions with complex dynamic environments such as architectural sites.

The speculative prototype assumes a landscape-like environment with various degrees of slope. This terrain contains abstracted resources, represented by sticks of three separate lengths, that can be used as building material. At the beginning, the robot does not know the shape of the

environment or the distribution of resources. Criteria for selection, sorting and building are supplied by human designers. The robot aims to collect and use material in an efficient manner, saving time and energy.

The setup does not explore all elements that might be needed for the realization of full scale autonomous construction robots. For example, a robotic arm instead of a mobile platform runs a static vision system instead of on-board perception and uses schematic end effectors to simplify aspects that are not central to the investigation. However, an approach that experiments with physical prototypes can highlight important challenges of integration at other scales because some key constraints that limit small experimental systems – size, processing capabilities, power, energy consumption – are similar to those that define implementations at many scales.

Robotic Platform

The project deploys a custom assembly consisting of:

1. Robotic arms with six degrees of freedom (Fig. 1)
2. End effectors: grippers, air blowers, sensors
3. Depth and video cameras
4. Notebook computers and microcontrollers

A robot operating system with custom-written components is used for calibration, control, communication, coordination, perception processing, planning and acting.
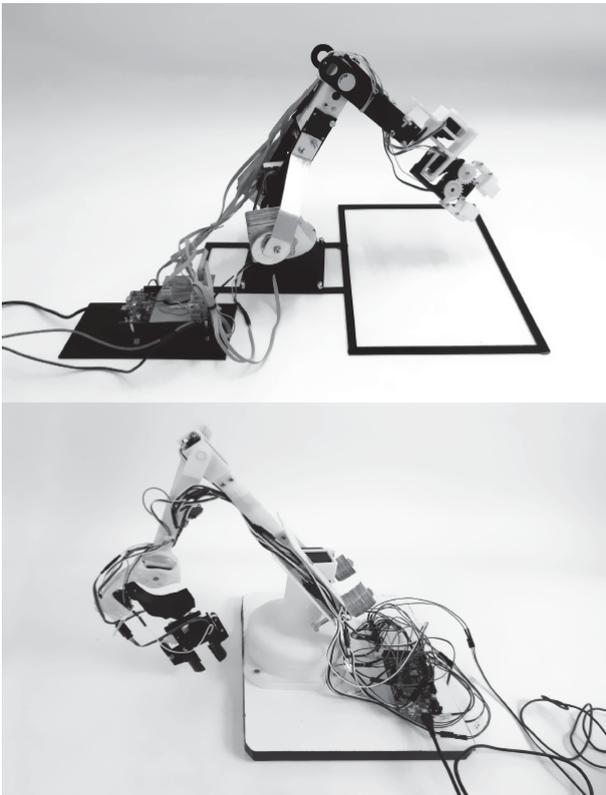
Fig. 1. *Autonomous Architecture*, 2014, two of the several robot arms designed, constructed and operated during the project.

Perception

For perceptions, the project uses depth information and color images supplied by Kinect sensors. These could be positioned in arbitrary locations and calibrated using markers. In real-world scenarios, such information can be provided from multiple sources (satellite, aerial photography, geographical information systems, on-demand surveying (e.g., with drones) on-board sensing, etc.).

Reasoning

The system employs the biologically inspired operational architecture that consists of a behavioral (or skill) layer, a deliberative (or sequencing and planning) layer and an interaction layer. [11, 12] Unlike purely reactive systems (such as boids) that are only able to operate in the present, deliberative agents of this type can consider the past, the present and the future.

Path Finding. To operate in complex environments, mobile robots need to determine their own paths. In the experiments discussed here, these paths have to be generated from the robot's current positions to locations where resources can be picked. These paths can respond to the properties of the terrain such that obstacles (e.g., walls or watered areas) or hard-to-pass regions (e.g., mud) are avoided. Access to resources may require intermediate tasks, such as a construction of access routes by removing material or building bridges. In this project's implementation, three-dimensional evaluations using versions of A* algorithm are used to compare costs of access to the locations mapped by the perceptual system (Fig. 2).

Task planning. In response to a high-level human command or an instruction supplied by an overseeing artificial-intelligence system, a robot needs to plan a sequence of actions. In this case, it:

- Finds an area that is suitable for construction; in this prototype, less sloping areas, as determined through the analysis of the depth-camera data, are deemed to be more suitable;
- Finds an area suitable for exploration;
- Finds resources by analyzing vision data;
- Sorts resources into types;
- Creates a subset of resources within a distance threshold and generates their coordinates (Fig. 2, left);
- Plots paths to these resources and compares retrieval costs (Fig. 2, right);
- Determines the type needed for the current stage of construction and retrieves it; and
- Places the resource into the structure (Fig. 3).

This basic sequence can be made more sophisticated and complex: the site might need to be prepared for construction, for example by removing the resources and placing them into a temporary storage; access routes might need to be prepared to reach blocked regions, etc.

Fig. 2. *Autonomous Architecture*, 2014, detection of resources and comparative path planning.

Actions

Based on the plans described above, the robot performs two main activities: exploration and plan execution. Exploration is done virtually, as an analysis of perceptual data incoming from a vision system that sees all of the scene. In some versions, this is complemented by the sensors mounted on the robot. When an experiment begins, the system starts exploring and building a representation of its environment. The scenario where the perceptual data is supplied by a vision system external to the robot is possible in the real world but unlikely to be sufficient and can to be complemented or replaced with on-board perception that will make map construction more complex and gradual. [13]

When the system receives an order, it uses this representation to build the initial state of the planning problem. The system then performs task planning. When ready, it executes the plan. When execution is completed, the system reverts to the exploration mode that allows it to update its representation of the environment, taking into account any changes.

Exploration. In this project, exploration consists of obtaining and processing of the depth and color information in order to 1) subdivide the site into regions suitable for retrieval of resources and construction, based on heights and slopes and 2) identify resources by the processing of color blobs, filtering of artefacts, calculation of centroids and orientations, estimation of sizes and sorting.

Plan execution. The execution of the plans is done with robotic arms instead of actual mobile robots. This simplification does not undermine the overall value of the experiment because execution is done in a way that is compatible with the use of mobile robots. On the other hand, the use of mobile platforms would introduce new design challenges some of which were considered but are outside of the scope of this paper.

Execution consists of three behaviors: 1) the 'move' behavior takes the robot to a destination resource; 2) the 'take' behavior consists of grasping a resource and requires alignments to be accurately resolved; and 3) the 'build' behavior consists of placing a resource onto a target site in a desired relationship to an already built structure, if any. The form of the resulting structure can be pre-specified or generated in response to available resources. While the project has conducted experiments in this area, the detailed discussion of them is also outside the scope of this presentation.

Fig. 3. *Autonomous Architecture*, 2014, retrieval and construction sequence.

Discussion

Using variants of the setup discussed above, the project could experiment with a range of scenarios involving operations with objects and amorphous matter, such as earth and water in a range of speculative architectural proposals.

The experiment confirmed that interdisciplinary teams with engineering and architectural backgrounds can sketch complete systems, designing hardware and software with low-level components and integrating them into workflows that use multiple robotic arms, perceptual devices and custom end-effectors. The use of higher-level tools, such as industrial robotic arms for hardware or

ready operating systems such as the Robot Operating System (ROS) can bring obvious benefits in robustness and capacity. However, the use of such systems requires greater prior knowledge, impeding interdisciplinary, participatory collaboration in speculative system design.

Five years since their analysis, this paper agrees with the conclusions of Moussete and Dore that sketching in hardware remains quite challenging despite the recent emergence of new toolkits. [14] Yet, such sketching is necessary for design innovations in the domains where conventional architectural ontologies and epistemologies come into question and reliance on existing types and practices is insufficient or constraining. Thus, this project's experiments highlighted that:

- In unknown environments, a condition that is typical to landscape or urban settings, the behavior of an autonomous system depends on the operation of sensors (and actuators that enable sensing). Collection, analysis and integration of such dynamic and continuous data, as an evolution of site analysis, is a new and interesting challenge in the architectural domain;
- Construction is a sustained and contingent process of many operations. All of these operations can fail in distinctive ways and the system has to cope with these failures without undermining the overall process. In industrial and product design, development of necessary robustness is typically done via prototyping and versioning, an as-yet uncommon workflow in architecture;
- Given that resources found in actual sites are not purpose-specific, they have to be found, recognized, extracted and sorted before use. Fully preprogrammed or purely reactive behaviors are insufficient in such cases because adequate autonomous systems have to evaluate and compare multiple scenarios while avoiding possible impasses.

These findings suggest that the effort needed for the prototyping of robotic systems in architecture can be justified by the benefits that are likely to ensue from the integration of increasingly common industrial robots with the capabilities of artificial intelligence.

Conclusion

This paper presents an empirical study that outlines the capabilities necessary for the tasks of autonomous construction in the physical world. The study used a working prototype to test system integration, practicalities of possible workflows, required knowledge, available building blocks and near-future prospects. The project demonstrated that it is possible to construct a simplified but functional system for design speculation with cheap hardware and commonly accessible software tools. With modifica-

tions and additions, the prototypes constructed for the project can support diverse design scenarios and promote otherwise-impossible exchanges with relevant stakeholders.

Acknowledgements

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A Double *Détournement* in the Classroom:
HK Protest Online Game as Conceptual Art

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Abstract

This paper examines the role of digital *détournement* during Hong Kong's Umbrella Movement in late 2014 through the prism of *HK Protest Online Game*, a conceptual art game made in response to Hong Kong's pro-democracy protests. Created by an undergraduate Hong Kong student, this work invites a critical reflection on playability by questioning the relationship between videogames, play, and "real time" violence. As an unplayable game, it reroutes the player to contemporaneous street demonstrations in Hong Kong, serving both as a *détournement* of police aggression and of videogames that commercialize violence. Reversing our expectation of games as playful and political action as non-playful, *HKPOG* presents its game as unreal and posits Hong Kong's protests as sites of play. The paper considers related digital artwork and the use of *détournement* during the Umbrella Movement, including umbrellas themselves and digitalized "derivative works" also known as "secondary creation" (*yihchi chongjok* in Cantonese and *èrcì chuàngzuò* in Mandarin; 二次創作). As Hong Kong's central government pushes for new legislation to regulate "derivative works," this paper raises the concern that the creation of such works, whether in the classroom or not, may be restricted or prohibited in the future.

Hong Kong's Copyright (Amendment) Bill

In the wake of the Umbrella Movement, Hong Kong's central government attempted to pass the Copyright (Amendment) Bill to "update" its copyright laws. The law's stated purpose is "to revise outdated laws, prevent online piracy and keep the Copyright Ordinance up to speed with the fast-moving digital world and international standards." [1] According to critics, however, the law is ambiguous:

> The new bill carries exemptions for caricature, parody, pastiche, satire, news reporting and commentary. It also requires those who repurpose others' material to cite the source of the original work and obtain permission from copyright owners… Opponents say the requirement puts too heavy a burden on authors of derivative works and would leave them vulnerable to civil liabilities and criminal charges. [2]

Critics of the bill call it "Internet Article 23," which refers to "Hong Kong's anti-subversion bill that was shelved after a massive protest by half a million people in 2003." [3] Hong Kong's "netizens" fear that their "right to play" online is at risk. According to Peter K. Yu,

law professor and co-director of the Center for Law and Intellectual Property at Texas A&M University School of Law:

> "They drafted the legislation so broadly that it covers most of the activities the netizens have been doing…Just saying 'we're not going to prosecute you' doesn't address the concerns of the netizens. Most people now interpret this as something that targets their freedom of speech." [4]

What are the implications for creating digital artwork, including art games, that "plays" with source texts, such as digital *détournement*, if such forms are restricted or prohibited in Hong Kong? The bills lacks a clear exemption for "fair use" or "user-generated content," so, if the law passes, it may have a chilling effect on digital writing courses in Hong Kong that invite work such as Tony Chan's *HK Protest Online Game* (*HKPOG*), the subject of this paper. *HKPOG* uses unattributed photographs from various news outlets and a video from Youtube. [5] In the worst case scenario, such works may no longer be permissible, and free speech, especially political and artistic expression in the realm of *détournement*, would erode further.

At the time of the submission of this paper in late March 2016, opponents have successfully filibustered the Copyright Amendment Bill in Hong Kong's Legislative Council and effectively derailed its passage for this legislative term. [6] However, the legislature may take up the bill again in the future, and it is important to consider further how best to revise the bill, so it protects artistic expression. As Hong Kong continues to navigate between its freedom of expression, digital technology, and pressure from mainland China's central government, it is important to examine the use of digital *détournement* in Hong Kong society, and this paper attempts to advance this discussion.

HK Protest Online Game (HKPOG)

The "Umbrella Movement" refers to pro-democracy protests in Hong Kong during the fall of 2014. Informed partly by the worldwide Occupy movement, student groups, such as Scholarism and the Hong Kong Federation of Students, engaged in street demonstrations and the occupation of major thoroughfares. The protestor's central demand was a fairer electoral process ("genuine universal suffrage") for the election of Hong

Kong's Chief Executive in 2017. The police's use of pepper spray to disperse the protesters on September 28 "inspired thousands more people to take to the streets" in subsequent days. Umbrellas served both as a defensive measure against pepper spray during the protests and as a symbol of pro-democracy goals. The demonstrations ended peacefully in early December 2014 without any major concessions by the central government. [7]

Tony Chan's *HK Protest Online Game* is a conceptual video game created in response to the Umbrella Movement during the height of the protests. [8] (It appeared on November 12, 2014.) Submitted for an undergraduate course called "Writing for New Media" taught by the author at Hong Kong Baptist University, the work was also selected by the online arts journal *Drunken Boat* as part of its special feature on the Umbrella Movement. [9] For the assignment, students had been asked to take an existing text and repurpose it through new media. Students were advised to use a text that has some social power. [10] Many students chose to create work in response to the Umbrella Movement, but Chan's work stood out as especially successful in its concept and execution. In addition to fulfilling the assignment, he sought to make a politically-charged critique regarding the Umbrella Movement.

HK Protest Online Game consists of five linked webpages designed with Weebly, a free website-building platform. The first page contains text declaring, "Website of HKPOG (HK Protests Online Game)" and depicts an enlarged photograph of a young man dressed in black, wearing protective goggles and raising an umbrella in each hand. A white cloud of pepper spray wafts in the background, evoking the feeling of a warzone. [11] At the bottom of the webpage is a menu consisting of four boxes entitled, respectively, "Game Preview," "How to Play," "Download," and "What Is HKPOG?" (*Fig. 1*)
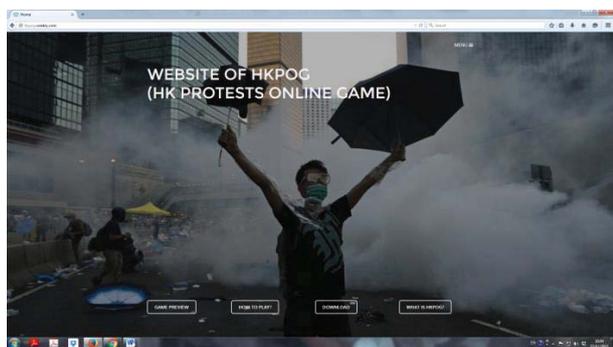
Fig 1. Front page, HKPOG, 2014, Tony Chan, webpage.

Reading from left to right, one would naturally click on "Game Preview," which reveals a video of a Hong Kong police officer spraying what appears to be white foam directly into a demonstrator's face. (*Fig. 2*) Imported from Youtube, the 37-second video is entitled "How to Use Pepper Spray on Elderly (Hong Kong)."

Fig 2. "Game Preview,"HKPOG, 2014, Tony Chan, webpage.

Most readers would proceed by clicking on the next box on the bottom far left of the screen: "What is HKPOG?" This page shows a bird's eye view of protestors gathered at night in the streets at Admiralty, site of the central government's headquarters and epicenter of the protests. (*Fig. 3*) A short text offers a summary of the protest movement:

> Hong Kong protests, also known as Umbrella Revolution, began in September 2014 when activists in Hong Kong protested outside the Hong Kong Government head quarters [*sic*] and occupied several major city intersections after China's Standing Committee of the National People's Congress (NPCSC) announced its decision on proposed electoral reform.
>
> It is a War for democracy.

Fig 3. "What Is HKPOG? " HKPOG 2014, Tony Chan.

The next box one would likely click is "How to Play" on the bottom far left of the page. This page opens to reveal the "rules" of the game, including the explanation that players may choose to be a demonstrator "fighting for democracy" or a policeman "fighting with the citizens" (i.e., against the citizens). (*Fig 4*) There are two images in the foreground: a young man in goggles putting plastic wrap around his face for protection from pepper spray and a flank of policemen in gas masks. In red text next to the young man, three "rules" for the protestors are given, including the rule: "Demonstrators can only use cheap and poor protective equipment." Next to the image of police, contrasting rules are provided in blue text: "Policemen can only use expensive and well protective equipment." Interestingly, the final rule for the

police is that they should be well-compensated: "Policemen can get income regularly." This rule introduces an economic critique related to income inequality, which, as the protests continued, became an increasingly important part of the criticism directed at the central government. [12]
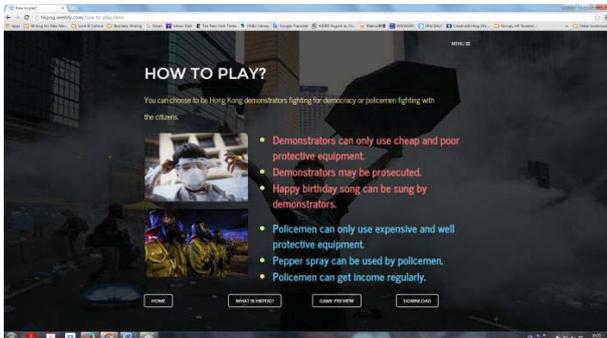
Fig 4. "How to Play?," HKPOG 2014, Tony Chan, webpage.

The "Download" menu option on the far right remains. An unsuspecting reader would probably save this option for the end, as most people are cautious about downloading files from unknown websites. Upon clicking this last option, the reader finds the following message: "I am sorry to inform you that the game can not be downloaded because… IT IS REAL! Hope that you can enjoy the game in Hong Kong right now." (*Fig 5*)
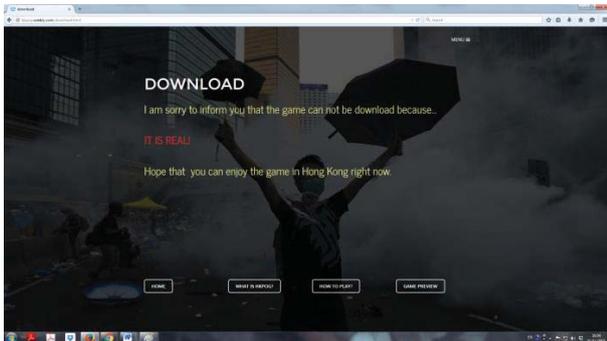
Fig 5. "Download," HKPOG, 2014, Tony Chan, webpage.

The anti-climactic message can be read as a double *détournement*: it twists or reroutes police aggression into a videogame format, thereby trivializing state violence and diminishing the status of the police force as a respected public entity, while at the same time, it twists or reroutes the videogame experience itself to the contemporaneous, mass public demonstrations, thus frustrating the user's anticipation of escaping into the game. The targets of the work are both the state's violence *and* its citizens seeking pleasure in the play of violent videogames.

In preparation for this conceptual writing assignment, students were assigned to read Sol Lewitt's "Sentences on Conceptual Art," Raphael Rubinstein's "Gathered, Not Made: A Brief History of Appropriative Writing," and Kenneth Goldsmith's "It's Not Plagiarism. In the Digital Age, It's 'Repurposing.'" We discussed an array of conceptual artworks, including John Cage's 4'33", Robert Rauschenberg's "White Painting," Mendi Obadike and Keith Obadike's "Blackness for Sale," Brian Kim Stefans' "The Vaneigem Series," Robert Fitterman's "Directory," and Josef Kaplan's *Kill List*. In addition to considering the use of social media as possible tools for conceptual art, we explored a range of conceptual art practices, such as collage, rewriting, mistranslation, recombination, erasure, centos, and *détournement*. We also discussed the intersection of digital literature and art games, including examples such as Jim Andrews' "Arteroids" and James Nelson's "Game, Game, Game, and again Game."

HKPOG as Conceptual Art

Chan's work is a conceptual videogame, or more precisely, a conceptual art game. In the words of Sol Lewitt, the term "conceptual art" refers to artwork in which "the idea or concept is the most important aspect of the work." [13] Conceptual art has additional characteristics as well, such as those delineated by Peter Goldie and Elisabeth Schellekens: it tends to be "anti-definition, anti-medium, de-materialized, anti-aesthetic, linguistic, esoteric, ironic, and self-reflective." [14] As an unplayable game, *HKPOG* is clearly conceptual in nature, and as a digital work that engages the rhetoric of videogames, it can be classified as an art game.

A distinction between "art games" and "game art" may be helpful here. Matteo Bittanti defines the latter as "any art in which digital games played a significant role in the creation, production, and/or display of the artwork. The resulting artwork can exist as a game, painting, photograph, sound, animation, video, performance or gallery installation." [15] Cory Arcangel's *Super Mario Clouds* (2002) is often cited as an example of game art. [16] In contrast to "game art," Bittanti defines "art games" as "videogames specifically created for artistic (i.e. not commercial) purposes." [17] Bittanti also cites Tiffany Holmes's definition of art games as "an interactive work, usually humorous, by a visual artist that does one or more of the following: challenges cultural stereotypes, offers meaningful social or historical critique, or tells a story in a novel manner." [18] Moreover, he cites Rebecca Cannon's description of the features of "art games:" "They always comprise an entire, (to some degree) playable game…Art Games explore the game *format* primarily as a new mode for structuring narrative and cultural critique..." [19]

Astrid Ensslin's picks up on this distinction and uses Rebecca Cannon's emphasis on the rhetoric of videogames in making art games to note that in art games, "competition itself is often manipulated, suppressed, and/or presented as a ludic fallacy." [20] *HKPOG* explores the "game *format*" because it is called a "game," presents "rules," appears to be downloadable like other online games, and implies playability in the manner of a first-person shooter game, and yet, competition is "suppressed" in the game. Ensslin further classifies art games into metagames ("that is, games that

are about games and gaming") and a subcategory called "anti-games," which are "a subform of metagames, even more specific and/or political in their artistic intent in that they use antiludic design to question, challenge, and/or ridicule aspects of commercial game culture." [21] Based on the various distinctions above, HKPOG may be a conceptual art game or, simply, an "anti-game."

Both Corrado Morgana and Ensslin emphasize the nature of *détournement* in art games. Morgana, for instance, writes, "art games are rapidly détourning mainstream game expectations…," and Ensslin notes, "They are often humorous and/or critical, challenging, for instance, cultural stereotypes, social or political matters, or détourning aspects of the mainstream (gaming) culture in which they are embedded." [22] [23] On the other hand, given Ian Bogost's distinction between art games and game art, *HKPOG* could be viewed as "conceptual game art" in the sense that it is not playable, but rather it is work that can be exhibited or viewed. Bogost distinguishes between "artgames" and "game art" by claiming that the former are games "that get played" often by game developers who happen to be artists, whereas "game art" are "games that get exhibited" by practicing artists. [24] This slippage between terms brings to mind Espen Aarseth's claim that games are "not one form, but many" and they "share qualities with performance arts…material arts…and the verbal arts." [25] Importantly, Bogost notes that "what we lack are discussions of the developing conventions, styles, movements through which games are participating in a broader concept of art, both locally and historically." [26]

Finally, *HKPOG* also evokes Laurie Taylor's use of the term "concept art," which is distinct from "conceptual art." Rather, "concept art" refers to "the representation of the necessary elements of the game world and/or the character within the game world such that the character and the game world becomes logically distinct, and/or differentiated through their own style." [27] Yet, Chan's project is an inversion of Laurie Taylor's contention that videogames "unwittingly used concept art to generate the belief of an ideal" which perpetuates the player's imagination of the game. For Taylor, concept art "becomes the super structure from which each game unfolds and into which each game enfolds itself." [28] In *HKPOG*, however, the unplayable game points us to reality as a super structure of power relations between the state and its citizens. At the same time, the player's imagination of previous games is what makes *HKPOG* so effective, because the player anticipates the game based on previous game experiences, raising the level of surprise on the final page. As Taylor notes, concept art shapes "a consistent view on how videogames should be" for players and creators, which is crucial for conceptual art games to be successful. [29]

Détournement and the Umbrella Movement

Ken Knabb points out multiple nuances in Guy DeBord's

key term "*détournement*," by noting that it "means deflection, diversion, rerouting, misuse, misappropriation, hijacking, or otherwise turning something aside from its normal course or purpose." [30] As Elisabeth Sussman states: "Detournement proposes a violent excision of elements…from their original contexts, and a consequent destabilization and recontextualization through rupture and realignment." [31] Ensslin makes an explicit link between Debord's notion of *détournement* and playfulness: "Detournement is particularly suited to games and other ludic activities as tools for artistic processes of dissolution, appropriation, reassembly, and subversion more generally." Furthermore, she suggests that "playfulness," is a "particularly salient principle in twentieth-century criticism" as it relates to the carnivalesque (Bakhtin), bricolage (Lévi-Strauss), and deconstruction (Derrida). [32] By its very nature, *détournement* invites a playful engagement with reality, because of the need for an existing text or object to "détourn."

A passage from Guy Debord and Gil Wolman's "A User's Guide to Détournement" (1956) illustrates how *détournement* was employed in a subversive fashion during last year's protests in Hong Kong. They state:

> *Détournement* not only leads to the discovery of new aspects of talent; in addition, clashing head-on with all social and legal conventions, it cannot fail to be a powerful cultural weapon in the service of real class struggle. The cheapness of its products is the heavy artillery that breaks through all the Chinese walls of understanding. [33]

If the playability of videogames entails choice and consequences, then *HKPOG* draws attention to the limits of one's choices and outcomes. Instead of being a game in which one may forget one's life temporarily, this conceptual art game reminds the "player" of the reality of "real-time" violence. Chan's work teases, or "plays," the user with the enticement of playability, only to reinforce the actuality of contemporaneous violence on the streets. The work itself, a seemingly cheap, mass-produced (downloadable) online game, embodies what Debord and Wilmore described as "heavy artillery" that can "break through all the Chinese walls of understanding." [34]

As noted previously, *HKPOG* employs *détournement* on at least two levels. Firstly, it suggests that police action during the protests was excessive and violent, in the manner of a typical videogame. That is, the police state regarded its citizens as mere players of a game in which the state cannot lose, at least in terms of physical or military superiority. By seeming to trivialize police violence towards protesters, the game highlights the police's excessive use of force, ridicules it, and underscores our embrace of videogame violence. Secondly, and relatedly, it forces the player to check his or her excitement for a "game" inspired by the protests by revealing that the game is not real, thereby puncturing

our thrill for a diversion. It twists online games that we assume to be escapist pleasures into a subversive instruction to join the unprecedented occupation of Hong Kong's streets.

As an anti-game, *HKPOG* reverses our expectation of games as sites of play and political protests as non-playful. We assume games to be playful, such as first-person shooter games embraced by the US Military for recruitment and training. In these games, one plays the game either for enjoyment, or, in the context of the military, in preparation for the "reality" of warfare. Instead, *HKPOG* makes its game unreal and posits Hong Kong's street protests in support of democracy as sites of play. In fact, the Umbrella Movement was a site of much playful engagement. By "play," I am referring to Johan Huizinga's concept as described by Alexander R. Galloway: "it is free…it is not part of ordinary life…it is secluded in time and place…it creates order (in the form of rules), and…it promotes the formation of communities of players." [35] The primary example was the voluntary and collective remaking of public spaces through the occupation of roads complete with furniture on the street, flowers inserted into spaces in the road for light reflectors, and artwork created in response to the movement, including sculptures, songs, and drawings. [36] Furthermore, protestors at the occupied sites followed "rules"—no violence, no drinking, no money changing hands, no littering, etc. There were opponents, competing strategies, and a primary objective: "genuine universal suffrage." There was also an outcome: pro-democracy protestors arguably "lost" by not gaining any electoral reform. On the other hand, the purpose of the activity was not pleasure or "joy" (Huizinga), unless one infers from "genuine universal suffrage" the goal of long-term enjoyment, but this does not mean that protestors did not take pleasure in their efforts. The thoughtful engagement of my students, including their boycott of classes during the first week of the movement, in response to the police's use of pepper spray, suggested a tenor of seriousness and hopefulness not found in the typical classroom, most likely because the protests were voluntary. As *HKPOG* suggests, it felt as though the "real," for a couple of months in late 2014, had become more compelling than the spectacle.

HKPOG also invites a brief consideration of the *détournement* of umbrellas during the Umbrella Movement. Umbrellas were twisted from a tool that protects one from the weather into a defensive weapon that protected protestors from pepper spray, exhibiting the process of "destabilization and recontextualization." Umbrellas became defensive "artillery" for use in "clashing head-on" with the Hong Kong police, who represented "social and legal conventions," including stagnant electoral reform. Umbrellas functioned symbolically as well, as when students held up cheap, mass-produced umbrellas during graduation ceremonies, alerting the public to their desire for political change. [37]

Related Digital Artworks

HKPOG resembles the anti-art impulse of the Fluxus movement, which "produced mixed-media artifacts (*intermedia*) and unplayable games involving social interaction and humor." Ensslin gives an example of an unplayable game: Robert Filliou's *Optimistic Box #3* (1969), "a wooden chess box containing no pawns but instead two labels saying 'So much the better if you can't play chess' on the outside and 'You won't imitate Marcel Duchamp' on the inside." [38]

In terms of digital art related to *HKPOG*, Brian Schrank describes "Gonzo gamers" who détourn military and adventure-style games for subversive ends. His examples include Joseph DeLappe's *dead-in-iraq* (2006-), in which DeLappe "détourns the networked shooter game *America's Army* (developed by the US Army as a recruiting tool) by logging into the game, and then texting the names and ranks of every US soldier killed in Iraq." [39] Another game that critiques videogames and violence is *Velvet Strike* (2002) by Anne-Marie Schleiner, Joan Leandre, and Brody Condon. This is a set of game "intervention recipes" intended to disrupt the networked tactical shooter game *Counter Strike*. For example, as Schrank explains, "Instead of gunning down terrorists, the artists chat about baking." Schrank also cites his own students who created *Gonzo Gamers* (2013), a project in which students invented recipes for disrupting games, and GoonSwarm, a collective of players who engaged in "avant-garde play" in *EVE Online*, a "brutal capitalist" massively multiplayer online game (MMO). [40]

More "game art" than "art game," Jon Haddock's *Screenshot* series is another videogame-related work that uses actual violence as its focus. Drawn in isometric perspective in Photoshop, Haddock's series appear to be stills from videogames featuring iconic images, such as the famous "Tank Man" photograph from Tiananmen Square that served as the model for *Wang Weilin* (2000). As Henry Lowood notes, "Haddock thus transformed the nature of the screenshot as "captured" image, from a media moment stored in personal memory to a digital screen stored on his computer, and from an event beyond our control to a strategy game waiting for the next move." [41] These works are notable in the context of *HK Protest Online Game*, because they engage the uneasy gap between actual violence and videogame play.

There have been at least two "real" videogames inspired by Hong Kong's recent political protests. The first one, "Love and Peace," was designed by nxTomo, a Hong Kong-based game company and appeared only briefly in the summer of 2014. The game anticipated the mobilization of students later that year, but it was taken down by the developer after two weeks. [42] During the Umbrella Movement, a second protest-themed game emerged from game makers in Hong Kong. Designed by Fung Kam-keung, CEO and founder of Awesapp Limited, "Yellow Umbrella" depicts a street scene in which student protesters cannot attack, but rather, they can only defend themselves from "waves of police

officers, triads, angry anti-Occupy protesters and even Chief Executive Leung Chun-ying himself" by "using umbrellas, incense sticks, and durian fruit." [43] [44] (*Fig. 6*) The game clearly sympathizes with the pro-democracy protestors. It is currently available and has been downloaded over 40,000 times as of October 2014. [45]

Fig. 6. Yellow Umbrella video game. 2014, Awesapp Limited.

It should be noted that Chan's work is especially resonant in Hong Kong, where videogames are ubiquitous. Ride any subway line and you will find passengers playing *Candy Crush Saga*. Benjamin Wai-ming Ng writes, "Hong Kong, a free port city with a population of more than 7.1 million, is one of the major game consumption centers in Asia." [46] Hong Kong is a "mature market" for games, including leading game developers with offices in Hong Kong and players using a mix of "handheld games, home console games, computer games, and online games, whereas outside the home they play arcade games, handheld games, and mobile games." [47] Ng also notes that "game piracy is the key factor in popularization." [48] *HKPOG* plays off this history of online piracy in Hong Kong by presenting itself as a free game. *HKPOG* is especially striking in the context of commerce-driven Hong Kong, because it resists commodification. The videogame industry in Hong Kong has an intricate link to the state as well. In 2011, the Hong Kong government spent 4 million Hong Kong dollars to sponsor the Asia Online Game Awards." [49] Former chief executive Donald Tsang "used game-related jargon in public to show his affiliation with grassroots society" and "game-related jargon also appeared in a public examination organized by the Education Bureau of the Hong Kong government." [50]

"Real-Time" Violence

Quoting Huizinga's description of play as "a stepping out of 'real life' into a temporary sphere of activity with a disposition all of its own," Ian Bogost suggests that Huizinga's notion of the "magic circle" reveals a gap in the sense that videogame players may leave a game with strong emotions, such as rage or humiliation. In this way, the perceived "safety of games" is misleading. [51] In the case of *HKPOG*, the reader is refused from entering the "magic circle" and, rather, is invited to enter "real life." Chan's critique of violence and videogames, based

on real events, also recalls Nick Dyer-Witheford and Greig de Peuter's *Games of Empire: Global Capitalism and Video Games*, in which they argue that games should be read "within a system of global ownership, privatized property, coercive class relations, military operations, and radical struggle." [52] They cite the banalization of war, in which "war becomes part of the culture of everyday life," and how "the long-standing interaction of video game culture and the military apparatus is a component in this process of the banalization of war." They also claim that commercial games have surpassed "the Pentagon's in-house simulations" to the point that the U.S. government now collaborates with commercial game makers. [53]

In the case of *HKPOG*, the dark photograph on the first page, featuring an individual wearing protective eyewear and holding up umbrellas in a gesture of defiance, evokes first-person shooting games. On the "How to Play?" page, the last line in red text reads: "It is a WAR for democracy." and the site's use of Ariel, which resembles the sans-serif font often found in shooting games, adds to the borrowed rhetoric from military-themed games. The combat atmosphere of the website builds excitement and suspense, yet Chan's work frustrates our consumerist urge to "download" and own the game; instead, it instructs us to enter the streets and "enjoy the game in Hong Kong right now." The player, expecting a thrilling shooting game, is left impotent on the final page.

Roberto Simanowski notes that for Debord, "the cinema had become the cathedral of modernity, reducing mankind, previously an autonomous, contemplative subject, to an immobile, isolated, passive viewer, sitting in the dark and fixed in front of the shining screen." Debord employed détournement in an attempt to "free" cinema "from the dominance of the spectacle." [54] It would seem that this description does not apply to interactive videogames, because while gamers may be in the dark, they are not passive and not necessarily isolated. Taking his cue from Debord, Baudrillard "argues that the rise of the mass media has led to a fatal confusion between the real and its representation" [55]. For Baudrillard, the difficulty of "contemplation" in the face of the screen persists in the realm of videogames as well, despite, or rather, because of its interactivity. As Kim Toffoletti puts it, "…Baudrillard suggests that the increasing interactivity between the viewer and the screen (which also includes the Internet, video games, multimedia, etc.) actually diminishes any distance from which the viewer might cast a moral judgement." [56]

The ability of a videogame to invite contemplation depends on the nature of the game and what it asks of the player. Even Baudrillard admitted that some cinema permits contemplation, as when he wrote of Luchino Viconti's mid-career films, "…there is meaning, history, a sensual rhetoric, dead moments, a passionate game, not only in the historical content but in the direction." [57] In some ways, the player is drawn to *HKPOG* because it appears to be an escape from "reality" into "spectacle," or at least, it is a safe

abstraction of reality, like most games. As Baudrillard wrote, "We prefer the exile of the virtual…to the catastrophe of the real." [58] The reminder of "real-time" violence in *HKPOG* places the game under the category of "radical political," based on Brian Schrank's recent classifications of videogame art, in the sense that *HKPOG* "reminds us that reality is in play and that play requires real risk." Schrank gives the example of *Toywar* (1999/2000) as a "radical political" work that combines art, politics, fiction, and "real" life. [59] It should be noted that there was no violence at the time of the work's posting (in mid-November 2014), but the work evokes the first night of the protests when police used pepper spray, and it spoke to the fear of protestors that more state violence may erupt at any moment. In fact, the first night when the police used pepper spray triggered memories of Tiananmen Square for many Hong Kongers.

Species of Play: Pranks and Culture Jamming

This essay has explored *HKPOG* as a conceptual videogame with a subversive purpose, in the context of *détournement*. Other categories of subversive art, such as "pranks" and "culture jamming" may apply, but these terms are more likely to invite the critique that *HKPOG* undermines its political aims by reinforcing the status quo, or feeding the "spectacle" it aims to critique. I submit that HKPOG resists this critique and remains primarily an example of *détournement*. One reason the term *détournement* is worth preserving as a description of Chan's work and others like it, is because as Debord implied (when he said that film is best suited to *détournement* and "can attain its greatest effectiveness" and "its greatest beauty,") *détournement* is the term that is closest to the values and possibilities inherent in politically-charged art-making.

Bogost refers to the category of "prank" in terms of digital work when he describes Cory Arcangel's *Super Mario Clouds* and Myfanway Ashmore's *Mario Battle No. 1*, as "more art object than videogame prank" in the sense that they are not playable. [60] It may be tempting to refer to Chan's work as a prank, yet, the context in which *HKPOG* was created—during unprecedented occupations of major thoroughfares in Hong Kong—suggests that the political urgency behind the work makes it primarily an example of *détournement*. The work fulfilled an assignment for a course, and so, it may never have been created without the structure of a course to encourage it, however, artworks may be created for multiple purposes, and it was clearly Chan's intention to make a pointed political critique. In his brief description of the work, Chan refers to "serious issues," and "humor or black humor" as they "show the tension between…[the] protest in reality and [the work's] casual style" [61] In Chan's biographical note on *Drunken Boat*, he is self-described plainly as "a supporter of the student movement." Importantly, the work figuratively reroutes the user to the streets in an implicit call to action. [62] Chan's work also evokes

Bogot's claims for the future of videogame pranks: "They are commercially unviable in large part, but socially meaningful, justifying considerable effort even if they disappear soon after use…" [63] The ephemeral nature of Chan's work is paradoxical: it exists in perpetuity (until he takes it down, Weebly goes offline, or the video is removed from Youtube), and yet its power is derived primarily from its relation to the protests themselves, which are no longer happening: "Hope that you can enjoy the game in Hong Kong *right now*." (Italics mine.)

One may further consider describing *HKPOG* as an example of "culture jamming," a derivation of *détournement*, however, as Christine Harold notes, "…Debord and his comrades were decidedly opposed to parody as an effective rhetorical strategy, because it maintained, rather than unsettled, audiences' purchase on truth." [64] Richard Gilman-Opalsky critiques the term "culture jamming" as a "liberal fantasy" and calls rather for collective acts of revolution. [65] In this way, *HKPOG* can be seen as part of an urgent panoply of online activity during and after the Umbrella Revolution that sought to critique Hong Kong's central government. This kind of collective, contemporaneous action often included playful, creative works called "derivative works" or "secondary creation" (*yihchi chongjok* in Cantonese and *èrcì chuàngzuò* in Mandarin; 二次創作), including memes, rewritten song lyrics, subtitling videos, etc. [66] One prominent online group, Mocking Jer (學舌鳥), is a volunteer collective that makes satirical videos critiquing the government. [67] Digital *détournement* is especially effective in Hong Kong, because Hong Kong's youth are savvy when it comes to using new media. Repurposing digitalized texts happens quickly, increasing its appeal to young people, and it is communal in nature, because the works are easily sharable. Yet, given Hong Kong's proposed amendment to its copyright laws, playful online expression, including digital *détournement*, faces an uncertain future.

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Reading Digital Art in the Age of Double-Coding

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Abstract

Against the background of the collapsed dichotomy between high and low culture as well as the concept of postmodern double-coding (allowing surface and in-depth perceptions to occur simultaneously), the essay offers a close reading of a classical example of digital art: *Der Zerseher* (*Iconoclast*) by Joachim Sauter and Dirk Lüsebrink (1992), an interactive installation where viewers (observed by hidden eye trackers) deconstruct a painting (presented on a screen) by looking at it. Beyond the facile claim that the work reverses the power hierarchy between painter and onlooker, the essay discusses the irony that (if we understand perception as an autobiographical act) the image cannot be de-viewed on a semantic level if it deconstructed on a physical one. The essay finally reveals the artwork as a commentary on art history and connects it to aesthetic discussions about the end of interpretation and the culture of presence. Against the prevalence of technique over content and meaning often in place in digital artworks, the essay ends with a call for an "erotics" of interpretation.

The postmodern bridge of cultural gaps and the collapse of the dichotomy in art after the advent of digital media

Jay David Bolter, in his ISEA keynote 2012, addresses the dichotomy of high and low/popular art referring to the common opposition of classical music and painting versus pop and rock. Bolter holds that there is no center of art today and he elaborates this idea in his book *The Digital Plenitude*, forthcoming with MIT Press in 2016. In this book Bolter, as he explains in a forthcoming interview, aims to examine the two developments in the second half of the 20th century that define our media culture in the 21st century: the advent of digital media, websites, video games, social media, mobile media and all the remediation of so called traditional media like film and print that now appear in digital form on the one hand, and, on the other hand, the end of our collective belief in Culture with a capital c, the collapse of the agreed on hierarchy in the visual arts, music, literature and scholarship and even politics. As Bolter holds: "This collapse is a sort of open secret in the sense that we all know implicitly that it is happening. But many of us are unwilling to acknowledge the consequences of it. Many of us write about media culture today in a way that seems to be determined to ignore that history, taking extreme positions seeing digital media either as utopia or dystopia and utopias and dystopias are always measured in terms of implicit cultural standards." [1].

Bolter's talk is indebted to Leslie Fiedler's famous essay "Cross the Border – Close the Gap" (1972) declaring the obsolescence of the old distinction between low and high culture. Equally important in this context is John Barth's essay "The Literature of Replenishment" (1980) that offers the concept of a post-modern perception of art as a synthesis of pre-modernist and modernist modes of writing, i.e. the naïve illusionism, suspense, immersion and clarity of "traditional" writing on one hand with the anti-illusionism, self-reflexivness, irrationalism of modern writing on the other hand. [2]

Barth's suggestion is a kind of postmodern double-coding which allows the audience to enjoy the artwork in both, a rather superficial as well as a deep digging approach. His examples are Italo Calvino's *Cosmicomics* (1965) and Gabriel García Márquez' *One Hundred Years of Solitude* (1967) and he could easily have added Umberto Eco's *Name of the Rose* (1980) that was released shortly after his essay. Barth's idea is not limited to literature but includes all kinds of art. Thus, he offers an analogy for a perfectly double-coded artwork referring to "good jazz or classical music: One finds much on successive listening or close examination of the score that one didn't catch the first time through; but the first time through should be so ravishing – and not just to specialists – that one delights in the replay." [3]

The concept of double-coding is also used in architecture – as for example in Charles Jencks' 1977 *The Language of Postmodern Architecture* – to describe architecture whose playful elements contain historic references simultaneously allowing a perception on the surface but also a reflective perception open to complex significations. In a similar way, Paul de Man, in his 1979 *Allegories of Reading*, distinguishes between a rhetoric and aesthetic reading, the former being more analytical, distant and attentive and the latter more sensual and immersive.

The concept of double-coding leads to a kind of democratic aesthetics: In contrast to the conceptual *modern* artwork, the *postmodern* artwork attends to both demands on art (pleasure and reflection) at the same time, liberating the audience to decide about the depth of its engagement. If one reads Fiedler with Barth, the gap which Fiedler urged to close has moved from different artifacts to different ways of perception: the new "high" art is the coding of and search for the *deeper* meaning, the old "low" art is a superficial perception.

Against this background one can argue that writing about media art today can still undertake distinctions concerning the aesthetic potential (and arguably value) of a specific artwork. However, such distinction and evaluation can no longer apply old criteria of high and low, reflection and pleasure, meaning and presence. Rather it has to discuss the potential of an artwork to allow for an encounter with the artwork on different levels of engagement. The following discussion intends to illustrate such constitution of an artwork and approach to it with a classical example of interactive art from the early days of the artistic use of digital technology.

Interactive viewing as remediation: A case study of double-coded perception

Der Zerseher (literally, "dis-viewer," also known as *Iconoclast*) by Joachim Sauter and Dirk Lüsebrink (1992) is an installation where the viewers deconstruct a painting by looking at it. The painting – Boy *with a Child-Drawing in His Hand* (ca. 1525) by Giovan Francesco Caroto – is a framed rear projection onto canvas behind which, invisible to the viewer, an eye tracker is installed (camera, PC, video-tracking software). The cam- era sends the information about the viewer's eye movement to the computer, which locates the center of the iris and the point where an infrared light reflects from the viewer's eye. With the resulting data, it can precisely identify the part of the painting the viewer is looking at. This part of the painting is consequently distorted. The observer who encounters this work in a museum environment, not expecting a painting to dissolve under her gaze, realizes that the more she looks at the painting to discover its meaning, the more she destroys the object of her analysis. Because this comes as a surprise, it may contribute to confusion, but it will certainly also reinforce a reflection concerning the difference between this kind of experience of a painting and the more traditional way. It is part of the irony of the work that the painting can be restored only by disinterest in it. If more than thirty seconds elapse without the picture being viewed, it reverts to its original condition.

This installation fundamentally changes the perception of a visual object. As the artists state, "In the past an old master might leave an impression in the mind of the passive onlooker—now the onlooker can leave an impression on the old master." [4] *Der Zerseher* promotes one of the most important qualities of the computer, namely interaction, as Sauter proclaims in an interview. [5] This interaction, this impression (and power) of the onlooker on the old master is the basic experience this artwork provides. The onlooker experiences herself as dis-viewer of a painting looked at. However, a closer look at the meaning of the grammar of interaction reveals that *Der Zerseher* deconstructs the painting presented only on a superficial level while preventing the painting from being deconstructed, dis-viewed in a deeper sense.

Marcel Duchamp once declared that the gaze – that is, the spectator – makes the painting which is mirrored in Jean-Luc Godard's famous saying: "It takes two to make an image". Concerning statements about the participation of the viewer in creating the picture one can argue that de-viewing does not require the technology applied in *Der Zerseher* but – in a less literal and more conceptual way – takes place all the time when looking at a picture. "Making the picture" in this case means to see in it what one brings to it. The viewer is never the passive onlooker that Sauter and Lüsebrink suggest, but rather a person with certain ideas and ways of seeing the world. The viewer carries all the pictures she ever has seen with her when stepping in front of a new picture. She activates all the concepts she has developed about children and childhood when looking at a painting of (and by) a child.

It is this problematic effect of knowledge as overwriting or distorting the perceived painting that inclines Georges Didi-Huberman to suggest a more passive mode of perception, the alternative of "not-grasping the image, of letting oneself be grasped by it instead: thus of *letting go one's knowledge about it*". [6] Knowledge and concepts govern our perception of reality, not only of painting or art. "We see what we know and what we are" would be a colloquial way to express the fact that perception is an autobiographical act.

If one agrees that the spectator constructs the picture she sees and therefore deconstructs the picture the artist saw while painting, one understands that *Der Zerseher* only renders literal what is a general phenomenon of perception. One could even argue that this interactive installation allows the onlooker less in way of opportunity to make an impression on the old master's painting than would be the case in a painting that does not physically react to the viewer. Because each area of the painting fades away under the viewer's gaze, there is limited time for her to look ideas *into* the painting. The painting seems to escape its appropriation by the viewer. The installation prevents the painting from being de-viewed on the semantic level by de-viewing it on the physical level. It is a shift of deconstruction from the viewer's mind to the canvas' surface.

So far, the argument does not take into account the painting itself. If one moves on from a sensual to an analytical approach to the artwork one will wonder why Sauter and Lüsebrink have chosen this particular painting for their installation. Is there a deeper correlation between the painting and the installation? The artists note: "This painting shows the first documented child-drawing in art history – an adequate metaphor for the state of computer-art at the early 1990s." [7] This explanation affirms the importance of the painting's content for the installation's message. Equally important, however, seems to be the fact that the painting duplicates the action of the installation: looking at a painting.

The mutuality of this feature helps indicate a difference. The boy in this painting does not de-view the drawing in his hand in the physical way. Does he do it in the semantic sense? One doubts this for two reasons: The drawing is assumed to be his own creation, which explains why the boy looks up while presenting the painting rather than looking at it – and, more importantly, the boy represents an innocence that makes him unlikely to be a source of de-viewing. It is understood that a child has developed less in the way of cognitive concepts to guide his perceptions. A child is expected to be more open to reality than an adult, to carry less baggage of other pictures and ideas when stepping in front of a painting.

Hence, the boy in Caroto's painting may indeed be the passive onlooker in whose mind the painter leaves a strong impression. He represents the innocence that the adult viewer no longer possesses. *Der Zerseher* is the symbolic destruction of such innocence and thus becomes symptomatic for the history of art and of media. The boy in Caroto's painting not only represents innocence in an ontogenetic way, but also in a phylogenetic way. Living at a time when images were exceptional in everyday life and may have had a huge impact when encountered in public spaces, this boy also represents the 'childhood of visual culture.' The time of this painting is the time before or just around the birth of the history of art – which, as Didi-Huberman notes, places the figurative under the "tyranny of the *legible"* and was effective in terms of "dissolving or suppressing a universe of questions the better to advance, optimistic to the point of tyranny, a battalion of answers". [8] The child in the painting embodies a certain suggestion of the innocence of mankind in its dialogue with paintings.

By contrast, people today – especially in the Western world – are adult when it comes to the undertaking of looking at paintings and images. We are trained in the reading of paintings, and we are familiar with different modes and forms. Not only impressionism, which caused scandals once, but even the most abstract representation seems usual to us. Painting has more and more moved to the edges of representation, reflecting not only its own materiality as in formalist painting but also its environment beyond the canvas: the tools, the frame, the gallery. Examples are the use of living objects as brushes, such as reeds or naked women in Yves Klein's *Cosmogonies* and *Anthropométries* in the early 1960s, the use of houseflies as paint in Damien Hirst's *Armageddon* (2002), and Daniel Burens *Within and Beyond the Frame* (1973), with its moving beyond the gallery space.

The actual content of a painting can often be found in the way of its production and in the way of its presentation, in dialogue with its location. *Der Zerseher* moves one more step in this direction by making the audience an active physical element of the painting. It is one more step away from what is represented on the canvas within its frame toward a meta-reflection. This is also, as it was the case with Yves Klein's anthropomorphic brushes, a step toward the spectacular. The de-viewing of an inexperienced child from the early sixteenth century seems to be an appropriate symbol for the expression of such a situation of excess and lost paradise. One imagines the artists behind this installation smiling, as proud of their clever production as the child is of his drawing. In this light – the light of art history and visual culture – *Der Zerseher* provides, as it de-views a painting, a clear view of contemporary painting and of viewing itself.

The erotic of art in the cultures of presence and meaning

The concept of double-coded perception as more analytical and distant perception or more sensual and immersive perception can also be discussed with respect to the "culture of presence" in opposition to the "culture of meaning" as developed by Hans-Ulrich Gumbrecht in his 2004 *Production of Presence: What Meaning Cannot Convey.* Gumbrecht attributes the culture of meaning with distance, reflection, interpretation and the culture of presence with the aspects of sensuality and intensity, pleasure and immersion. In opposition to the attempt of interpreting an artifact – and thus taming it – he advocates a sensual connection to the world.

Gumbrecht's concept results from his interest in the material aspects of an artwork, which dates back to 1988 when he co-edited the anthology *Materialities of Communication* (English-language version 1994). The title of his essay in this anthology, "A Farewell to Interpretation," is already allied with Susan Sontag's critique of interpretation in her famous 1964 essay „Against Interpretation". In the same spirit Gumbrecht states: "We should try to reestablish our contact with the things of the world outside the subject/object paradigm (or in a modified version of it) and by avoiding interpretation – without even criticizing the highly sophisticated and highly self-reflexive art of interpretation that the humanities have long established". [9]

Gumbrecht sees his position as in line with other condemnations of the paradigm of interpretation and dominance of semiotics and "intellectualism," such as George Steiner's 1986 *Real Presence,* Jean-Luc Nancy's 1993 *The Birth to Presence,* and Erika Fischer-Lichte's 2008 *The Transformative Power of Performance: Re-enchanting the World.* In a review Gumbrecht calls the aesthetic put forward in Fischer-Lichte's study the "philosophy of a new aesthetic sensibility" liberated from hermeneutics and semiotics, an "aesthetics for the present time" valid not only in the field of performance but also with respect to poetry or painting. [10]

The future of such „aesthetics for the present time" lies apparently in digital media as a passage in Gumbrecht's *Production of Presence* suggests where he considers the "'special *effects'* produced today by the

most advanced communication technologies" as possibly "instrumental in reawakening a desire for presence". [11] Gumbrecht does not further explain this notion and never really applies his concept to digital art. However, the implication that special effects in digital media often do not convey any meaning but only intend to present themselves is in line with the observation in Andrew Darley's 2000 *Visual Digital Culture: Surface Play and Spectacle in New Media Genres* noting the prevalence of technique over content and meaning in contemporary culture, the prevalence of a "culture of the depth-less image," a "fascination with the materiality and mechanics (artifice) of the image itself". [12]

It is exactly such "fascination with the materiality and mechanics" of the image itself that is central to the perception of *Der Zerseher* and many other examples of digital art: from *Text Rain* by Camille Utterback and Romy Achituv and *Deep Walls* by Scott Snibbe to *Listening Post* by Mark Hansen and Ben Rubin and *Bit.Falls* by Julius Popp. From the perspective of Gumbrecht the appropriate engagement with such artworks would be the 'embrace' of their presence as he proposes in his essay "A Farewell to Interpretation". The erotic connotation of this proposition mirrors the final sentence in Sontag's essay „Against Interpretation": "In place of a hermeneutics we need an erotics of art." [13] The eros of aesthetic immersion seems to be ensured best through a sensual and immersive rather than analytical approach to the artwork. Is, against this background, a close reading reaching beyond the fascination with the materiality and mechanics of an image or installation, a reading as illustrated above with the example of *Der Zerseher* the unerotic destruction of the artwork?

In his essay "Criticism and Truth," published at the same time as Sontag's "Against Interpretation," Roland Barthes notes, "Only reading loves the work, entertains with it a relationship of desire." [14] Although to read is to desire the work and to "want to be the work," to go from reading to criticism intensifies and redirects the desire: "It is no longer to desire the work but to desire one's own language". [15] Criticism makes the reader to embrace herself rather than the work. The desire of one's own language is a form of narcissism or autoeroticism. It is the eroticism of a person who uses interpretation to find her own voice; erotics on the ground of hermeneutics. The invitation to this form of autoeroticism, however, starts with the author of the artifact allowing the audience to enjoy the artwork in both, a rather superficial as well as a deep digging approach. The hermeneutic erotic of the artwork presupposes a double-coded artwork that offers to just fall in love with the materiality of the artwork but also to find love in the semiotics of this materiality.

The role of the artwork in the age of visualized communication

It is digital media that intensify the trend towards spectacle and immersion away from reflection and interpretation. One example is the visualization of communication in social media such as Facebook and Snapchat. The promised deletion of pictures in Snapchat promotes a visual chatting where one does not text that one is going to the movies but sends a snapchat of the entrance to the theater; one does not write about how one is doing but sends a selfie in front of the TV with a drink, feet up, on the coffee table. Snapchat thus promotes the transition – and in terms of media history a return –from the symbolic practices of language to a 'language' of visuality that media philosopher Vilém Flusser predicted as part of the development of digital media in the 1980s. [16] This transition replaces a reflexive communication model of language with an associative model applied to images. The sender's sovereignty over information is reduced from that involved in choosing the words that describe a situation to simply choosing the situation that is proposed for description. In other words, one only has to decide whether a certain moment should be transmitted in a snapshot or not.

The next step in this development of non-verbal and non-reflexive, immersive and frictionless sharing is proposed by Mark Zuckerberg. As he declares in a virtual town hall Q&A session on July 1, 2015 about the role of the Oculus Rift for the future of Facebook: "We'll have AR and other devices that we can wear almost all the time to improve our experience and communication. One day, I believe we'll be able to send full, rich thoughts to each other directly using technology. You'll just be able to think of something and your friends will immediately be able to experience it too if you'd like. This would be the ultimate communication technology." [17] Zuckerberg proposes the same changes in the field of journalism and hopes for "more immersive content like VR" on Facebook calling it "rich content" in contrast to "just text and photos". Thus, in a full-fledged "Facebook-Society" the BBC slogan "We don't just report a story, we live it" could become true in an unexpected and unwanted way once eye witnesses with immersive material on developing stories draw the audience from extensively researched and analysed reports. [18]

The ongoing boom in affective computing and wearables may lead to a form of communication that is, deep inside and through its medial setting, an obstacle against interpretation – though not at all against algorithmic analysis. This situation raises the question of how art – especially art working with/in digital material/ity – should reflect the cultural consequences of technological advancement. Will it simply embrace the development and celebrate the beautification of visualization as Aaron Koblin, head of Google's Data Arts team, suggests: "in the hands of a new generation of digital artists, data is undergoing a metamorphosis – from a unit of information into a fascinating, beautiful, and expressive medium"? [19] The heroes of such

perspective of "data-driven digital art" are "artists" such as Facebook employee Nicholas Felton "who tracks the data generated by his everyday activities – what he eats, who he meets, where he goes – to create beautiful annual reports of his life." [20] To be sure, there is nothing wrong with beautification and fascination – as long as it does not degenerate into mere "Data Love" [21] but still invites to what John Barth considered the second stage of perception where one starts to see more and think more about the work at hand. However, if beautification and fascination does not lure the audience into a deep digging approach, if digital art does not side with meaning, it may be popular but hardly high in terms of deep reading. [21]

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Between Decay and Preservation:
A Personal Approach to Media Art Archiving

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Abstract

Now that more than 40 years of electronic art history have passed, it is generally agreed that museums and art institutions are facing a serious problem in respect to the preservation of works of media art. A large number of historical media art works are currently disappearing due to the technical as well as organizational difficulties that their maintenance entails. While this might seem to be a problem that is only of concern for art historians and archiving specialists, artists and creative practitioners will also have to play a role in the development of practical solutions and innovative concepts to deal with the issue of decay and conservation.

Background

Dr. Oliver Grau, one of the leading figures in the field of media art history and the founder of an international conference on this topic [1], writes that many key media art works of the past 50 years are currently being lost. He states that a large part of our cultural heritage is in danger of disappearing because it is not being collected or preserved [2]. Grau argues that there is still too little awareness of the negligence of the public museums toward this art form. According to him, media art has played a key role in addressing the dominant problems of our times, but it has never managed to gain access to the art market or be properly preserved by art museums. There are some laudable initiatives such as the ZMK Digital Art Conservation conferences and the publications of that institution [3]. All and all, however, we must become more aware of the fact that our cultural heritage is being lost.

To deal with the issue of decay, impermanence and archiving we created a series of artworks called "Portrait on the Fly". In the current paper we will describe this project in detail and also look at the context of art, decay and conservation by describing various artistic strategies related to our own art practice.

Art, Decay and Melancholia

Sean Cubitt addresses the ethical component that is linked to every archiving strategy. He writes "archival encounters bring us face to face with fragile but living entities [that] carry freights both of intentions from their makers and of the accidents that have occurred to them through their lives." [4] He therefore sees the archival object as a form of confrontation with our ancestral artefacts. Pointing towards the archivist's melancholic understanding that not everything

can be saved, Cubitt recalls Walter Benjamin's suggestion that "we are the posterity to whom past generations looked to be the ones who judged." [4] This permanent state of melancholia, as described by Cubitt, is a topic that artists have also addressed.

The Dadaists, for example, reacted to the horrors of the First World War by dealing with issues of decay, loss and destruction in their works of art. In the Dada Manifesto of 1918 Tristan Tzara writes: "abolition of memory: Dada; abolition of archaeology: Dada; abolition of prophets: Dada; abolition of the future: Dada." [5]

Another reaction to the political horrors of the times can be found in the Japanese Gutai movement. In the Gutai Manifesto of 1956 Jiro Yoshihara writes "Lock up these corpses in the graveyard. Gutai art does not alter the material. Gutai art imparts life to the material." [6] Florence de Mèredieu states that after the defeat of Japan in the Second World War, when the emperor ceased to be regarded as sacred, Japan went into a profound state of trauma. Artists in Post-War Japan reverted to a latent nihilism that exalted the beauty of destruction. While Gutai to some degree celebrated destruction, Mèredieu also detects a playful and festive attitude in this art movement: "it is because chaos heralds new beginnings and creates the conditions that make new experiments possible. Beauty is simpler and more fragile there. Ephemeral, like the actions of the group." [7]

Chaos and destruction were also described as sources of new energy by the German artist Joseph Beuys, who had been a soldier in World World II and had suffered serious depression: "Chaos may have a healing aspect; in its link with the idea of an open movement it channels the energy heat of chaos, [thereby transforming it] into something ordered and put into form." [8]

Kristine Stiles suggests that the body of the artist holds aesthetic and social signs that also commute political power. "In this sense, destruction art is a warning system, an aesthetic response to human emergency that occurs in the lapse between theory and practice in terminal culture." She suggests that the artist, when faced with extinction, must, if s/he takes responsibility for his/her trust, put art in the service of survival, as "the body conveys the interdependent, interconnected and contingent state of the individual and the collective in survival" [9]. This personal connection between the artist's body and general states of destruction, decay and disappearance can be found in many other examples of art history. The Viennese Actionists in Post-War Austria often performed painful rituals, ceremonies and self-mutilations on their own bodies or those of dead animals [10]. Artists around the Italian Arte Povera movement also introduced elements of decay, for example by utilizing natural materials

that decompose or age. A famous example is Piero Manzoni *Artist's Shit* from 1961. [11] This proponent of the Italian Arte Povera movement produced ninety 30 gram tins of his own excrement and sold them for the value of their weight in gold. While this is clearly a parody of his own status as an artist, it can also be seen as an interesting strategy for archiving himself and conserving a product of his body as an artwork.

Gustav Metzger's manifestos of Auto-Destructive Art include many interesting points that show some relation to today's media art. In his manifesto of 1959 he writes: "Auto-destructive art can be created with natural forces, traditional art techniques and technological techniques.…The artist may collaborate with scientists, engineers. Self-destructive art can be machine produced and factory assembled. Auto-destructive paintings sculptures and constructions have lifetimes [that vary] from a few moments to twenty years. When the disintegrative process is complete, [they should be] be removed from the site and scrapped." [12] Two years later he included the term auto-created art and proclaimed: "Auto-creative art is art of change, growth, movement. Auto-destructive art and auto-creative art aim at the integration of art with the advances of science and technology. The immediate object is the creation, with the aid of computers, of works of art whose movement are programmed and include 'self-regulation'". Electronic devices enable the spectator to "have a direct bearing on the action of these works. Auto-destructive art is the attack on the capitalist values and the drive to nuclear annihilation." [13]

A good example of this type of auto-destructive art is Jean Tinguley's Homage to New York, which he realized for the sculpture garden of the Museum of Modern Art. The plan was to create a self-destroying machine that was composed of a meteorological balloon, breakable bottles, a piano, hammers, saws, bicycle wheels and other items he had found. Unfortunately the machine refused to destroy itself and Tinguely wrote: "It wasn't the idea of a machine committing suicide that fascinated me primarily, it was the freedom that belonged to its ephemeral aspect- ephemeral like life, you understand. It was the opposite of the cathedrals, the opposite of the skyscrapers around us. The opposite of the museum idea, the opposite of the petrification in a fixed work of art." [14]

Another radical proclamation of destructivism in art was made by Rafael Montanez Ortiz, who became famous for his participative piano destruction performances. In the Destructivism Manifesto of 1962 he wrote: "The artist must give warning, his struggle must make a noise, it must be a signal. Our screams of anguish and anger will contort our faces and bodies, our shouts will be 'to hell with death,' our actions will make a noise that will shake the heavens and hell. Of this stuff our art will be, that which is made will be unmade, that which is assembled will be disassembled, that which is constructed will be destructed. …The art that utilizes the destructive processes will purge, for it gives death, so it will give life." [15]

It is interesting to see that even in the manifestos of Dada, Gutai, Actionism and Destructivsm there is always a component of creation that is linked to destruction and decay. Perhaps this is because the artist has a melancholic longing to transform destruction and decay into a creative process, even after the artefacts have disappeared.

Decay and Conservation in Media Art

Of course artists have been dealing with archiving and conservation strategies for a long time. They have always been interested in strategies to keep their artefacts and create long-term value, for example by having their works included in important museums, collections and foundations.

The situation in media art is, however, more complicated due to the fragility of digital technologies. The Variable Media Network (1999-2005) coordinated by the Daniel Langlois Foundation in Montreal and the Solomon R. Guggenheim Foundation in New York, claimed that media art is innately ephemeral and that reinterpretation would be the best way to conserve it [16]. However, there is now more understanding that institutions must shift their focus and assume more responsibility for communicating the historicity of historic works of media art. In a recent exhibition called *Digital Artworks. The Challenges of Conservation* the ZKM Media Museum in Karlsruhe showed that the strategy of storage and hardware preservation has its place in the conservation of digital art and that several different strategies must be simultaneously employed if digital artworks and their contexts are to be conserved [17].

An interesting point concerning media art preservation is also made by Spanish media artist Antoni Muntadas, who states that both the artists and the museum are responsible for employing preservation procedures. He however suggests that " museums and artists need to accept [the fact] that there is a need to destroy more [artworks]. Artists should destroy more works, and keep works that are most relevant. Why keep all the work ? In scientific research, for example, only data which is relevant is kept. In artworks, we could keep what we think is the synthesis of the work. Everything that surrounds the works, those things that become the objects of fetishistic admiration or market interests, should not be preserved. We need to destroy more. We need to make decisions." [18]

This connection between artworks that survive and ones that are lost is also pointed out by media art pioneer Jeffrey Shaw. He states: "This is also interesting, because [in some cases] …technological obsolescence …does impact the viability and integrity of the work, but in other cases the aesthetic and functional properties of the work can transcend that." He says that the longevity of an artwork gives him a certain pleasure as this piece of art "starts to go beyond the time of its immediate concerns. Because then it becomes a historic object, and it becomes a reference in terms of art history and you can see it in a different light." [18]

Referring to media art, Jussi Parikka writes that today "the big challenge is to think through what to do with decay and processes, and how to tap into cultural heritage, and hence also [what to do about the] conservation of digital art that is about electromagnetic fields, number crunching, network pings, and screens that are only stable when they refresh." [19]

Portrait on the Fly- An Artistic Approach to Media Art Archiving

For 25 years we have been creating interactive artworks that deal with artificial life processes and evolution and are linked to user participation. Many of these creations only appear when the user interacts with them, so their essence is ephemeral. However, conservation has always been an important focus for us and we keep updating, upgrading and porting the hardware and software whenever it is possible to do so. But, as pointed out earlier, digital obsolescence is becoming more and more of an issue, especially at times when hardware and software are being replaced at an ever increasing rate.

It is of course unfortunate that many important artefacts of media art are currently disappearing because they are not being properly collected and preserved. When talking to our artist friends we often heard that their early media artworks have vanished because nobody had the time and money to preserve them. However it is also clear that Antoni Muntadas is right when he claims that artists need to become more proactive and make decisions about what to keep and what to discard. We therefore decided to create an artwork that deals proactively with the issue of impermanence in a pragmatic manner. Similar to the Destructivists, we use the issue of decay as a motif for a series of art works.

They are called *Portrait on the Fly* and consist of a series of interactive portraits, plotter drawings and video portraits. Their main motif is a swarm of digital flies that can compose faces and outlines of people. An inspiration for this series was derived from the fantastic portraits that Guiseppe Arcimboldo made from parts of plants and animals in middle of the 15th century. Roland Barthes ascribes a certain scientific method to Arcimbodo's research into botanical as well as zoological details. At the same time, he remarks that artistic freedom and monstrosity are celebrated in these paintings [20]. While Arcimboldo's portraits are composed of many different animals, for *Portrait on the Fly* we only utilize one insect, a simple fly. In many cultures the image of the fly is associated with death and decay. In forensic entomology, for example, the fly is used to determine the exact time of death, as it is the earliest insect to infest a corpse and it plays an important role in the decomposition of bodies. [21] We are aware that using the symbolism of the fly in our artwork is rather morbid, it signifies a certain fragility of media art per se.

Portrait on the Fly – interactive version

Portrait on the Fly (Interactive Version) is composed of an interactive monitor that shows a swarm of ten thousand flies [22]. The algorithms for their movements were programmed by us; they were inspired by the behavior of real flies and simulate the motions these insects make when they are flying.

When a person positions him or herself in front of the monitor, the camera detects his or her outline and communicates it to the artificial insects. They then begin to arrange themselves so as to reproduce his or her facial features, thereby creating a recognizable likeness. As soon as anybody poses in front of the monitor, the flies are attracted to the image of his or her face. Within seconds they invade it, but even the slightest movement of the head or facial features drives them off. The portraits are thus in constant flux; they construct and deconstruct. *Portrait on the Fly* is a commentary on the extent to which we love to make pictures of ourselves (Selfie-Culture); it has to do with change, transience and impermanence. It celebrates the ephemeral moment of self-portraiture; each image only exists for one brief instant.

Fig 1. *Portrait on the Fly,* 2015, Laurent Mignonneau and Christa Sommerer, interactive installation.

Fig 2. *Portrait on the Fly,* 2015, Laurent Mignonneau and Christa Sommerer, interactive installation.

Portrait on the Fly – Plotter Drawings

Portrait on the Fly (Plotter Drawings) also exists in the form of a series of plotter drawings. Snapshots of digital fly portraits are printed out in plotter-style drawings of the 1960s. Ephemeral moments of interaction are thereby immortalized in the form of graphical drawings.

The first of these artworks is an auto portrait. The series includes likenesses of important media art experts, theorists and artists, such as Jeffrey Shaw, Frieder Nake, Mark

Wilson, Hans Dehlinger, Edmond Couchot, Hannes Leopoldseder, Christine Schöpf, Peter Weibel, Lynn Hershman, and many others. Its aim is to conserve valuable original images of the historic figures who are involved in media art. The idea of going back to a unique original image after having explored process-based and ephemeral art also relates to a fundamental problem of media art - the need to create artefacts which remain unaltered.
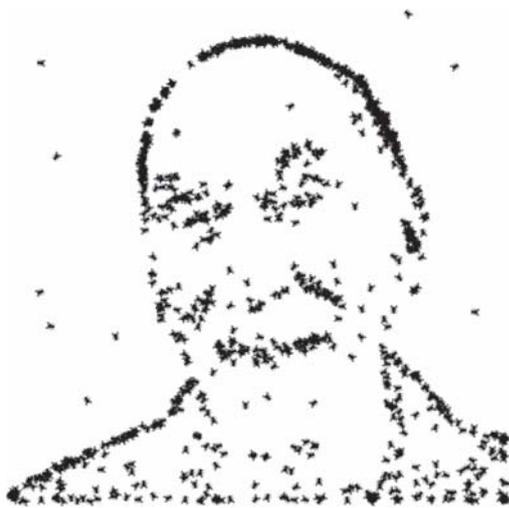
Fig 3. *Portrait on the Fly (Frieder Nake),* 2015, Laurent Mignonneau and Christa Sommerer, plotter drawing, original, signed.

Fig 4. *Portrait on the Fly (Jeffrey Shaw),* 2015, Laurent Mignonneau and Christa Sommerer, plotter drawing, original, signed.

Portrait on the Fly – Video Portraits

This is an ongoing digital archive which consists of short video sequences where the moving portraits of well-known media art pioneers, scholars, artists, theorist, gallerist and organizers are turned into swarms of flies. They include so portraits of Marie Hélène Tramus, Christiane Paul, Sarah Diamond, Peter d'Agostino, Gerfried Stocker, Oliver Grau, Maurice Benayoun, Paul Thomas, Jill Scott, Paul Sermon, Simon Biggs, Greg Garvey, Thecla Schiphorst, Jean-Luc

Soret, Chu-Yin Chen, Dominique Moulon, Nina Czeglédy, Ellen Pau, Wolf Lieser, Anita Beckers, Tomoe Moriyama, Erkki Huhtamo, Machiko Kusahara, Hiroshi Ishii, Ryszard Kluszczynski, Annick Bureaud, Derrick de Kerckhove, Jean-Louis Boissier, Anne-Marie Duguet, Sabine Himmelsbach, Karin Ohlenschläger, Maria Grazia Mattei, Victoria Vesna, Sean Cubitt, Minoru Hatanaka, Masahiro Miwa, Joachim Sauter, and many others.

It is a personal collection of fly portraits of our peers who shape and have shaped the field of media art. It is our personal homage to our friends and colleagues and a celebration of the archivist's melancholic understanding that not everything can be saved. Torn between knowing that media art is a form of art that is linked to decay and destruction, this work also envisions a format that can survive longer. Or as Jeffrey Shaw expressed it, "your biggest problem, your biggest challenge is the mortality of the artists who made these works. Because once they are gone, you're lost." [23]

Fig 4. *Portrait on the Fly (Anne-Marie Duguet),* 2015, Laurent Mignonneau and Christa Sommerer, screen shot from video portrait.

Conclusion

In this paper we have shown that decay is a topos that we encounter throughout many decades of art history. From the Dadaist, to Gutai, the Viennese Actionists to the manifestos of Arte Povera and Destructivism, impermanence has been a topic that inspired many artists. Media art is an especially ephemeral form of art, since its components are particularly prone to obsolescence. A recent surge of media art archiving strategies shows that there is a longing for more permanence and for the conservation of artefacts of art history. We have taken a proactive approach towards media art archiving by proposing a personal artistic strategy that involves the collection and preservation of portraits of important media art protagonist. At the same time we highlight the problematic and melancholic component that is related to such an undertaking. We are aware that celebrating decay is always linked to new possibilities of creation. Or, as Ortiz said, "the art that utilizes the destructive processes will purge; it gives death, so it will give life." [15]

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Microtemporality: At The Time When Loading-in-progress

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Abstract

Loading images and webpages, waiting for social media feeds and streaming videos and multimedia contents have become a mundane activity in contemporary culture. In many situations nowadays, users encounter a distinctive spinning icon during the loading, waiting and streaming of data content. A graphically animated logo called throbber tells users something is loading-in-progress, but nothing more. This article investigates the process of data buffering that takes place behind a running throbber. Through artistic practice, an experimental project calls *The Spinning Wheel of Life* explores the temporal and computational complexity of buffering. The article draws upon Wolfgang Ernst's concept of "microtemporality," in which microscopic temporality is expressed through operational micro events. [1] Microtemporality relates to the nature of signals and communications, mathematics, digital computation and dynamic network within these deep internal and operational structures. [2] Through the lens of microtemporality, this article offers a new understanding of a throbber icon beyond its symbolic form and human sensory reception. It opens up the cultural and computational logics that are constantly rendering the pervasive and networked conditions of *now*.

Introduction

Loading images and webpages, waiting for social media feeds and streaming videos and multimedia contents have become a mundane activity in contemporary culture. In particular, this includes network connected devices from fixed desktop computers to portable tablets and smart watches, all involving data transmission across multiple sites—referred to as data streams. In many situations nowadays, users encounter a distinctive spinning icon during the loading, waiting and streaming of data content. A graphically animated logo called throbber tells users something is loading-in-progress, but nothing more. Unlike a progress bar, a throbber is perceived as repeatedly spinning under constant speed. In contrast to a progress bar which is more linear in form, a throbber does not indicate any completed or finished status and progress. Commonly, a progress bar explains such computer operations, for example, transferring and copying specific files and directories, and illustrating installation procedures. Arguably, when a software application connects to a technological network, such as a home or mobile Internet network, things get more complex.

This article investigates the process of data buffering that takes place behind a running throbber. In particular, it examines the temporal complexity of data streams, in which data processing and code inter-actions are operated in real-time. The notion of inter-actions mainly draws references from the notion of "interaction" from Computer Science and the notion of "intra-actions" from Philosophy. [3][4][5] The term code inter-actions highlights the operational process of things happen within, and across, machines through different technical substrates, and hence produce agency.

This article is informed by artistic practice, including close reading of a throbber and its operational logics of data buffering, as well as making and coding of a throbber. These approaches, following the tradition of artistic research, allow the artist/researcher to think in, through and with art. [7] Such mode of inquiry questions the invisibility of computational culture. By focusing, using and producing a throbber, it suggests a different engagement and possibility of seeing this cultural icon and its related background activities in a different way. This article also draws upon the concept of "microtemporality" in the work of Wolfgang Ernst, in which microscopic temporality is expressed through operational micro events. [1] Microtemporality relates to the nature of signals and communications, mathematics, digital computation and dynamic network within deep internal and operational structures. [2] Ernst's microtemporality is also linked to his notion of discontinuity which is grounded on Michel Foucault's *The Archaeology of Knowledge*. [8] According to Foucault, his concept of discontinuity offers an alternative perspective to understand knowledge beyond its stable form of narration and representation. [9] Both Foucault and Ernst use the term discontinuity as a means to examine the gaps, silence and ruptures of things that go beyond signs or representational discourses. Although a throbber icon becomes a standard way of implementation in contemporary software culture, the micro events that happen behind a throbber indeed react differently. This complexity of time conception is explored and exemplified in an experimental and artistic project calls *The Spinning Wheel of Life*.

Rethinking the notion of time beyond users' perception, this article and the artwork open up the cultural and computational logics that are constantly rendering the pervasive and networked conditions of *now*.

A cultural reading of a throbber

With its distinct characteristic of spinning design that indicates background processing, the throbber icon acts as an interface between computational processes and visual communication. One of the earliest uses of the throbber can be found in the menu bar of a Mosaic web browser in the early 1990s, developed by National Center for Supercomputing Applications (NCSA) and the browser interface was designed by scientist Colleen Bushell [10][11]. The browser throbber contains a letter 'S' and a globe that could spin when loading a web page. This kind of a spinning throbber, with the company browser's graphical logo, has also been seen in subsequent software browsers. While the throbber spins, it visually indicates actions are in progress. These actions, from a user point of view, could be interpreted as the loading of web data or connecting to a website by a software browser. From a technical perspective, it involves Internet data transmission and a browser that renders the inter-actions of code. The spinning behavior stops when a webpage is finished loading within a browser. A web browser, according to Tali Garsiel and Paul Irish, is software able to render and display requested content, make network calls and requests, and store data locally. [12] In this respect, the spinning throbber icon represents complex inter-actions of code under network conditions. A throbber with its spinning characteristic, therefore, can be said to be rooted in, and specific to, Internet culture.

More recently, the throbber icon is no longer only attached to software browsers, it also appears on different web and mobile applications, and social media platforms in particular. The contemporary throbber transforms into a spinning wheel[1] that consists of lines or circles that are arranged in radial and circular form, moving in a clockwise direction. Each individual element of a wheel[2] sequentially fades in and out repeatedly to create a sense of animated motion (see Fig 1).
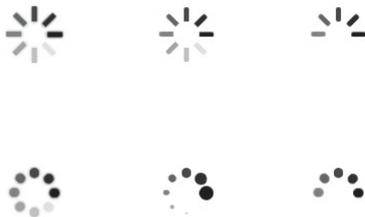
Fig 1. *Throbber sequences in the form of circles and lines*,

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[1] The use of lines that indicates the progress activity of a computer can be found in the early operating system of Unix. [13]

[2] Coincidently, the visual design of a throbber is similar to the design of early wristwatches (with crystal guards) that were made for soldiers in World War I. Both include the concept of a wheel in the form of circles or lines of the petal shape. See: http://www.oobject.com/category/earliest-wrist-watches/

2015, designmodo, web, the image is retrieved from http://designmodo.com/css3-jquery-loading-animations.

These spinning wheels appear after a user has triggered an action, such as swiping a screen with feeds to requesting updated information. They also appear after a user has confirmed an online payment, or is waiting for a transaction to complete. Most commonly, it is seen when a user cannot watch a video clip loading smoothly over an Internet connection. As a result, an animated throbber appears as a spinning wheel on a black colour background, occupying the whole video screen while the video is buffering.

A throbber represents the speed of network traffic that also seems tied to our emotional states and perception of time. Emotionally, it can be annoying and frustrating while one encounters buffering because it involves interruption. [14][15] Things do not flow smoothly, and users become impatient in waiting for an unknown time or watching for something yet to come. As James Charlton puts it: "It is a gaze that goes beyond the screen to an event not yet here." [16] To Charlton, the loading time of the throbber is wasted and unproductive as it is often associated with the perception of the slowness of a network.

Perhaps, there is a desire in which things would flow continuously, as something like broadcast television. The notion of flow was theorized by a media scholar Raymond Williams in 1974, in which the programming of content implies continuity, stemming from the experience of viewing and reception. [17] The interruption, what Williams calls "natural break," of the advertisement on television, is a planned flow as part of the television production. [18] Most importantly, the notion of flow is an expected sequence, such as the number of breaks and the corresponding duration, to engage with audiences. Therefore, television exhibits a relatively stable temporality. However, in a networked medium, the interruption, such as buffering, cannot be planned as with television insofar it is subjected to its material conditions at any moment of time.

The material nature of the network exhibits something that is unpredictable, unstable and discontinuous, which is beyond seemingly 'natural' breaks, and beyond visible and apparent interruptions. In the following section, I will elaborate on what I refer to as 'discontinuous microtemporality' as a way to rethink the notion of flow and stream in networked environments.

Discontinuity in streams

The network structure of today's communication channels and their streams are often understood as providing a direct connection between users and services or between two communication partners, even though there cannot be any direct links on digital networks. The metaphor of the flow conceals the fact

that, technically, what is taking place is quite the opposite. There is no stream in digital networks. [19]

In a general sense, data is generated under different circumstances in the network environment, traversing at various speeds and spaces across platforms and continents. In the context of data buffering within computational networks, temporality refers to the processing and the unfolding of data over time that generates differences and rhythms. Although there are numerous scholarly works discuss temporality in relation to the subjectivity of time, [20] less attention is paid to the material aspect and the nondiscursive realm of temporality. This comes close to what Ernst describes as 'microtemporality,' focusing on the detailed processes of computation. Instead of examining obsolete objects,[3] as demonstrated in much media archaeology, the emphasis is more associated with the nature of signals and communications, mathematics and computation within its deep internal and operational processes. [21]

In today's networked communication, data is regularly perceived as a stream, indicating its characteristics of vast volume, the speed of update and delivery. However, Florian Sprenger reminds us that the notion of flow and stream are metaphors. The temporality of the perceived flow/stream involves imperceivable discrete-time system, [22] the transmission of data packets, [23] temporal storage and transfer, [23] and micro-decisions by numerous protocols. [24] A stream produces differences and rhythms due to things—calculations, mathematics and logics—that are executing and running in real time. The implication is that these operative processes cannot be seen as planned sequence of flow, and that there is a temporal dimension to such operative logics that reconfigure our understanding of temporality in computational processes.

As opposed to continuous-time signals in analogue systems, the digital adopts the model of a discrete-time system with independent variables in signal processing. This model means that each discrete state is countable and measurable with a distinct value, and can be represented by a sequence of numbers. The signals are discrete in time (see Fig 2), alluding to the value between two discrete-time instances is not defined. Therefore, the 'flow' of data that we experience through a screen is discrete in its nature. Within digital signal processing, the data stream is discontinuous (discrete) regarding its time signal.
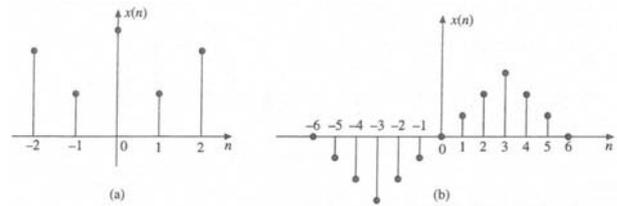
Fig 2. *Discrete time signals*, 2015, A. Anand, Kumar, Print, Copyright 2015 by PHI Learning Private Limited.

In the early design of modern communication networks, the concept of 'packet switching' was fundamental to understand how data was organized and flowed. A data stream was chopped into smaller blocks as 'packets' that were then sent a communication channel in and through different routes, rates, and sequences, known as packet switching. According to Paul Baran, one of the inventors of the packet switched computer network, real-time connections between a sender (transmitting end) and a user (receiving end) are an illusion. Instead, the fast enough data rate gives a *sense* of real-time connection between a sender and receiver. [23] Fundamentally, the routing of a data packet transmits through different nodes and routers. Although a selected path is based on "adaptive learning of past traffic," there are real-time decisions that have to be made to locate the shortest path due to the dynamic of network conditions [23]. In other words, data travels "via highly circuitous paths that could not be determined in advance". [23] Data packets are inscribed with a sequence of numbers and the function of checksum that made them possible to reformulate a correct sequence that makes sense of the perceived content. This assembling process involves the use of a temporary buffer. Baran explains as follow:

On the transmitting end, the functions include chopping the data stream into packets, adding housekeeping information and end-to-end error control information to the out-going packets. On the receiving end, each multiplexing station uses terminating buffers temporarily assigned to each end addressee to unscramble the order of the arrived packets, and buffer them so that they come out as an error-free stream, only slightly but not noticeably delayed. [23]

What is interesting here is the barely noticeable delay time that gives the perception and illusion of a stream. In this journey of data packet transmission, Sprenger argues that there are numerous "micro-decisions" that are made through network protocols. [24] For instances, the decision of locating "the most efficient path to the destination," the speed of data processing and "the priority of incoming packets." [25] All these decisions are made to control how data is distributed. Even though the time may not seem significant, still there is time lost along the journey. [26] This journey involves interruption at different nodes, transmitting and receiving ends in which data disassembling and assembling occur.

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[3] For instances, Friedrich Kittler's analysis of the gramophone and typewriter in 1999, or Wolfgang Ernst's analog radio and phonograph in 2013.

As such, "[t]he stream never flows uninterruptedly." [25] This constant interruption constitutes the notion of microtemporality that includes decision-making processes, controls and regulations that are programmed at the level of protocols and are inscribed in the stream.

Such processes do not only occur at the network level but also at the memory and storage level which are highly relevant to code inter-actions that involve both hardware and software. [27] Data is processed at a receiver's end (as input data in the buffer) and is stored temporary and locally until the data is further processed by the software application (as output data). The term buffering describes the process of input and output of the buffer – the activities of writing and storing, reading and processing that are happening at the same time but not acting on the same bit and piece of data. Buffer refers to the processing of all kinds of data with different "data transfer rates and/or data processing rates between sender and receiver." [27] In other words, the processing of data consists not only of the transferring part but rather as Ernst remind us, through "a coupling of storage and transfer in realtime." He continues, "[w]hile we see one part of the video on screen, the next part is already loaded in the background." [22]

Theoretically, Just in Time (JIT) delivery is used in streaming media, allowing for the playback of partially received data temporarily stored in the client's buffer. In this sense, both the playback of buffer data and receiving the remaining data can be made simultaneously (and, in addition to the case of video and audio, this is also commonly experienced in loading any relatively large size file such as a PDF or an image within a browser). Therefore, streaming "is achieved by buffering the transmitted data before the actual display." [28] Ideally, according to Meinel and Sack, "buffer empties itself at one end just as quickly as it fills up at the other end". If there is transmission delay that is within a threshold time t, it is regarded as unnoticeable in playback. [28] However, if the delay of the individual segment exceeds the threshold time t, a throbber will display. A throbber is seen when loading a big chunk of data, which is commonly seen on video sites such as Youku or YouTube, mostly due to the instability or low bandwidth of a network that causes the delay of data segment arrival (exceeds the threshold time t).

Indeed, buffering is highly related to time, inasmuch as the primary purpose of a buffer "is to reduce time dependencies of the data and to decouple input/output from the program execution." [27] As a result, data can be consumed (as input) and processed (as output) at a different rate. Data, in the case of streaming, is actively and repetitively being stored (write) and removed (read) in the buffer with different rhythms (see Fig 3), oscillating between the invisible and visible, and this is how we can only immanently experience the microtemporality of buffering.
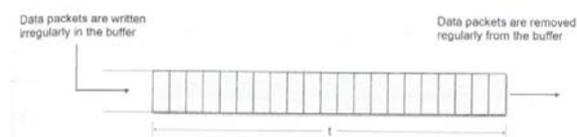
Fig 3. *Principle organization of a playback buffer*, 2013, Christoph Meinel & Harald Sack, Print, Copyright 2013 by Springer.

From the operative logic of streaming, we know there are calculable processes, data transmissions, reading and writing of the buffer at different rates. The operative logic is automated, and is built into the infrastructure of software as code. What has been written in the buffer will be automatically read and processed. However, technology does not guarantee that all the data is written in the buffer.

Dropped frames (frames of video that are dropped during playout) are a relatively common experience in real-time communications and video streaming. Sometimes the issue of dropped frames is seamless because it does not create significant quality degradation. Such visible and invisible dropped frames are caused by packet loss, the absence of certain parts of data during data transmission across nodes and routers through the journey. Time lost, as mentioned above, includes micro-decisions making as well as interruptions and delays. Packets are required to queue up and wait for the transfer while the network is congested. Under streaming conditions, data is continuously transmitted from a sender to a receiver across multiple sites. However, the amount of buffer space is limited at each site which means the newly arriving packet has no space to the stored while the stored packet is still queuing for its next routing. In this situation, "packet loss will occur-either the arriving packet or one of the already-queued packets will be dropped." [30]

Packet loss does not only limit to streaming applications but also other kinds of software applications in contemporary software culture. For real-time conversational applications and media streaming platforms, such as Skype and YouTube, the delay time for each packet is crucial because the transmission demands have to be perpetual as conversations and live concerts are unceasing. On the one hand, the absence of data is central as packet loss is related to the degradation of quality, and it could immediately impact the visual or audio quality with jitters or glitches in a live environment. On the other hand, if data arrives with a significant delay, the application design at the receiver's end is then required to determine if such data will still make sense in playback, in particular where conversation and data are continuously played-back as a stream. In deciding whether the data should be played-back or ignored, acceptable latency becomes a decision that is inscribed in the software and platform design. A serious data loss may even result in the automatic termination of a connection. More precisely, data packets are not only transmitted at different rates (speed), but also with the

potential to be dropped at any time as absent data. In addition, absent data might not cause noticeable effects in digital communication as it is subjected to the amount of loss and the level of acceptable latency that are designed into software applications.

Therefore, not all data is treated equally and has the right to arrive at the destination and able to take a perceptible form. The automated micro-decisions and computational processes, again, reconfigure the temporality of networks by discarding absent data. The notion of microtemporality explicates the invisibility of computational culture by shifting our attention from what is visible on a screen to invisible micro events that are running in the background.

The Spinning Wheel of Life

Such reflection of invisibility is made apparent in the artistic project *The Spinning Wheel of Life*, emphasizing the microtemporal dimension of code inter-actions that are manifested in the throbber. The title of the project is borrowed from a 'wait cursor' in the Macintosh Operating System X designed by Apple. The wait cursor is colloquially known as "The Spinning Wheel of Death," referring to the malfunction or failure of a running program or a system that leads to screen freezes. The name takes on negative connotations, as the problems are usually difficult to diagnose. My version of the spinning wheel is designed to reveal the microtemporal complexity of data transmission and storage, and takes buffering to be a cultural activity that is nonhuman-oriented. The project does not involve human manipulation directly, but rather it processes in real-time through code inter-actions. The visual outcome is subjected to the technical conditions of its operation at a given moment in time.

The Spinning Wheel of Life consists of a throbber that animates in different rates. Each ellipse within the throbber represents a new data packet arrival. The time for each fading ellipse is adjusted to an optimal level in which a balance of the visual composition is achieved. Since packets arrive at multiple time and space, and sometimes a huge amount of packets arrive at almost the same time (the time is down to milliseconds), the visual throbber yields an unusual and uneven spinning wheel—from having just a few ellipses to a full throbber with all the ellipses displayed brightly. Each ellipse fades in and out with different tempo, subject to the network conditions in real time. The project makes apparent the underlying notion of discontinuous microtemporality.

Figures 4-9 below have documented the animated movements of *The Spinning Wheel of Life*; it reacts to the network packets that are generated from running a YouTube playlist in real-time.
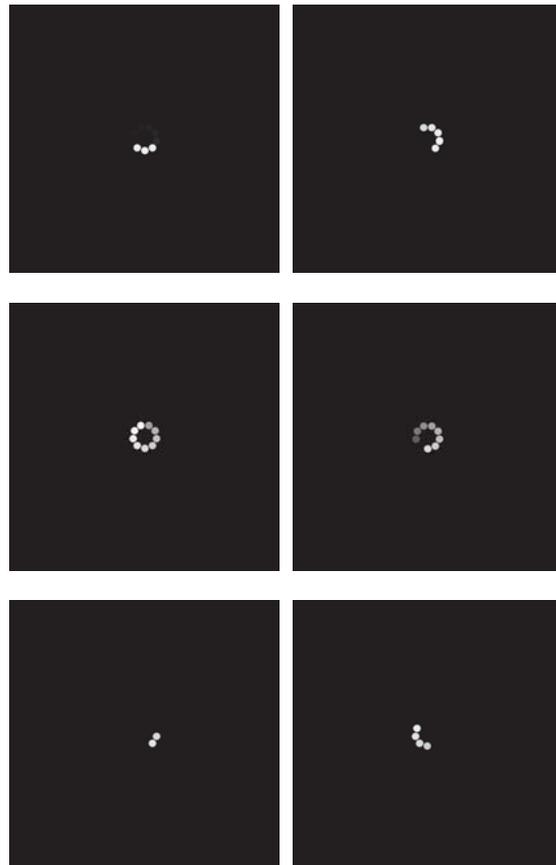
Fig 4-9. The animated visuals of *The Spinning Wheel of Life* (2016)

There are different rates, tempo, pulses, pauses and rhythms at multiple scales - from the operations of the CPU to network routers, from the transmissions of senders to receivers, from the writing to the reading of buffers, and from continuous streams to discontinuous packets. The artwork presents an ongoing operative processing, addressing the microtemporality of its inter-actions that underpin the networked logic of contemporary software culture.

Time is an important element in contemporary software culture as it governs how a signal is processed, how data is transmitted and how micro-decisions are made. As a result, a stream is constantly being interrupted since the start of data transmission, but not at the time one encounters a throbber animating on a screen. The complex process of buffering, as I argue, exhibits a very particular temporality that sheds light on an understanding of software culture and how it processes time.

Conclusion

The notion of discontinuous microtemporality highlights the temporal dimension of the stream as part of our contemporary condition. As Peter Osborne remarks, contemporaneity "is primarily a global or a planetary fiction," which suggests a stream is highly capitalized under these globalized processes that disseminate into

every part of the world. [31] *The Spinning Wheel of Life* calls for critical attention to these networked but also mediated processes, not only at a planetary scale but at the microtemporal level of operations. In this contemporary software culture, things are immanently networked, and data are constantly generated, the notion of discontinuous microtemporality highlights not only the differences and rhythms of code inter-actions, but also the absent and silent of data that is beyond human sensory reception. The complex process of data buffering, as I have argued, exhibits a very particular kind of discontinuous microtemporality. This sheds light on not only the computational logic behind a throbber, but also the real-time dynamics of computational networks in a general sense, and hence the rendering of the pervasive and networked conditionings of *now*.

In other words, the artwork is a reflection of the perpetual, cultural and social changing conditions. On the one hand, the existence of a throbber is a by-product of a commercial application that informs users to wait for an unknown period of time. On the other hand, through the development of various services, such as live streaming, big data analysis, social media platforms, data predictions and transactional applications, it offers a critical space to understand how a throbber is being made operative. A throbber is a cultural phenomenon that appears in almost every application that requires a live computational environment. A throbber is not only a technical or visual object but also entangled with other cultural and micro processes that render the unknowable more knowable.

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Techno Sex in Art: Mating Man and Machine
In the Solve et Coagula Experiment

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Abstract

Techno Sex concerns embodied and situated experiences. One central research question is in how far advanced technologies allow for corporeal and physical techno-sexual experiences? In particular how one can establish satisfying physical connections between technologies and humans? The paper presents *Solve et Coagula* as one of the imperative media art projects to create a physical amalgamation between a human user and a computer programmed to feed of the users emotions. The project demonstrates how a tactile bodysuit in combination with the development of a haptic language can be used to create corporeal connections in applications relevant to techno sex. The project reveals usability issues relevant for the design of future haptic systems facilitating for intimate relations between humans and machines.

Mapping the Field

Today technologies are used in abundant ways to enhance how humans conduct and experience sex. Techno Sex comes in a great variety, spans across several fields and problem areas. It currently poses more questions and challenges than it can answer. How do Techno Sex impact human relations? Is it transhumanism on steroids? If more appealing and less threatening than 'true' intimacy, can it then enhance and improve sexuality, overcoming the many sexual tensions and repressions currently experienced? Will Techno Sex with its Sex Bots provide solutions that eliminate prostitution? Or is it hypersexualizing our society? With a consequent negative impact on how women are valued. From a biopolitical point of view, Techno Sex might even be the perfect prison or societal control mechanism: if it gets so good that it keeps us happily and busy in (some kind of) bed, then there's no reason for joining the ®evolution outside in the streets. [1]

From a technological point of view, the current status of Techno Sex is rather primitive and far from the dream of the perfect humanoid replica or omnipresent sex slave. Actual techno sex toys and robots are mechanically speaking crude and based on haptically cold, unnatural materials such as plastic. Although there are several interesting products ranging from Real Dolls to Chat bots and digitally controlled vibrators synchronized to 3D, navigable porn movies such as RealTouch™, we are still in a position where we sexualize technologies more than the Tech Sex products actually singlehandedly satisfy us. [2] Such sexualizing of technologies is called The Pygmalion Syndrome: 'that is indicative of the highly mythic content with which we as a culture have imbued our thinking machines. [3]

One central research question is therefore in how far advanced technologies allow for physical techno-sexual experiences? In particular how one can establish satisfying physical connections between technologies and humans? How to make Techno Sexual experiences like Ivan E. Sutherland's 1965 description of *The Ultimate Display*, the display that transforms the virtual into the physically real and possibly even lethal? [4] In the context of electronic art, this paper investigates a techno-sexual fusion between a human user and a machine tuned to emotional experiences. The actual physical connection of a human to a techno-sex interface is a haptically complex problem. To achieve some kind of sensorial connection akin to 'natural' sex between two humans is one precondition for having Ultimate Techno Sex, as Sutherland would describe it. A fundamental challenge is how to technologically create an experience of feeling touched? This can be solved in several ways and the *Solve et Coagula* (SeC) artistic experiment demonstrates how it is possible to mechanically reproduce complex patterns of touch applicable to the experiencing of techno sex. [5]

Status Questionis: Corporeal Techno Sex in Art

How do we make art out of the techno-sexual, that is aesthetically valuable experiences resulting from the erotic amalgamation of body and technology? The techno-sexual can be described as any technology that somehow affects human sexuality and human sexual conduct. The Techno Sexual domain has a long history. Like what monkeys of both sexes are observed doing today, early human ancestors must have done too, that is masturbate with sticks, stems and even plants. [6] Humans have also carved elaborate masturbation devices for centuries, the oldest known dating 28.000 years back.

[7] In the context of electronic art Techno Sex can also be understood as cybersex, describing erotic and sexual pleasures experienced through cybernetic, digital, and computer-based technologies and communication. [8] [9] Whereas sex and sexuality plays a historic, and at times explicit role in the visual arts, there has not been many explicitly touch based Techno-Sex experiments within the community of electronic art. Two of the best-known and most innovative projects involving touch in a sensual manner significant to the understanding of techno erotic experiences are Telematic Dreaming (1992) by Paul Sermon and Bodymaps (1995-97) by Thecla Schiphorst. [10] [11]

Telematic Dreaming connects two double beds, each with one participant, in separate locations via a real-time videoconferencing network. The participants see the projection of each other on the bed, thus giving a visual and telepresent impression that they share the same bed. The video-based installation contains neither direct tactile stimulation, nor any sexual references, but users report a strong sense of physicality both when touching the projection of the other and when being virtually touched. [13] The installation is a prime demonstration of how haptic vision, that is how users produce a mental impression of being touch by watching the live imagery. This indicating how and why we can find telematic embraces intimate, personal, and often sexual.

Bodymaps: artifacts of Touch is an interactive video and sound installation controlled by a computer. The participant sees an image of a lady projected down onto a bedlike structure covered in white velvet cloth that is in itself inviting and sensual to touch. Underneath the bed sheet there are embedded 15 electromagnetic field sensors and eight force sensitive resistors. The bed can so detect touch, pressure and the amount of force applied to the surface. Touching the bed, the projected body responds and comes 'alive' with sound and movement. The artist Schiphorst' intent of the work is to create a relationship between participant and technology that invokes a space of experience, reflection and vulnerability.   Although the intention is to raise awareness of one's relationship with oneself through the act of touch, the installation produces strong haptic sensations indicative of how touch can be experienced erotically in the context of techno sex.

The *cyberSM* project by Stahl Stenslie and Kirk Woolford is known for the use innovative haptic technologies in combination with explicit sexual references. [12] In 1993 it demonstrated the first haptic, full-body, person-to-person communication system between Cologne and Paris. It created a multisensory Techno Sexual experience based on real-time, visual, auditory, and tactile communication through a computer environment. Users wear bodysuits with built-in vibrotactile, heat- and electric-current-based stimuli, and the participants were enabled to physically "touch" each other over distances. The bodysuit stimulated eight larger zones on the body, thus inducing an immersive sense of being touched. At the outset, participants had to choose their own visual identity, or avatar, from a large 3D "bodybank" of scanned and digitized human bodies. Any gender can be combined, creating transgendered avatars. The project so involved both gender play and the concept of liquid personalities and identities. When the avatars are exchanged, they function as an interface both to be touched and to transfer touch. cyberSM represents a first, but functioning version of Rheingold's teledildonic vision, capable of forming strong emotional and sensual ties between its participants. [14] It was the first media art project to involve haptic bodysuits. This touches on an ironic aspect of full body, immersive Techno Sex: you somehow have to dress to have sex.

Solve et Coagula – Mating Man and Machine

The *Solve et Coagula* project by Stahl Stenslie and Knut Mork was shown at C3 center in Budapest and at Ars Electronica 1997. [15] The project developed a bodysuit interface with a full body haptic sensory resolution. [16] The installation can be described as a techno-sexual experiment with the purpose of conceiving a new life form that is half digital, half organic. It was an original experimentation with what could be labeled a symbiotic system with an interdependent sensory loop between man and machine. The project therefore describes its resulting output as a 'transhuman cyberorganism'. The sexual experience thereof is dependent upon a machine body and emotions that simulate the trans-species encounter. The project subtitle says 'mating man and machine'. This is accurate in as far as the project attempted to pair man and computer together through physical sensations. The cognitive and corporeal experiences are mixed and materialize as the shape of the cyberorganisms' new machine-body.

Fig 1. *Solve et Coagula*, 1997, Stenslie/Mork, multisensory VR installation, Views from the installation. In the middle the user surrounded by the 'creature' which the body suit rendered physically real through haptics. Copyright Stenslie.

One artistic goal was to question what happens when the machine acquires humanlike emotions, and the human

turns machinelike. This was achieved by joining user and machine through the bio-cybernetic interface consisting of a sensoric stimulation-suit in combination with visual and aural immersion. The machine is essentially an 'intelligent' software programmed to 'feed' on the user's input. Examples of input that influence the machine are the users' indirectly expressed emotions like fear and lust, and controlled bodily expressions like speech, shouting and movements. The users emotions are recognized by preset analyses of ranges and combinations of sound and touch. In turn the machine attempts to sensorially manipulate the user into certain affective physical expressions by vibrotactile output in the bodysuit, 3D sounds and an immersive VR imagery. If the computer-based intelligence were in a state of 'anger' it would encourage 'angry' movement and vocal expressions from the user. If it is lustful it responds to 'lustful' input. Several models and parameters for emotional input and output was designed and tested for this causal interaction loop. The machine is 'fed' through the readings by the sensors placed inside the bodysuit, and the user can influence the computer-creature to adjust the intensity and dramaturgy of the installation. The art-experience has become a techno-sensual fusion of man and machine, pushed forward by a symbiotic interactivity, a form of interaction that is dependent upon the user's presence and bodily functions.

The SeC Installation

On entering the installation the participant steps inside a five-meter tall ovoid shell of metal arms. This is another example of the contextual and psychophysical coding of the installation. In SeC one of the goals was to construct an encompassing physical installation that corporeally impresses the user in a completely immersive manner.

Fig 2. *Solve et Coagula*, 1997, the five-meter tall installation of iron at Kunstnernes Hus in Oslo. Copyright Stenslie.

An effective perceptual experience is a matter of several senses playing together, including details down to the visual design of the equipment. Also here the psychophysical coding by design of the physical

environment was important to guide the user's perceptual experiences. Video beamers projected a view of the creature's constantly changing body on projection surfaces placed around the installation. The visual manifestations change constantly in response to the participant's movements and vocal output.

The SeC Bodysuit and Techno-Sexual Tactility

One of the crucial research questions is how to make Techno Sex physically experiential. In SeC the body suit worn by the participant is the key component to a physical, two-way techno-sexual stimulation. The suit serves as an intelligent, two ways communications interface between the machine and the human. It provides (i) tactile stimuli so that the creature can touch the participant's body and manipulate his haptic perception, and (ii) built-in pressure sensors through which the creature can sense the user's body.

The suit was designed in one piece that was easy and fast to dress. It was built like a human skin to be wrapped around the body. Altogether it weighed around two kilos including cables and was both fairly comfortable and transparent to use. What however had a noticeable weight were the control cables that attached to the suit as an umbilical cord. For the 120 zones 240 cables were used, two for each vibrator. Their weight influence the user's movements, but by attaching them on the back and hanging the cables from above this was not a too noticeable a problem.

Fig 3. *The SeC bodysuit*. 1997. The 120 tactile effectors are equally distributed throughout the suit, effectively covering the whole body. The user holds the pressure sensitive devices in each hand. Copyright Stenslie.

In other projects involving bodysuits such as cyberSM, bodysuits covered only parts of the body. The term 'areal-effectiveness' can be used to indicate how much of the total area of skin/body it stimulated. The overall areal-effectiveness of cyberSM was approximately a third of the body, and therefore comparatively low. The SeC project developed the first bodysuit to practically completely cover the body. Inside the SeC bodysuit the participant is equipped head-to-toe in the tools needed

for interacting with the artificial intelligence: the lightweight body suit, microphone, and a head-mounted display.

The term *Tactile resolution* can be defined as how much of the body is being stimulated at what intensity and by what stimuli. The SeC suit had a vibrotactile resolution of 120 zones each haptically influencing an area of the body approximately five by five centimeters in size. A zone was comprised by a custom-made vibrotactile vibrator where a micromotor served as the main haptic output effector. Through the custom built interface each effector was individually controllable and variable in strength from the slightest shivering to intense vibration. The zones were equally distributed across the body apart from the feet. This exception had more a practical reason of risk for cable strain and breakage. Besides this the feet are indeed an interesting area of the body to include. In their hands the user held two organ-shaped pressure pads with built in, custom-made pressure sensors and effectors.

Fig 4. *SeC pressure sensitive interfaces*, 1997. Part of the SeC bodysuit. Copyright Stenslie.

One main advantage of the SeC' suit compared to other bodysuits and haptic devices is the increase in vibrotactile resolution to cover the whole body. This enabled more complex haptic expressions and outputs.

Towards a Haptic Language of Physical Techno Sex

The development towards a haptic language is long and at least dating back to Giovan Battista della Porta (1535 – 1615). He proposed a cryptographic and telegraphic system built upon a direct stimulation of the flesh. [17] In his system, two 'friends' were each to have an open and fresh wound. Around the wound there should be two circles containing the alphabet. Communication should happen by 'typing' letters with a knife on the one 'friend'. The other 'friend' would then 'sympathically' feel the corresponding letters and vice versa. Messages could so be exchanged. It is hard to foresee a practical way of constructing such a 'bodygraph', but a symphatic translation of touch is conceptually relevant for the use of the body to both write and decipher message, and hence to the development of a functional haptic language.

The author's own observation throughout several trials has shown that many users have common reactions to the same haptic outputs, thus indicating the existence of a haptic language that is corporeally comprehensible by all humans. To complete its description is out of scope for this paper. The intention with this paper is to start the listing of contributions to a future vocabulary of touch. A haptic vocabulary is a supply of expressive techniques or devices, possibly a list or collection of terms or codes of touch available for assemblage into meaningful haptic expressions. The resulting combinations should literally make sense. With the increase in sensory resolution the SeC suit, one could for the first time talk about having the possibility of developing a more expressive haptic language.

The resolution enabled the construction of complex sensory patterns to be imprinted on the body. To better design these haptic patterns the 120 effectors were mapped out onto a generic 3D drawing of the body. (Figure 5) On this image the various touch patterns were drawn so that we could more easily envision their effect and code them into the computer for testing. The patterns were designed both in sequence of zones triggered and the individually variable strength of the effectors. The design of the patterns varied from string-like, linear triggering of the effectors to larger areas being triggered simultaneously. The first SeC version used around thirty different patterns in various combinations.

The haptic perception induced by the patterns varied. The haptic vocabulary developed into being able to create distinct sensations from being pulled, pushed, resistance, weight, (human) touch, tickling to objects and 'insects' crawling around on the users body. One user in the initial blind test was not told anything about what the sensations could or should mimic, but reported several strong and distinct impressions ranging from objects moving through the body to insects crawling around. Many users had an impression of the suit being alive.

To maximize the physical effect of each effector it was important to get it placed as close and firmly onto the skin as possible. The suit was designed with lightweight, stretchable cloth that was easy to strap onto the different body parts. More effect was achieved when users were naked beneath the suit, but due to the large number of participants and for hygienic reasons they were allowed to wear light clothing underneath. The strength of the effectors was still felt even then. The custom-built control interface has a maximum electric output of ten amps power. When several of the sensors

were triggered the users were given a strong sensation of the effect of one watt of electrical power.

Inside the installation these patterns were triggered by the emotional states of the computer according to our dramaturgical evaluation of their effect. For the first time having experience with the whole body as a sensual canvas, it became a matter of open experimentation of finding out what sensation each pattern would trigger in what state of the installation. As was found, this also varies from user to user, but there are definitively patterns that most users recognize. Additionally to the predesigned patterns the installation would also trigger individual zones-based upon the character's state of mind.
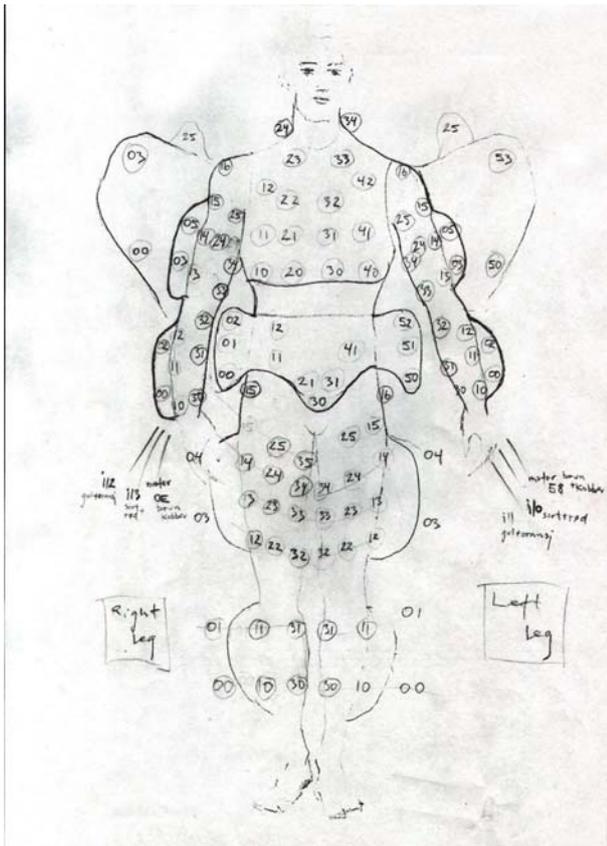
Fig 5. *SeC bodymap*, 1997. Illustration showing the effector placement in the SeC bodysuit. Copyright Stenslie.

Physical 3D Sound Environment

The computer-based creature speaks to the participant through moving, three- dimensional sounds projected from the eight channel sound system surrounding the installation. Its 'voice' is a bizarre, mutant-like combination of organic noises and distorted samples of the human voice. The sound, and in particular in combination with a subwoofer, also has a physical effect on the user. Normally sound is discounted as corporeal stimuli beyond listening to music. As the extremely loud music performances by the Austrian art group Granular Synthesis shows, it can indeed be used to create strong corporeal sensations. [18] The implementation of 3D

sound in SeC was first meant to create audible aural movements in the space of the installation. This was thought to help the user as points of reference for their navigation. In practice it is hard to map a physical installation, 3D visuals and sound precisely together. One of the problems here is the need for a larger, reflection-free space to ensure a higher degree of control over sound positioning. However, even if the sound was less of a navigational helper, it did have a corporeal effect on the body. Having a powerful speaker and subwoofer at hand, the sound of the installation proved to fill the space with a certain sense of physical and sensual density. It affected the body with an additional corporeal sensation.

Sensual Interaction through Voice and Touch

The installation gets its input from the user through voice and body. Just as the creature expresses itself vocally to the participant, so does it in turn respond to the sound of the participant's voice. It attempts to analyze the pitch and tone of their utterances as some kind of emotional feedback, and respond to the participant in ways it deems appropriate. Through two kidney/organic like shaped figures held in the hands, the participants could touch the creature by pressure sensors. (See figure 4).

Sensory Reset

The perceived strangeness of the situation being placed inside an alien setting has the effect of resetting the user's expectations. Without familiar clues from familiar environments such as the computer screen, mouse and keyboard, the user does not anymore know what to expect. This leaves him or her open to what can happen next, susceptible to new impressions. Such a technique of 'sensory reset' is a known applied method within commercial exhibition design. Catching the attention of visitors is essential in these contexts. A similar notion to the 'sensory reset' is also found in Merleau-Ponty's understanding of habitual perception. Our body is comprised of two layers, the *habit-body* and the *body at this moment.* [19] To the habit-body the world is obvious, transparent and manipulative. To the *body at this moment* the natural connection has broken down and it has become externalized as 'a thing manipulatable in itself' (ibid).

Every user was met by a personal guide that both instructed at the start of the installation and asked the user about his experience at the end. Although we did not record all users' responses, most of them verbally gave a positive feedback of the overall experience. Psychophysically designing the environment through the architectural dramaturgy of the physical appearance appeared to have a positive influence on the users impression. As the dramatic looks of the physical installation demonstrates, the psychophysical manipulation is a technique to tune the users mental and physical attention and manipulate them towards sensibility for specific aesthetic expressions. An

additional important factor to the visual presentation is the audible dimension.

Visual and Aural Immersion enhance Tactility

The participant wears stereoscopic viewing glasses through which they are visually immersed inside the computer-constructed 3D reality of the creature's body. The creature presents the participant with organic 'body parts' as representatives of its various emotional states. The creature brings the participant to each body part through a vein- or intestine-like labyrinth of tunnels. It has five different organons, each representing a different state of mind of the creature. The visuals as well as the sound became important to contextualize how the users experience being touched. The touch patterns appeared to be better understood when synchronized with the immersive visuals. One reason for this is the unusual stimuli of being touched 'intelligently' by something as mechanical as a bodysuit. As McLuhan writes on hot and cold media, users always appear to be looking for sense and meaning. Cold, low bandwidth media can therefore at times be more interesting and emotionally immersive than hot, high bandwidth media. [20] Although rich in stimulus, the multisensory design in combination with the alien look of the installation was 'cold' as its unfamiliarity made users having to decode and fantasize about possible meanings and functionalities.

To make sense out the touch one needs a certain haptic resolution. In difference to the cyberSM suit where the touch alone was too mechanical and abstract a stimulus, the SeC bodysuit could make aesthetically interesting content out of the touch patterns alone. However, the combination of sound, visuals and touch provided the necessary multisensory bandwidth to expand the value of the experience.

Techno Sexual Usability Issues of SeC

Techno Sex does not need to mimick or even look like 'natural' human sex. Like the early Furry Muck chatrooms, embodied forms of future Techno Sex might become rather different from what we are now used to think of sex. [21] [22] The SeC installation also leaps away from ordinary perceptions of erotic imagery and visualizes the machine more like alien organons.

Even if unusual and almost bizarre in appearance, the installation was designed to be easy to understand and use. All feedback from users pointed to this. Each user was dressed by an assistant that also explained how the basic system functions. User responses varied from those dancing around to passive behavior where some users just stood still waiting for things to happen. In most cases the users of the installation would move and look around, but it was generally harder to make them use their voice. Emitting loud vocal expressions seem to have a higher social threshold. Many participants appeared reluctant to for example scream.

The multimodal interactivity system of SeC attempted to manipulate the senses into a sensory symbiotic relationship between user and computer system. It thereby confronts the user with unknown, strange and -from the point of view of Techno Sex- also seductive phenomena. This fusion of technology and art attempted to transform the artistic experience into an aesthetic process of procreation. Even if different and abstract in nature, the project points towards Techno Sex as not just a possibly physical experience, but also as something that fundamentally affects our relationship to technology.

The Haptic Future of Techno Sex

The partial overview of previous haptic and sensual experiments has shown that the questions and problems of using touch as a medium in electronic art has a relatively short history. The mentioned projects dealing with touch and touching technologies are early examples with many shortcomings, yet their output point towards future solutions for bridging the still unsatisfying physical gap between body and technology in Techno Sexual interfaces. The projects mentioned further indicate how applying the medium of touch can enrich user experiences, both techno sexually and otherwise. Today most of us are embodied in technologically supported realities where desires and Pygmalion syndromes are much part of reality. More hands-on projects are needed to acquire a deeper and critical understanding of these emerging techno-sexual cultures. Artistic research projects like Solve et Coagula affirms how little we know about our own techno-sexuality and points out how further experimentation is needed to evaluate both the utopian and dystopian consequences of Techno Sex on humans and society.

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CASH RULES EVERYTHING AROUND ME: Reading the Recuperation of Hip-hop through Rancière's Political Aesthetics and Attali's Distinguishing of Signal and Noise

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Abstract

Since Rancière, critical, cultural and social theorists have broadly accepted that aesthetics are inherently political. For instance, while the normalization of certain marginal voices can be understood as a distinguishing of signal and noise, the way in which aesthetic homogenization can become compulsory within certain communities is often cited as a mode by which accepted aesthetic paradigms can enforce social or ideological positions. As such, it would seem that the ability to broadcast/popularize minority or radical aesthetic paradigms would be a potent way to normalize those voices and forward alternative ideological agendas. However, the Situationists noted that aesthetics are also easily co-opted by the hegemony and can thus be stripped of their revolutionary potential; they dubbed this process, "recuperation." Illustrating this co-optive process, this paper identifies the aesthetic norms of hip-hop culture through the application of Rancière's "distribution of the sensible" and then traces how those norms have been co-opted, ultimately undermining hip-hop's aesthetics-based revolutionary potential. However, and in order to suggest an alternative mode of radicalism, we combine Rancière's aesthetic taxonomy with Attali's, proposing a shift in focus away from "pure aesthetics" as a mode of radicalism and towards distribution as a future potential mode of revolutionary cultural production.

Introduction

In 2013, for the MTV Video Music Awards (VMA), Miley Cyrus (a white, female, pop singer launched by Disney) performed her now infamous 'twerking' spectacle. 'Twerking' is a dance style that, while popularized by pop stars like Cyrus, originated in the New Orleans Bounce music scene (a subgenre of hip-hop) in the 1990s. [1] Internet commenters responded to Cyrus' performance with critiques ranging from, commenters who were scandalized by Cyrus' overt sexuality and apparent tastelessness [2] to politically and racially charged critiques of Cyrus' appropriation of black culture and objectification of black bodies [3].

The range of these critiques exemplifies the multi-vocal network of micro-communities engaging in their own specific identity politics which characterizes the current landscape of cultural production and consumption in the network age. For Rancière, such a multi-vocal network would seem practically utopian, owing to the privileged position he affords to speech as an a priori condition to participation in government. This privileged position is based on an Aristotelian reading of citizenship as defined by having a stake in government, and thus a requirement to not only to speak, but to be heard/recognized as speaking, hear-able.[1] [4] For Rancière, aesthetics "is a delimitation of spaces and times, of the visible and the invisible, of speech and noise." [5]

Moreover, the disparate critiques of Cyrus' performance also reflect Rancière's politics in that each of these critiques is premised on a general acceptance of an aesthetico-political paradigm which, as Rancière suggests in *The Politics of Aesthetics,* is represented by "the trajectory of Situationist discourse -- stemming from an avant-garde artistic movement in the post-war period, developing into a radical critique of politics in the 1960s, and absorbed today into the routine of the disenchanted discourse that acts as the 'critical' stand-in for the existing order." [6]

By characterizing this discourse in this way, Rancière roots the current aesthetico-political paradigm in Situationist ideology/discourse. This ideology can be identified by the use of avant garde artistic practices to undermine 'the spectacle,' as described by Guy Debord in his *Society of the Spectacle*. In his text, Debord considers how spectacular aesthetics blind a population to the un-democratic reality of their existence by directing their attention toward the normalized activity of consumption. Thus, the spectacle is instrumental in forwarding the capitalist agenda as it relays the message that consumption is the individual's proper role in a society. [7] To combat the power of the spectacle, the Situationists staged avant garde art events (situations), which were meant to disrupt the normalized aesthetics of the spectacle, to present potential contra-narratives, and to build communities

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[1] Of course, in practice, the seemingly democratic nature of online communication is undermined by the forces of uneven technological access, the rise of web 2.0, and the subsequent re-emergence of portal-based browsing (among others). However, while these conditions undermine the inherently democratic structure of internet technology, the internet still lends voice to a much wider population than in previous epochs – and is thus, more democratic in structure, if not in practice). Furthering the principality of heard-ness within his philosophy, Rancière situates the political nature of aesthetics in the ability of aesthetics to create communities based on the social construction of shared aesthetic forms (to socially distinguish signal from noise.)

around those narratives. In essence, the Situationists sought to undermine the hegemonic sign system perpetuated by capitalism by injecting the voice of a radical 'Other.'

But, as theorist McKenzie Wark points out, almost as soon as this mode of radicalism was formalized, it was already being 'recuperated' – co-opted by the capitalist hegemony and integrated back into the spectacle:

> Recuperation began from the very moment the Situationist International was founded… the organization was dissolved precisely because its recuperation was by 1972 already complete. ... It had become merely a collective celebrity, part of the spectacular consumption of 'radical chic.' [8]

Thus, the toothlessness Rancière associates with this mode of criticality can be ascribed to this recuperation, or making clichéd, of the Situationist discourse.

Recuperation then, as a process of capitalism's colonization of radical voices, offers another reading of Cyrus' performance. In this case, Cyrus' performance can be read as a symptom of this process of 'recuperation,' "the activity of society as it attempts to obtain possession of that which negates it." [9] As such, Cyrus' performance would suggest an alternative reality to the hypothesis forwarded by the Situationist mode of radicalism, one in which capitalism absorbs radical voices and ultimately renders them mute through their resulting ubiquity.

Shortly after Cyrus' VMA performance, 'twerking' was added to the online Oxford English Dictionary as: "[to] dance to popular music in a sexually provocative manner involving thrusting hip movements and a low, squatting stance." [10] Strikingly, this definition completely divorces twerking from its ethnic, urban, and cultural roots in the New Orleans Bounce scene and removes any potency it may have had as a symbol of those roots. This breaking of the relationship between the sign (twerking) and the referent (low-income, urban, black, southern culture) is realized through the appropriation of the sign by an increasingly broad cross-section of the population which impregnates it with more significance than is sustainable. Thus, we see how the sign, 'twerking,' once associated with a particular micro-identity, is subject to a degradation of meaning through ubiquitous use; ultimately rendering the signifier entropic, static, or without a discernable referent. This process results in a signifier that ceases to have any continued political or cultural valence. Furthermore, twerking was not simply rendered "mute" (Rancière), but through this process was commodified and integrated into the spectacle.

Much of the criticism launched at Cyrus in the wake of her 2013 performance was premised on Cyrus' (mis)appropriation, resulting from her privileged position as an attractive, cis-gendered, white celebrity. However, while Cyrus is certainly complicit in the process of recuperation, in so far as she is an object of the spectacle, the actual tension within Cyrus' performance might be less the result of cultural insensitivity on the part of Cyrus, and more symptomatic of the culturally systemic process of recuperation, as it is realized today. Since, this example reveals how the process of recuperation silences radical

voices by making them into cliché, for the revolutionary, activist, or activist artist, there lies an inherent tension between the political promise of aesthetics to create and to give voice to communities, and the recuperation via appropriation that will undoubtedly follow the emergence of that voice, normalize the voice, and, ultimately, render it again invisible and powerless.

Broadening the frame from the single incident of Cyrus' VMA performance, we can see how this process of recuperation through appropriation is realized throughout the history of American hip-hop. By tracing the lineage of hip-hop in terms of Rancière's "distribution of the sensible," we will be able to not only show how cultural products are inherently political, in that they give voice to the disenfranchised, but also to draw out those aesthetic elements of hip-hop which are appropriate-able and thus recuperable. Furthermore, we will be able to show how within Rancière's "aesthetic regime of the arts," the necessary link between signifiers and their referents has been broken [11] and that the resulting "aesthetic free play," which for Rancière reflects "a kind of liberty and equality," [12] actually necessitates that we look outside of Rancière's aesthetic taxonomy towards transmission as a more effective means by which a cultural product might actually forward an 'anti-spectacle' agenda without being silenced by the forces of recuperation.

Ranciére's Concretization of Forms

Thus, to trace the lineage of the hip-hop aesthetic, it is also necessary to explicate Rancière's aesthetic taxonomy and to relate that taxonomy to hip-hop's initial construction of an aesthetic language. Hip-hop was born in the African and Jamaican neighborhoods of the Bronx, during the mid 1970s, as a form of folk music. As the musical form matured, it grew beyond being just light hearted party music and, by the 1980s, had developed into a vehicle for sociopolitical commentary. Accompanied by a slowing United States economy, this politicized hip-hop had a readymade audience in the youths of low-economic areas. Throughout this period, hip-hop's ability to reflect the social, economic and political realities of the disenfranchised launched it as a popular musical genre and (ironically) contributed significantly to its growing commercial viability. While, since the 2000s, there has been a steady decline in the production of hip-hop music, [13] the language, musical forms, fashion, dance styles, and history have been reclaimed by – and now frequently appear in – many alternate facets of mass/popular culture; for instance, in the example of Cyrus' VMA performance.

It is these same elements which Rancière identifies as defining the aesthetic of the cultural product, in the process of its concretization as a recognizable cultural artifact. Rancière defines aesthetics in terms of a "distribution of the sensible" or "what presents itself to sense experience." [14] Extending this definition, artistic practice for Rancière becomes, "'ways of doing and making' that intervene in the general distribution of ways of doing and making as well as in the relationships they

maintain to modes of being and forms of visibility." [15] Thus, for Rancière, artistic practice not only manifests new modes by which cultural objects are produced, new aesthetic forms, and new ways of creating those forms, it also allows those forms to become recognizable or visible as a cultural object within a given society. When new art forms are coming into being, it is these aesthetic traits that are being concretized, formalized, or distinguished from noise, and it is also these aesthetic traits that will define that cultural object – for instance, by genre (under Rancière's regime of representation, at least). Generally summarizing this process, Rancière writes:

The principle regulating the external delimitation of a well-founded domain of imitations is thus at the same time a normative principle of inclusion. It develops into forms of normativity that define the conditions according to which imitations can be recognized as exclusively belonging to an art and assessed, within this framework, as good or bad, adequate or inadequate... [16]

In order to further outline definition of aesthetics, Rancière, drawing on Plato, proposes a specific trio of sense-able aspects inherent to cultural objects: "the surface of 'depicted' signs, the split reality of the theater, [and] the rhythm of a dancing chorus." Each of these sense-able aspects "structure the manner in which the arts can be perceived and thought of as forms of art and as forms that inscribe a sense of community." [17] The first of these three experiential aspects of the cultural object, "the surface of 'depicted' signs," encompasses the object's formal qualities and works, for Rancière, as an "interface." [18] Further in Rancière's aesthetico-political framework it becomes important to recognize that these signs are not linguistic in that they do not represent *meaning* but instead manifest a system of doing and making which makes the cultural object identifiable *as* an artistic gesture. [19] Meaning ascribed to these signs under the representative regime of the arts wherein a consistency is maintained between subject, form, and author breaks down under the "aesthetic free play" that is realized in the aesthetic regime of the arts. This consistency, essential to the work of art under Rancière's "representative regime of the arts," is referred to as an "adequation between ways of being, ways of doing, and ways of speaking" and should be apparent in the initial formation of an aesthetic -- owing to the fact that, that aesthetic is in the process of emerging from and inscribing the community to which it belongs. [20]

The development of hip-hop in 1970s New York is a prime example of this communities are created through the concretization of socially agreed upon formal attributes. The birth of the 'breakbeat,' which became the backbone of hip-hop music, is credited to DJ Kool Herc, a 'hard funk' disc jockey (DJ). 'Hard funk' is distinguishable by the 'break,' short percussive measures that act as transitions between different parts of the song. Kool Herc realized that these 'breaks' elicited elevated levels of excitement in his audience, and in order to prolong this excitement, Kool Herc would isolate and only play these transitions. [21] Thus, the 'break' – which was

originally just a functional element of musical progression – was lifted out of its original context and reorganized into a new musical form; Kool Herc lifted the *noise* (the funk break) from the *signal* (the funk song) to create a new signal.

Kool Herc, and other breakbeat pioneers, invented this technique by using multiple turntables. By playing the break on one turntable while cueing up subsequent breaks on other turntables, a DJ is able to rapidly switch between records being played. However, this early technique had its drawbacks in that each time the DJ wanted to start a new break, the stylus had to be lifted and dropped at (roughly) the desired location on the record where the break began. This process was slow, imprecise and generated much extraneous noise (pops/hisses). DJ Grandmaster Flash however, made improvements on this technique by muting whichever turntable was being cued, nullifying any undesired noise. Furthermore, instead of lifting and dropping the stylus, Flash would leave the needle on the record while manually rewinding the record to the beginning of the break. This combination of muting and pulling back records allowed for a seamless blend of breaks. Finally, Flash selected records with similar beats per minute; thus, he was able to create more rhythmically seamless mixes. Flash's less 'raw' techniques garnered the attention of disco DJs, who were used to smoothly segueing between unaltered tracks; and, these DJs began to emulate the beat-mixing style.

As well as creating a technique for the seamless mixing of breakbeats, Grandmaster Flash and other second generation DJs (Grandwizard Theodore) forwarded the 'art' of hip-hop DJing by injecting additional agency into the act of playback. These DJs began to use the turntable as an instrument as opposed to simply as 'playback equipment.' They added techniques such as 'scratching' (in which the sound that results from a record being pushed and pulled while in contact with the needle is performed rhythmically to the music) and punch phrasing (which is the playback of small segments from one record on top of another already playing record). With these techniques a DJ was able to create completely new compositions. Finally, as sound equipment evolved, the use of monitoring headphones, audio mixers, and cross faders, gave DJs the ability to more accurately isolate and cue breaks, layer tracks, and add effects – which in turn allowed an even more polished form of hip-hop to emerge. This new (refined) version of hip-hop was more palatable to a wider audience and paved the way for hip-hop's commercial viability. [22]

In addition to pioneering multi-turntable based DJing, Kool Herc is also associated with introducing the hip-hop vocal style of 'rapping' – the practice of rhythmically speaking lyrics over an assembled breakbeat. This rhythmic vocal style has its origins in the older African griot traditions of 'boasting' and is closely related to the practice of 'toasting' in Jamaica, 'talk over reggae.' While early forms of rapping consisted of relatively simple and repetitive interjections meant to 'fire up' the crowd, disco DJs created elaborate verse-like routines as they brought the practice into mainstream dance clubs. These routines

would eventually become more popular than the fragmented chants of Kool Herc and his crew. [23] Thus, this Afro-Caribbean practice was formalized into what we now recognize as 'rapping.' Finally, as the spoken component of this overlay increased in complexity, the 'MC' (Master of Ceremonies, rapper) came to be distinguished from the DJ (disc jockey, creator of breakbeats), thus formalizing a division of labor within a distinct musical form.

Therefore, DJ Kool Herc, along with his New York contemporaries, drawing upon African, African-American and Afro-Carribean roots, enacted Rancière's definition of sign formation as the concretization of a process of doing and making that is inherently different from other processes of doing and making through the invention and formalization of the stylistic elements we now understand as hip-hop – the layered breakbeat with lyrical content spoken over it.

The Split Reality of the Theater

Rancière contextualizes the formal attributes of an aesthetic through his second sense-able aspect of the cultural object, "the split reality of the theater." Herein meaning (either narrative or sign-based) is conveyed through the exchange between sender and receiver, between artist and audience. [24] Moreover, distinguishing formal elements and speech signs (narrative intentions) Rancière writes:

> This is how the 'planarity' of the surface of depicted signs, the form of egalitarian distribution of the sensible stigmatized by Plato, intervened as the principle behind an art's 'formal' revolution at the same time as the principle behind the political redistribution of shared experience. … Politics plays itself out in the theatrical paradigm as the relationship between the stage and the audience, as meaning produced by the actor's body, as games of proximity or distance. [25]

Narrative signs, thus, are not just the linguistic or explicitly representational images/text within the cultural object; narrative signs can also be found in the relationships created between the artist and the audience as well as in the mode of performance or in the presence that emerges from the performance. Thus, cultural or political messages can be embedded explicitly, but they can also arise in an indirect fashion as references to, or as the result of, the cultural context in which the artform exists, or which the artform creates.

In hip-hop we can see these discursive modes beginning to be formalized in the lyrical content of the songs as well as through the personas which were universally adopted by hip-hop artists. The proto-rap of Kool Herc and his contemporaries established repertoires of phrases and chants. Steffan "Mr. Wiggles" Clemente, a member of the legendary breakdancing crew Rock Steady Crew, refers to this in his description of routines from rappers of that era:

> You had somebody come up grab a mike and just start gettin' busy. First thing they always said is, "Yes, yes, y'all / To the beat, y'all / It's Hip-Hop, y'all / Ya don't stop / Keep, keep it on / Till the break of dawn / Keep – keepin' it on – ha! / Now, while I'm singin' my song." [26]

Thus, these largely meaningless, but repeated phrases became not about relaying an explicit message, but about signaling to the audience the position of the performer/performance as hip-hop -- much like the formal elements revealed in Rancière's first sense-able dimension.

However, while this lighthearted, often meaningless, and largely boastful banter remained the narrative content of early rap at live parties, with the move into recording, producers of hip-hop began to explore the more serious narrative potential of the form. In 1982, Grandmaster Flash and the Furious Five's "The Message" was released on Sugar Hill Records. "The Message" – widely considered the first sociopolitical hip-hop song – gained recognition from critics and established the genre as a musically and politically progressive sound. [27] The lyrics of socially conscious hip-hop generally address the racism, poverty, and violence that the urban poor experience, and are extended in the hardcore hip-hop genre, "gangsta rap," which also references these 'urban' themes to comment on social problems or expose issues of urban life. [28] In support of this sociopolitical gestalt, hip-hop also began, in the 1970s, to develop a unifying political narrative of 'authenticity' or "keeping it real;" "hip-hop became about staying close to one's roots and being true to oneself." [29]

Moreover, these narratives are not expressed solely through the lyrical content of the music, but through the attitudes and stylistic decisions made by the performers. For instance the gestures and postures performed by 'gangsta' rappers tend to exhibit a hypermasculine aggression which can be interpreted to be a reaction to their marginalized social environment. [30] While, for hip-hop's more ubiquitous call towards "authenticity," socio-cultural symbols such as: being black as opposed to white; having come from the inner city as opposed to the suburbs; or having cultural roots in the "old school" as opposed to the mainstream are visually realized through the appearance and projected identities of hip-hop artists. [31] Thus, these modes by which hip-hop uses representational symbolism (both lyrical and visual) to relay both genre-defining narratives and sub-genre specific politics reflects Rancière's second sense-dimension "the split reality of the theater," as well as Rancière's "representational regime of the arts," wherein intentional (and sometimes unintentional) messages are discursively passed from the artist to the audience.

Creating Communities

It is within the tendency of audiences to take ownership of these relayed signifiers that Rancière situates the third, and final, sense-dimension of aesthetics, "the rhythm of the dancing chorus." [32] In this dimension, Rancière refers to the community which is created around, and in response to, a specific cultural object. This community

(audience) is a reflection of the prior two dimensions as it is a response to those dimensions, but it also follows its own emergent logic, resulting in its own socially-constructed coherence. [33] In the case of hip-hop, we recognize this dimension through the audience's adoption of certain clothing, language, and lifestyles as a signification of one's membership in the community.

Just as other musical subcultures develop specific fashion traditions, hip-hop's 'street' fashion was made visible through the icons and stars that led the movement. Hip-hop groups (such as Run-DMC) adopted 'street' fashion, such as baseball caps, gold chains, and sneakers. As a result, and combined with the commercialism of Run-DMC's single "My Adidas," the hip-hop community embraced the gold chains and unlaced sneakers that their heroes wore. [34] Far from a totally coherent style though, at this point in the history, the hip-hop community defined by these cultural signifiers was fractured into region-specific sub-genres, adopting small permutations depending on the region or city the performers/fans were from. West coast hip-hop audiences donned Lakers' caps and sunglasses, while the practice of sagging one's jeans was an inner city trend.

As the commercialization and materialism of hip-hop grew, the genre moved further away from its humble (poverty-based) roots and towards success-based narratives. As artists became more affluent, they prompted the genre to shift focus away from the plight of urban poverty and towards an aspirational model of capitalist wealth accumulation and consumption; in short, hip-hop artists rewrote "The American Dream" for a minority, urban population. With this shift away from poverty as the primary narrative, the fashion or style of the genre also moved more towards the outward display of material wealth as the new genre identity. In the words of hip-hop artists Outkast, "It's not how much you make, but how much you spent." [35] Thus, through surrounding oneself with name brand cars, alcohol, and clothing, hip-hop devotees signify their membership in the culture of monetary success that hip-hop has come to represent. This shift was possible (did not undermine hip-hop's 'authenticity' narrative) because it did not emerge from a single artist or song, but instead was a socially constructed amalgam, inspired by the audience's response to the body of work in dialogue with the shifting priorities of the artists themselves. Thus, we can see how this construction of a genre 'style' reflects Rancière's conception of the "rhythm of the crowd" in that it reflects what Rancière calls a "unanimous consensus of the citizenry." [36] This final aesthetic dimension is perhaps the most visible manifestation of the mode by which aesthetics are political (construct communities) as it results in communities that are immediately recognizable as 'Other' to those outside.

The Aesthetic Regime of the Arts

Therefore, we can see how, through its development as a dominant cultural genre, hip-hop has created both a formal and a symbolic language, recognizable to those who follow it – which creates a community that, in response to the messages relayed by the performers, becomes a self-determining crowd, adopting its own set of symbols to distinguish its members from those outside.

While Rancière does not consider this tri-fold distribution to be an exhaustive account of the sense-able (aesthetic) dimensions of cultural objects, he sees this delimitation of the sense-able as indicative of the mode by which we must approach cultural objects. In essence, for Rancière, "the important thing is that the question of the relationship between aesthetics and politics be raised at this level, the level of the sensible delimitation of what is common to the community, the forms of its visibility and of its organization." [37] With the hip-hop community then, these become the consumption of hip-hop (most likely within the context of urban poverty), the breakbeat and the spoken word rapping over it, popularized and ultimately adopted by a larger (pop) community through the formalization of various beat-mixing techniques, and the fashion and personas adopted by fans of hip-hop to outwardly signify themselves as belonging to the hip-hop community.

The problem arises though at this stage of an aesthetic concretization, when the trifold distribution of the sensible has been achieved, and is recognizable to those outside of the community. For it is at this stage that the genre comes under the aesthetic regime of the arts, which is the characterizing regime of postmodern society, and which leads to a dissolution of the consistency held between artist, subject and audience in the representative regime. On the one hand, the aesthetic regime seems democratizing because it releases art from the formal constraints of genre -- as defined by the aforementioned consistency. However, there are also paradoxical dangers associated with this freedom.

Foremost, Rancière situates the seeming failure of modernism within its inability to recognize the community-building (political) aspect of art which is still apparent under the aesthetic regime even though direct lines of signification have been complicated.

The idea of modernity is a questionable notion that tries to make clear-cut distinctions in the complex configuration of the aesthetic regime of the arts. It tries to retain the forms of rupture, the iconoclastic gestures, etc., by separating them from the context that allows for their existence… The notion of modernity thus seems to have been deliberately invented to prevent a clear understanding of the transformations of art and its relationships with the other spheres of collective experience. [38]

For instance, the third sense dimension, the rhythm of the chorus, remains intact under the aesthetic regime as Rancière suggests in his discussion of intentionality and appearance of characters in aesthetic literature. "Now, when meaning becomes a 'mute' relation of signs to signs, human actions are no longer intelligible as successful or unsuccessful pursuits of aims ...They are intelligible through the clothes they wear, the stones of their houses or

the wallpaper of their rooms;" affinity replaces intentionality. [39]

However, while signification might exist for an individual or a community, signifiers under the aesthetic regime are free-flowing and subject to appropriation; Miley Cyrus can adopt the dance style 'twerking' or wear rhinestone studded trucker caps just as easily as producers of her music can appropriate the now normalized breakbeat. It is towards this free exchange of signifiers that Rancière and Attali refer when they discuss 'mute signs' or 'primitive sounds,' respectively. Hence, it is at this level, the level of mute signs or formalizations that aesthetics become susceptible to recuperation.

Recuperation

The problem then for radicalism under the aesthetic regime however lies in the thermodynamic path the aesthetic regime creates for the voice of the 'Other.' The normalization of a community's aesthetic, which occurs through appropriation undermines the community's ability to be heard as a result of its voice no longer seeming radical in the larger social landscape; once integrated into the spectacle, it can no longer disrupt the spectacle, which is the definition of recuperation.

Within a given community, the appropriation of aesthetic elements by a larger community might not affect the coherence of the community. For instance, hip-hop's ongoing culture of 'authenticity,' which representationally requires a consistency between the hip-hop artist, their subject matter, and their audience ensures that the hip-hop community regularly self-regulates and expels artists or individuals who do not maintain that consistency. Furthermore, the rise of both the 'hood and the bling aesthetics show how the community maintains perspective towards authenticity while allowing for material success among its members.

However, we can see how the emergence of the breakbeat, rapping, 'street' fashion, 'bling,' etc... -- as the concretization of a (black) counter-narrative aesthetic identity -- manifests Miley Cyrus as a potent symbol of the recuperation (colonization) of that counter narrative.

There is a catch-22 inherent to this understanding of recuperation as a means of capitalism's colonization of radical (or alternative) voices. While the appropriation of alternative cultures does eventually lead to their recuperation, appropriation still remains necessary in the struggle against hegemonic (specifically white patriarchy's) dominance of popular culture. Hence, minority voices must be appropriated in order for minorities to be heard/hear-able within dominant cultural (and subsequently political) discourse. This catch-22, then, suggests that as the injection of alternative voices into the spectacle can only disrupt the spectacle for a short time, capitalism itself must be fought on a different plane of the cultural object.

Dissemination

It is towards Attali, then that we can turn for a potential plane in which radicalism might still be able to effect change. Attali and Rancière share similar perspectives towards the formal concretization of an aesthetic. Both recognize that individual elements have no inherent meaning and that meaning is attributable through social forces and the relations created between the elements. However, Attali simplifies his aesthetic discussion in order to allow a discussion of 'transmission' (or distribution) as another dimension of the cultural object. Transmission is not sense-able, but is inherent to capitalist modes of production/consumption and potentially provides a more direct pathway by which alternative voices might insinuate themselves into the socio-cultural consciousness while directly attacking the capitalist structures of our society.

In *Noise*, Attali distinguishes four networks of musical distribution. Each of these networks reflects a socio-economic structure and is correlated with a specific technology. Beginning with 'Sacrifice,' or "the distributive network for all of the orders, myths, and religious, social, or economic relations of symbolic societies," Attali describes a network of distribution which is centralized ideologically (around religion) and decentralized economically. [40] In this network, music is shared through the repertoires of griots, jongleurs and minstrels. The second network Attali describes is 'Representation.' In 'Representation,' the performance of music adopts a use-value – becomes spectacle/entertainment – and is played by specialists in spaces specifically designated for musical production, such as concert halls. The third network is called 'Repetition' and appears with the invention of recording at the end of the 19th century. As recording technologies allowed for the storage of 'Representation'-based live performance, they also allowed for solitary consumption and collection of music. Under 'Repetition,' music becomes a tradable commodity object. The final network, 'Composition,' for Attali, lies outside of the capitalist exchange system, as the music is performed by the self, for self enjoyment. Thus, in this as-yet-unrealized utopian network, music could only be experienced by others (audiences) as a by-product of a musician's self enjoyment. [41]

By referencing the emergence of free jazz in reaction to modal jazz, Attali illustrates how those oppressed by the network of 'Repetition' make progress towards attaining political and economic freedom through the creation of new languages and paradigms. In the 1950s and 60s, record companies ostracized black musicians by only hiring white musicians that 'sounded black.' In response to this, the free jazz movement was organized independently in order to grant black musicians a means of production. These musicians developed a unique and expressive style and, as a result, were able to fund the production and distribution of their music within their own community. For Attali though, while this re-capture

of creative autonomy resulted in a more improvised and unconventional musical style, the decision to distribute the music through concerts and record releases parallel to, but independent of, the major labels trapped the musicians in the formal networks of 'Representation' and 'Repetition.' Free jazz's failure to actually divorce itself from the capitalist mode of distribution arrested free jazz's potential transcendence of 'Repetition' while placing free jazz in direct competition with the more popular 'Repetition' network of the major labels. For Attali, free jazz's eventual silencing was a direct result of free jazz's inability to overcome its designation as 'noise' precisely because it was "inscribed on the same level as the messages circulating in the network of repetition." [42]

The history of hip-hop parallels Attali's characterization of free jazz; Hip-hop also emerged independent of the recording industry, and was also experienced via live performance (hence representative of 'Representation'). However, by 1970s, hip-hop musicians did not face the racial stigma that free jazz musicians had, thus the move into the studio (towards 'Repetition') was quicker. In 1979, Fatback Band's "King Tim III" and Sugarhill Gang's "Rapper's Delight" were released commercially. "Rapper's Delight" achieved mainstream success and thus paved the way to major labels for artists Kurtis Blow, Ice-T and Run-DMC. Corporate endorsement led to hip-hop's mainstream exposure, but also cemented it in Attali's network of 'Repetition'(thus still impotent as a vehicle for radicalism) and, in Rancière's terms rendered it cliché (via appropriation). For Attali, 'Composition' is the way beyond this entropy, however 'Composition,' the solitary enjoyment of playing music by musicians," would, by removing the music from the social sphere, render it again invisible by stripping away the audience required for its recognition as art in the first place. Drawing from that though, it is precisely this necessary trio of artwork, artist, and audience that manifests a way forward. In short, Attali's 'Composition' can (and may have already) be achieved if we expand the frame of the musician to include the community; Attali's conception of the solitary musician is transformed into a body corporate, consisting of musician, music, and audience.

Radical Modes of Distribution

Capitalism's most basic structure is the exchange of commodity objects for currency in which the bourgeoisie, through ownership of the means of production, set both the price of exchange and the price of labour. Profit is maximized by setting wages as low as possible and commodity prices as high as the market will bear. [43] As Attali points out, music only becomes beholden to this system of object exchange under 'Repetition,' as it is only under 'Repetition' that the means of production must be leveraged to produce music. However, in the 1970s the cassette tape afforded audiences and communities the means to independently record, duplicate and share audio recordings without access to high-cost recording studios. Niche musical movements of the time took advantage of

this new technology to grow beyond their localized scenes. Hip-hop DJs used the cassette tape to record mixes -- originally created only as backups or filler material for live events. Some DJ's however, responding to audience demands, began to sell their mixtapes, even producing custom mixes for those willing to pay a premium. [44] However, mixtapes did not represent simply the independent commodification of the music as many were made by the audience for consumption or sharing. 'Bootleggers' brought tape recorders to live parties and captured whichever routine or set happened to be on for the evening. As hip-hop also began to receive radio play, enthusiasts would also record directly from the radio. Hence, the mixtape allowed the audience to enact Attali's 'Composition' through the ease with which recordings could be 'dubbed' (copied and/or modified) and shared.

'Dubbing,' or 'to dub,' used in the context of mixtapes, originated in Jamaica, where it means to make a copy, or to 'double,' and includes instances of re-recording where generative changes are made to the original. For the Jamaicans, the act of taking recorded material, modifying it, and then re-recording it is understood to be the same as copying ("doubling") the original. [45] Thus, the lack of differentiation between copying and remix that exists in the etymological roots of 'dubbing' suggests that, despite legal arguments forwarded by the recording industry, for hip-hop 'dubbing' points to one mode by which the community engages in collective action. Owing to the perceived consistency between the musician and the community throughout hip-hop's development (the musician was seen in the community, and the community in the musician), which is realized in the call and response model performed during live events, sampling, dubbing, and remixing become an essential extension of that model into asynchronous (recorded) space in support of the communal project of hip-hop.

Hence, the mixtape exhibits how the spirit of Attali's 'Composition' can be enacted not by transcending 'Repetition,' but rather by creating 'Composition' within a decentralized 'Repetition' that directly challenges the capitalist system of production/consumption. This decentralized 'repetition' is only furthered by the rise of the internet.Digital music recordings can be sampled, edited, replicated and distributed with greater ease and at lower cost than ever before. Certain contemporary hip-hop artists such as Chancelor Bennett and Felipe Andres Coronel take advantage of this expanded access to the means of production in order to further undermine the established system of production and consumption. Chancelor Bennett, a.k.a. Chance the Rapper, does not contract with record labels, but distributes his music freely. His vision is centered on hip-hop's community-building power, thus he endeavors to create, in his music, a space wherein the line between creator and consumer is regularly blurred. Towards this end, he focuses on improving his musical quality rather than the potential profits of capitalist distribution. [46] Felipe Andres Coronel, also known as "Immortal Technique," famous for focusing on issues such as class struggle and institutional racism, approaches alternative mode

exchange in an even more confrontational manner. Recognizing that record companies siphon profit from musician's labour and that those same companies act as the arbiters of who is potentially heard and who is not, "Immortal Technique" encourages his audience to digitally steal his music, but caveats this with a call to each fan's personal responsibility as an inductee into the community of hip-hop. He charges his fans with the responsibility to broadcast those pirated tracks into the very eyes, ears, and situations with which his music grapples: the face of injustice, in front of police, in front of racists, etc... In this way, "Immortal Technique" hopes to inject his activist message into all aspects of society while ensuring that the voice of social awareness is not silenced. "Because, [in the words of "Immortal Technique"] that is the true spirit of hip-hop." [47]

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Media-Aesthetic Expressions of Worldly Sympathy
The Illuminations of Le Tricolore

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Abstract

This article departs from the observation of the worldly phenomena of media-aesthetic expressions on urban surfaces that followed the terrorist attacks in Paris on September 13, 2015: The colors of Le Tricolore were illuminated on landmarks, embassies, museum buildings, and various architectural facades in at least sixty cities around the world. In the paper I consider how these media aesthetic phenomena occurred by certain modes of behavior, with certain modalities of existence and conditions of becoming, as phenomena that not only appear but also disappear, circulate and function within the public domain. The paper considers the relationships the flag illuminations may have with the genealogy of media aesthetic urban surfaces, with artistic "massive media" and emotional spectacles of memorial events, and also considers how they may form a hybrid commons by mechanisms of virality, transversality, and other networked connections. Overall, the paper reflect on how our media-aesthetic engagements are deeply engaged with our communicative existence, including its sensibilities, imbalances, and biases.

The Illuminations of Le Tricolore

Posted on the website of the Aurora Opera House, shared on websites and social media and sent to the people of the French Republic through the French Embassy in Valletta, on November 14th, 2015:

"Nationality, ethnicity, religion and race, even though they should not, tend to divide us. Music should remind us that, above all, we are part of one humanity. So it is despicable to see that violent assaults are targeted to houses and patrons of the arts. As a reminder of the one humanity we belong to, the Aurora Opera House (Gozo, Malta) sports the French colours, with sympathy, empathy and support. #ParisAttacks" [1]

In the days following the attacks on Paris by Islamic State that killed 130 people on November 13, 2015, a remarkable reaction appeared in urban environments. Le Tricolore, the French flag in the colors blue, white and red, appeared on world landmarks, embassies, museum buildings, and various architectural facades, one by one, in at least forty countries. Le Tricolore was displayed via colored light on statues, monuments and buildings; it was projected as images and mapped onto urban facades, buildings and walls, and it was integrated into permanent LED facades. The illuminations emerged as media-aesthetic modes of expression on urban surfaces, in worldwide responses to the tragedy. [2] [Figure 1]

Fig 1. *Sydney Opéra House (tricolore flag) 14 & 15 & 16 November 2015,* Sydney, 2015, photo by Ludopedia, digital photography, Wikipedia Commons.

The flag illuminations followed a similar reaction in London and New York City after the Charlie Hebdo-attack in January 2015. Back in January, The French Embassy on Trafalgar Square, the County Hall opposite the Westminster Parliament and Tower Bridge in London were lit with the colors after initiative of Boris Johnson, the Mayor of London. Also, the spire of the Empire State Building in New York City was illuminated. However, the overwhelming number of flag illuminations that followed the Paris attacks on November 13 formed into a global gesture of sympathy, solidarity and tribute to France as a nation, seemingly intuitive, covered by news media worldwide, and circulating widely in social media.

When new media aesthetic phenomena like these occur, with so much worldly resonance and media attention, we have to consider what they mean and what they might tell us, as 'media aesthetic symptoms' of

contemporary urbanity. We are familiar with the "half-staff" (or British, "half-mast"), the flag flying below the summit on a pole as a symbol of respect, mourning or distress. This tradition is known since the seventeenth century, with the flag lowered to make room for an "invisible flag of death" flying above. The flag projections might be considered a technologically advanced "renewal" of this gesture, with the flag as icon gaining new proliferative, ephemeral, and distributive opportunities in the (im)material adaptation as projection or illumination. Similarly, we are familiar with the gesture of mourning, respect and remembrance in the moment of silence, and we might consider this familiar gesture echoed in the cases where monuments and buildings normally illuminated went dark. From the day of the attacks, Friday, November 13, the Eiffel Tower went dark [Figure 2], which was also the case after the Charlie Hebdo attack in January. So did the Empire State Building in New York City, as well as the Eiffel Tower replica at Paris Las Vegas over the weekend. [3] We could approach the media aesthetic phenomena of the flag illuminations as phenomena of visual culture with significance by way of their symbolic value, as forms of *representation* of gestures of sympathy, solidarity and tribute in an image driven media culture.

However, if approached not as icons or symbolic images that represent something, but rather as media aesthetic phenomena that occur by certain modes of behavior, with certain modalities of existence and conditions of becoming, as phenomena that not only appear but also disappear, circulate and function within the public domain, they may offer an entry point to questioning seemingly complex aspects of our contemporaneity.

Fig 2. *The Eiffel Tower in Paris*, Earthcam screenshot posted on Twitter by @Ramisms, 4:26 PM on November 13, 2015.

Cultural Aesthetification and Expression on Urban Surfaces

For a while, we have been experiencing an *aesthetification* of our surrounding world, our social life forms and our life narratives. This aesthetification is intertwined with our media condition; a condition in which, according to an oft-quoted position of Peter Weibel, "…media experience has become the norm for all aesthetic experience". We particularly encounter this aesthetification of our life world in the meeting of media

and aesthetics on mediating "surfaces". For example, urban screens – small screens on mobile devices, digital cameras, mobile phones, information screens, video billboards, windows of any given computer desktop, larger screens of home theatres, the lens of Google glasses or augmented reality goggles. These aesthetic surfaces constitute 'a visual regime of navigation' [4] or 'consoles for interfacing' [5] in our contemporary urban context.

That our urban culture is increasingly organized by media aesthetics is nothing new, nor is the tendency of spectacularization that we see in current aesthetic appropriations of urban surfaces. The projection of images onto urban surfaces appeared already in 1860s in the United States, where slides of images and text were projected outdoors on screens, blank walls and public monuments. This was by mean of the magic lantern known as the 'stereopticon' – promoted by advertisement but also used for exhibition and musical entertainment. [6] Erkki Huhtamo notes how in 1904, a magic lantern manufacturer, T.H. McAllister, describes five modes of projecting slides in outdoor spaces: on walls, shop windows, screens mounted on moving horse-drawn carts and screens erected on the roof (using either front or rear projection). [7] Since then, we have witnessed media aesthetic surfaces of walls, billboards, architecture, mobile and permanent screens, and in illumination – mediating layers of light, which, ever since the first powerful arch-lights were used as ornamental lighting for illuminating public monuments and architecture in Paris in the 1840s, have contributed to organizing our urban environments and culture. [8]

Today, we are familiar with installations for illuminating monuments and architecture, sometimes in efforts of enhancing the appearance and 'meaning' of the existing architectural structure at night, other times by adding communicative layers or images on top of the architecture or urban surfaces. A famous example is the lighting of the spire of the Empire State Building, which has been lit since 1976 when Douglas Leigh, an advertisement and lighting designer responsible for a lot of the electric billboards in Times Square, proposed to lit the spire with blue, white and red – the colors of the American flag, for the country's bicentennial celebrations. The Empire State Building's tower lights have maintained a tradition of changing colors to recognize various occasions, organizations and days of note throughout the year and supposedly inspired the spire of the One World Trade Center and many others around the world to act in the same manner. [9] In the illumination of the spire of the Empire State Building, we might find the first example of using illumination as a media aesthetic mean to express a collective mood of the city, an added layer of meaning beyond augmenting the architecture.

Over the past two decades in particular, we have witnessed how the use of light, LED facades and projection (mapping) no longer belongs to the domains of advertisement, news, community media, art (and cultural events), which are genres proposed by Brynskov

et al. to be identified within the domain of "media facades" in particular. [10] Interestingly, these genres are not too different from the types proposed by McAllister in 1904. In very recent years we have witnessed how modes of media aesthetic, visual expression are fusing into other spectacular modes of communicative use. For example, the changing results of the election for Danish parliament on June 14, 2015 were projected onto the façade of Christiansborg, the parliament building in Copenhagen. For another example, projection was used by protesters when a grand image including the words "Modi Not Welcome" were projected onto the House of Commons in London on November 8, 2015, in advance of the Indian Primi Minister Narendra Modi's visit to the UK. [11] In convergence with various modes of communicative gestures of informative, commercial, cultural, protest or emotional content, aesthetification of urban surfaces has reached a state of seemingly unlimited creative use, as an efficient mean of expression in public to a broad audience.

At this point in time, we have cultivated certain modes of visual expressive behavior and also a more or less worldly familiarity with how to decode these modes of expression. We have developed a media aesthetic visual language of aesthetic expression on urban surfaces that makes sense and is appropriated globally, almost regardless of the level of technological advancement.

While at first the encounter with the documented flag illuminations from around the world might grant us the thrill of feeling globally, emotionally connected, in mutual recognition of the meanings of sympathy, solidarity and tribute, these illuminations might also reveal a new face of networked spectacle culture. This is not governed by culture industries capitalist incitements in a conventional sense, although cultural and official institutions initiated most of the illuminations and the motivations for doing so *could* relate to the opportunity of conveniently having their sympathizing gesture distributed in news and social media worldwide. Rather, the nature of the networked spectacle culture we might be glimpsing is characterized by much more complex cultural forces; forces that avoid our awareness and cognitive reflection on the cultural, social and political consequences of these media aesthetic expressions.

Emotional Spectacles – Hybrid Commons

Artistic initiatives have contributed to developing a discourse of aesthetic expression on urban surfaces, however in manners different from communication and advertisement (oftentimes in critical responses to the governance of urban visual culture by culture industries) – towards spectacles of more emotional premises, often in creating situations of communality or shared experience. We find this already in the avant-garde movements of the 1960s, where installation art took up technologies for image projection referred to as "expanded cinema," with an early example found in Jeffrey Shaw's *Corpocinema* [12] from 1967 installed at Museumplein in Amsterdam. Such forms of public art installations, which up until today have advanced with

the given technological developments, are termed by Dave Colangelo as *massive media*, which "…comprise those practices and places of exhibition that combine expressive architectural-scale elements (in the form of urban screens, public projections or media facades) and telecommunication elements unique in their geographical reach." [13] We find a variety of massive media in artistic engagement of urban surfaces where artists use and re-activate the existing infrastructure of urban screens for artistic purposes, either in temporary visual projections or on "displays" integrated into building façades. These are sometimes referred to as 'media facades,' activated with computer-based design and enabling electronically animated, computer-controlled ornamentation of architecture. [14]

A significant orientation within Massive media for this context of inquiry we find in installations that have sought to establish an *emotional commons* in monumental events. This is for example the case in Elle-Mie Ejdrup's *Peace Sculpture* from 1995, which on May 4th, the date of the liberation of Denmark from the German occupation, employed a 532-kilometer laser light along the west coast of Jutland in Denmark, from Skagen to the German island of Sylt. The laser light connected the massive fortification complex of more than 6000 bunkers that were constructed on the Danish coast during the Second World War [15].

Fig 3. *Tribute in Light (air force 2)*, September 2008, photo Denise Gould, digital photography. Wikipedia Commons.

Also *Tribute in Light* in New York City can be considered a monumental event with an emotional commons [Figure 3]. The installation was produced by the Municipal Art Society of New York (MAS) and conceptualized by artists Julian Laverdie and Paul Myoda in 2001 in remembrance of the September 11 attacks on the US. *Tribute to Light* consists of two shafts of light made of 88 searchlights clustering 8,000-watt lights. These are projected skyward from the roof of the Battery Parking Garage on Morris Street on every September 11 in memory and mourning of the fall of the twin towers on 9/11. The Tribute in Light can be seen for more than 60 miles on a clear night. [16] The vast documentation of *Tribute to Light*, which a Google image search shows, reveals what according to

Colangelo is a central contribution of massive media, namely when they come to interrogate the interdependency of contexts, people, technologies and places, "…to imagine and construct a hybrid 'commons'." [17]

The "relational architecture" by Rafael Lozano-Hemmer exemplify the notion of a hybrid commons, taking advantage of the Internet and advanced telecommunications technologies. *Vectorial Elevation* from 1999, initiated in celebration of the arrival of the year 2000 in Mexico City's Zócalo Square with eighteen searchlights positioned around the square. These could be controlled via an online 3D simulation program on the Internet via which users could choreograph six second-sequences of light design. The participation of thousands of people from 89 countries via the virtual reality program was groundbreaking. [18] *Tribute to Light* and *Vectorial Elevation* exemplify two aspects of the hybrid commons – the first by its afterlife and circulation in an online global commons, the second additionally by enabling for active participation by remote audiences. Today however, one and a half decade later, we may have to expand our conception of the hybrid commons even further. The virtual landscape, intermingling news channels, social media, personal web spaces and online presence of soon every event taking place in our material reality, enables hybrid commons to form in complex relations and levels of "participation". Sometimes a commons forms in unprecedented ways by mechanisms of virality, transversality, translocality and other networked connections.

Recently, we have witnessed how monumental events of emotional spectacles been appropriated for wider celebratory or memorial purposes. Moberley Luger has described a shift in monumental events from commemoration practices toward an emphasis on hope and healing; an emphasis in aesthetic initiatives towards qualities of having some kind of active, healing characteristic [19]. For the celebration of The United Nations Educational, Scientific and Cultural Organization (UNESCO)'s 70th anniversary, on November 16, 17 and 18, 2015, the project titled Mosaic of Change displayed powerful projections onto the façade of the UNESCO headquarter in Paris and onto the monument of The Symbolic Globe. [20] The projection included images from the UNESCO archives that reflected the accomplishments of the multinational agency over the past seven decades. However, because of the terror attacks that happened a few days before the anniversary, new images were added to the projection in light of these tragic events with the word PEACE appearing on the side of the UNESCO headquarters in six different languages. [21] Thus the celebratory event was turned into a gesture of contemplation, hope and healing.

A similar pathos of hope and healing was engaged in Berlin on November 9, 2014, for the 25th anniversary of the fall of the Berlin Wall. 8,000 glowing, white balloons were set up as part of the project titled *Lichtgrenze*

Fig 4. *Balloon celebration of the 25 anniversary of the fall of the Berlin wall*, 2014, photo by Elgaard, digital photography. Wikipedia Commons.

(lightborder) to recreate 15 kilometers of the route of the border of the previous Berlin Wall between West and East, passing landmarks such as Checkpoint Charlie, Brandenburg Gate and the Reichstag. [Figure 4] The event was initiated in memorial of decades of separation between East and West and the deaths of 138 people who were killed along the Berlin Wall between 1961 and 1989, as they tried to flee from the East Block. *Lichtgrenze* was designed by the brothers Marc and Christopher Bauder as a symbol of peace in Europe, twenty-five years on from the Wall's demolition. The balloon-wall installation involved the release of the balloons at night time, from 7pm and over a span of 25 minutes, in a coordinated dramaturgy accompanied by Beethoven's Ode to Joy. Attached to the balloons were messages from citizens and other participants. Following the release of the balloons, thirteen large-format video screens showed film collages with moving images from the 9th of November 1989, and the entire event was documented and aired at several large screens. [22]

Perhaps we can consider the flag illuminations in light of these expanded media aesthetic initiatives, as forms of massive media closer to monumental events than art installations, and as cultural modes of media aesthetic expression on urban surfaces that appropriate the emotional spectacle in uncoordinated, imitative gestures. In *Global Activism, Art and Conflict in the 21st Century*, Peter Weibel identifies a current phenomenon of "cultures of repair," which he locates in today's protest groups, such as the Occupy movement, which searches for ways out of the environmental, financial or democracy crises in reaction to the partial inability to act because of the structure of political system. [23] These initiatives of "cultures of repair" operate by making unequivocal responses to overcoming crisis in performance-based interventions combined with distributions through the mass media. Perhaps we can consider the flag illuminations in a similar manner as cultural acts of "repair," as rapid responses to crisis by means of the privilege of being able to respond visually, rapidly and with great emotional impact – with worldly resonance in a hybrid commons. As such, while the flag illuminations are not pre-planned, coordinated aesthetic initiatives like the examples above, they imitate the

performative aspects of these installations as "emotional spectacles" while inscribing in a media-aesthetic culture of responding to world events (in memorial or celebratory gestures) and evoking a hybrid commons. In the flag illuminations, we recognize a performative aspect of our ability to respond to stimulus in the world, which is causing a both actual and perceived reciprocal influence between humans and environment with digital media. [24]

Networked Behavior

Something significant and fairly revolutionary about the recent developments in urban media aesthetics, which particularly through "screens" have come to aestheticize so many aspects of our lives, is the modality of these screens as "networked," forming into what Andrew Murphie calls "screen ecologies". [25] Networked media signal the end of traditional notions of media – as known for almost a hundred years. Since Félix Guattari's anticipation of the soon-coming network society in 1989 [26] and the rise of the network society (Castells 2000) we have witnessed how network technologies and network logics have gained magnificent impact on how we organize and understand developments in our world today. A significant effect of network culture concerns how the increased speed of communication has created a "global now"; [27] with an expanded horizon of the electronic present and shrinking horizons with respect to the past and the future, an increased pace of exchange, and optimized management of global reaction, conflict and collective action. Significantly, the 'global now' has encouraged a pervasive feeling of temporal stress among societies and individuals. [28]

Our actions and expressions in our urban reality are intimately related to our cultures and behavior in networked media. As such, aestheticized urban surfaces can be considered to convey the virtual transformation of our material (physical) relations – which are changing with 'virtual forces' of the global now. In *Feed-Forward*, Mark Hansen uses the rubric "twenty-first-century media" to specify what makes the new (networked) forms of media that are prevalent in our world today different in substantive ways from their predecessors. He points at how twenty-first-century media catalyze a shift in the economy of experience itself; a shift from a media system that addresses humans first and foremost (agent-centered perception), to a system that registers environmentality of the world itself (environmental sensibility), prior to and without any necessary relation with human affairs. [29] Environmental sensibility yields an enhanced human contact with a sense of "worldly sensibility," referring to human experience in relation to a larger domain of experience, which indicates the displacement of 'perception' with 'sensation.' [30] Hansen explains a consequence of this sensible condition: "In light of this increasing data-fication of cultural products and processes, coupled with the general acceleration of culture as such, we thus find ourselves faced with the imperative to respond – to take deliberate action and to make conscious decisions – *in situations where deliberation is no longer the relevant level of experience*. Faced with such situations, we cannot but experience a certain cognitive opacity as our consciousness perpetually – and vainly – struggle to "catch up" to what is happening." [31] As such, our techno-culture puts increasing demands on us to act in the absence of sufficient awareness and time for conscious deliberation.

While this is perhaps first and foremost a description of a condition of our behavior in social media networks, the flag illuminations nonetheless mirror some aspects of our behavior in networked media. We might consider the illuminations as gestures of showing sympathy via expressive identification with an issue or locality, one that we are familiar with in online social networks like Facebook. Consider for example the similarities in the gestures of illuminating the flag on urban surfaces with personal appropriation and posting of the slogan and logo "Je suis Charlie". This slogan was created by French art director Joachim Roncin after the massacre at the French satirical newspaper Charlie Hebdo on January 7, 2015, which proliferated over the Internet and also appeared in physical demonstrations. Following the new attacks on Paris in November, the slogan and hash tag updated to "Je suis la Paris" [Figure 5]. One could argue that the flag illuminations in a similar manner signals sympathy via identification with France or the French population, which the flag represent. An even more explicit example perhaps, concurrently with the emergence of the flag illuminations in various urban environments worldwide, Facebook offered its users the ability to cover their profile pictures with a translucent layer of the French Flag, intended as a gesture of showing sympathy and solidarity with France after the tragic events.

Fig 5. *Je suis Paris*, November 18, 2015, image by Mark van Brnkhorst (Sweet Sans Heavy), H. Hoffman/H. Berthold. Derivative work of Je Suis Charlie by Joachim Roncin & Charlie Bebdo. Wikipedia Commons.

The behavioral forces underlying the flag illuminations on urban surfaces may be considered reflective of behavioral forces we find "online".

I would think that many who re-circulated the slogan or appropriated the flag online were motivated by experiencing connectivity with a larger domain of people, in a form of shared experience. With the best of intentions, showing one's sympathy in this manner might have seemed to many as an intuitive, almost natural response. For many, this was probably joined without deep consideration on what Facebook might gain from generously offering the aesthetics of the half transparent flag and the infrastructure for sharing, or what such clearly expressed sympathy with one nation in the world might exclude of expressions of sympathy with other nations that had recently undergone similar horrors. These examples reveal the mode of cultural acceleration in which we find ourselves faced with an imperative to "respond," "take action" via visual expression (without having to invest much else), and this is the same force of cognitive opacity combined with temporal stress that we see surface in the acts of initiating the flag illuminations. We should not forget that the flag illuminations "existed" (and still exist) as much in their virtual presence as in their urban contexts; documented, distributed and re-distributed online while building up a hybrid commons.

When considering the effects of the monumental gesture of the Tricolore-illuminations in a mode cultural repair, even if we agree to these as signs of sympathy, solidarity, respect, love and support (rather than attempts of publicity, which would be the judgment of a more cynical account of these initiatives), we have to consider them as both reflecting and reflective of a worldly sensibility. We need to be careful with and critical about how this sensibility is 'managed,' because it feeds back into the networked, worldly, emotional system. The grander, brighter, more powerful and globally visible these "events" become, the bigger their hybrid commons, and the more they come to interrupt and intervene into our worldly (im)balance.

Worldly Sympathy

When reflecting on the complexity of *sympathy* in our current condition with twenty-first-century media, such a gesture is never neutral. The media-aesthetic response of a memorial gesture of sympathy expressed with the flag illuminations reflected a tendency in global media today in which some events in certain countries are granted more worldly attention than events in countries less covered by Western media, either because these are taking place outside of the western hemisphere or because they are of less "concern" to the western world.

A poem went viral on November 14, written by the Indian blogger Karuna Ezara Parikh from New Delhi. With the title "It is not Paris we should pray for," the poem continues, "… It is the world. It is a world in which Beirut, reeling from bombings [one day] before Paris, is not covered in the press. A world in which a bomb goes off at a funeral in Baghdad and not one

person's status update says, 'Baghdad,' because not one white person died in that fire…" [32] The expressions of illuminating a national flag on urban surfaces did *not* happen after the explosion in Beirut, killing at least 43 people and wounding 239 on November 12. [33]; nor after the roadside bomb targeting Shias in Iraq, killing 26 people and injuring more than 60 on November 13 [34]; also, not after the 'destruction' of the Russian civilian airliner with 224 passengers flying from Sharm al-Sheikh to St Petersburg on October 31; not after 102 Turks and Kurds were killed by two suicide bombers at a peace rally in Ankara on October 10; not after 149 students were killed and 79 wounded at Garissa University College, Kenya, on April 2nd; and also not after every frequent attack in Baghdad, Syria and many other places in the world, to mention just some of those tragic events of terrorism that one could show sympathy for. Out of my introductory exhaustive – but probably not complete – footnote listing of flag illuminations in response to the Paris attacks, only in Giza did the projections on the pyramids also include other flags than Le Tricolore. They included the Syrian flag, in memorial of various attacks on Syria, and the Russian, in memorial of the destruction of the Russian civilian airliner. Another unfortunate observation to note is that Facebook has not (yet) offered any other flags filters than the French to go on top of one's profile picture, which is selected under "customize your profile picture," then "causes" from a drop down list.

Another misrepresentation of the situation of sympathy is found on the mirror.co.uk, writing on Saturday November 14 about the phenomena of the flag illuminations in response to the November-terror attacks in Paris: "Iconic buildings across the western hemisphere displayed Le Tricolor in a show of solidarity after the slaughter that left at least 120 people dead". [35] As my listing in the footnote [36] shows, the gestures of lighting, projecting and streaming of the colors of the French flag were not only a "western gesture" but occurred all over the world. Even though not all initiatives had been carried out on November 14, the presumption that these reactions would only be found in the West yet again reflects a western-centric (and ignorant) perspective on the world.

So why was this intuitive, expressive response to acts of terrorism with illuminations of Le Tricolore on monuments, buildings and urban facades initiated after the attacks on Paris, in disregard of a number of other horrific terrorist attacks in 2015, or at this point in our techno-cultural development in which this mode of visual response is possible? Perhaps, as cynical critics might say, because the world "cares" more about Paris. But even if we are to give this claim some thought, we should not fail to conclude too hastily that this is because people in Paris are considered "more important" or "nicer" than people in Syria, Iraq, Libanon, Russia, Kenya, Turkey or elsewhere. Perhaps the explanation is rather that there is a mythical thing about Paris that elevates the concept beyond the city, as the connotation

of "Paris" involves as much "love," "art," and "culture" as it does the geographical city.

Another thing to consider, which was suggested to me by a Danish artist who's specialized in video and digital art, is that the colors of Le Tricolore, in terms of clarity and contrast, are ideal for mediated representation. While this suggestion might sound 'banal,' as the artist noted himself, Le Tricolore *is* nonetheless an aesthetically "pleasant" and easy adaptable image to display. We should not underestimate that the intuition with aesthetics is sometimes motivated by impulses that might depart in something as simple as that. However, as well-intended and sympathetic that the Tricolore-illuminations might have been, we might have to follow up with some reflection on how our media-aesthetic engagements are deeply engaged with our communicative existence, including its sensibilities, imbalances, and biases.

Generative Surfaces

The ongoing emergence of new flag illuminations in the days that followed the attacks, as well as the echoes of documentation of the illuminations across the world's media, indicated that the illuminations not only represented but also *generated* collective expressions of sympathy, and reactions. To my knowledge, we witnessed the first flag illuminations in this expressive mode in London in January 2015, after the massacre at the offices of satirical magazine Charlie Hebdo in Paris on Wednesday January 7, 2015. Following the attacks on Paris in November, we witnessed a worldwide response of illuminations and projections in over 60 cities around the world. Yet again, tragically, following the attacks on Brussels on March 22, 2016, this media aesthetic mode of expression had manifested, and this time we witnessed the colors of the Belgian flag illuminating the world's monuments.

In making a distinction between three ecologies: the environment, the social, and human subjectivity, Félix Guattari is concerned with the evolutive processes of "logic intensities". Guattari reminds us that a certain politics of process is pertinent to the network [37]. When considering the networked condition of society, we need to rethink the social in relation to its ecologies, in particular the new "techno-social" ecologies and the generative relationship between media ecologies and cognitive ecologies. Our cognitive systems, perceptual systems, techno-social conditions and the world are enmeshed within each other. The network is as much a concept as an 'inescapable social event'. [38] We may consider how the networked condition of our world has not only enabled new aesthetics, but also new modes of acting and being.

In our current media culture, all the virtual structures that inhabit networked ecologies produce dynamic form, and this feeds back into that which produces it. The result, as noted by Murphie, is "a proliferation of differentiations within all media expressions" [39] – continuous transformations of media expressions. With the ecological approach to the proliferation of screens, Murphie considers how screens as complex ecologies, by

interacting with us in more and more ways, have gained a *generative* status in our everyday life. This is different from a perceived status of screens as fixed circuits of representations or framings in which we would be absorbed in a society of spectacle of simulacra. In the new setting of networked media, screens are intensities in relation to other intensities (rather than controlling devices). [40] As such, media aesthetic surfaces in our urban environments today not only organize communication but generate contact, connectivity and culture.

The new media technologies, expressions and instantiations we witness impact and uphold media ecologies as much as they arise from them. We might consider how the flag illuminations have instigated a generative protocol for expression of emotional gestures on our urban surfaces. The expression of projecting a country's flag after acts of terror changes might be a phenomena occurring now but perhaps not in a few years, and it will inevitably change how networked gestures of sympathy and mourning will happen in the future.

This generative point also applies to all other media aesthetic phenomena (and, I would argue, phenomena in general). Even if the technology or medium used for an urban media art installation seems to remain the same, or was used for a similar installation five years ago, the recent installation inhabits a networked ecology as a dynamic form, and the networked ecology is changed from previous feedbacks. Hence the meaning, impact and significance of the installation – or media aesthetic expression – can never be repeated but always change in correlation with developments in the current ecologies from which it emerges. More importantly, our media aesthetic expressions and related cultural, techno-social or political implications cannot be "undone" in terms of how it feeds back into the media aesthetics of our urban networked cultures and the ecologies from which these emerge. This is why it matters how cultural, social and behavioral changes depart from connections and divergencies between media and aesthetics.

Conclusion

In conclusion, we can no longer understand and approach media aesthetic phenomena as single, isolated or 'one-site' specifics but must take into account the networked reality that conditions these (and future) phenomena. This means we have to consider the meaning and power of media aesthetic phenomena in terms of a hybrid commons, rather than (just) public space in a traditional sense. Media aesthetic expressions contribute to sharing culture and renovating ideas of what it means to be public. When considering the conditions of media aesthetic phenomena, we have to also take into account the forces that drive our "digital" cultures and behavior. We have to understand that these phenomena do not represent aspects of or ideas about the world as much as they construe and generate our world. It is crucial that we continue to challenge the aesthetic means by which we

interfere with the emotional infrastructure of our world. We should be aware and attentive to what installations like these add to public space, our hybrid commons, our digital present and our becoming in it.

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Part II

Short Papers (peer-reviewed)

Performing Identity through Wearable Sensing

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Abstract

The current technology fervour over wearable technology that collects user's intimate body data, under the pretense of medical or fitness monitoring, highlights that it is time that critical questions were raised. The ethics of corporate ownership of body data for consumerist agendas is rarely discusses beyond the fine print on these devices [5]. More awareness and education on these issues, would potentially allow more access, ownership, and creativity in the use of one's own body data, and ways to express personal identity through this data.

This paper highlights these issues, through discussion of a new collaborative project by the authors, which brings performers together to help address the ethical issues around identity and data ownership when using wearable technology in performance. The project develops methods to use and hack commercial wearable devices, as well as making handmade e-textiles sensing devices for performance. As such, we aim to engage performers to access their own physiological data for personal use, but also to create unique and interactive performances.

Wearable Devices in Context

The zeitgeist around corporate medical or fitness monitoring highlights that it is time that critical questions were raised on the ethics of corporate ownership of this data for profit and government surveillance. Wearable apps and device development is a growing commercial field. With smart watches, fitness trackers and sport tech, such as Nike Fuel Band, Fitbit, and Jawbone, there are many devices that are designed to collect user data through sensors, such as accelerometers, gyroscopes and pedometers, breath sensing, heart-rate monitors, and calorie trackers. These technologies and other concurrent developments in electronic textiles, medical/biotech, have all evolved to the point that there is a community called the Quantified Self Movement based upon bodily self-monitoring. BBC recently reported that "97,000 apps are on sale in the mobile health sector" (Forrester, June 2014) that track this data. Many tech companies and start-ups are working to make the next wearable device or application for body data tracking.

General users and the public must be made more aware of the ethical issues of body data collection.

Everyone should have the right to access, own, explore, and use their own body data, as well as to interpret or reinterpret this data however we choose, to express our own personal identities, which is presently easy since the companies hold it as proprietary and only sell it to insurance or medical companies (Forrester, June 2014).

Currently the wearable tech companies, who can then sell it on to whomever they wish, own our physiological data, collected by wearable technology companies via mobile apps and devices. In one news story, (Rose, 12 November, 2014) fitness data from these devices is being used to monitor one company's employees' fitness, which could easily be used against them.

During a time of public cynicism around spying and data collection practices by governments and corporations, brought to the fore by the Edward Snowden revelations, artists, designers and performers should be involved in the wearables discourse as critical agents to educate the public about the corporate colonisation of the body through wearable technologies.

Exploring Through Performance

Researchers in recent years have been exploring these issues from the mobile health dimension, but, as Susan Elizabeth Ryan has noted in her recent book *Garments of Paradise* (2014:8), few are exploring the full potential of wearable technology in performance, let alone the other related issues of identity and body data ownership in performance. She writes:

> *Wearables in the context of performance present opportunities for exploring our relationships with our bodies and how we move them...* [or how] *communications interfaces, and other soft and sensory technologies allow us to experience or transcend our bodies, and how the concept of theatrical performance can be expanded in virtual space* (2014:8)

As researchers and artists we question how this unique individual data demonstrates who we are as people, and how movement and our physiology can demonstrate

that. Does this relate to the performance of identity [1]? We would like to question how body data might be able to demonstrate who we are, through movement, through our physiology. How does access to personal data enable the performer to show their identity, rather than what is subscribed by the corporation making the sensing devise? How can we explore these issues while enabling people access to their own data, especially in performance contexts, in order to interact with it? How can we explore these issues while enabling people access to their own data to interact with, especially in performance contexts? The Performing Identity Through Wearable Sensing project hopes to highlight:

- the need for new directions and to transform engagement in performance using wearable technology,

- identity and body data ownership issues in the current zeitgeist around wearable technology development,

- the need for critical discourse on wearable tech in general, but within the performance community in particular, the transformative potential of making experiments in 'performing one's own identity' via body data and self-made wearable sensing devices and garments.

This collaboration addresses the issues, challenges and problems of developing methods of making and using handmade wearable sensing to access physiological data to create unique interactive performances. As such, we aim to share Maker/DIY practices with the local performance communities and educate these communities in making their own electronic textiles-based devices. We see this as way to draw these communities into the development, evolution of, and conversation around wearable technology, data collection ethics, and in particular how wearable technologies might enhance performance creation, while being playful, challenging work.

In the context of this project, we wish not only to help performers to use and make their own physiological sensing devices using electronic textiles and accessible technologies for DIY smart fashions costumes, but also to enable them to use them to express and perform their own identities as they choose.

One current exploration of this notion by the authors is through programmable garments that are used within live dance performance. In this piece, vibration motors, such as the ones found in mobile devices, are embedded into costumes. The buzzing patterns indicate a choreographic score for the performers. This score is a representation of data previously collected with a fitness tracker by one of the authors. The piece questions if the identity of the choreographer can be revisited through a performance and through a smart textile device. It also raises issues over who is the owner of this data – the choreographer or the performer w ho is now taking this data and reinterpreting it to their own ends. It may be considered a metaphor for the corporate appropriation of personal data collected through fitness trackers.

Practical Investigations

In April 2015, the authors had a ten-day residency to immerse more deeply and practically in the project's concerns. Two approaches were explored within the work with performers during this time, including using commercial biosensing devices as well as DIY wearable tech devices.

Within our first explorations we focused on what we know about the commercial biosensing products that we chose (Polar belt and OMSignal shirt), and how we could start to play with layers of interpretation, based on what we know about data types they collect from our bodies. We revealed this knowledge orally in layers, which was a very complicated task for the dancers in terms of interpreting information through embodiment and movement.

As we revealed more information to the dancers – about the devices/garments, the data they were collecting the nature of our research, the ethics and corporate activities of companies who made the devices – their movement changed from a free flowing dance to more gestural, smaller, intense movements. Their movement transitioned from dueting with the other performer to solo performance. They moved from an embodied, responsive, expressive body to confused, individuated, over-analytical, paranoid, less-connected and engaged body. However, it was not the device itself that triggered this movement response. Based on their observed movement, it seemed that it was the idea that the data from their bodies was being collected and used - by both us (the artists) and the businesses that sell these devices. The devices themselves and the functions they sensed had less of an impact on the movement and the movement qualities. The dancers had trouble seeing these devices beyond things that would collect numbers. They were changing their expression based on the concepts we were having them explore, rather than experience of wearing the devices/ garments themselves, which they soon forgot they had on.

Figure 1, Hacking the Body 2.0, 2015. Using commercial biosensing wearable technology in performative contexts with dancers.

The second part of the project focused on the use of DIY sensors and actuators in handmade garments. The dancers reported much more affinity towards these garments and more interest in how the actuators in them triggered them to move. These garments were more sensual, delicate and elicited more tactile, intimate responses by design. They were playful in this way was well. Each of the handmade sensors was unique and personal in design, style and required close up interaction, touch and engagement.

The overall long term direction of this project is to refine methods of working with performers to enable them to control how they use the physiological data from their body or the data from another performer. This will be developed through further iterations of sensing and actuation via devices/wearable technologies they wear. This may then allow them to interact or respond to biosensing to create new movement 'dialogue' or interaction with other performers and therefore explore identities. In this way, the performers reclaim the data sensing and collection by using the technology as another tool to help them devise movement and co-create or choreograph performance works. This circumvents, and puts into new light, the ethical issues of corporate ownership by putting the ownership back into the hands of the user. This in turn may be considered a critical act of making and confrontation of the issues of surveillance and data control.

Figure 2, Hacking the Body 2.0, 2015. Dancers performing with DIY wearable sensing devices created by the authors.

Summary

Throughout this research, questions about ethics, data collection, how we use wearable tech, and how these devices reflect our identities are raised. By using performative practices and new devices, new idea s about what we are sharing and what this may mean begin to emerge. Future practical explorations include: organising more performance experiments and continuing to develop different approaches to using wearable tech in performance contexts, as well as making more robust custom wearable tech garments, embedded with both specialist sensors and actuators, that enable the performers to intervene with each other's expression using their body data. The ultimate goal is that performers engage with their own and other's body code to create new forms of 'live data performance', where the performer is initiating the interaction, using the wearable devices to aid their interaction. There are no concrete conclusions as yet, as the project is still ongoing and a new recent phase has involved performance for audiences with new custom made garments (due to the nature of the funding), rather than more strict research. Thus, more research work needs to be done with the new garments and newly developed technologies. Stay tuned.

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Semiotics of Glitch Artistic Practice

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Abstract

Glitch art is typically described as a kind, or style, of production error: "accidental" (caused or found) mistakes in the production or translation of a digital work. However, much of glitch is created using intended errors, or even simulations of error, created via reproducible means. The latter defines glitch aesthetics, as distinct from glitch production. This paper explores the semiotics of various types of glitch in the context of a fluctuating artistic practice.

Introduction

Imperfection, mistranslation, misuse, and malfunction remain potent tools for creating artistic meaning. Glitch, traditionally, has been described as a kind, or style, of production error: "accidental" (caused or found) mistakes in the production or translation of an analog source to digital. Glitches blur the distinction between information and noise by investing error with meaning. One or more parts of a digital object, an image for instance, are shifted, flipped, inverted, skewed, warped, ripped, sliced, or otherwise made noisy. A classic example is opening a digital image file in a text editor and then changing some characters before saving the file. When integrated into a work of art, whether deliberately or after-the-fact, these techniques create dense amalgams of intentionality and discovery, collapsing traditional distinctions between medium and data.

"The glitch is the entropic process acting on the data, whereas the artifact is what is produced when that altered data is read." [1] There has been much experimentation by artists in the manipulation of real and simulated production errors, in efforts to produce meaningful work. Depending on the medium, the predictability governed over raw materials has caused us to reconsider what glitch is, its scope and its future.

Glitch as a Flexible Continuum

Iman Moradi identifies a difference between pure glitch and glitch-alike. [2] Pure glitch is accidental, coincidental, appropriated, found, and real. Glitch-alike is deliberate, planned, created, designed, and artificial.

"Most glitch artists are always, directly or indirectly, trying to answer one question: How much agency should I provide to my systems of destruction? Their post-utopian strategies aim to identify where the 'tipping point' is: When and how can a glitch be found and transition into something new?" [3] Aside from instigating random mechanistic errors, or working directly with the digital file itself, there are techniques for replicating it artificially. Examples include introducing noisy data to functional algorithms or applying these algorithms in unconventional ways. Compositional practice of this nature is rather meant to assist the artist in answering the question, "How do you glitch on purpose?"

With this in mind, I propose two contrasting concepts that can both be called glitch but highlight fundamental differences in approach and mechanization: Glitch Production and Glitch Aesthetics. Glitch Production can be further defined by varying the amount of artistic control and stochasticity involved in creating glitch art.

Glitch Aesthetics

Making errors in a visible system creates a perception that emphasizes the artificiality of representation. Traditionally, the aesthetics of glitch dissolve differences between functionality and dysfunctionality. It interrupts the event and breaks down the expected. "The artist tries to catch something that is the result of an uncertain balance, a shifting, un-catchable, unrealized utopia connected to randomness and idyllic disintegrations." [4]

In the same article, Nick Briz continues by comparing glitch to cubism by its reduction of natural forms into its basic geometric constituencies. Glitch aesthetics is similar as it exposes a system's algorithmic processes into an aesthetic form. Glitch art focuses on popular culture by appropriating it via errors occurring in software, video games, images, videos, audio and other forms of data. Artists primarily search the material landscape in order to chance upon, catch, grab and record a glitch, rather than intentionally create them.

Phillip Stearns' *Year of the Glitch* is a tumblelog documenting images he produced with modified digital cameras and custom software processes. The customization of electronics provides him with endless creative possibilities for the reinterpretation of pixels. "I like thinking about glitch art as being the art of artifacts." [5] This concept of artifact stretches our definition of

glitch art: "Glitch is a term that for me involves a mistranslation or swapping of actual binary information, and that binary information is a language base. So for me glitch is more language based, whereas an analogue distortion is more medium-based. It's an inherent quality to the material and a noise that is part of that channel of communication." [5]

The epistemology of electronic performance has caused a departure from an error-prone glitch. If everything is randomly messed up, time-based glitch art leaves itself in a precarious situation. Most performing artists require at least minimal control over their system, which, in turn, expands the dialectics between imitation or simulation of glitch and the "pure glitch" in its historical form. This reality has led many artists to attempt to create glitch art using a range of tools.

Glitch Production

Category 1 – Chance-based Hacking

At one extreme are techniques of glitch production that are maximally stochastic and over which the artist has minimal control in real time. True circuit bending emphasizes a trial-and-error, lo-fi aesthetic, where often cheap battery-powered sources of circuitry are used, turning ordinary electronic devices into something unexpected. The aleatoric nature of 'bent' performance embraces spontaneity and randomness, while emphasis is given on the process of creation, rather than the instruments themselves. A common technique is to break open a ready-made electrical device and compromise the circuitry, often causing shorts. Circuit bending performers have limited control over their esoteric hacks while producing true aleatoric happenings, in a similar aesthetic to some of John Cage's work.

Category 2 - Input Hypersensitive Glitches

Glitch aesthetics can also be achieved without truly random or stochastic elements. Some systems are extremely sensitive to initial conditions but are, strictly speaking, fully deterministic from input to output. However, as with the first category, the artist exerts little control over the final product. Analog circuit inventions such as the Cracklebox [6] demonstrate the difference between chance error and system control – as the operator interacts with the instrument, the amount of perspiration and conductibility of their skin causes the box to produce radically different sounds. In the traditions of circuit bending, there is no error or system breakdown. Nor is the sound-producing circuit subject to the performer's control. Rather it shows a predetermined way of sound creation influenced by the unique performer.

Anyone who hears a Cracklebox would describe it as glitch aesthetic. However, the Cracklebox does not incorporate any circuit malfunction, or any stochastic elements. Sounds produced by the box are entirely deterministic. However, the sounds are exquisitely sensitive – very tiny differences of input create drastically different output. It is a tool with very little artistic control over the final realization but using entirely deterministic means.

Category 3 – Error-prone glitches

Interesting glitches are revealed by unforeseen delays or miscommunications throughout networks. Targeting bandwidth, memory limitations and packet transmission dataflow are all tools for data glitches. These tools are under the control of the system, but introduce small stochastic elements.

Imperfect Transmissions is a work for networked laptops created by Butch Rovan. The piece reappropriates the latency, or time delay between the sending and receiving of data, where unpredictable arrival times are translated into unexpectedly complex rhythmic events. [7] Time intervals are recorded between sent and received ping messages. These time intervals are then retransmitted and new delay times are calculated and again sent. This process is continuously repeated as all values are mapped to sound control parameters on each computer. Sound sources for each laptop are predetermined but the overall sonification of network inconsistencies gives rise to unique performances.

Fig 1. *Imperfect Transmissions*, 2010, Butch Rovan, live performance image capture of original footage, ©Butch Rovan.

Category 4 - Lost in Translation

Another category are techniques that involve no random elements but that afford the artist modest control over the output, or at least the ability in real time to adjust how "glitchy" an artwork will be. For example, misinterpretation within a machine's data mapping allows an artist to explore the ratio of control versus stochasticity. This method allows a performer almost complete autonomy over performance and is almost entirely predictable to the performer, except for a certain amount of corruption entering and influencing the system. This could be construed as a misrepresentation and gives rise to anomalies in the system mapping.

Misinterpreted data has always been a rich source of glitch. Laetitia Sonami, in her keynote at the New Interfaces for Musical Expression conference describes her own journey from seeking despotic control over her self-made controller instrumentation, the Lady's Glove, to facilitating the unforeseeable failings of a DIY system

for live performance: "Unpredictability became more and more welcome. Having conceived the lady's glove originally as a "controller", the surprises were limited to functional errors, or structural limitations. For instance the bending of one finger forces other muscles to trigger and contribute unintentional events, which in turn shape the performance. These unintentional effects revealed themselves to be crucial to an adaptive performance. The switch from control systems to exploration systems seems to me now inevitable." [8]

Fig 2. *Lady's Glove*, 2014, Laetitia Sonami, live performance image capture, ©Laetitia Sonami.

Category 5 - Imitating the Glitch

Finally, artists may simulate glitch production using systems that are maximally deterministic and controllable. Many glitch philosophies concern the *study* of uncontrolled and stochastic glitch with the aim of replicating it "artificially." For example, performable works are created ahead of time, where the artist laboriously refines each gestural moment, dictating an intricately planned structural flow. Controlled simulation of sabotage can facilitate hegemony of digital representation and the passivity of its subjects.

There are many examples of highly engaging pieces that try to mimic authentic-looking glitch, usually in post-production based upon printed footage. Ryoichi Kurakawa's glitch graphics and glitch sound takes their source materials almost always from nature. His audiovisual performances are predominantly pre-rendered sessions, where enormous detail is labored over in the software before finally rendering out a printed file ready for playback.

Fig 3. *syn_mod.1*, 2015, Ryoichi Kurakwa, live performance image capture of original footage ©Ryoichi Kurakawa.

Imitated, or simulated, glitch resembles aspects of real glitches found in their original habitat but are deliberately constructed. Essentially, artists are after the look and sound of the glitch ethos, not actual untamed errors. "The glitch aesthetic may be rooted in the look of malfunction, but when it comes to actual practice, there's often not much glitch in glitch art." [9]

Many performing glitch artists require control over their systems, believing that chance anomalies are not part of their stylistic vocabulary. The difference here is not, as it is sometimes supposed, between deterministic processes and stochastic ones. Rather, the difference lies in the artistic intention. Errors are outside the performer's control, whether the cause of that shift is deterministic or not, and perhaps are not useful towards defining individual style.

Whether stochastic or deterministic, the process of manipulation will only be reproducible in any meaningful way if the input-output mapping is predictable in real time. This predictability is what I am interested to find in glitch art, as a key to understanding intentionality. What users might perceive as "glitchy" can arise from a normally working function of a program. Sometimes these might originate from technical limitations, such as low image-processing speed or low bandwidth when displaying video. Or visibly pixelating the image by allowing the compression of parts to remain static over different frames when, for instance, the transfer speed drops. And then there are handcrafted systems whose purpose is to create these artifacts in an algorithmic way.
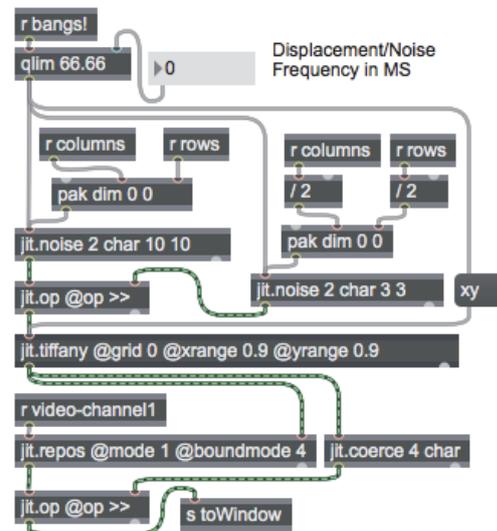
Fig 4. *Glitch Artifact Patch*, 2015, Vade, Griffin Byron, Max 7 patch ©Griffin Byron.

Above is an example of a Max patch influenced heavily by Vade's template library of patches [10] for glitching movie playback. Scrubbing through frames of the input source video can instigate further glitchery, as in the following additions to the patch.
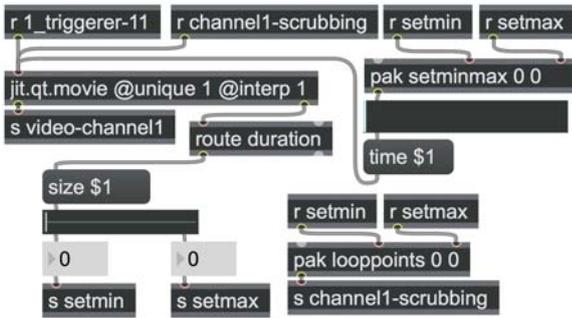
Fig 5. *Glitch Scrubbing Patch*, 2016, Griffin Byron, Max 7 patch, ©Griffin Byron.

Another example of a controlled glitch demonstrates how an audio signal can be used as an input source for manipulating video, as in the below patch.

Fig 6. *Glitch Audiovisual Patch*, 2016, Griffin Byron, Max 7 patch, ©Griffin Byron.

Varying the Control

There is a history in improvisatory performance whereby performer control can be varied in real time. In the context of glitch art, the ability to dictate the amount of control provides a kind of hybrid glitch.
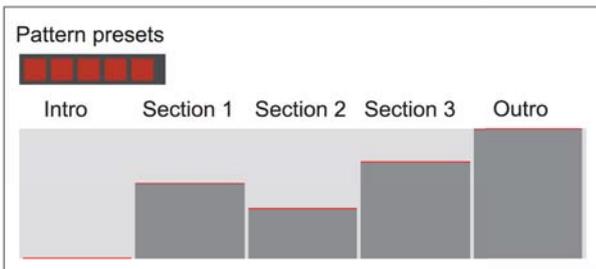
Fig 7. *GUI for introducing a percentage of glitch randomness*, 2016, Griffin Byron, Max 7 patch, ©Griffin Byron.

The above image shows a potential user interface for a performer to add an overall amount of glitch randomness to each section within the whole compositional structure.

The below image demonstrates how glitch engines can be swapped out on-the-fly, allowing randomness to specific modules. These presets can be triggered by MIDI or some other sensor system.
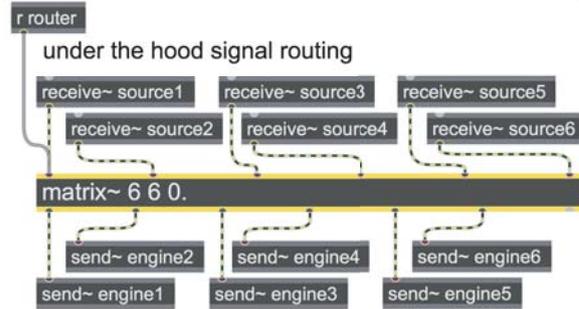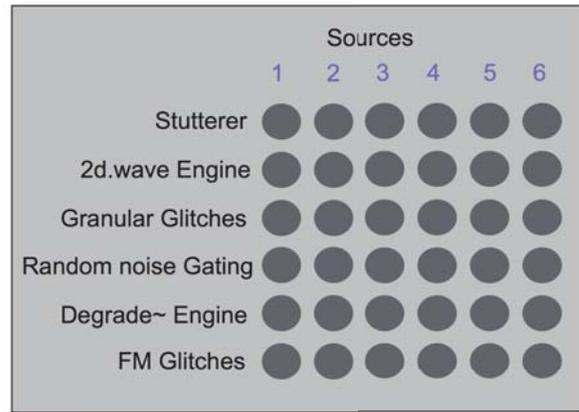
Fig 8. *Routing idea for specific glitch engines*, 2016, Griffin Byron, Max 7 patch, ©Griffin Byron.

Conclusion

This paper has provided a framework for understanding the various pathways artists have undertaken when utilizing techniques for producing glitch. Despite a rich body of work falling under the stochastic glitch category, historically and leading up to today, how to "glitch on purpose" via glitch production can be a much more useful tool.

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Re-enacting And Open Sourcing As Methods For Experiencing Programmed Art Utopia

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Abstract

Programmed art is the definition given to the body of works by a group of Italian artists active between the end of the 1950s and the beginning of the 1960s. This definition was introduced by Bruno Munari and Umberto Eco in 1961 in the Almanacco Bompiani and used in 1962 on the occasion of an exhibition hosted at the Olivetti show room in Milan, featuring works by the artists of Gruppo T. Gruppo T's artworks embedded the utopia of an interactive democratic art made for everyone and open to everyone's participation. The paper addresses the strategies for making the Gruppo T's utopia current in our days through the application of open source and DIY approaches that propose collaborative solutions to kinetic art preservation as well as subversive model to art distribution.

Programmed art utopia

Programmed art is the definition given to the body of works by a group of Italian artists active between the end of the 1950s and the beginning of the 1960s. This definition was introduced by Bruno Munari and Umberto Eco in December 1961, for the publication of *Almanacco Letterario* by Bompiani, and used on the occasion of the exhibition hosted in Milan at the Olivetti show room in 1962, featuring works by Munari, Enzo Mari and the artists of Gruppo T (Giovanni Anceschi, Davide Boriani, Gianni Colombo, Gabriele Devecchi, Grazia Varisco) and Gruppo N [1]. These artists produced works through the application of processes similar to those of technological and design research, such as creating prototypes that were then reproduced as a series of varying artifacts. Gruppo T prefigured a mobile, variable, metamorphic world. It was the beginning of the 1960s, yet their art was already interactive and immersive. Nevertheless at that time their artworks were difficult to be read, understood and accepted.

The work by programmed artists belonging to Gruppo T (active circa 1959-1968) has been defined one of the biggest taboo of contemporary art [2]. This omission is also connected to the fragile nature of kinetic artworks, which makes them difficult to preserve, exhibit, enjoy and exchange on the art market. Moreover, the artists developed fragile and reproducible artworks in order to communicate their will to disrupt the art market system and to produce art made for everyone.

Fig 1. *Scultura da prendere a calci* (Scuplture to be kicked at), 1959, Gabriele Devecchi, Synthetic sponge, elastic thread, weighted base, CC BY NC SA.

Re-enacting and open-sourcing as method

On September 1-7, 2014, five groups of artists, designers and researchers, together with two members of Gruppo T, gathered at SUPSI FabLab in Lugano. The goal was to build prototypes of kinetic artifacts that would translate the main principles of Programmed Art into the codes of contemporary culture, following the tenets of peer production, namely open source hardware and software and digital fabrication technologies.

The workshop was based on action research through making, with a view to updating Programmed Art by reprogramming the artworks with new tools, using the techniques and processes of interaction design and maker and DIY culture.

The workshop initial concepts reside in the key changes in the field of participative creation and development of

interactive artworks: open source hardware and software, open design and the use of Creative Commons licenses all foster collaborative design processes, and the users/co-creators are members of widespread, networked communities which share knowledge in order to complete or expand on the work of artists and designers [3]. Fab labs and the various kinds of distributed infrastructures for DIY and peer-to-peer production mean that anyone can now benefit from the constructive and creative potential of technology that for a long time was too complex for the lay person.

Looking at this context, we envision the possibility to resonate with the utopia of Gruppo T about a multiplied art made for all and highly reproducible by using the model offered by open source development: we open sourced the parts and the files of derivative artworks that are built upon Gruppo T's utopia. Opening the artistic practices of re-making masters'artworks in our case became the act of re-programming them with open technologies and principles [4].

Experiencing the utopia

During the workshop "Re-programmed art", each artist set about translating Gruppo T's artworks into a form that would enable anyone to reproduce, repair or subvert it, in order to elicit reflections on the practices involved in creating visual effects, visualizing physical phenomena and interactions, manipulating mechanisms and playing with materials and technology.

The results of the workshop are five artworks whose specifications and source files are released under open licenses and Creative Commons licenses. They are artworks, but also experiential prototypes that allow the public to comprehend Programmed art through a direct interaction. The prototype *Esacono*, for example, is a translation of the concept that generated the series *Strutturazioni cilindriche virtuali* by Giovanni Anceschi (1963-1966). The concept is described in issue no. 22 of the magazine *il verri*, but it was never produced due to the limits posed by the technology of the period. It is a cube suspended by one corner which has six motors embedded into each side. The motors drive two rotating rods that draw six truncated cone shapes in space, creating virtual volumes. The speed varies from motor to motor, and as a consequence so does the effect of the six shapes drawn in the air at the sides of the hanging cube.

The prototype Magnetic Drawbot stems from the principles of the work by Davide Boriani, who in the series *Superfici magnetiche* presents machines that perform a single program, generating changing, developing images. *Magnetic Drawbot* is the result of a research project with a playful element: ferrofluid unexpectedly turned out to be an unpredictable sort of ink, which when animated and magnetized by hand, created very distinctive graphic effects.

Fig 2. *Esacono*, 2015, G. Anceschi, S. Cangiano, D. Fornari, plywood, DC motors, Arduino, CC BY NC SA.

Fig 3. *Magnetic Drawbot,* 2015, Giorgio Olivero, Fabio Franchino (TODO), various media, CC BY NC SA.

Fig 4. Giovanni Anceschi, Gruppo T's member, working with young designers at the Fablab Lugano during the workshop, CC BY NC SA.

Conclusions

Remaking or reprogramming works by Gruppo T might sound subversive in the context of the art world and its market rituals, with their reverence for what is historicized and rare, and obsession with originality and the unique work of art. Yet in our view this project resonated with the poetics of Gruppo T, and various statements and episodes involving members of the group. The 1960 limited edition of Miriorama objects for Danese heralded a vision of art as multipliable and portable, like Bruno Munari's *Sculture da viaggio* (Travel Sculptures), with the addition of the kinetic elements and transformations that characterized the work of Gruppo T. In our view the Alessi 2010 re-edition, in full agreement and collaboration with the artists and archives of Gruppo T, was a significant confirmation of the initial idea of re-programming, not just re-making, because every remake based on new technologies and new materials entails a radical process of re-design. And while on one hand this betrays the uniqueness and originality of the artwork, on the other it answers new questions concerning the conservation of artworks that cannot be simply contemplated, but call for active audience participation.

After a week-long workshop spent translating and subverting the artistic concepts of Gruppo T's work, we realized that applying the new paradigms of collaborative development, augmented by the Internet, helped us to understand how to achieve the distributed, everyday aesthetic action that was part of the Gruppo T's utopia [5].

Through the open making of derivative works we learn how to liberate the artwork and to ensure that it lives on: once it is part of the commons, it is not a case of granting everyone the right to reproduce it, but rather conferring the responsibility to preserve its essence.

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Chasing after the Mixer

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Abstract

The authors examine the No Input Mixing Board (NIMB) as a complex instrument that reconfigures the politics of composition, cognition, control and expression in the context of Electro-Acoustic Improvisation. The notion of performance is relocated within the entanglement of the modulatory body of the artist along with the sound producing devices. Rather than control, the posture of the artist is best described as a form of existential availability to the instrument. This view rejects virtuosity as the pure control of the artist's mind over the instrument, as well as the delegation of performance to automated machines.

Chasing after the Mixer

The Mixing-board is traditionally an instrument of control manipulated by a sound engineer to control the sound levels of input both and output signals. Toshimaru Nakamura, involved with the Japanese free improvisation scene, is one of the pioneers of "No-Input Mixing" which transforms the mixing-board from a mere input device into an expressive instrument in live performance. Because of its inherent unpredictability, the No-Input Mixing-board (NIMB) constitutes a paradigmatic live performance instrument. As we will show, the apparatus of the NIMB turns the rational engineer into a performer who does not control sound levels, but instead modulates the partially unpredictable output of the NIMB to expressive ends.

Technical setup

Toshimaru Nakamura uses a mixer with 8-channels together with a few extra effect devices. The feedback is generated by connecting the outputs of the mixer into its own input which creates a network between the different channels with sufficient gain for the noise in the system to produce a sound. Simple alterations to the volume and EQ can have a variety of effects on the sound: volume changes, frequency changes, rhythmic fluctuations (produced from very low frequencies) and timbral effects. As a rule, Nakamura uses the effects only inside the feedback channel of the NIMB, thus making a distinction between sound generation and manipulation. The effect devices, like hall, delay or distortion, have particular phase and frequency responses. Inside this feedback circle, phase and frequency responses feedback into itself, thus can leading to complex filtering, resonance and oscillation effects. Due to this, a hall effect in a feedback circle will no longer sound the same. In addition, minute details in a circuit greatly influence the frequency and phase response due to how the effects of the details of the circuit are multiplied onto themselves, meaning even a deactivated effects device may affect the sound produced:

"Some of the effect units are just 'not in use' just like a filter where the signal go through without turn on, but the effect gave me a certain sound character to my noise, feedback sound. I started like this and I don't want to change it. When you connect some effects units, without turning it on, the sound becomes a bit muddy a bit dirty it is not purely clean. I liked it (…)." [1]

NIMB and unpredictability

For Nakamura, the NIMB is primarily a machine of newness, emergence. The instrument brings into the performance a large degree of independence and vitality, which turns the instrument into a tool of difference. Paradoxically, this conception of the instrument as a tool of difference does not point towards the multiplication of possibilities of play inside the instrument. On the contrary, most of the instrument design of NIMB is fixed and limited:

"I don't want to expand my system I don't want to look out side of my boundaries. I don't want do add more effects. I use 5 or 6 effect units. I want to keep this size." [2]

The deliberate limitation of the possibilities inscribed in the circuitry of the NIMB is paired with an alleged refusal to learn from the very experience of play: "I never learned to become better on the mixing board (…) I don't want to study" or "practice". He even tries not to remember what he has learned before. "I do not want to feel confident on stage" [3]

The posture of Nakamura contradicts the classical concept of virtuosity understood as technical excellence. [4] Instead, he highlights the importance of a particular

way to listen and react to the instrument that amounts to a form of existential availability [5] to the instrument: "Sometimes the mixer just leads me. The mixer goes ahead of me, and I was chasing after him. Sometimes it happens. In many cases it happens, which I like. [6] You can't totally control no-input music because it's all about feedback. Things like turning the tuning knob, even by one millimeter, make a big difference to the sound." [7]

The kind of "chasing after" Nakamura is talking about implies that one does not try to predict the sudden qualitative changes happening in the NIMB. Instead we accept that each manipulation on the interface transforms how each fader or knob in turn will change the sound. Thus, while sculpting a sound, one has to accept the constant drift of meaning of each fader. While it would be possible to learn what a movement of a single fader or knob could mean (how it affects the sound), this knowledge is only valid up until another fader or knob is changed. This means that any mapping of functions we might have in our interpretation of the instrument is constantly changing. This ever-evolving map, however, is limited as the general realm of sounds made possible by the instrument is limited thus making it at least partially understandable. The act of playing is still driven by linking the change of sounds to the changing of parameters despite the fact that this link is under constant change. This lack of confidence is directly linked to the *continuously* shifting affordances of the instrument. Above, we described how each parameter affecting the sound is dependent on the settings of the other parameters. This means that the reliance on a certain control of the instrument – i.e. the expectation what a certain fader movement would do – is constantly undermined. In Massumi's words, the manipulation of NIMB yields a singular confound which is "an absolute variation, comparable only to itself: an "intrinsic" variation or self-variety." [8]

In NIMB practices, the performer never knows clearly how his gestures will be shaped/transduced by the instable and continuous analog circuitry of the mixing board. Instead, the NIMB player must modulate the electric signal according to the perceived and bodily felt output of the mixer. This makes the performer linked to both the source of the sound and to the modulation of this sound at any given moment.

Bodily felt sound events: the active availability to the instrument

The rejection of the NIMB as an instrument of control should not suggest that Nakamura is passive during the events unfolding in conjunction with the mixing-board. The entanglement of his body and the NIMB is paramount to his practice:
"Once I tried to use a bigger mixer 16 channels, because mine is 12 channels. Actually it is 8. Once I bought the big mixer. I thought this would give me a lot more possibilities. My sound palette will be bigger. I realized this is too big for me. I cannot touch everything. I

anyway only touch a few things I have only two hands, 10 fingers. So I went back to the smaller one (…) This is just a boundary just a limit - and I want to search within this limit." [9]

To favor mixing-boards with a limited number of channels should not be considered a limitation, but rather as an opening up of the possibilities to explore the intricacies of the modulatory body of the artist and the physical circuitry of the NIMB. Nakamura does not want to see his bodily input being bypassed or blurred in the complexities of technical mediations.

This echoes Ostertag's position on virtuosity where "an intelligence and creativity is actually written into the artist's muscle and bones and blood and skin and hair". [10] This posture of existential availability to the instrument is not passive. Keeping the traditional concept of virtuosity at bay does not amount to delegate the agency of the performance to the preexisting possibilities embedded in technological mediations. The NIMB does not establish a trivial relationship between its control system and the sound output produced by the manipulations of the body of the performer on the mixer. Instead, it connects directly to the intense engagement of the body of the performer with the NIMB. 'Chasing after the mixer' yields an active availability to its partially unpredictable sound events.

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The Role of Eye Contact and Spectatorship in Interactive Installations

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Abstract

Eye contact is an innate and powerful way to communicate intimacy. This paper investigates the effect of eye contact in interactive installations focusing on the relationship between artworks and spectators. In a traditional exhibition setting, spectators take the initiative to connect with the artworks by taking actions such as watching or listening; specifically, the artwork becomes activated as a result of the spectators' engagement with it. Therefore, the aesthetic experience of spectators and the spectatorship depends on the ways spectators see that artwork. But the gaze operates in a different fashion in interactive installations where the reactivity activates independently of the spectator. This paper proposes that interactive installations are activated in a different way that has implications for agency, mechanic systems.

Background context: Spectatorship in Traditional Exhibition Settings

Both John Berger and Michael Baxandall illustrated how the viewer's way of seeing would affect the interpretation of the artwork. American neuropsychiatrist, Eric R. Kandel argues that the relationship between artwork and spectator, which he called "beholder's share" is always interdependent. That is to say, art is necessarily completed with the perceptual and emotional involvement of the spectator. [1] "We never look at just one thing." said John Berger in his book "Ways of Seeing", "we are always looking at the relation between things and ourselves." [2]

Although the white cube is believed to be a neutral exhibition environment, O'Doherty argued that they are not a "neutral container." [3] A museology scholar, Helen Rees Leahy, elaborating the point by describing how different sensory stimulation is produced by using different schemata. [4] Therefore, the design of the exhibition area and how the artwork is displayed affect the presentation of, and therefore the meaning made of, each artwork. Moreover, the museum guide or the exhibition catalogue may also suggest spectator the 'proper' way of seeing the artwork. Art historian Baker mentioned in 1997 that "guidebook may suggest what a visitor should look at, even the route that he or she should follow". [5] For example, in MoMA's twentieth anniversary exhibition "Timeless Aspects of Modern Art", the exhibition designed a map to recommend spectator to follow the route and order to watch different artefacts. This limited how viewer to communicate and building connection with different artworks in a specific way.

Spectators' ways of seeing is about how our bodies choose to watch and how we situate ourselves in relation to the visual. Baxandall, in *The Period Eye,* also focused on how humans perceive visual images, depending on skills of interpretation. [6] Berger and Baxandall both suggested the ways of seeing or the skills in seeing could be acquired from both nature and nurture. Therefore, I would conclude the ways of seeing or the skills in seeing acquired are affected by experience, culture and education.

Factors Influencing Ways of Seeing

In the western culture nowadays the position for viewing paintings and photographs is at eye level, that is why normally galleries suggest that eye level is the 'best' position to hang painting and photography. But in Royal Academy exhibitions between 17th century to early 20th century, the paintings were all placed 'salon style' which means paintings were hung from floor to ceiling on the angled wall and spectators and therefore most paintings were viewed from below. Therefore, the cultural difference between generations not only shifts the way paintings are hung paintings, it also alters the way spectators to see paintings.

Different philosophers and psychologists such as Bertrand Russell (1926) and Ulric Neisser (Neisser, & Jopling, 1997) have made in-depth studies and then stated that experience affect one's behavior and also one's the perception of things. [7] [8] French sociologist Mauss in 1934 also mentioned a novice spectator could learn the skill or technique in viewing exhibition by experiencing and emulating the practiced spectators' behavior. A video-based field study has been done by Heath and Lehn, social interaction researchers in investigating how spectators in groups interact with artworks, specifically how the

social effect influences spectators in the ways that they see and perceive artworks. They discovered that one's way of seeing and perception will be affected by the other spectators in the same exhibition area. For example, a spectator will follow and imitate the previous spectator's ways of seeing, such as standing in the same position and assuming the same posture to look at an artwork. [9] This imperceptibly social experience shapes spectators the ways of seeing artwork in exhibition.

Education about art is also a significant factor that impacts a viewer's perception of art. When private owners and different institutions started to turn their private art galleries to publicly accessible spaces in the early 19th century, the education of the public about their behavior in a gallery started. "The behaviour of visitors to early museums (such as the British Museum and the National Gallery) and art exhibitions (such as those organized by the Society of Arts and the Royal Academy) was scrutinised, not only for compliance with the institution's rules of admission, but also for evidence of aesthetic receptivity and cultural competence." (Leahy, 2012) In 1832-1836, The Penny Magazine published three essays about encouraging the working class visit the museum, explaining what they could do, what they should pay attention to and introduce the rules of exhibition.

In summary, cultural background, experience and education in art are all factors that shape the spectator's ways of seeing, affecting the ways how they view art, these include how they stand in different location, distance and even affect how they spend time in viewing different artworks. Spectators in a traditional exhibition setting take the initiative to build a relation with different artworks, and that artworks are passively connected by spectators' ways of seeing. In this traditional aesthetic regime, the aesthetic experience of spectators and the spectatorship is very much depended on the spectators' ways of seeing.

Interactive art

The development of interactive art in 20th century suggests a new kind of spectatorship, a more interdependent connection between spectator and artwork. Before discussing the role of the spectator further it is useful to further define the terms such as "interactive media" and "interactive art".

Definition of Interactive Art

There is no agreed or clear definition of the term "Interactive Art". Different researchers offer different definitions of interactive art. For example, an interactive artist, Nathaniel Stern defined interactive art (and interactive installations) as "including works

of electronic and digital art that feature… interactivity is understood as the requires physical activity of a viewer- participant in order to fully realize a technology- generated and process- based work." [10]; Another interactive artist and scholar, Don Ritter suggests that an interactive installation should contain the features that include (1) a real three-dimensional space serving as physical environment, (2) audience must experience the work through physical action, (3) the physical form of the artwork changes and will respond to certain physical actions of spectators [11]. Media archaeologist, Erkki Huhtamo also give a more specific definition that interactive artwork is necessarily actuated by a "user". The interactive is not only involved physical bodily action, but also more important in mental, "the reception of art." [12] We could see that there are some things in common among different definitions. First, interactive art requires the participating and physical action of a spectator. Second, human participation is necessary to make the artwork itself to change accordingly. Third, artwork and participant have an intimate relationship in the process of making interaction and in generating the outcomes.

Many of definitions also associate interactive art with electronic and digital technology. But some argued that interactive art is not necessarily related to computers and electronic technology. For example, human computer interaction researchers Edmonds argue that people nowadays rely on many interactive systems such a washing machine in daily life and these programmable and electronic-based interactive systems have transformed participative art. [13] Daniels Dieter has a similar concern and notes that "Because of the way we today commonly speak of interactivity as a technical achievement, we all too easily forget that similar principles existed long before digital technology was ever introduced, though this was an interactivity between man and man and not between man and machine." [14]

Media Archeology of Interactive Art

According to Huhtamo, "Interactive media" is an outcome of the history of the human / machine relationship that goes back to the industrial revolutions that began in the second half of the eighteenth century." [15] Different technologies including media technology developed rapidly through industrial revolutions and produced new possibilities for interaction. Artists employed new technologies, and explored the connection between human and machines and also the connection between humans though using technology. They also tried to explore more types of spectatorship by constructing different aesthetic experiences.

In the 19ᵗʰ century, touching artifacts in museum was not allowed. ""Touching with one's eyes only" was a manifestation of an ideological "mechanism," where the formation of the aesthetic experience was associated with "stepping back"-maintaining physical distance from the artwork." (Huhtamo, 2007) But avant-garde pioneer artists Duchamp and Man Ray created unusual aesthetic experiences for spectators at the opening of the 1938 Exposition Internationale du Surréalisme. The exhibition environment was nearly dark, by giving flashlights to the spectator, the artists encouraged the spectators to come close to see the artworks to create an unusual aesthetic experience and interaction with the artworks and exhibition environment. (Huhtamo, 2007)

In this earliest stage of interactive art, digital technology is not yet employed. Most scholars use Marcel Duchamp 1913 "Bicycle Wheel" as the example of early experimental interactive art to start their discussion of interactive art. (Edmonds, 2011 & Huhtamo, 2007) The work "Bicycle Wheel" is commonly described as a pioneering work that used a "readymade" object in making artwork. Huhtamo mentioned that Duchamp chose the objects that we often touch with in our daily lives and the display of these readymade objects in gallery opposed the regulation of "untouchable" in traditional gallery. Duchamp displayed his readymade works with enigmatic texts encouraged the spectator to come closer to investigate, "further increasing the tension between "to touch or not to touch."" (Huhtamo, 2007) Although no one can sure that a spectator really did spin the wheel in the gallery, Edmonds and Huhtamo both agreed that the artwork displayed encouraged the spectator to interact in the simplest sense, to spin the wheel. (Edmonds, 2011) Another example of early interactive art is "Transformables" created by Yaacov Agamt in 1956 which is an adjustable painting that could be played by audiences. Those experimental interactive artworks such as "Bicycle Wheel" and "Transformables" and the unusual gallery experience created by Duchamp and Man Ray at the opening of the 1938 Exposition Internationale du Surréalisme encourages the possibilities of interaction between artworks and spectators and arguably created a more intimate aesthetic experience for the spectator than ever previously known.

1950s Onward: Interactivity

The development of electronics catalyzed the growth of interactive art. For example, Robert Rauschenberg in 1959 made "Broadcast", a painting with three concealed radio knobs and spectators were encouraged to turn the knobs in order to control the radio's volume and frequency. Personal computers invented in 1960s

and triggered a significant growth of interactive art and the development of ideas related to human-computer interaction. (Edmonds, 2011) Huhtamo has described this human- computer interaction as "interactive computer". "Computer could have an important role in facilitating, or managing, interaction... By 'managing', was meant that the computer controls the way an artwork performs in relation to its environment including its human audience." (Edmonds, 2011)

Huhtamo in the essay "Trouble at the Interface, or the Identity Crisis of Interactive Art" listed some "classic" interactive art created between 1970s -1990s such as "Videoplace" by Myron Krueger (1975), "Very Nervous System" by David Rokeby (1982-1991), "The Surprising Spiral" by Ken Feingold's (1991). He summarized the common characteristics of those works. Those characteristics are also the common definition of interactive art, including using computer technologies and necessarily to be activated by spectators and required the spectators to physically engage and interact to function the artwork and reveal the meanings. It seems that these "classic" interactive artworks constructed a "official" definition of interactive art, a canon.

The Power of eye contact

As shown in the discussion so far, interactive art using ready-made object, computer and electronic technology to create interactivity between humans and machine or between humans, builds intimate aesthetic experiences for the spectator. When eye contact is used and employed as the element in installation art, this paper claims it further strengthens the connection between spectators.

In psychology, eye contact is nonverbal communication and behavior. Research into oculesics has been conducted to explore the power of eye in in nonverbal communication. Cross-culturally, in both occident and Asia, eyes are considered the windows to our 'soul'.

There are important differences between mutual gaze and gaze. Mutual gaze is people looking at each other (eye contact) and the gaze is one person looking at the other. Research has showed that mutual gaze is an important factor in social communication and powerful in linking between humans. [16] Babies can innately detect mutual gaze and gaze direction." (Farroni, Csibra, Simion, & Johnson, 2002) and three month old babies can use eye contact to interact with adult caregivers. A nonverbal communication scholar, Mehrabian did a role-play experiment of a group of people in 1972 and discovered that the amount of gazing to the other is proportion to the amount that

they reportedly liked the other. The longer mutual eye contact is "signaling desire for heightened intimacy" and "perceived as an indicator of a longer relationship" [17]

My concern is whether artists employ this innate behavior, eye contact, in artworks. And whether doing so helps to build a more interdependent connection between artwork and spectator.

"The Looker" – A case study

In 2015 the author created an experiment to explore the power of eye contact in building intimate and interdependent relationship between artworks and spectators. The installation invites spectators to make eye contact with eyes projected inside a metal storage locker.

In *Storage Locker* there are two holes in the locker door. When spectator looks inside, sensors trigger projections of eyes to give eye contact with the audience. This immediate eye contact builds intimacy. Spectators mostly spent 30 seconds to a minutes to stand in front of the locker to interact with the installation. When I talked to some of the spectators, nearly all of them agreed that they feel connected with the eyes projected inside the installation and most of them agreed mutual gaze made the connection more intimate. When I try to further ask them to distinguish if the connection built is only with the eyes projected or also the whole installation, most of them had difficulty answering this question; and they would agree that this tight and intimate connection could not be built without the whole setting of the installation.

Moreover, some of the spectators including westerner and easterner asked if the eyes projected inside the looker are their own eyes. This question surprised the author a lot as the eyes projected inside actually are the author's own pre-recorded eyes.

Conclusion

In traditional exhibition setting, the connection between artworks and spectators and the spectators' aesthetic experience are very much depended on the spectators' way of seeing.

The existence of interactive art using ready-made object, computer and electronic technology to create interactivity between spectator and artwork enhances the aesthetic experience of the gaze. Sensors recreate the experience of agency. Spectator become part of the artwork in interactive art who can influence the process and output of the artwork which tighten the connection between spectator and artwork.

Technology and ready-made object in interactive installation continue to leverage the innate intimacy

evoked by human behaviors like eye contact to further strengthen the connection between artwork and spectator.

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Framing a Critique of Reality Based Games

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Abstract

In the last two decades, a series of games that interweave fiction with reality and often involve real world outcomes have appeared. Encompassing serious games, ubiquitous games, location based-games and gamification, these reality-based experiences seem entirely new. But what I here collectively call reality-based games have a past. Threading though the Surrealists strategies of automatism; the cybernetic utopian visions of Marshall Mcluhan, Buckminster Fuller and Stewart Brand; the social change objectives of the serious games movement; and the engagement strategies of gamification; there is a persistent motivation connecting the history of reality-based games. Specifically, the desire to put play to work. But too often the bodies that develop and promote these experiences work in isolation from each other. As a result, their knowledge and findings lack the self-reflection and critique deserving of the powerful experiences they create. This should not be, as the stakes are high given these game types are often global in scale. This paper connects the ambitions of reality-based games in artistic, progressive and corporate contexts and calls for a productive framework of critique for these game types, one that can be universally applied.

Introduction

Today, games are ubiquitous. This statement encompasses both the popularity of games, as well as their capacity to interweave throughout physical and digital realities. Mobilising ubiquitous technology, these games appear to appear everywhere at once, harmonizing with a player's everyday life and offering the capacity to improve it with feedback. The now common blending of transmedia storytelling, ubiquitous computing, social networks and games purportedly holds the ability to deliver a significant impact on a players understanding of the world, and their place in it. This flourishing of reality-based games is more than a celebration of contemporary games culture: it is testament to the exasperation at traditional ways of achieving things. Today's gamified experiences aim to address problems in the real world at personal and local levels, but also to reinvigorate participation in global issues. Such experiences resonate among those who are at once disenchanted with established methodologies and daunted by the scale of the problems faced. Through serious games, for example, players can re-approach the difficulties of the real world with a playful spirit of inventiveness, allowing for a productive reimagining of

reality by reconceptualising global dilemmas (such as hunger, poverty, financial inequity and environmental degradation) as game challenges to be solved. These ambitions are not new. The provenance of such gamified enterprises - and of the exasperation at existing systems - is located in the techno-utopian forecasts of Canadian media theorist Marshal McLuhan, who saw the possibility of a networked planet operating as a self-correcting organism capable of solving the significant problems it faced, and the influential 1960's polymaths: Buckminster Fuller and Stewart Brand, who took McLuhan's cybernetic concepts and applied them to games. But the prehistory of reality-based gaming can equally be found in the work of the modernist avant-garde – the Fluxus, Dadaists and Surrealists artists detected in games the possibility of opening up new ways of thinking about reality. Given these histories, is highly appropriate to discuss the application of games to real-world scenarios in a context of art and technology.

Reasoning

This paper considers how an interdisciplinary framework can be developed in order to constructively critique the multitude of games that travel under the name of reality-based games. These experiences include serious games and gamified experiences, but extend to all interactive phenomena created with ambitions to bring about societal improvement at various scales. The drive behind such a framework is the all-too-common appearance of games whose evocation for change is really little more than just a change in perception, a mental shift toward feelings of satisfaction and contentment. These games constitute a deceptive distraction from the very real problems at hand. As writer Heather Chaplin has detected of such experiences: "In a gamified world, corporations don't have to reward us for our business by offering better service or lower prices. Rather, they can just set up a game structure that makes us feel as if we're being rewarded." [1] Of most concern are experiences that operate under the banner of serious games: but that amount to little more than marketing, data collection or participatory pubic relations, sometimes successfully combing all three. Not withstanding the issues of privacy and persuasive influence, the great problem of these experiences is that they drain the often well-intentioned actions of participants. Elsewhere, I have termed these experiences "Exhaustive Games", so called as they

exhaust a players' compulsion to affect change, by exercising it safely within a virtual realm of a game, ensuring that no actual change in the real world occurs. So can, and if so how can games be productively applied to the ambitions of problem solving at a global scale? Here, I call for an open and ongoing discourse that is both transdiciplinary and transhistorical in scope, one that critically considers the opportunities and issues of a broad spectrum of games and play. Games are, and are able to present complex systems, yet thus far, much of the popular discussion of the field has relied on reduction and oversimplification to appeal to a broad audience.

Oversimplification

Accompanying the seismic shift towards games in recent decades is both the valorization of games, but also of the more ambiguous phenomenon of play. Play is easily connected with openness, independence, child-like behavior and abstraction from everyday. As a result, the very mention of play often evokes imaginings of innocence, freedom, and escape. Yet, we need only witness a cat toying fatally with a mouse, a child brutally bullying another, or the concentrated slaughter within a first-person-shooter to recognize that play is not an innately innocuous act. Play is a malleable ontology, a mode of being that heightens, presence, focus and enjoyment, a state of consciousness that can be as comfortably applied to war and torture as it is to music and games. However, as play theorist Thomas Henicks has noted, both scholars and designers tend to focus on play as a constructive, fair and friendly activity and are less inclined to use the term in contexts of destruction, humiliation and torture. [2] The framing of play should be attentive to who is playing, who gets to play, and at whose expense.

Oversimplification and valorization of games and play is at its most reductive when these experiences are regarded in terms of being 'good', without also asking: 'what constitutes good?' and 'who is it good for?' Some observers have detected an inherent optimism and utopianism in the serious games movement, optimism which it not without value in itself, so long as celebratory rhetoric does not loose sight of the critical aspects of games and play. These aspects include, but are not limited to: the privileges of play; the ideologies that games transmit; the transparency of designer motivations; the methodologies of engagement; and the entanglements of technology device production and supply chains.

Ongoing Discussion

In September of 2011, a spirited discussion occurred on the Games for Change listserver that took up some of these issues. The original topic line arose when a member queried how best to market a free online game that would educate youth on career opportunities in nuclear energy. This question provoked another user to reply critiquing nuclear power, stating, "G4C members should seriously question whether to help a game that promotes such an industry." [3] Another forum member

observed that, "the definition of 'doing good' seems to be what is under debate here." [4] The discussion continued for sometime, and remains online at the time of writing. It provides an excellent primer on some of the issues and antagonisms of serious game production and discussion. Reflecting elsewhere on this listserver posting, blogger Jorge Albor considered how to decide whether a 'game for change' promotes positive change, and takes up the inherent slipperiness of the term 'good'. Albor writes: "Games can both educate and indoctrinate. Indeed, we imbue all our cultural constructions with our own personal beliefs and ideologies, both intentionally and unintentionally. As one G4C member astutely pointed out, 'education is a political act.' The difference between persuasion and propaganda is a thin line, particularly when it comes to digital systems that can all too easily hide their intent behind a shroud of 'fun.'" [5] The welcome aspect of this conversation thread was not the answers it provided – there were no clear answers – instead the great value was in the questions it posed. Here I am unavoidably reminded of the ambitions of surrealist automatist games: not to arrive at new answers, but instead at new questions and aesthetics. However, a great many reality-based games appear to be solution rather than problem or question oriented. Games are too often offered as answers to issues. Nowhere has this been more so than in the field of gamification.

Gamification

In 2011, the term gamification pulsed white hot. Seeking to capitalize on the so called 'explosion of games', corporate entrepreneurs and marketing gurus created a confidence bubble around the idea that game mechanics applied to non-game products, could increase productivity, loyalty and revenue streams. This vision of games was completely foreign to games scholars, the broader games industry, as well as its many consumers, who collectively looked on with increasing irritation as corporate consultants who knew little of games and play, invented a gamification jargon to present a flimsy yet bewitching hallucination of games. Within this troubling vision, unsuspecting players would purportedly be rendered helplessly engaged in any activity, product or idea through the application of a thin lacquer of activities presented games. This concept of gamification received much condemnation, most significantly from games scholars Sebastian Deterding and designer and critic Ian Bogost, who wrote a series of articles on the matter, culminating with the article by the later titled: Gamifiction is Bullshit. [6]

The term 'gamification' enjoyed a giddy few months of before the hyperbole shifted onto new buzzwords. While gamification continues as a business concept, for many, it is forever condemned. Popular sentiment towards gamification in the academic community can be summed up by a PhD abstract that appeared in 2015 denouncing it as "a seductive strategy that utilizes play to promote control in the form of ludic protocol. Additionally, it is an ideological and design-based approach to surveillance that eschews disciplinary techniques of control; rather, gamification uses

seduction, in the forms of games and play, to encourage people to perform, track and submit to the data of everyday life." [7] While Lamar Hulsey's words express a now common attitude toward gamificaiton, one that may be well justified, I suggest the time is right to resurrect some of the ideas around gamification, and to potentially undertake what Professor T.V. Reed has tenuously titled 'critical gamification', an effort to "to take the word gamification back from the corporate world." [8] In other words, to re-appropriate the mis-appropriated territory.

Critical Gamification

A significant body of work in along trajectory has already taken place and appears in the collection of essays titled: Rethinking Gamification, edited by Mathias Fuchs, Sonia Fizek, Paolo Ruffino, Niklas Schrape. [9] Moving well beyond existing critiques, this book provides a thorough dissection of the terminology around gamification with sustained theoretical attention to some of the keywords that whizzed around all too fast. But of greater value is the books its historical contextualisation. Alexander Fuchs examines the history of gamification, and diffuses the contemporary "explosion of games" by recalling Johan Huizinga's work from 70 years earlier in which the substantial influence of games on business, society and culture is mapped throughout history. Gamification, Fuchs soberly reminds us, names a very small and recent development in a much larger historical process. Likewise, Felix Raczkowski's chapter investigates looks again into the past to consider gamification's economy of points systems finding it legacy in 1960s behaviorism and experimental psychiatry. One of gamifications greatest detractors: Sebastian Deterding admits the term remains a marketing buzzword, and a device of rhetorical persuasion, yet nonetheless opts to retain it, but alter its meanings. To re-hijack the concept of productively applying games to reality. In a media environment in which the discussion of games remains caught between describing them in alarmist and celebratory terms, what this book offers most of all is an insightful, reasoned and wide ranging discussion of reality-based games, a discussion and framework that this paper seeks to promote.

Conclusion

At the time of writing, reports are emerging of a game called *Sesame Credit*. This Chinese app gamifies a players' life by drawing information from their social media accounts, online profile and activities to score their real world credit rating. [10] According to British media outlets, the game engages a strong ideological component that ensures players obedient to the Chinese Communist party line will be rewarded while perceived dissident activities will reduce a players score. [11] Thus far, across the Western press at least, *Sesame Credit* has only been described in alarmist terms, but given claims that by 2020, Chinese participation in such an experience will become compulsory, perhaps appropriately so. Yet,

the very appearance of this game attests to the indefatigability of gamification, and highlights the ongoing need for a broad ranging and interdisciplinary discourse about the critical application of games in real world settings.

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Noise &/as Nervousness: Gertrude Stein in the Interface

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Abstract

This small paper focuses on '*noise as communicating presence*' [1] in performance and digital communication by mapping Gertrude Stein's 1934 lecture 'Plays' onto the interface through contemporary digital theorists Ulises A. Mejias and Alexander Galloway. How do the critical resonances between performance and digital media allow us to develop a theory for a practice that values the accumulation of these disturbances? I argue that Stein's spectatorial 'nervousness' provides a tactic for an expanded understanding of noise that positions presence – our own, the interface and those communicated with – firmly within digital communication technologies. I aim to use the intersection of media theory and performance to develop a theory that enables us to layer the agencies at play in a process, to attend to how 'interface as an intersection of these agencies'. [2] Ultimately, I argue that understanding this affective presence is vital to how and why we might act as 'accumulators or curators and of disturbance'.

Introduction: Performance & Process

The following will use a critique of performance from the 1930s as a means to think about 'noise' in artistic and critical interventions into modern communication technologies. Gertrude Stein's essay 'Plays' is about the theatre. It focuses on the relationship between the spectator and the action performed on stage, on how that relationship produces an affective syncopation that makes one 'nervous'. Here, I will explore the connection between that 'nervousness' and the sense of performerly presence created in internet-situated performances. In doing so, I aim to gain insight into the different operations of 'disturbance' in contemporary digital communication and art practices. Performance, as an artistic practice, is a generative process as well as an exchange based one. It necessarily requires an audience and a performer: the performance is a kind communication between these two parties, and for this reason performance has often been defined as a time-based form that occurs for both groups in at once. [3] However, contemporary performance theorists and practitioners have complicated this view of performance and this is the context of my work. [4] In this paper, I will address how Stein's 'nervousness', originally written to refer to live theatrical performances, can be extended into the terrain of contemporary digital performance practices. I argue that 'nervousness', as an understanding of the relation constituted by an artwork, has contemporary value for addressing how and why we might act as 'accumulators or curators and of disturbance'.

Repetition and relation

This paper is a reminder that our concerns repeat, historically and artistically. Or, rather, that they echo and the parallels or differences in the ideas that return are worth attending to. (The process of returning as marked by both difference and similarity is also the nature of performance. Richard Schechner refers to performance as characterized by 'restored behaviours': performances repeat [5]. More recently, Rebecca Schneider, in *Performing Remains,* has addressed the political stakes of how performance remains and returns [6].) Performance is attuned to this repetition but, for the purposes of this paper, I am more interested in the relationship that a performance generates. It is through exchange – one person witnessing another in something that has been named a 'performance' – that it constitutes it affects. As Maria Chatzichristodoulou writes, performance and digital arts both 'are inherently in process.'[7] These processes form a relation that operates in a tension between the intention of the person who 'produces' the performance and those whom engage with the processes it creates. It is the qualities of the relationship between a spectator and a performance that Stein addresses and that, I argue, can be mapped onto relationships mediated by contemporary digital interfaces. I am specifically interested in how artistic practices start to make use of digital interfaces – email, direct messages, videochat and so on – and the technical and emotional disjunctions they produce.

And so, what disturbances does Gertrude Stein bring to the practice of making and understanding within digital communication? Ulises A. Mejias, in *Off the Network*, argues that reframing our approach to 'noise' is a tactic for finding space outside the networks: the effort is in the shift 'from trying to solve the problem of *communicating in the presence of noise* to one that sees *noise as communicating presence'*. [8] This small paper will focus on the notion of 'noise as communicating presence' as it echoes in performance and will put forward a practice of accumulating disturbance by mapping Gertrude Stein onto the interface.

Stein & Nervousness

In 'Plays' – one of a series of lectures that made up a tour of America in 1934 – Stein turns her attention to the theatre and its 'problem':

This thing the fact that your emotional time as an audience is not the same as the emotional time of the play is what makes one endlessly troubled about a play, because not only is there a thing to know as to why this is so but also there is a thing to know why perhaps it does not need to be so. [9]

The dissonance between your emotional time and a play's emotional time, between you and me as we communicate across an interface, is what makes one 'endlessly troubled'. To be troubled, however, isn't necessarily a bad thing. It is the occasion for thought. Stein's nervousness easily becomes, comes from, the noise and mutation of a disrupted signal. Her emphasis on 'emotional time' points to the felt, the affective experience of being together as imperfect, disrupted. Stein finds syncopation in the theatre, a site where the audience and the performer are sharing time and space generally. There I will focus on how this affective nervousness, of being together whilst being out of sync, resonates with the asynchronic relations of contemporary internet communication practices. I argue that, in these instances, a similar nervousness is produced through an inverse process. It is the dissonance that comes from two (or more) parallel experiences, the unavoidable disturbance is/as the communication of presence. In our considerations of communication and the interfaces that mediate us, nervousness appears in the connection between the affectivity of relation and the functionality of a system that is the source of provocation. 'Nervousness' can be read as the affective experience of presence – our own, the interface and those communicated with – rooted firmly within the disturbances of digital communication technologies. This affective presence is, I think, significant in how and why we might act as 'accumulators or curators and of disturbance'.

Through Stein, I want to purpose a practice of accumulating disturbances in digital communication that does three things: firstly, foregrounds relation through an attention to presence (of people exchanging, of technologies mediating that exchange) as an aspect of a system's processes. Secondly, explicates 'noise' and disruption as instances that confirm the potentialities of exchange (thus, confirming relation of people and technologies). Finally, provides a framework in which noise, as nervousness, does not indicate confinement in a totality but rather confirm both the possibility and the actuality of an otherwise. It emphasizes our differing positionalities within the functions of modern communication technologies. Gillian Rose argues that, through the interface we can attend to the intersection of people and digital technologies that shapes and is shaped by their usages. [10] Nervousness as the result of both noise and one's experience of it as it occurs in and through our communications when they gather inside the interfaces of our networks. Stein's particular experience of performance, what she calls the 'nervousness' caused by a syncopation in 'emotional time' is echoed by Mejias's description of noise as communicating presence. The question is, how does

this help us to develop a theory for a practice that values the accumulation of these disturbances and the affective dissonances they produce?

Nervousness and Performances (1972 – 2014)

An early example of a performative artwork that actively stages this sense of disturbance as nervousness is *Boomerang*. In 1974, Richard Serra and Nancy Holt experimented with the looping of live broadcast television in *Boomerang* (1974). The work, which now exists as video documentation that can be seen on YouTube, is a single shot of Nancy Holt as she speaks about the experience of listening to her own voice (See Fig. 1). Holt narrates the experience of talking while listening to her own voice, slightly delayed, televised live. *Boomerang* is a touchstone for thinking about art's reflexive self-situating within technology. It is particularly pertinent to later internet art practices insofar as it plays with embeddedness in a communication technology that is infinitely easier within a ubiquitous networked culture. Understood in relation to contemporary (post) internet art practices, *Boomerang* anticipates the friction of a mediated relation across web communications. Its operations and effects are rooted in Holt's nervous relation with herself.

Fig. 1. *Boomerang,* 1974, Nancy Holt and Richard Serra, video. Copyright: MoMA.

However, in *Boomerang*, the artists are in a television studio using specific and specialized technology: the experience of a delay in sound is novel but is not directly reflective of friction in contemporary digital processes. However, it sets up a similar effect in contemporary artworks that are more clearly in dialogue with our actual experiences of technology today. In the Tate Room Live performance *Les Yeux d'Argos* (2014)*,* video streams between London and Paris are edited into the live performance as it occurs via Google+ and YouTube. As the connection between the performers (who are also siblings) skips and pixelates, these technical difficulties add to the shape of the performance while also reminding the spectator of their own conversations with far away loved ones. Similarly, Leah Lovett's *Contraband*

(2014) – a sing-a-long between London and Rio de Janeiro – strives for but can never really be quite in sync due to the slight delay caused by miles of fiber optic cables travelled. All three of these examples find their affect – or an important part of it – in the meditation of a relationship, with one's self or a distant group of people as it intersects with technical disturbances. I am interested in how this dissonance, either as the threat of failure or simply as the evidence of connection mediated between two locations, operates as an artistic tactic for intentionally creating nervousness.

Accumulating Disturbances

All of these works operate through the syncopation of communication technologies. Like Stein's experience of the theatre, this syncopation translates into a sense of being at different emotional times. The performer and the audience, or even the performer and her mediated self, are not concurrent despite also trading on the sense of being at once. The simultaneous communication, of videofeeds in these examples but also of emails and messages and the other instantaneous modes of digital communication, performs a connection despite our syncopation: a same time despite being in different emotional times. The noise of the connection – instances of digital friction – exacerbates the nervousness that comes from emphasizing those different emotional time; it erases the ease that a clear connection strives for and highlights the inevitable syncopation that comes even with the most 'perfect' connection. An artist's (sometimes prior) presence is added with an audience's present presence to create a performance – less a technological noise, more an acute feeling of being mediated by technological possibilities. The moments of friction, of noise or partial failure that the technology produces in mediating our relationship, makes us nervous. To be nervous is to know that there is noise, to hear presence communicated. Stein identifies something fundamental to the way in which a process of communication invites attention to itself, something that is 'is not a contradiction but a combination and that combination causes one to think endlessly.' [11] Thinking through Stein, a shift in understanding the noise – as opposed to the signal – becomes easier: 'noise as communicating presence' is Stein's nervousness, the technological confirmation of another's unsynced presence.

Thinking Endlessly

We – anyone who uses contemporary communication technologies with criticality, so perhaps everyone – are invested in the importance of thinking endlessly about what the effects of materials and relations situated in digital communication processes are. We think endlessly because our experience is syncopated as we speak across a video feed, we are having different emotional times. In *Les Yeux d'Argos,* to siblings are trying, failing and succeeding in their attempts to dance together between London and Paris

with striking results that emulate the tensions of any conversation with family performed over the internet (See Fig 2). The sing-a-long staged in *Contra-Band* (2014) is conducted in full awareness of the impossibility of harmony: disturbing the sense of community it strives to create is exactly the point. The dissonance, the annoyance and humour of its struggle belie the broader unease about censorship and the communication of political dissent. In both works, the nervousness of knowing that you are not at the same time as someone else despite the fact you are is integral to the performance. Technological disturbances and their affects function to highlight relationship while confirming the tensions implicate in that act of relating.

Fig. 2. *Les Yeux d'Argos*, 2014, Selma and Sofiane Ouissi, video, Copyright: Selma and Sofiane Ouissi.

This is the combination that is not a contradiction of being apart while being together, the noise of unsynced presence in which we are accumulating disturbances. This combination (that is not contradiction) is the 'along-sidedness' of a system, taken up by Alexander Galloway in his discussion of Serres in *The Interface Effect*:

> "Systems work because they don't work. Non-functionality remains essential for functionality. This can be formalized: pretend there are two stations exchanging messages through a channel. If the exchange succeeds – if it is perfect, optimal, immediate – then the relation erases itself. But if the relation remains there, if it exists, it's because the exchange has failed. It is nothing but mediation. The relation is a non-relation." [12]

For a practice of accumulating disturbances, syncopation is the relation that fails to erase itself. This it is the fact of existing imperfectly that throws the system into relief, emphasizing the processes it performs as they are made and seen to happen. I know we are talking, you know I am talking from somewhere else: 'noise as communicating presence'. The intention, in performance always, is to be practicing relation. This is an important way in which it runs counter to technological processes. That something happens, is made to happen and is experienced as happening. Accumulating disturbances demands attention to those parallel experiences. It is a

practice that holds on to the relation that fails to erase itself. This is also way a practice of accumulating disturbances for technology is useful: the combination *is not* a contradiction. It is relation that refuses to erase itself. And that causes one to think endlessly about that relation, a relation that is marked with the nervousness of its dissonance. Nervousness, in a practice of dissonance, is the visibility of relation.

Endlessly Troubled

Nervousness is the visibility of relations that are defined through the fact of their not progressing together. It is 'the certain proof that the emotion of the one seeing and the emotion of the thing seen do not progress together'. [13] The emphasis on emotion, not just the affective experience but also its implication within a broader cultural framework tethers the technical – a bad connection – with the experience of feeling and understanding that disruption. A feeling that becomes a means of understanding is exactly the communicating of presence that noise can and does produce. Mejias's larger project in *The Off Network* is to think beyond the network – as metaphor and as system – into something more complex and less confining. It thinks through and around the spaces that the network produces, attending to the 'noisy and unpredictable', the thing that makes one 'endlessly nervous' while also being the combination (not contradiction) that makes one think endlessly. The doubling of the interface as 'concerned as much with unworkability and obfuscation as with connectivity and transparency' is useful enabling the conditions suggested by Mejias, in which we shift from noise as disruption of presence to noise as confirmation of presence beyond the strictures or possibilities of the system. The 'endlessly troubling' nature of 'nervousness' ultimately rests in the desire to understand why it is functioning in this way and how it might be possible for it to function elsewise.

Conclusion: Communicating Presence

Within all of this, Stein's experience of performance – which here becomes a theory of accumulating disturbances in art for digital interfaces – is about how the processes, or internal logic, of an artwork and an experience is ultimately troubled and troubling empathetic relation. It is a theory that layers the agencies at play in a process, that attends to how 'interface as an intersection of these agencies'. [14] However, by thinking about Stein and her nervousness as a means for approaching noise, it has been my aim to begin the work of thinking about the differences between different kinds of performances. Here, social performances and artistic ones, digital and 'live' ones. Performance is a tricky term, and I believe that its expansiveness allows us to make tricky connections. Here, the experience of these intersecting agencies is one of nervousness, a nervousness that extends beyond the one to one relationships of communication or artistic practice into the interplay of agencies that

create and control these systems. The feedback and affects of being in relation make one endlessly troubled. Endlessly troubled in that we have to address ourselves to difference as a condition. The endlessness moves towards the possibilities of difference. The use, of noise/of failure/of syncopation, is that it opens up a space for thought that *acknowledges plurality*: an acknowledgement of presence that reinstates difference. Stein addresses nervousness with a blatant disregard for the conventions and functions of the form: not necessarily removing the nervousness of the form so much as making that nervousness the impetus of the drama. Ultimately what is at stake here is a thinking possibility in diversity while also thinking about its affects. One is nervous about different emotional times, something that I hope disrupts the utopian promise of noise as difference while still holding it as a valuable mode.

> **'It is in short the inevitable problem of anybody living in the composition of the present time, that is living as we are living as we have it and now do live in it.'[15]**

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The Uncanny Signal

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Abstract

This paper describes a developing series of highly speculative works and activities that suggest new ways to experience urban space, by listening to and analyzing audio environments using speech recognition and image analysisn software, to produce texts, voices and sounds that disturb our sense of the shape of our space, by changing our physiological, psychological and emotional states.

The city is considered as in a constant state of becoming, as a series of moments of lived experience, of active spatiotemporal events that suggest both time and space are often fluid when considered by a perceiving body. The project explores new cultural constructions of the city to reimagine and rediscover urban space.

The Concealed Uncanny

"...strange out-of-mind-and-body states induced by the morphings and animations of digital modeling, as well as by the sense that the new space of cyberworld is less a virtual version of reality as we know it than a preparation for a reality that we would rather not know." [1]

New and radical modeling, mapping and imaging systems have realized the construction of both physical and virtual spaces that were, until recently, impossible, even unimaginable. Increasingly novel, unknown or unknowable, exacerbated by diminished or non-existent powers of recognition, and the difficulty of distinguishing the virtual from the real, these spaces are disorienting and unsettling, and surround us with an anxiety of uncertainty. This anxiety has changed the sense of the physical body, its subjectivities, its cognitive and emotional internalizations, as everyday experience is characterized by constant ambivalence in the face of uncertainty and unpredictability.

One of Freud's original senses of the uncanny, that feeling of something appearing to have an inexplicable basis, beyond the ordinary or normal, seeming uncomfortably strange, included the notion of "the unhomely", the experience of strangeness associated with aspects unfamiliar to or out of place in house and family. This very particular strangeness was extended to include those spaces that had been transformed through destruction, as in war, that produced unsettling emotional and psychological states of anxiety, trepidation and psychosomatic trauma. Freud also suggested that there might be aspects of the uncanny that arise from feelings that are usually not allowed to come to consciousness and remain unspeakable. For this project, this suggested that the withheld or concealed might give rise to a sense of the uncanny at the moment that such concealment or withholding is apparent. Moments of recognition of presence rather than absence, pattern rather than randomness, might give rise to feelings that are synonymous with the uncanny. Early investigations have focused on coincidence, repetition, and revelation to explore the momentary perception that there is something meaningful arising from a place where there should properly be nothing meaningful, forming the basis of recent explorations of urban space.

The works set out to investigate the presence of the uncanny and its effect in the urban environment. While contextual dissonance and (un)familiarity is important in any consideration of the uncanny the work focuses on ideas about the recognition of meaning in chaotic and random systems.
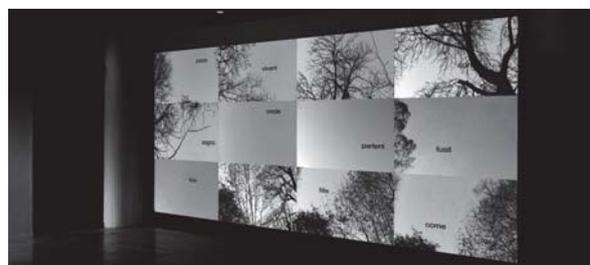
Fig 1. *Jardin du Luxembourg*, 2014, installation projection, © 2014

This investigation has resulted in the development of a series of works to suggest new ways to see and navigate urban space by looking at and listening differently to the ambient audio of our environments, to reveal, and to generate voices and sounds that disturb our idea of our surroundings by changing our psychological and emotional states. It associates Freud's uncanny with the mirage of urban life, looking for the presence of an unsettling unknown. The works take as their starting point ideas about the illusory nature of the city, through an exploration of the invisible and the concealed, the unseen and unheard, and the uncanny.

Early Work

Early work has concentrated on attending to our sonic environments. The project monitors ambient and environmental audio, using microphones worn by participants moving through urban spaces, and uses bespoke speech recognition software to tease, isolate and generate words, phrases and sounds from the noisy environment.

The intent is to draw attention to how we might perceive space differently through the lenses of the misheard, the half-heard and the imagined to perceive alternative realities. Referencing the seeing of images and hearing of sounds in random stimuli known as pareidolia, Electronic Voice Phenomena, and the uncanny transmissions of Numbers Stations,[2] the project exploits the deficiencies of speech recognition software, its tendencies to throw up false positives, to generate clusters of words, phrases and sounds that re-describe and remake urban space, enabling new topographies to emerge, new maps to be drawn, through new emotional responses to the city. This initial research is highly exploratory and consists of developing means and ways of analyzing ambient audio, using it to generate both non-existent and existing sound, and interpreting this in meaningful artistic ways, together with research into how participants can access this as they navigate through urban spaces, and how it can be translated into other forms for display in exhibition and other spaces.

This research explores means and ways to analyze the ambient noise in the city, and map this to a new psychological topography to re-imagine and re-make the city, using historical and contemporary conceptual models to open the city to change through disorientation and drift, through the perception of the most ordinary objects and places as poetically exciting, uncanny, and even supernatural. It uses the disorientation experienced when something hidden is revealed, to draw attention to a disturbance in the relational field made of the self and its surrounding space. As a participant moves through a city recorded ambient audio is analyzed using speech recognition software to generate sound and speech. The results are reminiscent of numbers stations transmissions: fragments of sound, human speech, buzzing, sounding like gibberish, but uncannily and disturbingly suggestive of meaning and structure.

Acoustically the natural and manufactured world is extraordinarily complex, multi-layered, and coincident. We are surrounded by noise to which we rarely attend beyond the simplest of registers. Many instances of frequencies that lie beyond the range of human hearing, occurrences of both destructive and constructive interference, or sounds that are muffled or suppressed are common, and develop a rich stew of sound that is difficult to molecularize beyond a very general level with few salient characteristics. Nonetheless such sounds do characterize the space they inhabit. Birdsong, screeching tires, music on the boulevard, all contribute to a sense of what a place is and importantly how it is to be navigated and what is likely to be experienced. Very loud or very jarring noises, and alarms, signals, sirens and other sounds deliberately designed to be noticed do rise beyond the general hum of the city, but they rarely, if ever, strike a listener as being more than their designed purpose. They call attention to danger, to movement, to laws and regulations, but they are familiar and understood, and form part of the fabric of sound that makes up the everyday acoustic space.

When noises with no apparent source or cause occur, listeners attend more closely both to their environment, and to the noise itself. In a recent example in September 2013, residents of Terrace, British Columbia, Canada woke at 7:30 AM to strange, loud, grinding and whining noises that lasted 10 minutes,[3] describing the noise as eerie. Even when a logical explanation was offered the sense of something uncanny remained. There are many more example as evidenced by the multitude of websites that track unexplained sound.[4] Bringing hitherto unheard or unnoticed sounds to the attention of a listener can invoke a wide range of emotional responses and intellectual, but in all the nature of the sound is interrogated: what, why, how?

The project is particularly interested in these sounds precisely because they reshape local space by changing an inhabitant's psychological view of the space. In the most extreme response to these sounds they become evidence of conspiracy, or alien activity or hauntings, but in all cases they change our sense of the shape of the world. What was once a short walk through a friendly alley, becomes an interminable passage through a frightening valley, an excursion to a sunny beach become a dangerous trip to shark infested waters.

In ways similar to those described by Alejandro Román as musivisual language,[5] the ambient audio used by the project establishes the shape, space and time of our immediate environment. Working beyond our conscious thresholds, it forms our expectations of what is to occur, as space is continuously inverted and twisted as Barthes' denotation and connotation conflate and "…narrative and diegetic processes tend to fuse, …causing frequent heuristic confusion between them." [6]

Fig 2. *endoscope observations, Paris*, 2014, large scale digital images, © 2104

Early work, using Google's Cloud Vision API, has produced word fragments from apparently empty, silent spaces, and initial experiments have teased words and phrases from ambient audio that does not have an obviously distinguishable or salient speech component. Using a combination of very simple speech recognition software, the words and phrases, largely nouns and adjectives, but often strings of vowels, emerging through computer analysis are, like other work looking for images of faces in random noise, often convincingly real suggesting, some actual voice or intelligence behind the words, though, however unsettling, in actuality they emerge only from algorithms carrying out the work of analyzing the audio, or the imagination of the listener. The ambient audio of the city has a mix of human, machine and natural sounds. The intent is to develop software that can attend to these noises and recognize within them real and imagined words, phrases and sounds, and use the results in installations and a wide range of artworks.

Voice-recognition software programmes work by analyzing sounds and converting them to text. They use knowledge of how language is likely to be said. Most modern systems recognize continuous speech with an accuracy approaching 90% under perfect conditions, but they are notoriously inaccurate in noisy conditions or when there are multiple speakers, resulting in false matches. This project sets out deliberately to exploit the occurrence of false positives to generate new meaning in the urban landscape, to develop algorithms to allow purposely sounds other than speech to be recognized as words, to allow multiple sound sources to be monitored, and to enable a set of parameters to be used to tune the analysis to reveal sufficient and different quantities of words. The software builds upon several of the available speech recognition software development kits but has committed early endeavours to using CMU's open source, speech recognition toolkit, Sphinx.

The sounds and texts generated rely on their context to give them meaning, but in turn, they also bring new context to the environment that generates them. Fragmentary, poetic, usually descriptive in nature, the texts and sounds generated will be used to create new street names, new maps, and other visual and audio

forms to transform and characterize the urban landscape through new emotional responses to the city. In re-characterizing the city, new nested cities emerge. As a participant travels through the city, texts and sounds thrown up by the recognition software distort and change the perception of the landscape. As the paths of participants overlay and intersect, these layers produce more and more complicated features that can be translated to topography, generating emotional maps of the city in terms of more or less psychologically charged zones as features within the city.

The work explores the idea of multiple cities occupying the same physical space, but comprising different psychological dimensions conjured up through various emotional valence - the intrinsic attractiveness or aversiveness of an event, object, or situation. Descriptors of place are fundamental in characterizing places. These descriptors are revealed through careful walks and explorations of the visible city during which the texts and sounds that emerge from the analysis of ambient audio, warp of our prevailing sense of space. In addition to the notion of Numbers Stations, the work builds on the legacies of Walter Benjamin's expression of profane illumination,[7] Anthony Vidler's architectural uncanny,[8] the Surrealist and Situationist projects to open the city to change through disorientation and drift, through the perception of the most ordinary objects as poetically exciting, uncanny, and even supernatural.

The works set out to explore the city using an interpretation of ambient audio environments within the contexts of surrealism and the uncanny in order to continually reconfigure the city in terms of its psychological and psychogeographic zones. In remapping the city the project opens a new sense of the dimensions of the city, by giving form to its immaterial, psychic shape.
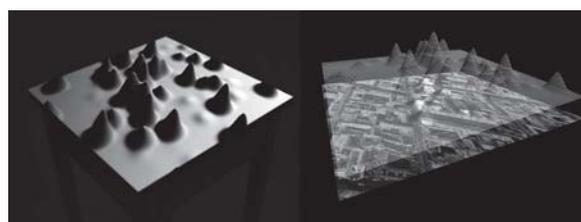

Fig 3. *maps of emotion, Paris*, 2014, interactive digital images, © 2104

Previous Work

The current project has grown out of recent work that used pattern recognition to reveal images and forms in random noise or unexpected places. One ongoing project explores inaccessible or unseen spaces in urban environments discovering some of the coexisting yet

unnoticed environments and ecologies hidden within the fabric of our cities. This work explored the hidden and unseen aspects of the urban environment, using very small diameter endoscopes, snake cameras and tiny microphones. Peering into the smallest of spaces, the gaps between buildings, a crack in the ground, the cameras explored the visual and sonic characteristics of the spaces and monitored the spaces for any activity through motion detection and pattern recognition, finding moulds, insect colonies, strange amalgams, and sounds, shaped by reverberant or anechoic chambers coexisting within the visible city.

Fig 4. *Endoscope Paris,* 2014, interactive touch enabled table top projections, © 2014

This work in turn grew from earlier work that used the ideas found in Electronic Video Phenomena to explore ideas about felt presence and absence, pattern and randomness. Installations took the form of blinded cameras, or cameras that were operating at the limits of their sensitivity, that sent visual noise to a computer that analyzed it for patterns that looked like human faces.
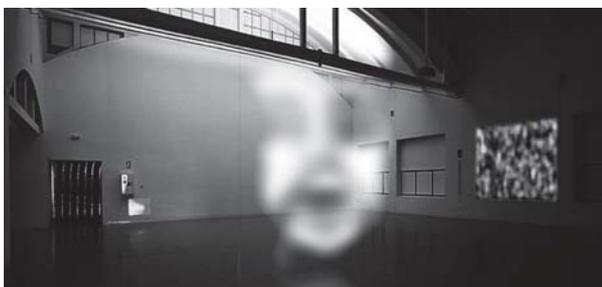
Fig 5. Ghosts in the Machine, 2008, Laboral Centro de Arte y Creación Industrial, Gijon, Spain, installation. © 2008

On occasion these faces and voices were utterly convincing and unsettling. They were, to all intents and purposes, real faces, real voices. They were not images of people, but another kind of image loaded with meaning, which arose accidentally, but irresistibly, from the hybrid interaction between machine and body, hinting at an immaterial hybrid body that existed in the pattern and information flows that were fusion of body and machine, and suggesting that there might be real information contained within the random noise of the work.

Similarly, any hitherto unheard or registered voices or words that are teased from the ambient noise of the city exist only in the inner processes of the computer, even if they are correctly recognized. Their reality, their connection to our sense of place, arises out of their context and their effect on our understanding of place. This new work seeks to extend the ideas of earlier work to a rather different real world situation, to understand the city through a re-characterization of place.

In the end the discovery of meaning comes from the effect of a poetic acting upon the imagination. Given the right situation, all manner of things may be suggested to the imagination, and as Freud himself suggests, the uncanny emerges when the distinction between imagination and reality is effaced. In this sense, and in the context of the project, echoing McLuhan's famous observation , perhaps the noise is the signal.

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3. http://news.yahoo.com/blogs/oddnews/strange-noise-and-city's-explanation-sparks-speculation-181742937.html, accessed March 2nd 2015

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Symmetry: Breaking Through the Looking Glass

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Abstract

For thousands of years artists have been inspired by symmetry in the natural world. Their work, directly or indirectly, led to the science of symmetry: the symbols and codecs enabling the analysis and expansion of this phenomenon as a visual language. Presently, symmetry is a vibrant topic led by research in Mathematics, Biology and Physics. But what has happened to this theme in the arts? Since M.C. Escher's works last century, there doesn't appear to be much interest in symmetry.

Symmetry is broken today, but in a good way. As in Lewis Carol's masterpiece, when Alice falls through the looking glass she find an enchanting and mysterious world, far more curious and engrossing then her winter ensconced Victorian drawing room. The same pageantry is exemplified in the various fields of art: although a powerful starting point, *breaking* symmetry yields greater complexity in subsequent manifestations. When integrated with other techniques and concepts, the resulting artworks are sophisticated, intricate and at times awe-inspiring.

Introduction

The mathematical proofs for the 17 plane symmetry groups (or wallpaper groups) were first established in the late 19th century. [1] But the practical, intuitive use of these systems was developed by the artisanal vernacular of the ancient world: Egyptian, Greek, Roman and numerous others. [2] Most celebrated for the extensive and creative evolution of these wallpaper groups were the traditional Islamic Artists spanning the 12th to 16th centuries. Their tiled architecture not only utilize all 17 groups, they exhibit a profound mastery of the subject – choreographed compositions in form, pattern, colour and cultural context. [1]

The visual splendour of these works can still be witnessed today at many popular sites such as in Granada, Spain. The Alhambra was transformative in guiding M.C. Escher towards a career featuring his famous tessellation artworks. Symmetry in the Western contemporary fine art world does not pay much homage to these ancient artisans or the popular graphic work of Escher, who is largely viewed in this field as kitschy. [3]
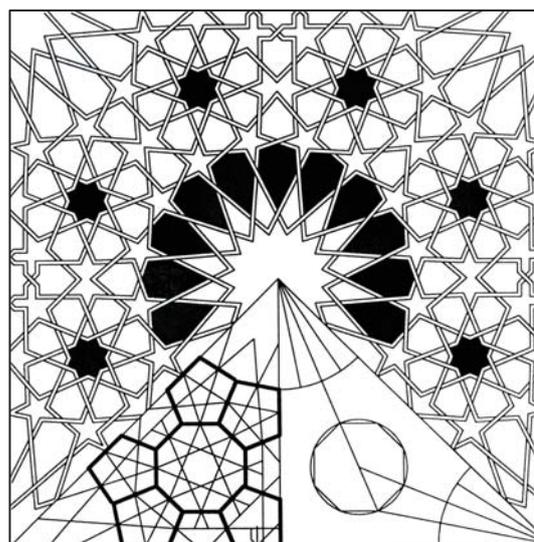
Fig 1. An Islamic Art construction of wallpaper group p6m ©World Scientific Publishing Co. Pte. Ltd. [1]

Computer World

The conditional rubrics used by the minimalists and conceptual artists of the 60's found a receptive serendipity with the development of the computer. This lineage has followed through to this day. UCLA's Programming Media II course examines programmes written by artists and musicians going back to John Cage in 1958. [4] At Victoria University of Wellington, design students are introduced to the works of Sol Le Witt, Vera Molnar and Edward Zajec in their 1st year. [5] Examples of such conditionally driven artworks are important for understanding how the computer can be used as a powerful tool for working with all modes of rule-based visuals, including symmetry: the artists who adorned the Alhambra had the compass and straight edge, today we have the personal computer. Zajec, in particular, not only crafts new masterworks meditating on symmetry, he also brings the topic into time-based media (see Fig. 2).
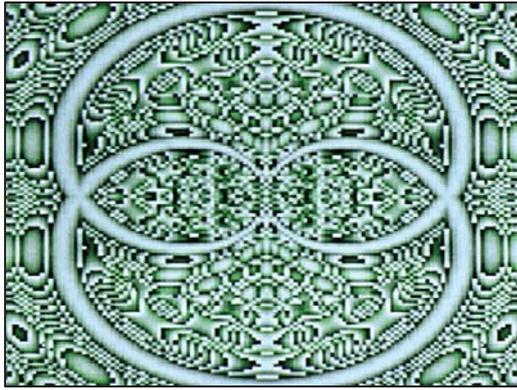
Fig 2. *Composition in Red and Green*, 1989, Edward Zajec, Digital Video.

Worldbuilding

Early theoretical works on the nature of artificial life also reinforce symmetry's creative fecundity. Dating back to Conway's Game of Life (CGL), the computer is established as the tour de force for simulation, beckoning analogy to other universes while creating new terminology like cyberspace and virtual reality. Created in 1970, CGL features very simple rules along with initial random pixel assignment. After a few generations, astonishing patterns (virtual organisms), typically exhibiting at least some initial symmetry, take hold and thrive in this black and white world. [6]

Fig 3. *Conways Game of Life*, Image from Javi Agenjo http://www.tamats.com/blog/?p=409.

Symmetry acts as scaffolding, pre-eminent in the cauldron of life, yet at the same time, a stifling homogeny, threatening to bind this wellspring within a crystalline prison. It is at the higher levels of organization where we see chirality (the "left-handed" corkscrew shape of all living DNA) [7] and approximate symmetry take shape (animals, after all, are not precisely bisymmetrical). Such staged evolution is neatly delineated in Valentino Braitenberg's treatise on synthetic psychology, Vehicles. [8] The book is based around thought-experiments where simple robots are fitted with a means to sense and move around a hypothetical environment.

The first conceptual vehicle proposed by Braitenberg is composed of one sensor and one motor, only able to change course within its world through external forces and frictions, but perhaps exhibiting life-like qualities by speeding up or slowing down based on the hot/cold fluctuations in the terrain. Vehicle 2 presents two sensors and two motors and multiple wiring strategies (see Fig. 4). Already we have an impressive set of behaviours on display, but by the time the book advances to vehicle 14, we have witnessed a dizzying, yet convincingly logical, array of neurological upgrades where the original simple symmetrical forms are buried deep within the hypothetical organism.
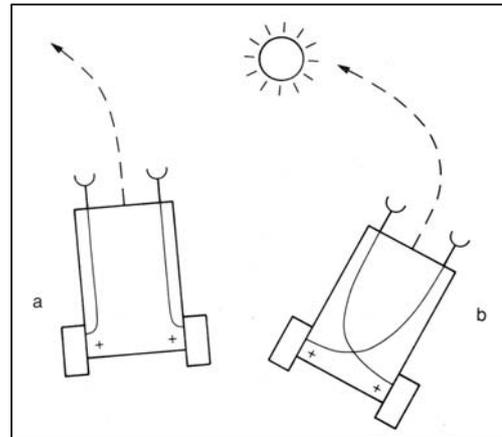
Fig 4. Vehicle 2a (coward) and 2b (aggressor). [8]

Graphic designers and computer artists often start with basic structures (or initial rules) supplied through software. Creative software programs feature customizable rulers and grids (grids happen to be a wallpaper group known as P1). [9] As useful as a grid may be for a starting point, in most cases artists understand there is something problematic if the work is not able to develop a visual logic that manoeuvres from this starting point. This is one of the most essential lessons in a basic design course. [10] So even though M.C. Escher's work was inventive and meticulous, its reliance on inherent structure is perhaps what has kept his work from connecting with a more erudite audience of museum collections and fine art research. While Islamic Art is even more reductive in terms of content than Escher's, the relationship to architecture, balance with materials and accessory ornaments, and most importantly, religious and cultural contexts, immediately places these works in a more refined and solemn place of reverence. One doesn't look at the Alhambra and start to decode its tricks or clever devices – it is one and part of a greater visual and conceptual totality.

Conceptual Symmetry

Symmetry is relied upon in a wide range of sensory modes. In the creative arts, it has been noted as a useful

strategy in music, dance and film. While M.C. Escher turned down an offer to work with Stanley Kubrick, the latter obviously possessed his own fascination with symmetry. [11] The Shining and 2001 are prime examples of how measured shots of radial and bisymmetrical views communicate unusual moods – a sedate meditation as a spurious backdrop for a more unsettling and discordant Weltanschauung (see Fig. 4). Yet again, another student of symmetry, Wes Anderson, employs similarly framed shots achieving a completely different psychology of anodyne frivolous romps driving his films.

Fig 4. *The Shining*, 1980, Stanley Kubrick, ©Warner Bros..

In the fine art world, we see symmetry deployed across a far more convoluted pathway of translations. Most notable would be a conceptual use of symmetry – playing with juxtaposed roles and social tropes in order to illuminate multivariate perspectives. For instance, one could consider Stelarc's self-bioengineering experiments as a rebel cry for transhumanism, striking out against biology's most ancient and ubiquitous heredity: bisymmetry. Ears assume a position high atop the bisymmetrical frame of humans – Stelarc's third ear transgresses nature, planting a flag in his own asymmetrical agenda.

Fig 5. Stelarc, *Ear on Arm*. 2008. Photo by Nina Sellars.

Before computer screens, sheets of paper contained regular segmentation for organizing and unifying thoughts, love letters and government edicts. In SWAMP's 2010 work Notepad, perhaps one of the most radical leaps from the starting point of pre-structured media is taken. At first glance, no leap is taken at all, as the content is not visible with the naked eye: all the

audience sees are blank sheets of legal pad paper - thin cobalt-blue lines breaking up the rectangle field of canary yellow. But as the artwork explains: *in* the medium is the message. Magnifying the blue lines reveals that they are actually microtext of the names of Iraqi civilians who were killed during the US led war in Iraq. The paper further served as a prop for a performance artwork and political protest as they were surreptitiously smuggled into Capital Hill stationary. [12] SWAMP's work often interrogates dichotomies of various forms. The group's projects Tardigotchi and Spore balance compositions poised between biological organisms and artificial life, a special sort of nature/culture reflection with a nod to Mary Shelley and golems of Jewish folklore.

Fig 6. SWAMP, *Notepad*, 2008, Photo by SWAMP. [12]

The Age of Creative Coding

Symmetry is not only expanded by conceptual exercises: the personal computer and the age of creative coding is reconnecting perhaps where the artists of the Alhambra left off. Joshua Davis has been known since the early days of Macromedia Flash, not only for carving out a new domain of code-driven graphic design, but also for freely sharing this code. In collaboration with James Cruz, his recent Hype project provides ample scripting tools for experimenting with colour, form and text. [13] Some of his recent creations with this framework have rendered amazingly vibrant graphics (sometimes with a finishing touch by hand – see Fig. 7).

Fig 7. Davis, Joshua, 2012, Photo by Pere Virgili.

A more popular predecessor to Hype is the educational programming language Processing. Casey Reas and Benjamin Fry evolved Processing out of John Maeda's group at MIT's Media Lab; their innovation quickly became a mainstay in curricula seeking to introduce computer programming to art and design students. [14] While the fact that Processing and Hype are freely available establishes a platform for creative coding, it is equally important to have code examples that illustrate design iterations. Many leaders in the creative coding community (including Davis and Reas) have shared such work frequently. A Whitney Museum commission by Reas titled {Software} Structures illuminates the boundless possibilities with circles. Starting with two overlapping circles to construct a perpendicular bisector, the artist develops his compositions with a series of savvy progressions (see Fig. 8) – sharing each step of code along the way. [15]
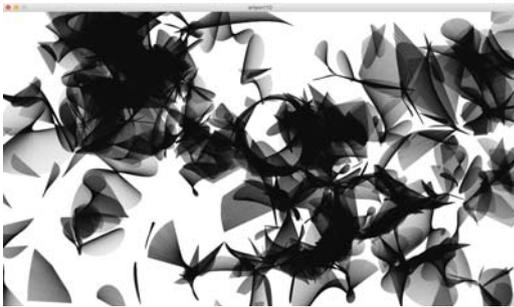
Fig 8. Reas, Casey, *Structure 3*. 2004. [15]

Originally built with Processing, CatsEye is a software project developed at Victoria University of Wellington that focuses on sketching patterns using imported images. [16] The p6m tessellation method heavily employed in the Islamic arts (see Fig.1) is one of the central mechanisms used in this software (see Fig. 9).
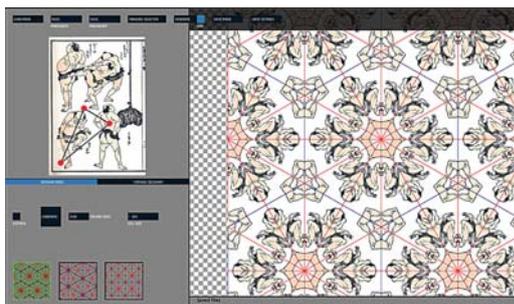
Fig 9. *CatsEye*, Image from Douglas Easterly and Ben Jack http://catseye.graphics. [16]

CatsEye uses p6m in a different way than ancient precursors: instead of underscoring the beauty of geometry, the manipulated tile is used to crop a scanned drawing, leveraging a simple, yet powerful, feature of modern computer graphics. This tool, along with transitioning the output through various forms of digital and analogue media, supports Easterly's attempt with recent paintings to utilize, but ultimate break, symmetry (see Fig. 10).

Fig 10. *Léger Comme Un Esprit*, 2014, Image from Douglas Easterly http://www.douglaseasterly.com.

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Posthumanism, New Materialism and Feminist Media Art

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Abstract
Some scholars understand the theoretical orientations of posthumanism and new materialisms to be in tension if not in distinct opposition to previous feminisms. This essay explores select works by two contemporary artists to suggest that posthumanism and new materialism have antecedents in previous feminist media arts. This proposition encourages the recognition of feminist contributions to the history of posthumanist and post anthropocentric art practices.

Introduction

The work of women artists working with technology is poorly represented in the art historical record. [1] Even today when both digital media and feminism have become popular, few publications about this art exist. The paucity of recognition in the art world notwithstanding, new media art by women continuously proliferates. [2] While some works address traditional feminist concerns such as the female body, identity, representation, feminist history and consumerism, others directly engage with recent theoretical currents in posthumanism and new materialisms. Some scholars understand these latter theoretical orientations to be in tension if not in distinct opposition to previous feminisms to which notions of gender, embodiment, subjectivity, legibility and signification were central. Such understandings often erase the contributions of feminism to the history of posthumanism. In this essay I will examine select works by two contemporary artists, Paula Gaetano Adi and Karolina Sobecka, who exemplify post-humanist and new materialists orientations and I suggest that this work has precedents in previous feminist media art. This proposition contests the erasure of feminist contributions from the history of post-humanist, materialist and post-anthropocentric art practices.

Posthumanism and New Materialisms

Katherine Hayles explains posthumanism as the deconstruction of the humanist subject and the attributes normally associated with it such as free will, self-determination and mastery. [3] In her book *How We Became Posthuman* (1999), Hayles countered posthumanisms that proposed a future in which the human mind would function as pure data and humans eventually would be replaced by machines. Drawing from evolutionary biology and cognitive science she proposed an embodied posthumanism that recognized minds as inseparable from the material and historical specificities of bodies. She viewed posthuman subjectivity as developing from a world always in the process of change. Consequently this subjectivity is chaotic rather than in control, distributed rather than autonomous and located in consciousness. [4] In more recent work she posits that in our era, digital technologies are integrated in our daily lives and communications infrastructure to such a great extent that we have evolved with them and it is difficult to differentiate human from nonhuman agencies. [5]

Similarly, the philosopher Rosi Braidotti associates humanism with a universalizing notion of the subject (white, male, able bodied), and proposes a critical posthumanism with special attention to subjectivity. Her critical posthuman subject is relational, constituted in and by multiplicity and is simultaneously embodied and located, not only geographically, but also affectively along hierarchies or gender, race and class. Critical posthumanism for her involves interconnections between humans, nonhumans, and the environment as well as the dissolution of "self-centred individualism," associated with traditional humanism.For Braidotti, the end of classical humanism is an opportunity to create new kinds of subjectivities, exemplified by contemporary cultural mestizajes and the ongoing propagation of genders and sexualities. The critical posthuman subject practices an ethics of relationality by building affirmative interconnections with humans and nonhumans. [6] After Donna Haraway for Braidotti, nonhumans include machines, animals and bacteria. [7]

Posthumanism shares some of the concerns of "New Materialisms," which investigate interrelations between technological, biological, environmental and social processes and human action. [8] Drawing from recent advances in fields such as physics, biology, chemistry, informatics and nanotechnology, new materialists refute traditional notions of matter as inert and predictable and instead understand it to be active, self-generating and unstable. In this framework, phenomena emerge and develop in relation to a multiplicity of interacting systems and forces that render untenable the ontological distinctions between organic and inorganic, animate and inanimate, human and animal, individual and environment. Consequently, like many posthumanists, new materialists reject traditional notions of subjectivity, unilinear models of causation, human mastery over nature and other nonhuman entities and detach intentionality from agency. The main difference between the two theoretical currents is the new materialists' emphasis on the dynamism and agency of matter.

Materialist theorist and political scientist Samantha Frost has argued for the necessity of feminism to come to terms with the interdependence of bodies and matter including the materiality or the body itself. In her

opinion, for several generations feminism was invested in constructivist analyses of how human bodies were formed by power through language, culture and politics. In contrast, new materialists argue for complex entanglements of chemical, biological, geological, social and cultural processes that shape both organisms and environments. New materialist feminists do not demand that feminists abandon the insights provided by constructivism. They do ask that feminists acknowledge the agency of matter and biology in their own right and "relinquish the unidirectional model of causation in which either culture or biology is determinative and instead to adopt a model in which causation is conceived as complex, recursive, and multilinear." [9] The goal is to investigate the ways in which matter contributes to support consolidate or disrupt power relations. These theorizations find affinities in contemporary art.

Paula Gaetano Adi

Paula Gaetano Adi makes art in a variety of media including sculpture, installation, performance and robotics. By her own description, her work attempts "to promote bodily inter-species, intercultural live encounters and explore the effects and 'affects' of different discourses in technoscience." [10] This statement alone indicates the artist's commitment to posthuman explorations.

Her robot Alexitimia (2007) consists of an autonomous agent, a semi-sphere made of clay covered with a soft latex skin that responds to touch by perspiring. [11] Plastic hoses and sensors placed under the robot's skin trigger water flow from a receptacle placed beneath the agent to simulate perspiration. By reducing the robot's expression to a corporeal process, the artist indicates the affective potential of robotic agents and calls attention to a decidedly expressive and underestimated body organ: the skin. According to a variety of experts the skin plays a fundamental role in the formation of subjectivity as it functions as the body's boundary between the inside and the outside. Hence it is central to the formation of the subject's body image and her identification with it. Through touch the skin becomes a site of communication and negotiation basic to the differentiation of the self from others or what we call personal identity. [12]

Alexitimia (in English Alexythimia) is a clinical term used to describe an inability to understand, identify, express or describe feelings experienced by the self or by others. [13] People with Alexithymia can only communicate emotions through their bodies and behavior. In humans, perspiration is associated not only with systemic regulation but also with affective states such as nervousness, excitement and fear. By sweating the robot simulates the powerful effect of material bodily processes for emotive communication in the absence of language.

Gaetano Adi's recent project TZ'IJK (2013) designed in collaboration with the architect Gustavo Crembil, incorporates traditional Latin American building technologies with contemporary robotics. The proposed installation, which already has a prototype, consists of a group of spherical robots. The body of each robot consists of an interior laser-cut polycarbonate geodesic membrane held together with an armature made with *angarilla* wood. The exterior of the sphere is then covered with *quincha*, an indigenous construction method consisting of clay mud mixed with thick grass, which is renowned for its strength and resilience. [14]

The robots lack the capacity to see, make sounds or ambulate. They can rock back and forth using motorized wheels set in the sphere's interior but the movement serves no specific purpose. According to Gaetano Adi, the project draws from the history of mestizaje and critical theories of postcolonial technoscience. Its tactical use of high and low technologies embodies "Latin America's anthropophagic, cannibalistic, and hybrid nature, and so proposes an alternative approach to the development of embodied artificial life." [15] Like *Alexitimia*, *TZ'IJK*'s behavior simulates emotional states. Rocking back and forth in humans and other animals signals stress and anxiety. The inability of the agents to speak and their seemingly erratic behaviors, not only question the instrumental efficiency of traditional robots by bringing attention to different kinds of abilities or "intelligence" but also open to reinterpretation recurrent narratives about the technological backwardness of indigenous and colonized peoples. The unification of traditional indigenous technologies with modern robotics manifest the robot's mestizaje, explores new avenues for creativity and affirms indigenous inventiveness.

Both *Alexitimia* and *TZ'IJK* are part of an important current in modern robotics that questions notions of intelligence as centralized and expressed through the manipulation of symbolic systems, ideas fundamental to traditional artificial intelligence research. To the roboticist Rodney Brooks the essence of intelligence consists of the ability to move around and sense a surrounding environment to the degree required to sustain an organisms' life and reproduction. [16] Some roboticists have demonstrated that even simple mechanisms such as a Weasel Ball can learn to explore its environment. [17]

Unlike the Weasel Ball neither of Gaetano Adi's robots ambulates. *Alexitimia* sweats and *TZ'IJK* rocks back and forth. Through these actions they evoke another kind of awareness that resides in the body. Some scientists investigate expressiveness in robots or other artificial agents, primarily through the emulation of human emotions by anthropomorphic or animal-like agents. [18] Gaetano Adi's robots resemble no humans or animals. They evoke affective states solely through their materials and behavior. In this way the artist expands the concept of the body and its matter to include synthetic components in line with current materialisms.

Karolina Sobecka

Karolina Sobecka works with a variety of media to engage public space and explore the ways humans interact with the world**.** *Thinking Like a Cloud* consists of a Cloud Collector launched on a weather balloon. Inspired on modern fog collectors used in areas of the world where water is scarce, The Cloud Collector consists of a 2 wing raschel-weave mesh that extracts 30% or moisture or 0.5-1.5 grams of water per cubic meter of cloud, a connecting funnel and a sample container with a reflux valve. [19]

The collector gathers cloud samples in the troposphere. The water it collects is then consumed by volunteers who record the effects of their ingestion in a log. According to Sobecka, "the cloud microbiome is incorporated into the human microbiome, rendering its new host part-cloud." A diagram in the project's blog explains that the resulting human is "10 trillion cells 5% human, 1% cloud 94% other." The "other" refers to microflora in the human body. The project offers participants a bacteria tasting menu that includes some species of microbes found in the cloud in a specific location, day and time. Sobecka proposes that the cloud water may affect the participants' ideology by making them think of "water, clouds, microbes, humans and systems "a little differently." [20] This conjecture resonates with the work of the theorist Elizabeth Wilson, who argues for the primacy of the gastrointestinal tract in the psychological development of humans. Literally, the gut is an open tube that brings the outside world into the body. According to Wilson, the outside world engenders the relations of self and other and through them the development of the self. [21] Then, one could propose that possibly one could ingest ideas and orientations towards the world. In sync with new materialisms, Sobecka's work emphasizes the complex relations of environment, mind and body. The work of both Gaetano Adi and Sobecka shares with previous feminist media art interests in expanding notions of subjectivity and stimulating reflexions about collective futures.

Examples from Previous Feminist Media Art

Even though before this century few feminist artists engaged with topics such as the human microbiome, the physics of virtual particles and nanotechnologies, the historical record demonstrates the existence of orientations now identified as "posthumanist" or "new materialist" in previous feminist media art.

Since the 1970's Lynn Hershman-Leeson has investigated posthuman dimensions of identity and the body. In her performance of Roberta Breitmore, a fictitious person who lived a real life during a four-year period (1974-1978) Hershman makes clear that identity is fictive, multiple, unstable and boundless. Hershman's replication of Roberta by commissioning four other women impersonate her further demonstrates her understanding of subjectivity as multiple and distributed. [22] In Hershman's later media works identity transcends the boundaries of the given body to admit a variety of couplings, structural and prosthetic, with machines. Her

photographic series *Phantom Limb* (1988) portrays women-machine hybrids in a variety of poses. The machines, such as TV monitors and cameras signal the media's alluring power over body and psyche to the extent that they have become naturalized body parts. Hershman's integration of humans with machines continued in her film Teknolust (2002) in which a scientist creates artificial agents that subsist on human sperm and in her artificial intelligence agents that exhibit human appearance, Agent Ruby (2002) and DiNA(2004).

Natalie Jeremijenko's almost entire artistic production since the 1990's has sought to provide opportunities for convivial collaboration, communication and exchange between the environment, humans and animals including geese, amphibians, fish, pigeons, butterflies, salamanders and rats. These projects exemplify aspects of the critical posthumanism outlined by Braidotti as they foster relationality across species and materially distinct entities. Many of Jeremijenko's experiments investigate the health of the environment, humans and other living beings. She understands "health" as a project shared among all of these entities and she employs contemporary technologies to facilitate connections among them. [23]

In her renowned work *OneTrees*, which began in 1999 in collaboration with plant geneticists at the University of California Davis, Jeremijenko cultivated and later planted clones of a hybrid walnut tree around California's Bay Area to show how the environment and the climate affected the growth of each tree. In the project as each specimen grew, it developed unique characteristics through interaction with its surroundings. Thus the physical identity of each tree was both singular and multiple, an idea communicated in the title of this work. This multiplicity in singularity indicates that genetics alone did not determine the evolution of each tree but rather its health was the product of a complex of interacting factors. In addition people could purchase artificial life clones of the trees in a CD ROM to grow in their computer screens. The a-life clones were linked to C02 monitors that analyzed the air in the location of the monitor, which in turn affected the growth of the simulated trees. This work demonstrated complex interconnections among multiple systems in the development of living entities. In that respect it could be seen as anticipating new materialist orientations.

Sobecka and Jeremijenko's interest in systems interaction have parallels in the work of other artists. For instance, Kim Abeles, made several "Smog Collectors" beginning in the 1990s. These objects, ranging from silk to dinner plates, register through color changes the quality of the surrounding air when exposed to it. All of the works discussed above have more distant antecedents in ecological art including site specific works of the late 60s, 70s and 80s by artists such as Betty Beaumont, Agnes Denes and Patricia Johanson.

Conclusion

Hershman has been making art since the late 60's and Jeremijenko since the early 1990's. Consequently their work is neither all contemporary nor exclusively historical. Like them Gaetano Adi and Sobecka in their work exceed the social and political construction of individual human identities and the restatement of human rationality and control by engaging with other organisms, materials and systems that render the human unstable and distributed. While Gaetano Adi and Sobecka address subjectivity and affect in their work, they incorporate new technologies and scientific knowledge in their art to reach across geographical, historical, cultural and material differences and establish affirmative and generative connections. The greater involvement of these two artists with contemporary scientific discourses and their affinities with new materialisms notwithstanding, in the history of feminist new media art, feminist, posthumanist and new materialist orientations overlap and remain difficult to disassociate.

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Foundations of a Design Framework for DIY Nomadic Public Screens

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Abstract

This paper discusses a new research-creation project, which proposes to explore the DIY making and deploying of human-scale portable interactive displays for the purpose of supporting both artistic exhibitions and performances. Made from colorful modular panels and electronic components, these interactive screens are meant to serve as mobile digital public displays and nomadic screens for artists, activists and others who wish to stage improvised events in public space. A key objective of this project is to recover, reinterpret and combine historical traditions of interactive media and visual storytelling to inform the design of these artefacts. Accordingly, this paper adopts a media archaeological approach to look at four topoi that might lay the theoretical foundation of a design framework for DIY nomadic public screens. In doing so, DIY making becomes a *détournement* of cultural appropriation in that, here, it is DIY minority cultures that draw on elements of dominant cultures.

Introduction

A digital public display is conventionally understood to be a component of media architecture, that is, a display embedded in a "field that comprises physical structures that utilize digital media to passively or interactively broadcast information to their immediate vicinity". [1] They either take the form of large-size stand-alone screens that rely on LED, LCD or plasma technology or else of video projections that illuminate façades of the built environment under dim lighting conditions.

As is often the case with locative urban technologies, these platforms are typically costly and can take up a significant amount of space. As a result, their design and implementation tends to be driven by infrastructural initiatives that involve collaborations between the public and private sectors, which can include actors as diverse as design practitioners in university environments, curators in art galleries, private-public technology partnerships in urban space and commercial stakeholders in private, semi-public and public settings. [2] Further, they tend to be maintained and controlled either by those who own the space or those who own the content. [3]

While the extant literature suggests that the interests of end users are generally well considered through research methods that include use scenarios, interviews, user studies, participatory design activities and consultative processes, all of these user-centered design approaches, however, present the same key challenge, namely that the "user's thinking can be constrained by what they know". [4] As a result, the politics of design around public screen technologies in the era of ubicomp is often fraught with normative assumptions and conventions of universal use, which determine what forms, content,

purposes and deployment contexts would be optimal. [5]

This, in turn, can place constraints on the possible uses of display-based systems in public space. Research that emerged from practitioners affiliated with the Urban Screen project initiated in Amsterdam in 2005 claim that portable screens might offer solutions to this problem and support access for more diverse publics. [6] Field observations conducted in-the-wild further suggest that a significant proportion of people would prefer interactive digital public displays to be designed as "contraptions or components that would be mobile, portable or easily dismantled and reassembled" and would make it possible to spontaneously stage cultural events in urban space. [7]

Activists, hackers and artists interviewed for this study deplored the fact that although digital public displays are increasingly being embedded in urban settings, they are not openly accessible for people to freely display their own content. Accordingly, many expressed the need to have access to a screen that they could move around for a given project or performance. Most interviewees also felt that it would be important to deploy these outside of tightly managed institutionalized spaces which they argued often "gentrify" and thus restrict free speech. [8]

This art paper explores how electronic artists might be poised to reimagine interactive digital public displays in today's context of DIY economies of making. It proposes to do so by presenting a new research-creation project, which consists in making and deploying human-scale portable interactive displays for the purpose of supporting both artistic exhibitions and performances.

Made from colorful modular panels and electronic components, these interactive screens are meant to serve as mobile digital public displays and nomadic screens for artists, activists and others who wish to stage improvised events in public space. A key objective of this project is to recover, reinterpret and combine historical traditions of interactive media and visual storytelling to inform the design of these artefacts. Accordingly, in this paper, a media archaeological approach is adopted to examine four topoi that could lay the theoretical foundation of a design framework for DIY nomadic public screens. In doing so, DIY making becomes a *détournement* of cultural appropriation in that, here, it is DIY minority cultures that draw on elements of dominant cultures.

The Topos as a Conceptual Approach

What follows presents existing tropes from the past that can be conceptually connected to the present. In keeping with the media archaeological approach, the objective here is to create a series of *topos* to be construed as

abstractions, which suggest possible metaphors to further develop the theoretical aspects of this design framework:

...a persistent cultural formula that appears, disappears, and reappears, gaining ever-new meanings in the process...topoi are building blocks of cultural traditions; they manifest both communities and transformations in the transmission of ideas. [9]

Huhtamo situates this scholarly practice well within the tradition of the humanities, that is, its purpose is first and foremost philosophical and discursive. One could argue that artists, designers and practitioners have always drawn their inspiration from visual and media sources across the boundaries of time and space. An issue collateral to this approach is that some may argue that it supports practices of *cultural appropriation*. Indeed, it is vital to critically reflect on the implications of this throughout this research-creation project. However, here, as we will see, the process at hand is the reverse of what is conventionally understood as cultural appropriation in that it is a DIY minority culture that uses elements of a dominant culture, subverting it at times in order to recast its meanings and impacts. By using historical sources to challenge current conventions of how interactive digital public displays are to be designed, one can evoke ways of reimagining them *within* existing legacies of culture.

Interactive Public Displays Are Ancient History

As elements of visual media culture, public displays have been a common fixture of the *polis* since ancient times. [10] Applying the media archaeological approach to this media platform reveals that large screen surfaces in private, semi-public and public space appear to have an equally far-reaching history of being interactive. For instance, the clusters of graffiti inscriptions that have been found in Pompeii on the façade of most buildings and inside homes are typically dialogical in nature with people responding to one another's comments. [11]

Moreover, onsite observations in the town-city of Pompeii shows that the practice of graffiti was actually widespread among all social classes and in all types of buildings, including basilica walls, which were found to have collections of poetry and prose as well as "extended conversations about the nature of love, scratched by a variety of different hands", while in other pedestrian sites, one could read graffiti of "legal and commercial rhetoric, improvised and crafted poetics compositions, dramatic performances and public readings". [12]

Public Space is Rhetorical

More recently, we find in China a media platform that seems to be formally reminiscent of Pompeii's dialogical walls: *tatzepao* – a public writing medium now known under the moniker "dazibao". Dazibao are big-character posters that were posted in China on city walls in the second half of the twentieth century. They could be published anonymously or signed by their author; as a single piece or as multiple sheets; in small or broadsheet format; as short as a poem or as long as a book; and in designated civic areas or in unexpected locations. [13]

In theory, the content of daziboa was a critique of the political regime in power. However, even though they were rhetorically intended to be vehicles of popular expression produced by contributors of "humbler backgrounds", in reality, masses of daziboa were at first tactically used by one elite faction to mobilize public opinion against another. [14] In the late seventies, one 200-yard brick wall in Xidan covered in dazibao that "attracted readers as well as open-air discussions and speeches" later became known as the "Democracy Wall", which echoes the large scale and pervasiveness of the Ancient graffiti and dipinti practices in Pompeii. [15]

In fact, both public media platforms share three important characteristics. The first, as noted, is that they can be used, either by radical or subversive groups or by an authority in power, sometimes simultaneously; a display wall showing a mix of views or including advertisements provides an example of this. Second, they can appeal to a mass of people moving through public space, yet they have less in common with "mass media" than they do with online platforms because individuals use them to self-publish. And third, they often serve as a catalyst for the production and spread of other unofficial publications, as Downing notes about dazibao. [16]

In the context of interactive nomadic displays, dazibao evoke the idea that public media displays are neutral technological artifacts that call upon cultural practices that are themselves not neutral at all, but are instead inevitably politically charged. Their history serves as a cautionary tale: public space is rhetorical. One must thus carefully think about how it should come to be activated with technologies of representation: nomadic screens may be neutral but their deployment contexts are not.

Technology To Support Emergent Happenings

The unpredictability of public space may be both its most dangerous and most appealing aspect. While public media displays are often used to broadcast programmed content, when they are appropriated, hacked or made available for improvised uses, one longitudinal field study found that they became sites of emergent and generative actions. As a study participant observed:

What struck me the most about these public media displays was that I could never effectively anticipate what was going to happen. It was not only often surprising, it was always surprising. I think that this had to do with the fact that once someone decided to use them, something was bound to happen: whether it was a small thing or a big thing, an intimate gesture or a far-reaching initiative, and whether it was about one's individual interest or the common good, what was being said, always had an element of surprise to it. And this was happening every evening, no matter who the user was. There was always some kind of impact on people, on public space, on passersby, or on those who stood there, compelled to go up and partici-pate too, but often never dared to. It was a context that gave us a sense that anything could happen and that the human element is what made this possible. [17]

Here, a public media display can become a space of possibilities – an affordance driven by human behavior, not by a thing. By virtue of this, added this interviewee, "the unexpected could always be expected". This echoes Rafael Lozano-Hemmer's explanations on the intended impact of his own "relational architecture" artworks:

> The real motivation behind relational architecture is the modification of existing behaviour, and generating unpredicted, chaotic, emergent behaviours by creating 'a situation where the building, the urban context and the participants relate in new, "alien" ways'. [18]

As unstructured as this seems, Allan Kaprow similarly detailed the rules of *Happenings* in a list of seven principles. [19] The *Fluxus* art movement then expanded on its meaning by proposing to mingle art and life in the context of everyday venues. While in the utopian realism of the sixties, this took the form of art "as an alternative project to reality…the aim of today's relational work involves opening an exchange space, within a closed artistic world" too often co-opted by institutions. [20]

DIY displays critically draw from these influences; they are to be designed for the purpose of supporting *emergent happenings*. As screen-based media, they also historically refer to the itinerant attractions exhibited in the nineteenth century: "mechanical theaters, moving panoramas, or magic lantern that evoked dioramas". [21]

Dioramas in particular allowed for the interplay of distinct media-cultural forms whereby, for instance, mechanical effects, painted backgrounds, animated figures and the management of light could be combined to achieve unique illusionary effects. [22] What connects the DIY interactive nomadic screens with such older media apparatus that anticipated cinema is their ability to produce visual spectacles that support performances held in temporary venues. In particular, it is how they can do this by including human presence: as Huhtamo remarks, moving panorama and magic lanterns were performed by a lecturer who contributed music or explanations. [23]

Hybrid Practices Combine Old and New

The human dimension foregrounded in the use of the DIY nomadic screens is not only performed, it is also understood as part of a larger, perhaps more holistic relationship to making. In this research-creation project, using becomes a crucial part of making. Design-in-use is seen as a way for DIY maker-performers to explore and develop the potentials of the material, the forms and interactive components that produce emergent content. The democratization of the design process is thus extended to include the experience of using the screens.

To conceptually support this orientation, a *multisited design* theoretical perspective will be adopted as a critical approach that applies multi-sited ethnography to the design and implementation of electronic artifacts within the realm of contemporary making practices. [24] Drawing from Marcus' recent work, the practice of making coupled with ethnographic engagements that reflect on the process of production are instantiated in the micro-context of "para-site events", which provide opportunities to transpose the experimental setting of the studio or workshop in-the-wild, where the exchange of knowledge takes place with new epistemic partners. [25]

DIY making-performing also draws on the physical and digital integration of design and craft skills known under the moniker of "hybrid craft", in which contemporary making practices make use of traditional craft skill sets in combination with the new design tools made available by digital technology. [26] In the context of this research-creation process, this is achieved by referring to one or more metaphors from the past as constitutive of the present – as with the topoi collected in this paper – in contrast with utopic imaginings of the future as generative of what might otherwise be possible.

For instance, ornamental screens could be proposed as a metaphor for a DIY nomadic screen. Ornamental screens are an antique tradition that originated in China during the Han dynasty and spread to all parts of the world in the past two thousand years. As such, they offer a far-reaching example of the historic interdependency between the local and the global in the political economy of making artifacts. In the nineteenth century, Western artists culturally appropriated folding screens as orientalising decorative artifacts, especially around the time of the Arts and Crafts movement. By referring to this history, the maker-performer can create a *topos* that supports both an ongoing working out of the process of making through appropriation as well as an opportunity for critical reflection that informs design.

Here, the potential of contemporary materials and techniques are used to reinvent old, traditional forms (ornamental screens) and making practices (craft). Indeed, folding screens were invented in China and later introduced to Europe in the late Renaissance period. They were modular, comprising one or more panels made of wood and paper or silk. Wooden screens were often lacquered, painted with gold and decorated with precious stones to dramatize the play of light when one moved around them. This attention to having their scenic backdrops enhanced by changeable atmospheric luminous effects suggests that they may be one of many artifacts that historically anticipated visual storytelling.

A DIY nomadic screen based on this metaphor would aim to critically recover these traditions by recasting and recontextualizing them in today's global world, but it also constitutes a site – in this case, a *topos* – for reflecting on the ethical implications of technology design as a cultural force shaped by the contingencies and politics of its geopolitical conditions. This project thus asks how cultural appropriation can become a means to experiment with temporarily embedding technologies of representation in different social settings.

Conclusion

The four *topoi* described in this paper have been proposed as abstractions that might serve to define the broad strokes of this research-creation project. They suggest that some of the common ground of digital public displays include their interactive potential, their

rhetorical and political purchase, their hybrid character and their status as relational objects that highlight human interventions over human-computer interaction.

Indeed, drawing on historical sources can at times paradoxically suggest new ways of thinking by way of *reimagining*. It is hoped that the use of *topoi* will give DIY maker-performers the freedom to engage in new kinds of utopic realistic visions that may not be entirely practicable, but that nevertheless provide fertile ground for critically experimenting with forms that come to coalesce around the nexus of culture–technology–space.

By laying the foundations of a design framework that will be further developed in collaboration with maker-performers, this work has firmly positioned this research-creation project in a practice-oriented design process that aims to highlight the crucial role that representational practices play in shaping today's world as one where agency is negotiated through access to media and space.

The next phase of this research-creation project consists in creating a user-friendly toolkit and organizing workshops to build relationships with epistemic partners. This would, in turn, present an occasion to determine by what means each maker-performer would see it fit to record their reflexive observations, and it would also foster discussions on other possible *topos* and metaphors that could initiate suitable sites for critical investigations. For what Massey calls the geometries of power – how space and location regulate access, power and control – is a contemporary phenomenon that affects the design and use of technological artifacts at a global scale. [27]

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The Anomaly: noise, ghosts and the multiverse.

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Abstract

In his 1999 publication "The Life of the Cosmos" the physicist Lee Smolin puts forward the hypothesis that black holes born from dead stars may spawn new universes [1]. He describes these new or "daughter universes" as having retained a trace or a memory of the universe from which they were born [2]. At his recent talk (2015) "Personal knowledge: embodied, extended or animate?**"** at Plymouth University, the anthropologist Professor Tim Ingold was asked "What is imagination?" His answer in short was that imagination may be some kind of longing. For some years now, I have been working with ideas of longing and science fiction, the inhabitation via imagination of other worlds, whether terrestrial or cosmological. In this article I will address aspects of longing in relation to memory, science fiction and the imaginary.

The philosopher and psychologist Hannah Arendt believes that stories allow us to resolve our internal narrations with that of the external, whether as individuals or societies [3]. The interface between the internal and the external is a negotiable boundary, porous and indefinite and stories are one way in which human beings make sense of the world, of emotions, histories or deaths. Stories cross many boundaries; the navigation of which can place us in the rich domain of the imaginary, a limitless place in-between worlds, disciplines and narratives. A place where we might experience that which is not physically or phenomenologically close to us, to our bodies, to our perceptions of things. This inter-subjectivity regulates our personal relation between our internal world, our narrative and that of the external, of people and societies. This inter-subjectivity is also a form of relationality in which we form and reform concepts of the other, the alien, the imaginary and the abstract. Science, a rich seam of storytelling, points not only to truths or discoveries but also to the narration of the concerns of the time, of how humans find themselves in the vast expanses of space and in the miniature world of atoms and molecules. Scientific ideas are often a beautiful series of narrations at the interface of the internal and external, a not so linear progression of phenomenon, logic and imagination. In the domain of the story-world, the "dynamic interplay of self and not-self" [4] allows us to see the self as other, as spectre. The story-world is non-linear, existing alongside, between and threaded through our lived experiences. Stories are events, temporal microcosms where spectres or ghosts inhabit both past and future worlds and perhaps events where "intersubjective encounters" [5] take place with nascent things and beings. To inhabit the story-world,

albeit temporarily, is to inhabit the language of the fantastical, the potential, the maybe. Events and things from the story-world have the capacity to underwrite everyday events, to exist as an alternative to reality. Stories haunt us. The language of stories is the language of noise, a structure that brings things into being.

Longing and the Other

Recently the quantum theorist Christopher Fuchs has described Quantum Mechanics as "a dynamic interplay between storytelling and equation writing. Neither one stands alone, not even at the end of the day" [6]. Stories and narratives are how the human brain understands things including time, evolution and the unknown. Telling tales of scientific discoveries, making linear the complex webs of histories are our way of drawing a thread, a line through the intersections of past events, the fissures or intensities of human perceptions and action, traversing boundaries and interstices between the abstract and the phenomenal.

In her book "On Longing, Narratives of the Miniature, the Gigantic, the Souvenir, the Collection" Susan Stewart states that narratives of longing are a "structure of desire that both invents and distances its object." [7] Whether vast or intimate, to see something, *the* something must be at a distance. This tension is evident in a great deal of science fiction where the narrative space between distance and proximity, other worlds and alien beings provide an uncanny blend of the familiar and unfamiliar, the discursive lines drawing in the remote, filling in the unknown, the alien. The trope of much of science fiction is the doppelganger, the almost human, the ghost, our other self, inhabiting an other world. Looking out into vast unknown of the universe requires exploring our desires, our dreams and our nightmares.

Lee Smolin put forward the idea that black holes may give birth to "daughter universes" [1] and that these universes would retain a trace or memory of the parent universe, "the physical laws in the daughter universe retains a memory of the laws in the parent universe (Martin Rees [2].)"

"We are made of star-stuff" wrote Carl Sagan in 1973 in The Cosmic Connection: An Extraterrestrial Perspective." [8] It is true that this recycling of matter and gases has formed and reformed into what we might call, at our time in the Universe, a temporary equilibrium. This equilibrium harbors life on our planet

but when our sun dies, the earth dies too and all the stuff; soil, rocks, bodies, water will be reformed, each of the elements forged into new forms, a vast transformation of energy and matter.

It is these transformations that Smolin believes give rise to the possibility of the birth of new universes. His theory is based on two hypotheses, firstly that "quantum effects prevent the formation of singularities, at which time starts or stops." [9] If this is so then time cannot end in the centre of a black hole, but must continue into a "new region of space-time, connected to our universe only in its first moment." [10] The second hypothesis, Smolin goes on to explain, is that the inception of our universe, what we might call the Big Bang, is an "explosion, or bounce, (is) a new effect that happens when matter is squeezed to some enormous density, larger than any we have so far observed." [11]

Smolin goes on to imagine all of the black holes in our universe, many holding within them the possibility to create new universes, each future iteration spawning new life, new worlds. He says "Perhaps it makes it a little easier to contemplate this possibility if one recalls that by itself the simple proposal that time never ends forces us already to conceive of a infinitude of events taking place that we, in our lifetimes, can never know of. All this picture really does is to rearrange all of these inaccessible moments [12]."

Iteration and the Doppelganger
Whilst bound to the earth by gravity humans live poised between the dark interior of the earth's innards and the vast weather world [13] of the atmosphere. Further out, our line of sight observes our solar system, the planets, visible to the naked eye and huge stars in other solar systems, we see the edges of our galaxy and other nebula, celestial constructions seemingly inert. Dark matter causes disturbances of the trajectory of our eyes and our telescopes, (an extension of our vision), warping space and time. This anomaly, causing a single star to be seen as twins, as a distant doppelganger, the uncanny star.

If Smolin and others are correct, we live in an infinity of universes, the multiverse, where each new birth has residue or memory of the older universe that brought it into being. As these new multiverses are born, each is only fractionally different than the 'mother' and therefore may contain the possibility of life, of a solar system like ours, of the possibility of consciousness.

Noise is an undercurrent of mutable implicit information, which points to possibilities, existences, at the interface, at the boundary. Noise is the intermediary, a ghostly interlocutor that passes information across internal and external thresholds. To be alive is to be haunted, by our past, others' histories and this haunting is a kind of longing, a future longing, a longing of imagination, of what may be. Of course to be alive is to be tangled in a skein of narratives of futures and pasts, to dwell in the interstices of our world. Smolin says of the structure of these other worlds, "time is no longer a simple linear progression. Instead time branches like a tree, so that each black hole is a bud that leads to a new universe of moments [14]."

This story of the multiverse comes at a time where endless human life on earth is doubtful. It is interesting then that our longing is engaged with the possibility of finding other worlds, habitable, almost like our own and perhaps accessible. Science fiction employs the other world and the doppelganger in order to explore the what if? What if our universe was similar to this one but slightly distorted, if gravity was different, for example. Human imagination seems to have always looked to see our world at a distance. One theory dating back to Ancient Greece was that the moon was thought to be a immense celestial mirror, reflecting an image of the earth to all those gazing at its surface and this is useful, as on an earth unable at that time to look back on itself, the image of the moon as a mirror serves as a space to see ourselves in the vast distances of space. Now that we are able see into space, into other galaxies, discover exoplanets, possible homes, stories of the multiverse may serve a purpose for us to imagine human life, lived out in multiple universes' planets now that our life on our home is fragile. And in our minds we imagine these other humans as ghosts or doppelgangers, as noise at the surface or interfaces of our world, as traces, at the very edge of our perceptions, other lives lived, just detectable.

"At the interface between the medium and substances are surfaces. Surfaces are where radiant energy is reflected or absorbed, where vibrations are passed to the medium, where vaporization or diffusion into the medium can occur, and what our bodies come up against in touch. So far as perception is concerned, surfaces are therefore "where most of the action is (Gibson 1979:23)." [15]

Each time a new universe is born, the tangled skein of iterations of these worlds vibrate and we would become aware at the periphery of the other, the alien, the ghost and a longing to unite ourselves with our other selves, out there at the interface between other universes. To merge with what might have been, what might become.

Ghosts
In science fiction, ghosts or doppelgangers are agents at the surface or interface of our worlds, traces of other lives, other beings, things just detectable, at the very edge of our perceptions, brought into being by extending the laws of physics, longing and imagination - the supersensible.

"In the virtual space of all tele-technosciences, in the general dis-location to which our time is destined – as are from now on the places of lovers, families, nations – the messianic trembles on the edge of this event itself. It is this hesitation, it has no other vibration, it does not "live" otherwise, but it would no longer be messianic if it stopped hesitating: how to give rise and give place donner lieu], still, to render it, this place, to render it habitable." Jacques Derrida [16]

And we might look at Derrida's vibration as an emanation of noise, in the vibration there are a multitude of voices, voices that have been and are yet to come, a haunting on an vast scale, a calling to the edges, the periphery, the boundary, the other world, the multiverse.

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An Origin of Interactive Art:
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Abstract

Nam June Paik is recognized for being known as the father of video art. However, some recent research about Paik focuses on his early interactive art. Since *Exposition of Music – Electronic Television Revisited* in 2009 represented his first solo show in Wuppertal in 1963, the study of his early interactive art has gained momentum. Nevertheless, regarding Paik a pioneer of interactive art is still a minor opinion in art history. This paper explores Paik's rich background about his early interactive pieces. When he studied musicology and composition in Germany, he wrote several articles about new music for Korean readers from 1958 to 1959. These still remain unexplored materials for both Korean and Western scholars. Among them, "Chance Music" was written right after meeting John Cage. It reveals significant clues to articulate his fundamental concept about interactive art. Based on the music background, Paik found how to appropriate musical instruments to make interactive art in his own way.

Introduction

Smithsonian Museum curator, John G. Hanhardt, had already stressed the relationship between Paik's progressive art and his music experiences in several exhibition catalogues of Nam June Paik. This paper agrees with the interrelationship and deeply traces his early music background in West Germany. Even though Paik graduated from the University of Tokyo with a thesis on Arnold Schonberg, a pioneer of twelve-tone technique, his major was the history of art and aesthetics. He was trained to articulate artworks in both history and philosophy. This background helped him not only explain his works but also convince his colleagues and institutions, such as the Rockefeller foundation, of his progressive ideas. Whereas his English pronunciation was sometimes hard to understand, his writing in English was as clear and visionary as his artworks. He left a plethora of clues about interactive art from his essays, statements, and pre-interactive works. Among them, his Korean articles about new music during the 1958-59 period are still unexplored materials for the study of his interactive art. This paper mainly will analyze one of these articles to find fundamental ideas about Paik's interactive art. The previous research paper, "A Pioneer of Interactive Art: Nam June Paik as Musique Concrète Composing Researcher," dealt with his article "A Report on the Paris Studio of Pierre Schaeffer and Musique Concrète " in 1958. It insisted that Paik actively applied the process of making Musique Concrète to his early interactive pieces. [1] In the following year, he wrote dual articles entitled "Chance Music." Whereas "A Pioneer of Interactive Art" explored his practical aspects of interactive art, this paper will use "Chance Music" to find his theoretical elements of interactive pieces. This new paper will reinforce the idea of Nam June Paik as a pioneer of interactive art.

Nam June Paik as a Musicology Student

After completing a thesis on Arnold Schonberg's serialism, or twelve-tone technique, from the University of Tokyo in 1956, Paik headed for West Germany to pursue his PhD in musicology. Schonberg's impact on Paik was so magnificent that he decided to study abroad in West Germany. [2] He finally settled down in Munich on November 23, 1956, and enrolled in the winter/spring academic year in the University of Marximilian in Munich. In the exhibition catalog *Time Collage* in 1984, Paik left his feedback on his first Japanese article in West Germany, *The Bauhaus of Music* in 1957; he said that he studied musicology rigorously so as not to regret the study abroad. [3] As a second choice, he considered becoming a professor who taught the history of medieval Western music in Korea. [4] Paik also recollected that he had "a kind of academic life" during this period. [5] Paik was an energetic musicology student who dealt with Western theories of music. Even though he quit his study in Munich soon to find a more progressive music practice, he obtained a lot of knowledge about both new and traditional music there. As a matter of fact, his study was not limited to music. He took diverse courses from architecture to art history, just as he did at the University of Tokyo. Based on his wide range of academic background, Paik published his articles about new music in the Darmstadt music festivals twice in the Korean newspaper *Chayushinmun*. The second article was written right after meeting Cage and right before showing his first project to the public during a great transitional time for Paik. This article analyzes several potential elements for his future projects as well as his artistic perspective.

Chance Music

"Chance Music – the yearly International Holiday Courses for New Music in Darmstadt festival" was published on January 6 and 7, 1959 in *Chayushinmun*. The topic of the article was the Darmstadt music festival that took place from September 3 through 12 in 1958. In this article, Paik mainly deals with "chance music" from American musician, John Cage. This is the reason Paik titled this article "Chance Music." In fact, Cage was not expecting to be invited to the Darmstadt music festival. He introduced his first performance in West Germany during the Donaueschingen Music Festival in 1954, which was a rival international music festival to the Darmstadt. [6] However, he only received negative feedback in Donaueschingen. For this reason, Dr. Wolfgang Steinecke, the founder and chair of the Darmstadt music festival, did not want to invite Cage to Darmstadt. Instead, he wanted to invite Cage's friend, talented pianist David Tudor. About two months before the festival, French musician, Pierre Boulez, cancelled most of his performances and courses due to technical problems. Because he was a headliner for the festival of 1958, Dr. Steinecke needed to find a decent substitute as soon as possible. He asked several musicians and composers to teach some courses and give some performances; however, he could not find any musicians who could replace Boulez. Finally, he contacted John Cage and David Tudor to ask them to take part in some courses and performances. As expected, Dr. Steinecke did not like Cage's performances and courses. However, Paik was one of few audiences who were fascinated by Cage's performances, and who found Cage's greatness in new music. For this reason, Dr. Steinecke did not ask Paik to translate his Korean and Japanese articles about this event. Paik did not translate Korean article about Cage into German, unlike his previous article, "The Music of 20'5 Century." [7] Music critic Heinz-Klaus Metzger edited the archives of the Darmstadt music festival and published the book *Darmstadt-Dokumente 1* in 1999. This book includes more than 40 letters between Dr. Steinecke and Paik, Paik's Japanese article, "The Bauhaus of Music," which translated it into German by himself, and a German version of "Chance Music." Kunsu Shim, a Korean musician in Germany, translated this article into German and his colleague, Gerhard Stabler, supervised the translation. [8] In the same year, this article was also introduced in the exhibition catalogue of *Nam June Paik Fluxus/Video*. This became significant literature for the Western scholars who have scarcely any information on Paik's Korean articles about new music.

John Cage in Darmstadt in 1958

At the beginning of "Chance Music," Nam June Paik mentions a relationship between a composition and a method of the composition. He stresses that twelve-tone technique cannot guarantee the quality of a composition. Conversely, Paik insists that we also cannot transcendently convict the method to create a composition. In other words, if a composition is great, we suppose that its method is great too. However, Paik insists that it is not a logical process because the method is not 'a priori,' but private or secrete. Paik emphasizes the difference between a method of composition and composition itself when we evaluate a composition. This first paragraph hints at Paik's progressive vision for new music. He was not satisfied with the popular twelve-tone composition, and was looking to Post-serial approaches for new music. His dissatisfaction can be clearly found in his Japanese article "Twelve-tone Mannerism." [9] When he was waiting for the 'After-Serialism' experiment, John Cage performed his unique compositions in Darmstadt. Paik was immersed in Cage's works and analyzed their particular methods in his article.

Paik explains Cage's methods of music composition and performance in detail. Cage's chance operation functions via random throwing of three coins based on the *I-Ching*, an ancient Chinese divination text. Reflecting the materiality of paper and the chance operation, Cage traces the natural stains on the paper with his pencil. Then, he overlays the paper with a transparent sheet of blank music notation. These stains become tones. Pianists can decide the tones' lengths freely. Whereas Karlheinz Stockhausen's chance music in the Darmstadt music festival of the previous year could be changed by performers' decisions, John Cage's indeterminate composition concentrated on the materiality of chance generators such as a coin and paper as well as performers' chance. In Paik's Japanese article "Serie, Chance, and Space," he compares a musician playing a composition by Cage to a car driver who can go any time during a green light. [10] His score is based on simple graphics like lines or rectangles. Because some parameters are missing in this score, musicians can interpret them in their own way. This indeterminate approach can make the music of change. Paik asks Cage that if one could make more than 20 compositions a day by using this simple rule, how one could choose among these a single composition for a performance? Cage answers that it does not matter which one is chosen. Paik was impressed by his answer, not because of irresponsibility, but because of its conformation to Nature by removing a fixed thought between consciousness and unconsciousness. Furthermore, Paik was shocked that the piano could be played in a new way when he witnessed a pianist that beat, hit, and scratched the lid and the body of the piano itself. Cage's idiosyncratic performance encouraged Paik to break through the rigid boundary of music and pursue avant-garde musical experiments such as a-music, anti-music, and action music.

Even though Paik mainly deals with Cage's chance music, in the second half of the article, Paik deals with spatiality in Karlheinz Stockhausen's experimental composition, *Group for Three Orchestras* (1958). Stockhausen turns a time-based medium, music, into a space-based medium by employing three orchestra teams, which surrounded the audience in a horseshoe

curve. In 1956, Stockhausen composed *Gesang Der Jünglinge*, which fused the sonic components of recorded passages of a youth choir with equivalent tones and timbres produced electronically. [11] The composition is historically important not only because it is a very early piece of electronic music, but also because it was one of the first uses of the spatial deployment of sound. *Gesang Der Jünglinge* had five tracks from five loudspeakers. This made an environment of surrounding sound for the audience. They were "in the eye of the sonic storm, with music emanating from every side and rotating in various directions." [12] Stockhausen developed the surrounding environment further. In *Kontakte* (1958), he used four different tracks, which were recorded by four fixed microphones positioned around one rotating loudspeaker. [13] This composition became the main score for *Originale*, a precise time-based theater consisting of diverse artists from a poet, a painter, a musician, and a sound engineer. Paik took part in the music theater as an action music performer.

In a similar context, Paik writes briefly that Pierre Boulez installed eighty-four microphones around the theater to realize a space where the position of sound would be equal. Paik was a high school student who dreamed of a communist society such as the one of Karl Marx's theories. In the same context, his obsession with equality was identified with his artistic intentionality. As Arnold Schonberg used each of the twelve tones equally, Boulez experimented with using any position of sound equally. This method was a new idea of accessing sound databases without bias. With his macro vision, Paik stresses that this mixed experience is not limited to music, but it becomes phenomenon, which prevails in diverse sciences and arts. [14]

After experiencing new ideas of music, Paik suggests that instead of extinguishing the flames of a young genius's extraordinary trials, [we] must directly take the path of genius [ourselves]. In this sentence, there is no subject as it is possible for Korean to omit the subject in a sentence. In the ambiguous sentences, the subject would be Paik himself since he had been composing his first work, *Hommage à John Cage* (1959) at that time. These sentences imply Paik's ambition toward a genius musician who can overcome his status as a racial minority. Paik adds, "even though Korean people do not understand the genius's trials at all, they first pick on him but in the end use sophistry to rationalize their own reactions." Interestingly, these sentences exactly coincide with his reputation in Korea 30 years later. Paik ends with a quotation from the famous German critic, Karl Wullner. "The history of new music for ten years is the history of Darmstadt for ten years." Paik emphasizes the role of the Darmstadt music festival as the core of art and new music as he did in his previous article, "The Music of 20'5 Century."

Three Steps for Nam June Paik's Interactive Art

Paik's interactive art can be defined by three different steps: a-music experiments, pre-interactive art, and interactive art in his first solo exhibition. After meeting John Cage, Paik's aesthetics about music and art thoroughly changed. Unlike his correspondent role in the East, he became a "cultural terrorist" as an artist performing action music in Europe, which subverted the traditional Western music. He practiced how to break the Bourgeois musical tradition and expand the realm of music into theatrical performance. Paik developed the idea of his a-music following Schonberg's atonal and Cage's a-composition. As a creator of a third kind of radical music, he coined the term "a-music," and thereby expanded the definition of music into including non-musical elements. In a letter from Paik to Dr. Steinecke on December 8, 1958, Paik informs Dr. Steinecke that he would include situations such as musicians talking with audiences and one in which a prepared piano would not be used as only a normal instrument, but also as a chordophone and a percussive instrument. He also would introduce a scooter, ready-made sounds, and a performance in which he would shoot a glass. The a-music idea can also be found in the following letter from Paik to Cage in 1959:

"I use here: Colour Projector. Film 2-3 screens. Strip tease. Boxer. Hen (alive). 6 years girl. Light-piano. Motorcycle and of course sounds. One TV. // "Whole art" in the meaning of Mr. R. Wagner." [15]

His performance began with the idea of Wagner's whole art, "Gesamtkunstwerk," which was opposite to purism, admired by Paik in his previous Korean article, "The Music of 20'5 Century." By betraying purism and elitism, Paik started his career outside academia. He lifted his violin very slowly above his head, and then forcefully smashed it on the table in *One for Violin* (1961). By breaking a musical instrument, he created much more radical sounds than Cage did.

After dismantling the musical instrument in a-music, Paik created his pre-interactive piece, *Urmusik* (1961). "*Urmusik* is Sigmund Freud's music box: it encourages the playful, evoking an infantile type of lust–the desire to make music–and welcomes the amateur who never went to music school." [16] Paik returned to his kindergarten memories. His sister remembered that he did not follow his master's instructions. He stubbornly played piano in his own way. [17] At the very beginning, Paik's piano was not an instrument, which generated beautiful sounds or harmonies, but an interactive device like a Fisher Price toy. This Freudian idea equally allows viewers to interact with *Urmusik* regardless their musical ability. *Urmusik* looks like a childlike object, which consists of daily materials such as a wooden crate, a tin can, and strings. The title means primitive music and implies a new starting point of music in Paik's musical background. After studying music too much, Paik returned to his kindergarten joy with the musical instrument. This instrument became the precursor of his interactive work. Paik's idea of interactive art started during "Cage Shock" in 1958, and completed with Paik's declaration against John Cage's indeterminate music.

There are two misleading topics between John Cage and Nam June Paik, Zen Buddhism and indeterminism. Paik emphasized that he was not excited by Cage's

theory but by his performance only. [18] Furthermore, Paik did not like Zen because he thought that Zen, in the United States, was based on Japanese nationalism. [19] Paik made this negative feedback about Cage's indeterminate music because Paik thought that audiences, passive listeners, could not distinguish it with a normal music. [20] In his statement, *About the Exposition of Music* in 1962, Paik suggested providing audiences with physical interactive experiences to create their own music. This is a significant change in Paik's artistic life, which directly led to his interactive art. Paik finally introduced his interactive art pieces in his first solo show in 1963. Whereas Cage maintained the role of piano as a musical instrument in his prepared piano, Paik denied the role of it in *Klavier Integral* (1959-1963), and made the piano an interface for interactive art. Through the piano, Paik provided audiences with the experiences beyond audio and visual media. By connecting each key with a hairdryer, a light bulb, a motor, or anything else, Paik created a five-sense synthesizer. From Cage's prepared piano, which Paik was surprised by in the Darmstadt music festival because he realized that the piano could be made new again, Paik developed his new piano art, *Klavier Integral* as interactive art.

Paik also actively used Stockhausen's and Boulez's idea of spatiality in music. In *Random Access* (1963), Paik visually attached many strips of audiotapes onto a white wall, and encouraged viewers to play it with the mobile header of an audio player in a nonlinear way. Similarly, in *Record Shashlik* (1963), Paik threaded several records through two vertical poles on a table. He made a movable head for playing a pile of records on two rotating axes. Each position on the records has an equal status regardless of its content. Audiences could choose any starting point of the records. In other words, viewers could nonlinearly play it with their spatial gestures. In Paik's interactive art, the most radical change is that a subject changes from musician to audience member. Paik pushed progressive music one step further than Cage and Stockhausen did. This experiment from images to sounds encouraged Paik to make a creative work in an opposite direction. Based on his knowledge of electronic music, Paik succeeded in making an interactive image on television. By connecting electronic music devices such as an oscillator, an amplifier, and microphones to a television, Paik created his first electronic interactive art piece, *Participation TV* (1963). Viewers could generate abstract images on the television by making sounds through the microphones. He created his first video art without a video device, and it became a pioneering piece of interactive art. During his diverse experiments, he actively employed multiple senses and cross-modality between images and sounds in his interactive art. This new kind of art was based on Paik's theories in new music and his practices in electronic music.

Conclusion

This paper traces Nam June Paik's article about new music in the Korean newspaper, *Chayushinmun*. This uncharted area depicted his passion toward new music during his energetic academic life in West Germany. After Schonberg's serialism, Paik actively explored post-serialism in the center of new music, Darmstadt. He actively analyzed ideas of the contemporary musicians, Karlheinz Stockhausen and John Cage in the Darmstadt music festival of 1958. The radical perspective in his articles predicted his unprecedented interactive art. Based on his progressive music background, Paik found a creative method for appropriating musical instruments into his interactive art. The study of Paik's musical background will bridge the gap between Paik as an experimental musician and Paik as an inventor of interactive art. Finally, it contributes to acknowledging him as one of the most creative pioneers of interactive art.

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The Unstable Characters: Reading of Chinese Text-based Digital Works

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Abstract

Chinese characters consist of "three levels of hierarchical organization: stroke, component, and structure." [1] This paper suggests that, unlike in works based on alphabetic languages, such structure is significant for analyzing and creating Chinese text-based digital artworks. The ambiguity of semantic meaning at the levels of stroke and component in a Chinese character as well as the culture of traditional calligraphy, which encourages artistic expression on the material level of brush writing, create tension but also potential that influence how we read the characters incorporated in digital artworks, whether as spectacle of visual effects or as a linguistic sign, or both. This paper will investigate the evolution of Chris Homhim Cheung's artwork series "Shang Da Ren" and will focus on two versions in the series: *No Longer RIGHT* (2011) and *Shang Da Ren* (2013). Although the techniques and basic concepts are almost identical in these two works, changing the context and the textual content in the newer version provides a very different experience for the audience as they read and interact with the work; this highlights the specificity of Chinese text-based artworks.

Introduction

Through analyzing text-based digital artworks, Roberto Simanowski (2011) suggests that not all digital works constructed with words can be defined as digital literature. They can only be considered as such if we can read the "words" in a work of art as individual linguistic units, rather than as simple typographic signs which cannot carry semantic meaning on their own. In the case of digital literature, alphabetic letters form words that function as linguistic units, while in text-based digital visual artworks the letters are merely typographic signs. [2] Simanowski uses the term "postalphabetic" for this kind of text-based digital work which is non-literature. Hence, the main criteria for digital literature is not what it is made of (alphabet as material), but the function of the material (alphabet which functions as alphabet). [3]

In the work *Text Rain* (1999), participants are invited to stand in front of a screen and see their own images being projected on it. At the same time, alphabetic letters begin to rain down on them and land on their heads and shoulders. The participants can interact with the letters in ways such as holding them or letting them drop on the floor. All the letters in this work come from a poem, and the artists consider that relevant to the work. However, as

not only the sentences but even the words are deconstructed, it is impossible for the participants to read or even notice the existence of the poem. Simanowski considers such kinds of artwork to be postalphabetic and non-literature, as even though they are made of alphabetic letters, they have already lost their linguistic value. [4]

Simanowski's model is important not just because it defines what digital literature or art is, but also because it helps us identify the function of the text in a work and to examine if the text functions as intended (by the author and/or as a premise to fulfill the concept of the work). In *Bit.Fall* (2006), political keywords collected from online media are visualized through a water screen. Apparently, the artwork wants to "question the stability of words through the utmost instability of writing material." [5] However, even though the audience can read the words, the spectacle of the water screen and the playfulness of placing one's hand in the water to distort the words invites the audience to view the words "not in order to discover how the text deconstructs its own rhetoric strategy, but to enjoy the spectacular way of its presentation." [6]

In this case, although the collected keywords carry significant linguistic meaning, the "grammar of interaction" of the artwork makes them hard to comprehend. [7]

Three Levels of Hierarchical Organization

Apparently, Simanowski's typology is valid for text-based digital works of any alphabetic language. However, it is a pending question whether it can be applied to digital works made with non-alphabetic, logosyllabic texts such as Chinese (including Kanji) and what significance might be revealed by applying this typology.

As a logosyllabic language, a Chinese character contains "three levels of hierarchical organization: stroke, component, and structure. Strokes are simple features such as dots, lines, and curves." [8] Components are "independent, meaningful parts that are constructed with strokes." [9] But, unlike strokes, they are "usually equivocal." [10] The traditional Chinese classification system clearly defines many basic components of characters, known as radicals, a list of which all Chinese dictionaries contain. However, from a modern cognitive

perspective, there is still no definitive theory or method on how to identify or isolate the "meaningful" components in all characters. [11] Because of that, it is arguable whether it is possible to deconstruct Chinese characters in a digital work in the same way words are deconstructed in a letter-based work such as in *Text Rain*, in order to liberate them "from their representational function" and transform them into pure visual objects in an interactive installation, [12] since the components or strokes of a broken character can still be maintained as meaningful parts.

By analyzing the Chinese text-based digital works *No Longer RIGHT* and *Shang Da Ren,* this paper will examine whether the scope of Simanowski's typology can be extended to logosyllabic text, and will investigate the characteristics of Chinese text-based digital work in comparison to alphabetic works.

No Longer RIGHT

Fig 1. The eight basic strokes © Microwave

No Longer RIGHT (2011), by Chris Cheung Hon Him, is the first of the series which would later be named *Shang Da Ren*. It was exhibited at a busy shopping mall and placed in a spot well-lite by both sunlight and artificial light source. The participants were asked to write eight basic strokes (which theoretically are the basic material for all Chinese characters: Figure 1) by hand on a piece of paper. The second paragraph of the artist's statement describes how it works after that:

> "Basically, handwriting carries and expresses our emotions. *No Longer RIGHT* provides a platform for participant to write and record their handwriting. When the participant finished writing the eight common strokes preset by the artist, the input process is completed. The work will then present and create a passage with the authentic 'handwriting' style. Through this artwork, the artist believes that people could recap their feeling of handwriting and how technology changes our daily lives." [13]

In this work, the created passage is in fact the first paragraph of the same artist statement, which questions whether modern technology can improve our ways of communication. The artist nostalgically pondered why people nowadays seldom use their hands to write since, as he continued in the second paragraph quoted above, handwriting can express our emotions. [14]

The representation of emotion is too abstract to analyze and beyond the scope of this paper, but it is worth noticing the implied connection between handwriting and emotional expression. While, looking at the passage being generated on the display, character by character with the strokes provided by "you," there is one immediate choice the participant needs to make: to focus on the content of the passage (the artist statement) or to look at the characters as if they are ceramics just being taken out from the kiln. The resulting characters, rather than the passage, seem intended to be the main focus of this installation work, as the artist stated in his technical statement, "Every character is embedded with the personal style of the participants. Or the other way round, the demonstrated script also suggests the unique style of the handwriting." [15]

Furthermore, not all the generated characters are always comprehensible on the display. If the structure of the character is too complicated and the strokes provided by the participant are too thick or too weird, the computer may generate an unreadable mess reminiscent of a Franz Kline painting stuck in a small square. In this case, the passage may not be easily readable and leave the participant with no choice but to pay attention to the visual characteristics of the results.

If we put this work into the alphabetic/ postalphabetic model, we can consider it to be both literature and art: as living a double life as both literature and installation with its own aesthetic effects. [16] However, it is also obvious that the visual "digital calligraphy" aspect in this work is stronger than the content of the artist statement. Although the statement addresses a valid issue of the digital age, it does not go any further and just repeats again the next time. On the other hand, the game of generating characters is unique, and each time you play, it provides a different result. This phenomenon can be explained by the notion of "text as event," which Simanowski used to describe the phenomenon of *Bit.Fall*, saying "words are more or less deprived of their linguistic meaning, which limits or liberates respectively the audience engagement with the text to a joyful play or intriguing fascination." [17]

What makes this situation different from *Bit.Fall* is the actions of turning the text in *No Longer RIGHT* to an event depending on the outcomes of the generated characters. Besides the literary quality of the passage, another factor affecting whether or not one focuses on the linguistic meanings is the degree of compatibility of the structures of the characters within the passage with the generating process. This argument will be explained via a comparison with the improved version of this work, and by showing why this situation could hardly arise with *Bit.Fall* or other alphabet-based works.

Shang Da Ren

Shang Da Ren (2013), the newer version of *No Longer RIGHT,* was exhibited in museum and art spaces in Hong Kong and Taiwan. In this version, the content of the passage had been changed to a twenty-five-word classic

article which shares the title of this work. The article *Shang Da Ren* has been used to teach children calligraphy since ancient times. It is well known to most Hong Kong Chinese speakers, and mainly consists of the most basic characters with very few strokes. Moreover, compared with *No Longer RIGHT,* the exhibition spaces were dimmer, and the generated characters were enlarged and projected on a much bigger, cinematic wide-screen several feet tall. Brushes were also placed on a table between the participants and the screen to mimic the setting of calligraphy practice. This setting is more conducive to the audience paying attention to the structure and style of the characters (Figure 2)*.*

Fig 2. *Shang Da Ren,* 2013, Chris Cheung Hon Him, media installation. © XEX GRP.

Because of these factors, most Chinese audiences could immediately recognize the first three characters of the generated passage, *Shang*, *Da* and *Ren* (literally mean: up, big and man), which also form the title of the article. Much as a Briton would quickly think of *Hamlet* upon seeing "to be or not to be," the whole generated passage need not to be completely legible for the audience to understand the reference. Thus, the name of the article itself, rather than the content of the article, already signifies the nostalgic feeling of handwriting and pre-digital childhood. Compared with *No Longer RIGHT,* which intended to deliver a similar message, this work is more efficient, as the audience need not to be briefed by the statement. Instead, "briefing" is achieved by the metaphor of the first few characters of the article and the setting. However, this result was achieved not only via the article, but also by virtue of the structures of characters in it.

The first three characters of the article, *Shang, Da* and *Ren,* are not only symbolic signs (like all alphabetic words), but as pictograph and ideogram characters simultaneously serve as iconic signs (in the case of *Da* and *Ren,* figures of man) and an indexical sign (*Shang*, pointing up). These kinds of characters usually consist of the fewest number of strokes and deliver the basic concepts of the world. By using these simple characters with the help of a large screen, the words are easily recognizable even if they were distorted by the generative process. Along with the connotation of the article title, the characters' unnatural shapes and strokes resulting from the generative process also remind the audience of their handwriting education in school. Similar to the previous version of this work, the rest of

the characters in the article were occasionally generated as incomplete characters. Sometimes, only parts of the components or strokes could be seen. By recognizing these meaning-carrying components, one may again be reminded of the childhood writing-learning process of memorizing a character with its separate parts.

The net effect of these factors makes the experience of *Shang Da Ren* more than simply the "joyful play" of generating characters. Due to the symbolic meaning of the title and the simple characters used in the article, it is more effective than *No Longer RIGHT* at inviting the audience to pay attention to the linguistic meanings of the characters and is able to serve as a poetic metaphor evoking nostalgic feelings and childhood memories. Such results are often associated with the aesthetics of good literature.

At this point, it seems the postalphabetic / alphabetic model can be applied to both works mentioned above. However, how to adapt the definition of alphabetic for a character-based language appears to be a much more complicated issue. This unresolved issue does not seem to pose a significant problem in analyzing the postalphabetic/alphabetic phenomenon in both works. However, in order to evaluate the structural differences of the *Shang Da Ren* series in comparison to English text-based digital work, Espen Aarseth's texton/scripton model will be applied to analyze the flow of information.

The Identical Text/Scriptons

In *Cybertext*, Espen Aarseth (1997) introduced the concepts of "scripton" and "texton" to explain the structural process between static data, algorithm, interaction and outcome in works of participatory text (ergodic literature). [18] Scriptons are "strings as they appear to readers," and textons are "strings as they exist in the text." [19] One can consider scriptons as the "verbal signs" a normal audience (ideal reader) can read/see in the work, while textons are the verbal sign data underneath the surface and stored statically in the work. In a digital work, a user inputs data into a program, and then the algorithm calculates and generates results by drawing from the textons. This process is called "traversal function," and the results are the scriptons. [20]

In the case of *No Longer RIGHT,* the textons of the work are the artist statement stored in the computer, and the scriptons, as what is showed to the audience, are also the statement. Since the "traversal function" of this work merely regenerates the same passage using the strokes provided by the audience, one can argue that the textons and scriptons are the same in this work, as Aarseth's model only deals with "verbal signs" as information data but not the visual aspects of the scripton.

In the case of the extended version *Shang Da Ren,* the texton content had been changed to the twenty-five-word article. However, since the traversal function did not change in this version, we should also consider the textons and scriptons to be the same in this case.

At this point, it seems to be irrelevant to apply Aarseth's model to compare these two works, as that

model only deals with textonomy (the study of textual media) rather than textology (the study of textual meaning), and has been described as "blind to content" by Katherine Hayles. [21]

However, if we consider other English postalphabetic works, such as *Text Rain* and *Bit.Fall*, it is always the traversal function that results in the disintegration of the linguistic value of the words. Their traversal functions are like a blender which destroys the semantic meaning of any words (textons) thrown in. There would be almost no difference if we put another poem or book in *Text Rain,* or changed the text from political to academic keywords in *Bit.Fall.* On the other hand, the traversal function of *No Longer RIGHT* and *Shang Da Ren* are identical. However, while *No Longer RIGHT* transformed the text from linguistic sign to visual object, similar to the case of *Bit.Fall*,[22] *Shang Da Ren,* which used the same "engine" as *No Longer RIGHT,* maintained its text and its linguistic value, and even the poetry of literary metaphor and imagery. It is the structure of the characters (textons) in both works, rather than the traversal function, which resulted a different condition of the scriptons, thereby leading the audience to perceive the characters as mere visual representations of their own writing (in the case of *No Longer RIGHT*) or also as linguistic signs simultaneously (*Shang Da Ren*).

Furthermore, the "three levels of hierarchical organization" of Chinese characters also remind us whether a character is a basic semantic unit of the language. If we consider the components or strokes as the potential basic semantic units, then the scriptons and textons are in fact not identical in both of the works. The textons are the strokes and components inside the characters, rather than the characters themselves. Although their traversal function is supposed to place the provided strokes back in the right place, it does not always work perfectly. This imperfection is not a bug but in fact an important aesthetic aspect of both works, since if all strokes were placed correctly and tightly, then the works would merely be boring word-processing machines and not allow participants to "recap their feeling of handwriting." [23]

Because of that it can be argued that a major difference between alphabetic and logosyllabic text-based digital works is the indivisibility and instability related to singling out the linguistic units within a character. Once the traversal function involves the deconstruction and reconstruction of the strokes or components of characters, it may create unique results in comparison to alphabetic works.

Conclusions

By studying English and Chinese text-based digital artworks, this paper suggests the postalphabetic/alphabetic method can be applied to non-alphabetic languages such as Chinese characters, but the definition of alphabetic (consisting of units carrying semantic meaning that can be read by the audience) can

be a complicated issue. However, by applying this model, we can examine the meaning-making process when one approaches a Chinese digital artwork that consists of unstable characters. Can the strokes or components from unstable/broken/blurred characters still contain any linguistic value? This question is essential for a critic to choose an appropriate approach and aesthetic criteria to judge a work. Furthermore, when Aarseth's model is applied to works of Chinese text-based digital artworks to, it also shows that characters may not be the basic verbal signs in the flow of information in a cybertext. However, such instances are rare in digital processes, as most works of digital text rely on the Unicode system in which a character is the basic unit, which means any process beneath the level of character is rare and difficult (except for applications of writing recognition). However, such difficulties may also suggest a direction for potential artistic creation.

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Posthuman Vision

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Abstract

This paper addresses one fundamental question: How does the relation between image and vision change when machines are involved? We argue that with neurosciences and computer vision, the image as a stable visual entity no longer exists, but that autonomous (machinic) vision does not necessarily render human vision or imaging obsolete. Adopting a posthumanist point of view, we stress *collaborative vision* across species, and proposes to define the posthuman image, or 'postimage' as the gathering/exchanging of (visual) data between humans, animals, and, increasingly, autonomous machines.

Posthuman Vision

Machines, vision, images

In his "Provisional Instructions to Kino-Eye Groups" (1926), Dziga Vertov writes: 'The movie camera was invented to penetrate more deeply into the visible world, to explore and record visual phenomena, so that we do not forget what happens and what the future must take into account'. [1] In short: it is a machine of vision! But if it sees, it does so for humans and with humans. The title of his experimental film, *Man with a Movie Camera* (1929) testifies to this close alliance between man and machine in cinematic vision.

Today, almost one hundred years later, the development of computer vision will soon reach a stage where machines of vision no longer need human operators to guide their vision, nor human spectators to see their images. That is, we will move from the 'kino-eye' as a *supplement* to human vision to the robotic eye as a *substitute* to human vision: from the eye that sees to show, to the eye that sees for itself (or for other non-humans). This is the horizon that we trace here: the consequences of autonomous (machinic) vision for the status and concept of the image and of the human.

On the relation between vision and image

In our book, *Softimage* (2015), we have argued that the 15th century architect, geometer and art theorist Leon Battista Alberti and his peers, through the use of the geometric tools of triangulation, built not only a new image (the perspective image), but also a new vision of the world. [2] We call this convention of seeing the *photographic paradigm of the image*: a paradigm which is based on the principle of the commensurability of perception and representation and which has determined, through a succession of technologies and over the course of almost six centuries, their forced convergence, from Filippo Brunelleschi's 1420 experiment up to today's Augmented Reality technologies.

The digital revolution brings new functionalities to this convergence of vision and representation. If, on the visual level, the photographic paradigm of the image remains operative, on the computational level the image reposes on a new, algorithmic paradigm. And these two paradigms function in perfect synergy: Powerful algorithms underlie today's image processing such as the ones used to stitch together billions of photo panoramas in Google Street View, or to enable our smooth navigation in these panoramas. These algorithms – just as Brunelleschi's experiment – aim at the best possible alignment of vision and representation. Centuries of training allow us 'digital humans' to deambulate, with almost the same sense of presentness and spatial continuity, through the Google World and the city space, in a correlation of what we see on-site and on-screen.

From the machine of vision to the softimage

Put differently: Linear perspective has been implemented in/by the human brain after centuries of adaptation – a sort of implant in charge of the computation of visual data – so that our system of perception (eyes/brain) has been augmented with a mathematical apparatus, the perspective system, which renders it capable of image framing and stabilization. The camera, as an image-producing tool, is a poor avatar of this complex apparatus of human vision or imaging, and, at the same time, its technical accomplishment, that is, its externalization. So the development of the modern machine of vision is based on two paradoxical moves: integration (in the human brain) and externalization (beyond the human body). The result of this double process is what we used to call the image.

With digitalization, the image becomes equipped with algorithms that gather, compute, merge, and display heterogeneous data in real-time. The result, however, is a different kind of image: no longer a solid representation of a solid world – a 'hardimage' as it were – but an unstable algorithmic configuration of a database: a 'softimage'. And while the famous 3D animation software, Softimage ®, was rendered obsolete in 2015 (with product support ending 2016), the softimage lives

on, not only as a multitude of image software, but in the sense that the image itself has become software.

The deconstruction/dissolution of image

The same ʻsoftʼ understanding of the image in the sense of ʻprogramʼ is at play in the development of the neurosciences (and neural networks) where vision is modelled as a process taking place along specialized cortical areas, with each area computing specific data, related to, for instance, motion, form, or colour. [3] If the cortical areas are overlapping/interacting, at no point of this computation of visual data involved in human vision are there ʻstable visual entitiesʼ.

Emulating this human machine of vision, machine vision follows the same logic: In automated border controls, assembly robots, military drones, or distributed sensing systems, video cameras are associated to other sensors. The sensors furnish various data (visuals, sound, heat, movement, biometrics etc.) that need to be processed, correlated, fused, and matched with a database, before human controllers (or the control program of autonomous systems) can take a decision/action.

Image and data

With the concept of ʻimageʼ dissolving under the assault of neuroscientific modelling and advances in machine vision, there are only two possible responses by image theory: either to abandon the concept (and thus the discipline) or to radically enlarge its definition/scope. We consider the second option.

Let us start with a very narrow definition of image as visual data rendered as a visual entity fixed onto a material support (sculpture, photo) or appearing on a digital screen. From there we can enlarge the definition to include every data that is rendered in visual form; this definition encompasses visualizations of non-visual data (thermal, ultrasonic, etc). The third step is to consider the image as a *data ensemble* that represents an ʻobjectʼ in codified form (bitstream) or sensory form (2D, 3D, holographic, sonic, etc.). Eventually we can define the image altogether differently: as an operation and as a process rather than a representation. From our earlier definition of the image as program (softimage) we arrive in fact at a very large definition of the image: understood as the relation of data and of algorithms that are engaged in an operation of data gathering, processing, rendering, and exchange.

This fourth definition takes us beyond the limits of the humanist and anthropocentric concept of the image in engaging a posthumanist point of view on the image. It takes us to a point where human vision is only one among many possible sentient systems and where we need to reconsider what images (and imaging) means with regard to non-visual sentient systems.

The robot's eyes: sensors, software, data

Mobile robots, remotely controlled or autonomous, involve images and imaging at many levels: at the level of orientation/navigation, at the level of survey and mapping, and at the level of data integration and visualization. SLAM (Simultaneous Localization and Mapping), for instance, allows generating a map of unknown territory using odometry (position estimation using motion sensors), laser scanning and sonar sensors. Hyperspectral Imaging captures a much larger visual spectrum than traditional optical instruments; it allows to build an image constituted of as many layers as frequency bands and thus, to characterize/classify the objects in the scene based on their spectral properties. Multisensor Data Fusion allows to merge data captured by different sensors or agents of a given system, and Distributed Consensus Algorithms allow to reach decisions among collaborating vehicles operating on the ground, in the air, on the water, underwater, or in space.

In short: The robot's eye – coming a long way from Dziga Vertov's ʻkino-eyeʼ – is a complex interplay of sensors, sensor data, control algorithms, actuators, and vehicles and it is where our fourth definition takes its full meaning. Until totally autonomous systems are operative, imaging still involves pilots, payload operators and image analysts, controllers and commanders. [4] As a consequence, we need to add to our definition of the image *the relation of humans and machines that are engaged in an operation of data gathering/exchange*.

Autonomous vision

But, given the rush towards autonomy of machines we will be increasingly, as Rosi Braidotti put it, ʻconfronted with a new situation, which makes human intervention rather peripheral if not completely irrelevantʼ. [5] The total autonomy of robots endowed with sensing/imaging capacities brings into question the fate of the image as a fundamental component of humanity. Moreover, the passage from human vision assisted by robots to fully autonomous robotic vision is part of what many fear as the imminent ʻrobolutionʼ or replacement of man by machines across all levels of society.

ʻVision machinesʼ, as Paul Virilio predicted in 1994, will not only be endowed with vision, but also with cognition, discernment, decision, and action. They will thus be intelligent and autonomous beings, similar to humans. Eventually, vision machines ʻwill function as a kind of mechanized imaginary from which, this time, we would be totally excludedʼ. [6]

Exactly twenty years later, Bernard Stiegler deplores what he calls the ʻautomation of societyʼ, where automated cognition replaces human thought. [7] To counter capitalism's tendency towards entropy in what has been called the ʻanthropoceneʼ, the geological epoch marked by the impact of the human species, he calls for a new society of the ʻneganthropoceneʼ, a society which privileges diversity of life, diversity of thought. [8]

Posthuman vision

We propose to connect Stiegler's call to the burgeoning field of posthumanism, where humans, technologies, and nature are no longer seen as separate (or antagonistic),

but as co-evolving and co-operating across species. Drawing on a set of posthumanist and new materialist theories, we posit that 'posthuman vision' is a *collaborative vision distributed across species*, that is, between machines/robots and humans/animals and any intermediary forms (cyborgs, biomachines etc.). [9]

As a result, the posthuman image, which we propose to call the 'postimage', is (or will be) not an objective (photographic) or subjective (human-centred) image, but *a collaborative image that comes to be defined as the gathering/exchange of (visual) data between humans, animals, and, increasingly, autonomous machines.*

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Flip the Book – Flip the Memories: a Case Study of Multimodal Interaction for the Library Located in Macao World Heritage Site

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Abstract

"*Flip the Book – Flip the Memories*" is a multimodal interactive artwork exhibited in Sir Robert Ho Tung Library, which is part of Macao World Heritage site. This artwork integrates smell with audio visual together into reading experience. When the reader turns the page of the physical book, it would trigger different videos projected on the book. Meanwhile, specific scents would be released from the side according to the videos. The video footages are collected from local video photographers, which have preciously captured the images of the old days in Macao. This artwork uses smell as an ambient medium to connect the present with the past. It aims to lead the readers to recall their memories from the past, also to think about the present while being surrounded by the environment of cultural heritage. By combining physical book with multimodal interaction, this artwork brings the cultural heritage visitors tangible and intangible experience altogether. This paper would take "*Flip the Book – Flip the Memories*" as the case study to discuss the opportunities and the challenges behind while bringing new media into cultural heritage, especially the role of olfaction in multimodal interaction.

Background

In the age of digital media, there is a challenge for cultural heritage to inherit and reinvent the traditional heritage into new media form. Rinehart and Ippolito, new media scholars, stated that new media brings the impacts on cultural heritage, especially on the aspect of social memory. [1] They believed that social memory is the way that society and people remember their own identities, in the form of official archives in libraries and museums or in the form of unofficial folklore among the general public. It is about the social environment of memory interacting with individual pasts.

Macao, former Portuguese colony, preserves twenty-two sites that blends the architectural influences between Portuguese and Chinese culture. These sites, including the historic streets, residential areas and religious buildings, were inscribed as "*The Historic Center of Macao*" on the UNESCO World Heritage List in 2005. [2] In the past ten years, Macao government has been making attempts on the cultural heritage conservation and revitalization by holding events such as exhibitions, performances and parades. Yet along with the economic growth caused by tourism and gambling industry, many other old buildings were influenced and the relevant social memories were fading away accordingly.

"*Flip the Book – Flip the Memories*" is an artwork developed under this context. It is one of the artworks exhibited in "*Video Creation Exhibition - A Reconstruction of the Fading Memory*" hosted by the local video organization called Audiovisual CUT Association. The organization found that the rapid and dramatic changes in the recent development of Macao have created profound social impact to the city and are leading to the fade-out of the collective memory. They felt obliged to arouse cultural self-consciousness of Macao by reconstructing the city memory. Therefore, they collected the old video footages from Macao video photographers, then invited artists to recreate the content in the formats of new media art. The aim of the exhibition is to recall and anchor the collective memory of Macao among the general public. Hence, instead of showing in the art museum for a particular interest group of visitors, they chose to display the artworks in the public libraries in order to get closer to the general public. This artwork took the form of multimodal interaction by combining smell with audio visual into reading experience in a public library which belongs to Macao cultural heritage site.

Related Studies

Multimodal technology has been rapidly advanced in recent years, the applications of using speech, touch, vision, and gesture for interaction are on the rise. [3] It bridges the gap between the virtual world and the physical world by engaging users with multimodal experience. Multimodal interaction has been applied widely in different areas such as entertainment and education. [4, 5] In the field of cultural heritage, Damala et al. used visual and acoustic augmentations to provide affective museum visiting experience in both physical and the digital environment for encouraging visitors self-motivated learning. [6] Clarke et al. brought visual, audio and haptic experience together in an interactive museum exhibit about steam-powered locomotive. [7] These applications mainly rely on audio visual and haptic channels. However, the sense of smell which is closely related to memory is seldom used in the form of multimodal interaction in cultural heritage. Here this paper would mainly explore the role of olfactory component in multimodal interaction in cultural heritage.

Smell is an evocative medium. The narrator in Marcel Proust's novel "*Remembrance of Things Past*" recalled his long-forgotten childhood memory through the aroma of madeleine dipped into a cup of tea. [8] This phenomenon is also described in the sociology study conducted by Waskul et al. that one participant described how a particular smell reminded her of the memories and feelings about her father even in her age of forty-nine. [9] Smell is also a subliminal medium. The aromas of a place could affect how the tourists perceive a city. [10] The ambient scent emitted in a department store influence the customers about the impression and behaviors. [11] Social anthropologist Uri Almagor once indicated that smells make the past has existence in the present. [12] It is about being "*here and there at the same time.*" The other senses, like sight, have limitations on dealing with the past, the future and the invisible. Yet the smells can recall almost the same feeling with its contextual association in the past. Smell connects "*then and now*" together. Could this powerful medium bring the new possibility of the multimodal interaction in cultural heritage?

In recent years, digital olfaction has been advanced in different areas like improving the realism of virtual environment, converting information, stimulating the gustatory perception, etc. [13, 14, 15] It opens up the opportunities to include smell as the multimodal interaction for cultural heritage especially for reinventing the social memory. The concept of "*Smell-O-Vision*" which originated from movie industry has strongly influenced the development of digital olfaction. It is the idea which allows the audience smell something related to what they see on the screen. For example, the scent of chocolate was emitted when the scene of chocolate factory was shown in the movie. [16] Many researchers have followed this approach when they developed digital olfaction in multimodal interaction. Smelling Screen is one of the cases. [17] Other attempt was also made to tackle the challenge by providing odours ahead of audiovisual content for a better synchronization effect. [18] However, smell is very subjective experience. By mapping the smell to a certain object, like using the scent of lavender to represent the lavender in the digital content, it may lead to individual expectation gap. Köster et al. indicated that the role of odours in daily life mainly is to link the people to the affective appreciation of surrounding and the episodic memories. [19]

Flip the Book – Flip the Memories

"*Flip the Book – Flip the Memories*" is an artwork that combines smell with audio visual with the action of flipping into reading experience. Its aim is to bring the evocative role of smell into the multimodal interaction in cultural heritage. By turning the page of a physical book, visitors would trigger different videos with the relevant smells alongside like reading a memory book. Smells are treated as ambient medium to provide the atmosphere for visitors engagement rather than representing a certain object in the video frames. This memory book is invisibly written by visitor's memories and thoughts. It consists of the videos provided by video photographers, the smells selected by the artist, the scenery at the heritage site and the memories of the visitor altogether. This artwork invited the visitors to rest, to recall and to think. When the visitor put on the headset and turned the page of the book, the videos would be projected accordingly on the papers. Meanwhile, specific scents would be released from the side. A guestbook is placed beside to let the visitors write down their thoughts and memories behind. It provided a chance for the visitors not only to rest at present, but also to recall their past and write about their future. These memories and thoughts could be very personal or collective ones.

Fig 1. *The installation of the artwork*, 2015, Mei-Kei Lai, photo, ©Mei-Kei Lai

This artwork was exhibited at the corner of the semi-outdoor courtyard area in Sir Robert Ho Tung Library as shown in Fig 1. The library itself is located in the heritage site that belongs to "*The Historic Center of Macao.*" It provides a special atmosphere where tourists and local readers meet. As its identity of cultural heritage, Sir Robert Ho Tung Library paid more concerns on culture promotion and the maintenance compared with other public libraries in Macao. For example, they would invite artists to redesign the reading corner in the library, scholars to share the cultural history of Macao, and musicians for outdoor performance. Besides, they also employ full-time architect as the consultant for regular maintenance in the library. If there is any construction of the exhibition, they would consult the architect to discuss if the artwork installation affects the appearance of the heritage. For example, it is not allowed to mount the projector on the wall of the library. Since this artwork includes olfactory component in the multimodal interaction, it may affect the library readers due to allergic issues. The indoor reading area was not considered as the scents would spread out to the whole floor through the ventilation system.

System and Interaction

The system of "*Flip the Book – Flip the Memories*" includes the projector, flex sensors and smell diffusers connecting through Arduino and Processing as shown in Fig 2. When the visitor turns the page of the book, it would trigger different videos projected accordingly on the papers. Three flex sensors were embedded respectively at the right bottom corner of three different pages. Once the system detects the action of flipping, it would trigger a random video to play. The original video footages were collected from the local video photographers. The artist re-edited the sources into four video clips. It includes a video captured the local Macanese community dancing and singing in Portuguese, a video captured the construction of the casinos, a video captured the night view and light pollution of Macao, also a home video captured how a Chinese girl celebrated Christmas with her family back in 1995.
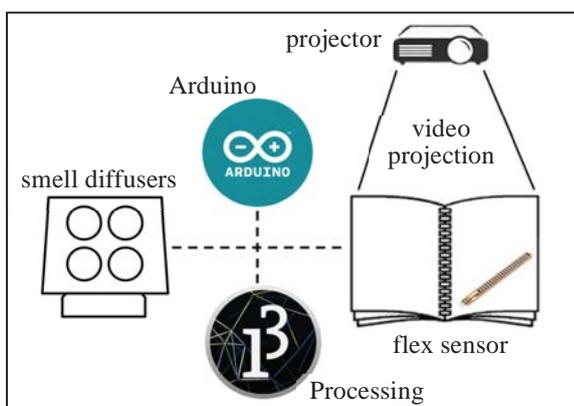
Fig 2. *The system of the artwork*, 2015, Mei-Kei Lai, illustration, ©Mei-Kei Lai

Instead of using the scent to match the specific object in the video, this artwork emitted the smells during the video transition. A black screen with subtitle was inserted in the middle of the video. It lets the reader focus on the present experience with smell without the interference from the video image. It also avoids the expectation gap and synchronization issue between visual and smell. The smell diffusers were placed beside the reading table. When the black screen was shown, it would trigger a preset smell released from the diffuser, as shown in Fig 3. The duration of the black screen with scent emission is about twenty seconds. It allows the scent spreading near the reader's position. Different types of scents were chosen according to the context of the videos. For example, in the video about a girl celebrating Christmas with family in her childhood, a sweet smell like fruit would be released. In the video about the construction sites, a smell similar to tobacco was chosen. In the video of Macanese singing in Portuguese, a smell of perfume like white musk was used. In the video of the night view of Macao, a smell like whiskey was chosen.

Fig 3. *The video projection on the book and the smell diffusers on the side*, 2015, Mei-Kei Lai, photo, ©Mei-Kei Lai

Observations and Discussions

Observations were conducted in a distance without interrupting the readers. Some passersby, at their first glance, would say, "*Oh, there is an e-Book.*", "*Isn't it a new facility of the library?"*. Other passersby simply gave it a glance and walked away without putting on the headset. Some readers simply enjoyed watching the videos without flipping the book. Once the readers found out that they could turn the page to change the video clips, they would feel curious and tried to find out the secret behind by picking up the book or waving hands on top of the page. Yet in most of the cases, the readers were not aware of the smells emitted from the side until they noticed the diffusers nearby or read the description of the artwork. Besides, interviews were conducted during the guided tour of the exhibition. Most of the visitors found the idea interesting as they could turn the page to watch different videos. It let them watching the old video footages on a physical book like reading the social memory book of Macao. When some visitors found that the smells coming from the side, they walked close to the smell diffusers. One of them responded, "*how come I smelled the odour of cigarette?*" while actually the smell of fruit was emitted just a few minutes ago. This may be caused by the scented mist stuck on the surface of the surrounding. Despite of this, most of the visitors found the combination of smell with audio visual is interesting though many technical issues needed to be solved. While watching the old footages of the city and experiencing the smells with it, the visitors started to talk about the old days of Macao and the change of the society in recent years.

Throughout this artwork, there are opportunities and challenges found behind. Due to the historic and architectural values, there are many limitations on the infrastructure of cultural heritages. Multimodal technology could enrich visiting experience without changing the architectural structure and heritage essence. Smell is an intangible media that exists in the air. The olfactory component of the multimodal interaction can

be changed from time to time according to the themes of the cultural heritage seasonal events. Its evocative and affective characteristics provide visitors engaging experience that transcends time and space. It could be applied in various ways such as telling the story of the cultural heritage and evoking the memories of visitors. In this artwork, the combination of smells with audio visual in physical reading evoked the visitors about the social memory of the city and prompted them interact with each other to share the old stories of Macao.

However, there are also some challenges behind. One is the context of olfactory interaction. Each cultural heritage has to find out its unique visiting pattern to match with the odour emission in multimodal interaction. Instead of using click-to-sniff, this artwork adopted the action of flipping as the trigger of the odour emission to fit in the multimodal reading experience in the library context. Another challenge is the selection of smell. In this artwork, the scents were chosen based on the artist's perspective on the social memory of each video clips. As olfactory perception is very subjective, the artists and heritages need to find out the smells which shared commonly among the target visitors while creating the desired multimodal experience. Last but not least, it is the technical issues of digital olfaction system. Each cultural heritage needs to find out its suitable olfactory output system for multimodal interaction. It can be based on the essence of the cultural heritage, the location of multimodal interaction, the duration of the events, the ventilation system, etc.

Conclusion

On one hand, the institutions of cultural heritage need to pass on the historic values to the era of new media. On the other hand, they face the limitations of construction and expansion in the current environment. Here new media technology provides new possibilities to reinvent the content by delivering multimodal experience. In this case, "*Flip the book – Flip the Memories*" integrated the tangible and intangible experience together by combining smell and audio visual with the action of turning page of a physical book. It brings the new perspective to the social memory and enrich the visitors' multimodal experience in the cultural heritage.

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Cyber Terrorism in name of Cyber Activism:

Discomfort in looking at some derivative works in recent Hong Kong

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Abstract

Increased awareness of cyber activism and civil disobedience in Hong Kong has led to a concurrent proliferation of so-called 'derivative works.' These computer-manipulated images are created for, and disseminated via, the Internet in response to the contested political climate of the city. This paper treats such derivative works as visual evidences to examine the ethics of image-making and photographic manipulation within the milieu of Hong Kong. It also discusses the cyber behaviour and interchange of image consumption and production via the Internet. Selected derivative works from social media and discussion forum in Hong Kong are framed as political expressions in relation to debates about pornography, misogyny, racism and terrorism. The emancipatory nature of derivative image-making practices, specifically non-hierarchical dissemination, is contrasted with an argument that these same practices are seen as a form of cyber terrorism that reinforces hatred of the 'other.' Derivative works, I argue, are not merely images of personal and political expressions but sites that embed and shape ideological repression. An image democracy without gender and racial justices as well as image ethics is not a future of hope and promise.

Derivative Works and Cyber Activism

Derivative works are known as 'secondary creation' ($ji^6ci^3cong^3zok^3$) of parodic nature in Hong Kong. Derivative works are digital composites made by assembling found images from different sources on the Internet. The power of derivative works lies in their performativity. The image-maker needs not to engage in the act of photographing. Through assembling found images, a new image is created and uploaded on the Internet for further dissemination. The 'new' image may then be downloaded and transformed by another image-maker. This chain and cycle of creation and reproduction of image characterise the very performative nature of derivative works.

In recent Hong Kong, derivative works primarily function as cyber activism, in particular in forms of social commentary and political persuasion to current affairs and political reform. Similar to political comics and other satirical arts in Hong Kong, the propagandist intention of contemporary online derivative images most commonly achieved by simplified, sensational and satirical portrayals of public figures and current affairs. Derivative works differentiate itself from the employment of visual references from entertainment, showbiz and cinema, for examples, the technique of screen capture and the simulation of image from screen. In contrast to traditional mass media, being factually correct (or politically correct) is not the key; rather attracting viewers' attention in very short browsing time is. Traditional visual media such as reportage photography aim to prompt sympathy from the viewers, by contrast derivative works discussed here are not sympathetic but largely sentimental and sensual.

In what follows, a selection of derivative works created in response to grassroots politics in recent Hong Kong are discussed in relation to identity politics. Derivative works are shown as sites of ideological conflict. Despite the democratic nature of participatory media, derivative works frequently show pornographic, misogynistic and racist portrayals of public figures for viewers' visual pleasure. My analysis begins with a diptych by comparing an original image (a screen capture) and subsequent derivative image (the pixelated), and discusses the use of pixelation as a gendered tactics.

Fig 1. A screen capture of a YouTube video uploaded by user 'Yim Faning', 2013, screenshot. © Yim Faning.

Misogyny through Pixelation and Insertion

Figure 1 is a screen capture of Leticia See-yin Lee at the inaugural event of Justice Alliance, a pro-establishment advocacy group. This screen capture, by only taking out a still image from the video footage, decontextualises the

event. [1] In the video footage, Lee dealt with chaos and crowds in the pedestrian zone in Mongkok, Kowloon and asked for help from the "Renmin" Police (the People's Police); an expression that does not exist in the territory of Hong Kong. This screen capture does not capture any decisive moment of the event. The chaos and the conflicts of the event are instead distilled to a female protagonist, Lee, holding a microphone in her hand, with a videographer at the background. Between these two people there is a middle finger gesture pointing to Lee by an unknown third person.

Fig 2. A derivative work of Leticia See-yin Lee created by a Netizen. Source, Date and Author Unknown.

This screen capture was widely circulated on the Internet. A few derivative works subsequently emerged such as one of her holding an ice cream cone made by inserting a found image. The derivative work shown here does not involve inserting another image. Instead, the microphone in Lee's hand was pixelated. (Figure 2) The visual connotation is hypnotic. We know Lee is holding a microphone in her hand but the pixelation treatment is a powerful cinematic reference to pornography, and we imply she is holding a penis in her hand. The maker's implication and viewers' imagination transgress the territories of the public and the pubic. The anonymous middle finger pointing towards her reinforces this sexual degradation as it simultaneously signifies an insult (literally 'giving the finger'), a command, symbolic violence, condemnation, demeaning and hatred towards woman.

Pixelation of photographic images in the public sphere is predominately found in mass media these days, where it is applied to the faces of vulnerable populations such as children, victims and 'celebrities' in order to protect their privacy by making them 'anonymised' hence unidentifiable. The Japanese pornographic industry pixelates genitalia as required and imposed by publishing laws on censorship in name of public decency. [1] The mosaicked microphone in Lee's hand connotes a female giving oral sex. This photographic manipulation

is characteristic of the visual rhetoric of derivative work, specifically that the meanings made of the derived may not share similarity to the original through deletion, changing and absence of context. Visual pleasure must be created in derivative works in order to attract viewers' attention. This raises the question of whose visual pleasure does these derivative works and this use of pixelation serve?

In 2011, Reporters Without Borders publicised an advertising campaign titled 'Censorship Tells the Wrong Story.' The campaign, through pixelating various body parts of world leaders from news photography, creates unidentifiable body gestures with sexist and pornographic connotations. Unlike other publicity image, in this instance, pixelation is not used as a mean to protect one's privacy. And such pixelation treatment opens up visual indeterminacy. The visual logic of this advertising campaign is straightforward. The pixelation implies the censorship of photographic images in the public sphere not only endangers freedom of press but also puts truth at risk. However, the choice of subject matter (think editorial angle), message conveyed, intention and impact in such portrayals should be called into question. The deliberately misleading image of a male touching a pixelated female body part (that is an act between Barack Obama and Hillary Clinton in the campaign) and an undetermined hand gesture of a male between his legs (performed by Vladimir Putin) are notwithstanding humorous, entertaining and appealing to many. However, the identity politics, and the racial and gender relationships embedded in these images reflects prejudicial gender and racial ideologies that are deep-rooted in our social and cultural values. Do these photographic manipulations help us in battles for freedom of speech? Or do they further reinforce the norms of sexism and male dominance? What is the cost to promote freedom of speech at the expense of gender and racial jokes? My observation is that these photographic manipulations are not only parodies but also means to typify the subject by reinforcing stereotypical parody. The typification process is not arbitrary, and in this discussion, the parody is subjected to women as sexualised objects.

Fig 3. Derivative works found on an adult discussion forum (www.5278.com) of Leticia See-yin Lee. Source, Date and Author Unknown.

The representation of women as sexualised objects is a common goal in image manipulation by the anonymous Netizen. Figure 3 shows two derivative works created by

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[1] The images illustrate the inaugural event of Justice Alliance, a pro-establishment advocacy group led by Leticia See-yin Lee, on the 4th August 2013. A screen capture was made at 00:11 from the YouTube video. The video footage was uploaded by user 'Yim Faning,' accessed December 30, 2015, https://www.youtube.com/watch?v=JoQ1bCaU1uw.

Netizen typically appropriates a wanted ad of a massage parlour in Shenzhen, and inserts faces of Pro-establishment political activist like Lee in the style of *Being John Malkovich*. The name of the massage parlour was pixelated in order to make the place anonymous. Lee's Chinese name was then superimposed on the pixelated title to provide a fictional context. The Pro-Beijing spokeswoman becomes the target for sexual parody, if not sexually harassment. Another example is less sexually provocative but in this case male domination and female subordination is amplified figuratively. The anti-occupy leader Lee was pictured with Leung Chun-ying, the Chief Executive of the HKSAR Government. A news picture by photojournalist Martin Lam dated on the 2nd December 2014 from *Apple Daily* captures an official moment where Lee submitted a letter of public request to Leung to terminate the Umbrella Movement in Hong Kong. In the derivative work, the context is dimmed to an immersive blackness, with the two protagonists leaning towards each other in the manner of *Gone with the Wind*. She is portrayed as submitting herself, instead of the public request, to Leung. They were pictured kissing each other in an awkward manner. Romance is only a façade. The gender stereotype played in this image reproduces and reinforces heteronormative patriarchy.

Fig 4. A derivative work of Leung Chun-ying and Leticia See-yin Lee appropriating a photographic image by Hong Kong photojournalist Martin Lam, 2014. Source and Author Unknown.

It is not only Pro-establishment and anti-occupy female political activist who is subjected to such sexist and stereotypical parody. Pro-democratic female politicians in Hong Kong are also targeted. Another series of derivative works play the ideas of the male gaze and male visual pleasure. The derivative tactic is, again, direct by inserting faces of Hong Kong politicians onto found images of protestors and criminals arrested by militants in other parts of the world. All male politicians were clothed and yet the face of Claudia Mo, the only female politician in this series, was inserted into a female protestor with her upper torso exposed. [2] (Figure 5) This particular image appropriates American photographer Eric Wagner's work *Liberated: Arresting America* (2). [3] [5] In Wagner's image, the female protestor was captured with a sense of hope and defiance on her face and political slogan painted on her bare stomach. The context of the "March For Women's Lives" provides a feminist and empowering reading of her voluntary baring of her chest. The derivative work does not prompt the idea of female empowerment, however. The local milieu in which the image was situated determines its meaning to Hong Kong viewers. This milieu includes, the political climate in Hong Kong, the relative obscurity of the original US image to local viewers, the cultural context and perception of displaying body in the public space, and the lack of a local feminist activism that includes baring the chest as a political pro-woman act.

Fig 5. A derivative work of Claudia Mo appropriating Eric Wagner's *Liberated: Arresting America (2)*, 2004. 2014. Source and Author Unknown.

Claudia Mo was portrayed with no facial expression of hope or defiance. Given the milieu described above, she was depicted as a sexualised object and the hanging brassiere strap implies sexual violence, not self-determined liberation. In short, sexual parody in derivative works is gendered and context-specific. These gendered objects have little to do with empowerment of

[2] This series of derivative works was founded on hkgalden.com, a discussion forum that is derived from the Hong Kong's popular discussion forum hkgolden.com. The web platform (hkgalden) itself is a parody of the popular forum (hkgolden). Six derivative works are uploaded by user 'BIZHUB' under a discussion thread titled 'Anti-occupy low-quality derivative works' and six pro-democratic politicians who were involved in the Umbrella Movement are subjected to parody, accessed December 30, 2015, http://hkgalden.com/view/173707

[3] Eric Wagner's photo essay was dated on the 31st August 2004 where he captured an anti-Bush and anti-republican street protest in New York City, accessed December 30, 2015, http://www.basetree.com/photos/no-rnc/liberated-from-republicans.html

woman and gender equality. Next we turn to the significance of these gendered visual manifestations created by Netizens and amateur image-makers. They habitually identified only by pseudonym and commonly mistaken for the 'Anonymous.'

Discussions about gender politics of cyber activists, the identity politics of the 'Anonymous,' and the ultimate dark side of Internet freedom argue that the gamer and hacker culture is male-dominated and it is in this broad counter culture that the Anonymous and the cyber activists are most commonly situated by scholars. For example, media theorist Kriss Ravetto-Biagioli observes that cyber behaviour that is intentionally offensive results 'toxic environments that silence voices – particularly those of the traditionally disenfranchised, i.e. women, people of colour, and the LGBT communities that Anonymous ridicules often and explicitly.' (Ravetto-Biagioli, 2013:184) [2] A male-chauvinistic and racially superior attitude seem to dominate the culture of high-speed browsing and gain viewers' fleeting attention, further visual exaggeration is thus employed. One should also note that the image-makers of derivative works are simultaneously consumer and producer of images on the Internet. One looks, grasps, appropriates, creates and uploads; and another generates a similar life cycle of image. These cyber behaviours are almost instant, in a click that is itself sometimes autonomous. The viewers who used to be the consumers of sexualised images are now also the producers of such images. Viewers are no longer passively reading images but actively engaged in making images and therefore part of constructing ideologies associated with those images. The aforementioned derivative works illustrate the unethical expressions in name of cyber activism and civil disobedience – they enable and perpetuate a misogynistic environment and render the utopia of image democratisation to the dystopia of discrimination and immorality.

Fig 6. A derivative work found on Facebook account 'Pro-police Alliance' with Chinese title 'Pro-police organisation advocates ISIS massacre; pan-democrats and students are the targets,' 2015. Author Unknown.

The Making of Cyber Terrorism

In the course of researching this paper, it has become clear that female political activists and political leaders have been targeted for sexual parody and hatred. Hatred

of woman is building up image after image. To look at derivative works subjected on women collectively suggests they do not only publicly shame a particular woman but womanhood *per se*. And the hatred is also extended to another dimension of global violence. This paper concludes with a brief discussion of another derivative work found on a Facebook account named 'Pro-police Alliance' (*Caang^{1}Ging^{2}Daai^{6}Lyun^{4}Mang^4*) in Hong Kong which suggests future research into derivative images and cyber terrorism is needed. In Figure 6, fourteen male pro-democrats (including legislators and activists) and student leaders who were involved in Hong Kong's Umbrella Movement were depicted (with their headshots inserted in a found image) wearing the orange jumpsuits first associated with US political prisoners detained at Guantanamo Bay and more recently associated with prisoners of ISIS that were executed. This derivative work is connected with ISIS use of orange jumpsuits, with one Internet commentaries saying, 'Beheading them all!' This derivative work typifies cyber terrorism. The politics of derivative works depends on the context in which they are made and seen, but their online dissemination means that the subtleties of personal, social-categorical, political, ideological, national and international meanings could not be easily separated. Derivative works which reinforce negative stereotypes and perpetuate hatred of other should not be explained by perceiving them as acts of parody, satire and harmless joke. The intention and implication of the satirical and parodic expressions should be cautiously handled. The future of images is not only about the degree of manipulation and technological advancement in ways to share and transform – it must include a debate about the ethics of image-making and sharing.

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Somplexity – An Experiment of Posthumanist Platonic Sex

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Abstract

As cybernetic progress is opening more pathways for telematics, the experience of presence in mediated environments is creating even more dissolution between corporeal intimacy and virtual intimacy. This ultimately leads to the questioning of the very nature of our being, identity and perception of reality. This paper addresses the neuro and cognitive aspects of tele-intimacy and through the discussion of the project Somplexity, examines what is the nature of our intimacy now? It will address the representational issues and performative aspects of tele-intimacy and develop a context for techno sex with neurofeedback system to mediate human perception of intimacy.

Introduction

Some (썸), a trendy word in Korea now, is an abbreviation of something (썸씽). It is used to conjure complexity in a relationship. The word has a sexy connotation of desire, intimacy, indeterminacy, and mysteriousness. The slipperiness of its definition makes it extremely difficult to pin down what Koreans mean by 'some'. The project Somplexity is an exhibition but also a social experiment that explores the complexity of the sexualized culture of our post-modern social world. Human's lust, love and attachment, Fisher et al has noted, can and often operate independently and this is validated by the neural independence of these emotion-motivation systems. [1] Given this, we can vindicate controversies and moral panics. Situated within an art context, we investigate the performative capacity of tele-intimacy, how it instigates interpersonal relationship and open up pockets of interaction and evoke emotions.

Exhibits

Project Somplexity was exhibited in Seoul Art Space Seogyo in Seoul, South Korea in September 2015. The project comprises of four interactive installations: SoMe Chair, Synchronicity Music Box, Differential of Memory and Generative Light, which were respectively placed in different zones in the exhibition space mapped according to the anatomical classification of the cerebral cortex in human brain:

— AC: Auditory Cortex;
— OL: Occipital Lobe;
— TL: Temporal Lobe;
— FL: Frontal Lobe.

The mapping of the exhibition space to different anatomical regions of the brain is a curatorial strategy to provide a metaphorical cue to understand the exhibits in neural correlation in different constituent within intimate relationships: love, lust and memory (Figure 1).
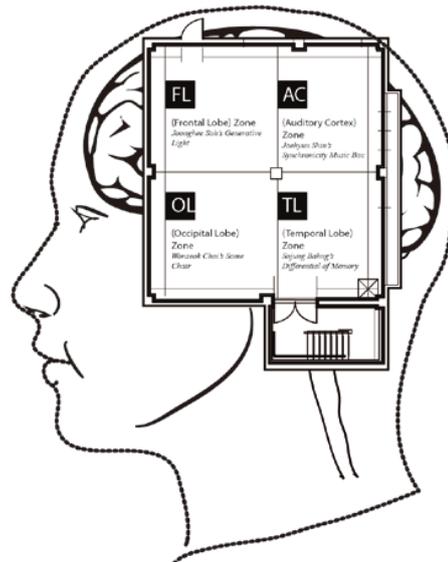

Fig 1. Floor Plan of *Somplexity* Exhibition.

Tele-intimacy

Two of the interactive installations employed EEG-controlled physical computing interface. The participants were provided a 4-channel EEG headset each to detect their brainwave and heartbeat as non-verbal communicative cues in the interaction process. IJsselsteijn defines interactive systems alike as "teleoperator systems that allow users to control and manipulate real-world objects within a remote real environment". [2] This kind of system are used to replace human to work in challenging environment but interestingly we see an increasing usage to draw people closer by allowing them to feel the presence of another person connected via network. Intimacy is a sense of closeness and it can be characterized by emotional intimacy (romantic love) or physical intimacy (sexual desire). Cybernetic is allowing both type of intimacy to assume an 'out of body' form to be intimately performed across time and space, hence tele-intimacy.

Posthuman and Human Desire

Katherine Hayles foregrounds Ihab Hassan's proclamation of the emergence of posthumanist culture that will radically transform humanism including human desire into symbolic representation. With this in mind, human external representation, including sexuality can be dissolved into quantifiable information and reproduced as both a signified and signifier. Michael Heim equates this to the platonic ideal which can only be processed through mental logic, in the realm of pure idea. [4] In speculating the aesthetic aspect of the project, of particular relevance, is Burnham's comparison of software with Duchamp's conceptual art, both are deconstructed into comprehension. [5] Along this line, we investigate the potential of understanding the quantifiable aspects of neurological functions in different components within intimate relationships.

In speculating if we can redirect sexual pleasure to some kind of neuron activities, Wonseok Choi's SoMe Chair (Figure 2) puts two strangers to test: participants' brain electrical activity are picked up by EEG reader. Via SoMe Chair, a neuro-feedback process will maintain a focused connection between the participants while amplifying their Alpha, Beta, Gamma and Theta brainwave frequencies (Figure 3). In a reciprocal fashion, one participant's level of excitement is articulated by different brainwave frequencies and these brainwave amplitude will modulate to the vibration on the chair which his/ her vis-à-vis partner are sitting on and the flashes of the strobe LED light and the soundscapes in the apparatus that enclosed their partner's head. The work investigates whether intimacy can be a telematics semiotic

process. Consequently, it asks if sensations can be endowed with the sensual communication. This assumption is based on Fisher et al. extensive research on the correlation between brain system and physiological functions associated with a complex human state particularly love. [6]
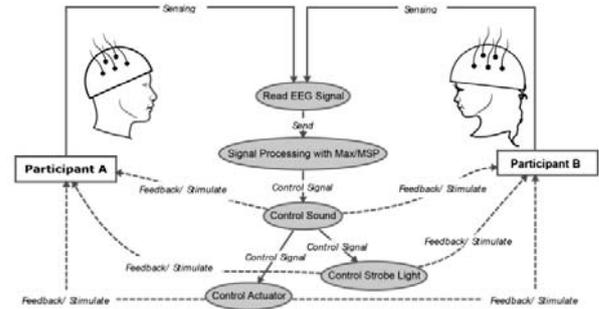
Fig 2. Data Flow Diagram for Wonseok Choi's *Some Chair* Installation.

Fig 3. *Some Chair*, 2015, Wonseok Choi, interactive installation. It was installed in OL (Ocipital Lobe). The occipital lobe contains the anatomical region of visual cortex which processes visual information.

Platonic Love and Eros

Jaehyun Shin's Synchronicity Music Box (Figure 4) deploys two 4-channels EEG headset to read the brain electrical activity of two participants and extends them to various prosthetic sound making objects with sexual innuendo. In the moment when the brain waves of the two participants are in resonance, harmony in the sound can be heard, producing a synaesthesia performance joining visual and audio. It put the participants in an active role to work towards a neural synchrony, validated by sonically coherent soundscape. With a bit of imagination, this performative piece is a witty simulation of a mutual orgasm of the brain in two participants. In ethology, the

attachment with the opposite sex (often called compassionate love) is characterized by mutual behavior and emotional union. [1] The performative nature of the audience looking at the participants attempting to reach the moment of congruent neural activity invokes the notion of a voyeur. In relation to "how subjective perceptual experiences can be explained in terms of the firing of neurons" [7], this voyeuristic situation opens a playful perspective to Broadhurst's argument for an intersemiotic significatory practice that transcends language to address qualia. [7] The language of nerve impulse that elucidates the neuronal activity which allows the participants to perceive a sense of intimacy is communicated by means of auditory instead of spoken language. However, as Broadhurst noted, "the 'experience' of that subjective perception is forever lost in translation" [7], the moment we start to describe a perceptual sensation objectively.

Fig 4. *Synchronicity Music Box*, 2015, Jaehyun Shin, interactive installation and performance. It was located in AC (Auditory Cortex).

The Issues of Going beyond Sex in Cybernetic

The best way for us to explain the implication of posthumanism on human sexuality is through the notion of platonic. Platonic describes love or intimacy that is free from sensual desire. Platonic love in this original sense rationalizes affection that is not sexual as the ultimate ideal form of love. It is important to note that the concept of platonic love was developed from Socrates's Eros. Micheal Heim posited that our affinity for virtual world stems from Eros. However, Heim's proposition is more related to our attraction to the intelligent machine, particularly those in the cyber world. But the paradox, of course is, how we know that we are in touch with a computerized entity and not with a real person in the network since Alan Turing provided the formulation that we cannot differentiate between human and machine

behind the screen. The inference of this is platonic metaphysics bridges the gap between Eros and computerized entities. [4] Even though we have yet to achieve the technological advancement to realize platonic notion of human nature in the cyber reality but we are, as Heim pointed out, "on an ontological continuity connecting the Platonic knowledge of ideal forms to the information systems of the matrix". [4]

Neuroanatomy and Intimacy

Sojung Bahng's Differential of Memory is the brain monologue dealing with the phenomena of the mind (Figure 5). Bahng meticulously dissected our integrated perception of reality into fragments of events prerecorded and stored in a video database analogy to the way temporal lobe forms explicit long-term memory in our brain. Audiences can actively participate in the projection of such reality by choosing the micro events they want to make visible in a multilayered video collage. The montage displayed on the screens is generated by sequencing user-defined tags on the video clips on a tag timeline. Each montage follows the general flow of the timeline. The underlying stochastic processes will produce a new sequence each time a montage is generated.

Fig 5. *Differential of Memory*, 2015, Sojung Bahng, interactive installation. It was located in TL (Temporal Lobe). The temporal lobe of the cerebral cortex contains the hippocampus that forms explicit long-term memory.

Bahng's work is acting as a metaphor for the brain itself, demonstrating the multilayered nature of consciousness. The unified whole experience is made up of micro conscious events; each one tied to the activity of different neurons/ nodes at different times and locations, in the processing system of vision. [7] It is this intricate brain's memory function that is important in the comprehension of her multilayered video installation.

Joonghee Soh and Sojung Bahng's Generative Light is similar to a confession room, where you come face to face

to a recursive reflection of yourself with a LED sculpture resembling brain's network (Figure 6). In tracing the shift from human to posthuman, which both evokes terror and excites pleasure, the pulse detector in Soh's piece acts as an indicator for our posthumanism readiness, signaling the LED sculpture to blink in resonance to your pulse rate, with that being the remnants of your intimate experience you have found in Somplexity. Fisher at al's comparative study between human romantic love and mate choice among mammals suggests that this mammalian behavioral 'attraction system' is associated with dopaminergic reward pathways in the brain, which upon activation will induce responses such as increased heart rate, sweating and trembling, alert and energetic. [6]
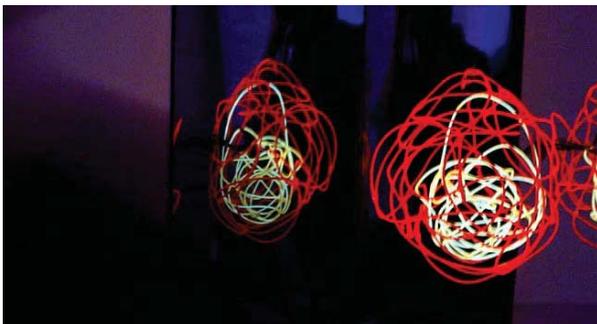
Fig 6. *Generative Light*, 2015, Joonghee Soh, interactive installation. It was located in FL (Frontal Lobe). The frontal lobe contains most of the dopamine-sensitive neurons in the cerebral cortex.

Conclusion

In Somplexity, cybernetic setups connect us across distance and time without that memory of skin against skin intimacy. Yet, our corporeal existence still dominates our perceptual experience. Heim's erotic ontology of cyberspace counters the preference for disembodied intimacy. [4] Riva and colleagues posited that psychological impact of the media is conditioned by symbolic representation but the physiological impact of teleoperations is conditioned by tangible interface in the realm of reality. [2] Besides providing a new context for aesthetic interaction, this project furthers our theoretical understanding of the fundamental challenge of mediating the perception of intimacy. The implication of this is that research in presence design will have to extend beyond the simulation with increasing fidelity but combine cognitive psychology, neuropsychology and socio-cultural issues as they have profound impact on the sense of being in a mediated environment. We highlighted the conceptual interaction between the seemingly remote fields of techno-sex and neuroscience research, and we are considering the perception of intimacy as the point of departure. For future study, a robust measure of user psychophysiological responses will be essential for the building-up of perceptual cues to simulate or substitute the experience of intimacy in a computer-mediated environment.

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Music in Print, How Publishing Has Been Able to Flirt With Music

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Abstract

Creating a publication about music has always been challenging, as the discussed matter couldn't be visually represented in the printed page in its own listenable form. Nevertheless independent printed media has experimented with DIY inventive strategies to include sounds at various levels in traditional publications through different formats than its standards (classic records or CDs). This integration goes beyond the 'multiple media' approach, as affects either publishing as a practice, and print as a medium, creating a symbiosis which can lead to different grades of interaction.

Sound Was Meant to Kill Print (After It Killed Voice)

Historically sound has been one of the first media to plainly rival print. We can even trace it back as sound, in form of voice, has been used as a medium to first transmit information in time and space in what has been defined as "oral culture", before any type of written or physical medium, thus of print. Oral culture was based on the transmission of knowledge through spoken word, using the collective, and personal, memory as storage space, which sometimes returned slight different versions, in a slowly evolving narrative. Initially writing, with its accuracy and stability in time, and then especially print, providing cheap and massive duplication qualities, have given a much powerful alternative to oral tradition, finally almost supplanting it. In this respect Marshall McLuhan affirmed later: "we have spent much energy and fury in recent centuries in destroying oral culture by print technology".[1]

One of the first visions of how print would have faced a changed mediascape, in some respect uniquely futuristic, was elaborated by Octave Uzanne and Albert Robida in their illustrated story La fin des livres, originally published in France in 1894 in the collection Contes pour les bibliophiles.[2] Uzanne elaborated on of a future world of publishing which would no longer have relied on the 'static' printed page, delivering instead all content through voice, both live and recorded, using a platform which nowadays would best be described as 'on demand'. But they were not talking about radio, wireless transmission had yet to be developed and popularised, neither they were describing any kind of telephone broadcasting, or, as we would say in contemporary

terms, 'cable radio', since it relied on live-through-wires content as well as playback of recorded content, which we would now refer to as online and offline content, distributed through the then-popular and fragile cylinder recording medium. Robida's illustrations depicted this future world in a very imaginative and effective manner, while maintaining the distinctive graphic style of the period, essential and descriptive. The future seemed to be one with electric wires everywhere, spreading the content of huge audio libraries into every home as well as in public spaces.

Moreover Uzanne argued that reading causes fatigue and apathy. Words heard through the 'tube', on the other hand, would convey energy, and thus reinforcing the concept that the gramophone, specifically, must inevitably supplant the printed page. The way in which Uzanne imagined this future scenario, anticipates several contemporary issues regarding the distribution of immaterial content. He thought that watchmakers, for example, will have designed reliable miniaturised gramophones (= iPods); the required mobile electricity (still an issue in the 21st century) is generated by harnessing the user's physical movements (one of many contemporary green test strategies for producing clean energy). The libraries would have become "phonographoteques" (= podcast repositories), while bibliophiles are now known as "phonographophiles" (= download addicts). Furthermore, in Uzanne's vision, the author becomes his own publisher (= vanity publishing coupled with customised print on demand), living off the royalties of his own works (= eventually crowdsourcing). Finally, city squares and crossroads would have featured kiosks where people can insert a coin in order to listen to works of literature (= digital kiosks, online micro-economies) through simple headphones which would have been so cheap that even the poor could have afforded them. One of the most retro-futuristic inventions is a kind of mobile device, filled with recordings of the author's works, which he can carry with him through the streets. Using multiple wire connections, spreading from the device, a small neighbourhood can be 'provided' with his audio content. And speaking of voice replacing paper, historically, even Thomas Alva Edison, attempting to envision a practical use for his early experiments in recording on cylinders, saw them as a 'paper-reducing,' as opposed to 'paper-

replacing' medium. The cylinders, wrapped in their thin aluminium foils, would contain spoken letters and memos to be shipped to their recipients, thus reducing paper use and speeding up the writing and typing process.[3]

Sound on Paper Media

Print and sound have often had an idiosyncratic relationship. A text which describes and analyses music is inherently talking about a quite ephemeral topic, which can eventually be only imagined and represented in the mind of the reader. So publications about music have a quite specific role: describing and verbally narrating something which can't be easily represented in the flat space of the printed page, but has to be omnipresent there. The writing, its style and content is obviously independent from the music representation, being subjective, but the "reading experience" and the whole understanding can eventually be improved through a better representation. This tension between the discourse about the sounds and the sounds themselves, is what researcher Rachel O'Dwyer calls "synaesthetic quality of writing about music."[4] This has led to finding ways to integrate music in paper in a 'recorded' or 'encoded' format to be executed by a machine. In fact the classic music score, or 'sheet music'[5], is an abstract representation meant to be decoded and executed by a human, thus it needs a series of imaginative, and so subjective, subsequent translations: after recognising the single note it's needed to imagine a performer playing it with the proper music instrument, so it can't be said that it contains 'recorded music', but an abstract representation of it. There are other types of scores which can instead be considered objective. The scores for player piano or for music boxes, in fact, are recorded music, no less than a vinyl or a compact disc, encoded in a mechanical standard, which in turn guarantees sufficient objectivity of the recording itself.

The Sounding Publication and Its Ephemeral Analog Media

Historically music magazines have tried to add recorded sounds in various formats, although struggling with the limits of the respective available media. Publishers started to have a chance to include vinyl records with the advent of the small 7" format, usually placing them within the magazines' or books' pages in order to protect their intrinsic fragility, sometimes miserably failing. That's why the technical solution of developing pure 'cardboard records', developed and used in the early seventies, could have been strategical: it'd have perfectly integrated a medium in the publishing workflow, which could have been then easily detached and used. Unfortunately the tests revealed on one hand a poor quality of sound, due to the poor details of cardboard grooves, and on the other hand being prone to weight in flattening the same grooves deteriorating sound quality even more. So although it'd have been a perfect extension in music magazines, it was used mainly as relatively cheap gift integrated in cereal packaging.[6] But even before the cardboard record, in the middle sixties, another technology for printing a lightweight record meant to be included in printed magazines, got wider acceptance. The so called 'flexi discs' in fact, used thin flexible vinyl whose grooves were moulded, initially nicknamed as 'phonosheet' or 'soundsheet'. It was usually square with grooves in the center, and a detachable extension useful for stapling it into the magazine's centrefold, or being held in the spine, without damaging it. The flexi disc became very popular in the Soviet Union in its golden era, the sixties, as it was attached to popular magazines printed by the state.[7] At the end of seventies some tests to include software on it were attempted, transforming it into a so-called 'flexy-ROM', potentially opening a whole new digital world, but unfortunately becoming quickly a dead medium.[8] The last analogue medium that was used to extend the printed content has been the Compact Cassette, less easily 'attachable' to a magazine, but still cheap and compact enough be packaged with the magazine itself, usually within a cellophane wrap. In this sense the whole Cassette Culture, established in the eighties' underground, created a spontaneous worldwide network through the exchange of mostly industrial and experimental music using this very medium and the global postal network as affordable and relatively fast distribution channel. There are at least a couple of remarkable examples in this movement which contributed to redefine the concept of music magazine, beyond its classic structure. The first was Tellus, a magazine made in New York in early eighties, entirely on an audio cassette, in the form of periodically edited music content. Despite it was subtitled "the audio cassette magazine", the editors claimed it was not a magazine but a "no wave Fluxus art form". Being issued fairly regularly, with a redaction of three editors, and with rigorously compiled mono-thematic issues, it's hard not to consider it a magazine in many respects.[9] In the same period, in Toronto, a city which at the time seemed to be culturally complementary to New York City and its lively publishing Lower East Side scene, another magazine was established with similar goals: Musicworks. It was a traditionally printed magazine, but being born by the collaboration between an early sound art gallery and another leading underground printed magazine, it was shaped around the its own flourishing scene, starting to include cassettes as perfect documenting companion.[10]

These attempts to integrate the sounds in the printed page (directly, or finding synergies with another medium that enabled the direct and natural expansion of the page) pushed the printed medium into being integrated in multiple media environments, but never loosing, with the exception of Tellus, its primary format and its role of 'directional container'. In fact, the recognition of the

printed magazine as the 'perfect interface', acknowledges it to establish, through its own structure properly exploited by the editors, the direction towards the readers can be pointed to, even if they have to switch or split their attention to another sympathetic medium.

The Sounding Publication (and Its Ephemeral Digital Media)

When publishing got rid of print physical constrains and landed in the binary domain a new configuration of media was delineated. It included a wider range of other media, since they were reduced to very same basic nature (binary code), including sound, and so its integration in any form within or aside the text became a natural further step. The first generation of 'digital magazines', or the so called "disc magazines" (which at large included digital magazines produced on cassette, floppy discs, cd-rom and dvd-rom) formed its own scene, in some respect very similar to the printed zine one, but aware, ahead of time, of how to integrate different media within the very limited storage space (although suffering a bit from a being most of the time uninterested in proper editing). The first popular format was the floppy disc. A rather conceptual example was the Italian literary and Mail Art zine Adenoidi, adding a 5 1⁄4" floppy disc containing colour pictures – which were also printed in black-and-white inside the paper zine itself, with the missing colours indicated by text captions with arrows pointing to the corresponding fields.[11] A whole 'magazine' on floppy discs, called The New Aladdin, was envisioned and realised by editor John Henson in 1987. He assembled a bi-monthly general-interest magazine using most of the interactivity available back then: animated graphics, games, music and stories which allowed the reader to ask questions.[12] The so-called Demoscene, a "computer art subculture that specialises in producing demos, which are audio-visual presentations that run in real-time on a computer"[13] was the territory where different disc magazines were produced within the constraints of a floppy disc storage space, like Caustic Verses, which included text, software and music.[14] But paradoxically enough the floppy has been used more recently as a form of appealing retro-futurism, adopting the most efficient compression standards, than at its own times for the evident limits in storage. The album Trunkeret & Ikonisk by Jonas Olesen/Batch Totem, for example, has been released in 2007 by the Ristretto label, on a 3.5" floppy containing 74 minutes of music in 1.44 mb, through the GSM 6.10 WAV format.[15]

Since the arrival then of the compact disc in its 'data' oriented version, the CD- ROM, more and more publications were designed as 'interactive' magazines. One trend was to reproduce as faithfully as possible the conventions and standards of print, while adding 'bonus' animated or audio content. Blender magazine (and its close competitor, Launch) was one of the very first to do this, in 1994 – publishing a CD-ROM magazine with original pop music-oriented content, including music, small videos and even advertisements.

Various 'interactive' CD-ROM magazines were also produced focusing on experimental interfaces, such as the seminal (and almost impossible to navigate) Blam!, which was in fact more a purely digital product than a normal publication. Yet another genre was defined by the emerging profession of digital designers, as exemplified by the mixed-digital-media Gas Book, a publication showcasing multimedia and electronic music talents within a single package consisting of a book, a CD-ROM, an audio CD, stickers and a T-shirt.[16] But the CD-ROM was also the last physical medium included for its capacity of containing data and/or software, on a much larger scale than the floppy disc. It has been the most effective medium to be attached to a publication, being cheap, minimally flexible, and with remarkable technical standards.

The mass access to telematic networks has then definitely changed the whole concept of 'augmenting' the static printed content with a more dynamic and continuously expandable one, but still being based in a physically and conceptually finite format. Internet and the other networks are coupling the terrific possibilities of digital with the real time access and responsiveness, which redefines the concept of distribution, or the time needed to make a cultural object available to be consumed in any place. This element potentially disrupts the space of the magazine, and its limits, not only because this space becomes infinitely ubiquitous with unlimited access through the network, but even more because on the networks the content is reciprocally linked through hyperlinks, so it's potentially infinite for every issue. It's not by accident then that one of the very first online magazines (dating back to 1994) was dedicated to a specific type of music: the rock-oriented Addicted to Noise. With no need of any sophisticated technology, it was the first online publication to include "audio sample alongside music reviews".[17] It clearly represents the end of the dichotomy between text and music, still maintained in all the previous examples, being them finally in the very same (digital) space, and they can also be enjoyed at the very same time. So if text and sound can be in the same time and space, in a digital networked form, the role of the static printed page becomes a different one: being pondered more than ever, meant to be preserved as long as possible, meant to represent a slower but more sophisticated reading experience. And this can be only reinforce by the use, for example, of QR codes. At end of year 2000s, in fact, different print magazines started to include QR codes in their pages, or black and white codes as large as stamps, that can be read and converted in URL by specific mobile phone apps, so paving the way to another plethora of dynamic ever-changing picture/sound/video extra content.

The Resonating Paper

But, after all its possible extensions then, an important question should also be posed: can paper itself 'resonate,'

eventually having the potential to directly convey sounds?

First this question should be properly framed, avoiding any reference to the metaphorical resonating power of words, but focusing instead on the physical properties of print and sound combined in a technical, conceptual and processual analysis. In this sense German artist Olaf Hochherz and his Rooms to Carry Books Through CD release can be inspiring. He uses a set-up consisting of an electronic instrument and ten speakers. The speakers are meant to properly distribute sounds across the room. The instrument is made by a rather elaborated combination of piezoelectric contact microphones and piezoelectric speakers placed inside a book. He uses first editions of early cybernetic theorists' essays, so these particular books, with that specific text printed, so with specific thoughts distributed through ink in that particular way, is influencing the transmission of sounds trough the pages, becoming then both a resonator and a filter. The "instrument" he constructs is based then on the feedback which starts to flow between the piezo microphones and the speakers. In order to play it the composer presses his hands on the top of the book, thereby changing significantly the feedback conditions. [18] Although this system implies a complex external infrastructure, here the medium itself is induced to produce its own sounds, based on its specific physical properties, which are formally described also by its content, becoming the same object of the aural investigation and involving the listener in a sort of forced feedback.

Conclusions

The inclusion of the aural dimension within or aside to the printed page has been realised or simply attempted with various strategies aiming to expand the reading experience. As new technologies and new media have become available, the symbiosis between the sound-related content and the text commenting (an integration between two very different media) has become stronger and in multiple different balances. The current scenario includes a huge number of digital publications whose forms try to integrate text and sound as well, but are developed being prone to the easiest technical solution, more than conceptually keep the two elements on the same, or comparable level. The result is a disruption of the "reading experience," so consolidated in print and challenged instead in the ephemerality and instantaneousness of the screen. When it comes to including sound in a digital publishing format, the experiments made with print, should inform the digital embodiments, eventually investigate proper "hybrids," which would keep the reading flow intact embedding sound in a way that the reader could use the aural part as a natural component of his own reading experience, and

not just being a further element to cope with. These kind of publishing hybrids would eventually integrate the two media in a way that it won't be relevant anymore if the publication is printed or digital, but what kind of reading experience it is able to provide.

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De-schooling Product Design Education, an Experimental Physical Approach.

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Abstract

Nowadays we are living in a fluid geo-politic landscape, the emergence arts and educational movements are playing between material and immaterial, this can be read as a symptom of unstable situation. Consciousness and perception of reality are related to internal and external factors as the sum of collective and social interactions. On the other hand, awareness and consciousness have an epicentre through our body as internal milieu or interoception and from outside/inside as proprioception, the awareness of body in space. The ancient Aristotle's peripatetic School and the context of Zen Buddhism highlighted the senses and the experimental knowledge as the first important tool in order to cultivate intellect. We might assume that each of us perceive the world differently according to the culture where we live in. To be able to perceive again we need, as Ivan Illich suggested in 1971 in "Deschooling Society", de-institutionalize the society and perhaps the first step could be de-institutionalizing education. The article will describe an experimental blend between physical theatre and design education in a non-tactile society (Thailand). Moreover the article will explore and underline how a physical theatre approach could be an important stimulus for a product design education especially in Southeast-Asia.

Introduction

In 1971 Ivan Illich wrote that "the current search for new educational funnels must be reversed into the search for their institutional inverse: educational webs which heighten the opportunity for each one to transform each moment of his living into one of learning, sharing, and caring." [1]

Notably the field of Design Thinking according to Beacham and Shambaugh (2011) is organized in four levels "… design and society, organization, education, and the designer" (p. 338). [2]

It is vital to discuss the term 'social design' as expressed by Margolin Victor & Sylvia (2002): "The primary purpose of design for the market is creating products for sale. Conversely, the foremost intent of social design is the satisfaction of human needs" (p.25). [3]

In the same direction, stage designer Ming Cho Lee once said, "designing for the theater was not just a question of design but of the play's relationship to history, society, politics, religion — to life itself". [4]

With the term of de-schooling the author means reframing the process of learning. If we assume that the most important thing of design is how it effects the society then the tentative of reframing design education could lead to a progressive de-institutionalization of society.

Thanks to the analysis of the current curriculum in product design used in Thailand the author has noticed that between the first and final year the requested skills such as interpersonal and psychomotor are decreased and vice versa the request of technical expertise is rapidly increased. Through the approbation of school committee he has tried then to encapsulate a physical approach to design institutional education. The fist program in industrial design, established by the oldest public university in the country, has already fifty years of history. Industrial design in Thailand is based on Bauhaus school of Art (Germany, 1919-1933) educational model and underlines the craft practice. Moreover, in the last ten years several private institutions have opened product design programs. At the moment for the bachelor level there are only two international programs (conducted in english language) founded by private universities.

Design and Theatre

Design especially product design is often related to industrial and social discipline, its aim is to create a conscious relation between user-products and their impact into the context. Attila Grandpierre, in his "The Physics of Collective Consciousness", underlined the prime role of performing arts, quoting the words of Vekerdy, he said that theatrical artists, especially in the ancient Japanese Noh Theatre, have a great effect on audience in three ways: using words, hearing, by movements, through seeing and the use of intense emotion. [5]

In 1970, choreographer Mary Overlie started to work on an improvisation method called 'six-viewpoints' which has been developed furthermore by the directors and physical theatre practitioner Anne Bogart with Tina Landau into 'nine-viewpoints'. [6]

Likewise to the design universal principles, human body, time and their spatial relationship are considered

as key elements for the physical theatrical approach. Since the Bauhaus era through the experiment such as Triadisches ballet developed by Oskar Schelemeller, design and theatre are recognized as a prolific and inspiring blend. [7]

Generally in the design field the relation between user and the product is stressed, but on the other hand in theatre field the important aspect is the ability to explore, underlining the social impact of a specific object or action. We might assume that each of us can perceive the world differently according to the culture where we live in. The combination of the two disciplines could activate alternative scenarios. In the comparative study between the key elements of design developed since the Bauhaus art school (1919-1933) and theatre based on Six Viewpoints by M. Overlie (1970), there are many similitudes. For instance shape and rhythm are considered as key elements and in both cases the body is the center of the study. Nevertheless emotion is totally absent in the design side. The aim of this research is to understand and eventually suggest how to fill the design gap in term of emotion and how to express it thanks to the physical theatre approach. Cultivate consciousness, through the senses is the proposed outcome of this experiments.

Body Culture, Between Senses and Function

Since the beginning of heavy industrialization the quality of the products was improved thanks to physical, cognitive and ergonomics studies. For example Frank and Lillian Gilbreth expanded Taylor's methods to produce a management efficiency technique called the "time and motion study". [8]

In 1906 Charles Scott Sherrington developed Julius Scaliger "studies of the sense of locomotion" as Jerosch and Heisel (2010, p.107), introducing the terms "proprioception" about movement, "interoception", and "exteroception" related to organs such as eyes, ears, mouth, and skin. In addition early industrial and social modernity brought a new entertainment era trough theatrical extravaganza productions as Tiller Girls in England and Ziegfeld Follies in United States of America. Efficiency and power was highlighted by the modern father of body-building Sandow Trocadero Vaudevilles, produced by F. Ziegfeld Jr. and the "soul expression" by dancers as Isadora Duncan. [9]

Furthermore "Form follow function" by L. Sullivan (1896) was the mantra among architects and designers and therefore a focal point for educators. Notably at the Bauhaus in Germany the experiments between space and body leaded the designer and choreographer Oskar Schelemeller to develop the performance called Triadisches ballet (1922). The Americans Delsarte and Mensendieck formulated and analyzed motions and positions. In 1926 Dr. Mensendieck co-founded with the designer Frederick Kiesler and princess-actress Norina Matchabelli the Brooklyn International Theatre Arts

Institute, as highlight by Phillips, "a laboratory of the modern stage" (2010, p.93). [10]

Frederick Kiesler, subsequently in his article Pseudo-Functionalism in Modern Architecture, emphasized in 1949 his principles as following: "function follows vision. Vision follows reality". Farther Wolfgang Jonas (2001) in his paper A Scenario for Design identified the value of observation in two main levels. He suggested, "Any observation is based on the dualism of self-reference and external reference". To sum up: there is a "real world" which we cannot perceive as it "really" is (p.70). [11]

Correalism was Kiesler neologism for correlation, "an investigation into the laws of the inter-relationships of natural and man-made organisms". "Gesamtkunstwerk" became then the outcome of his peculiar approach.

Notably, the Ecological Systems Theory of Human Development (1979) defined by the psychologist Urie Bronfenbrenner expanded the idea of reality and the value of time 'Chronosystem' as part of the environmental systems that every individual interact. [12]

Meanwhile, in the theatre practice, time became by the directors Bogart and Landau, another key element to the early coined six-viewpoints (2004, p.6). [13]

Recently Clare J. Fowler (2003) explained how the system of "interoception" as a whole, it constitutes the material me and it relates to how we perceive feelings from our bodies that determine our mood, sense of wellbeing and emotions (p.1505). [14]

This has led the author of this study to develop a methodology within a framework of design education in South-East Asia. This study aims to explore how product design education through a physical theatre approach can open new opportunities to improve the quality of culture-related to design practice. Due to the mentioned study and experiments conducted in and out the classroom, the author developed a deep consciousness about the relation between the design practice and the importance of the body. Furthermore, while operating as lecturer in a non-tactile society he started to develop concepts about how to enact body action and reaction to help students to embed new 'theoretic' knowledge (examples: dot, line, plane). Meanwhile the collaborations between the author and physical theatre production enacted the idea to bring the performance into the classroom. Moreover the practice of physicality of the theatre blended with the design way of operating it seems the most suitable way to enact consciousness.

The framework

As this article proposes to cultivate the collective consciousness, the physical theatre has become an experimental approach to de-schooling product design education and this section will discuss the framework of this supposition. Thanks to the collaborations with physical theatre production, the topic of education started to be examined under the perspective of skills with firstly the clear separation between episteme and tekne as

expressed by Bernard Stiegler on Technics and Time, 1(1994), and secondly regarding the relation between the called network effect and human body (Stiegler, 2015). [15]

As previously mentioned, the study is based in Thailand; according to Richard D. Lewis (1996) "Thailand is non-tactile society." (p.472). [16]

This is referred to the physical personal space. Thais can stand close but they are not comfortable to have any body contact with strangers.

Consequentially, the educational approach to product design seems to have two main directions, firstly the Sullivan "Form Follow Function" that aims to empower efficiency, secondly Kiesler "function follow vision" as expression of inner sensations and emotions. Lockton (2010) offered in "Design for Intent", four ways to deliver a behaviour change as "Motivating behaviour", "Enabling behaviour" and "Constraining behaviour": He describes education as an incentive to change attitudes. [17]

In addition, as underlined by Phillips (2010) Brooklyn International Theatre Arts Institute in 1926, the associate actress Norina Matchabelli (aka Maria Carmi) believed that acting is an art of "co-relation" between the brain, soul, and body modelled through the art of training where "inborn unconscious talent" can be studied and enacted "consciously". [18]

In 1999, Hertz, in his published work called "Synesthetic Art: An Imaginary Number?" quoted the neurologist Richard Cytowic who explained that "Synesthesia Greek, syn = together + aisthesis = perception is the involuntary physical experience of a cross-modal association. That is, the stimulation of one sensory modality reliably causes a perception in one or more different senses (p.400)". [19]

Furthermore, A. R. Luria underlines that the 'synaesthetic sensations' is a state within an individual where 'there is no real borderline between perceptions and emotions (Luria, 1969, pp.28-80). [20]

Josephine Machon, (2011) in her book explains the three key performance strategies peculiar to the (syn) aesthetic performance style; the "(syn) aesthetic hybrid", which is a special manipulation of the gesamtkunstwerk, a predominance of the actual body as text in performance and an unusual rendering of writerly speech to establish a visceral-verbal play-text (p.4). [21]

In 2000 "Punckdrunk a theatre company" brought synesthetic approach to theatre and they called it "immersive" or "promenade". The physical theatre approach to product design education aims to create a gesamtkunstwerk, an art composed by multiple senses. From the author understanding Synaesthetic art might refer to either art created by synaesthetes as Carol Steen and Wassily Kandinsky or art created to convey the synaesthetic experience as some contemporary arts performance based on the work of Jerzy Grotowski. The limbo area between consciousness and unconsciousness became perhaps the area where alternative ways of education should focus their effort in order to gain access and motivating a behaviour change.

Freshmen, First Blended Approach.

As mentioned previously in the chapter Body Culture, Between Senses and Function, while operating as lecturer in a non-tactile society, the author started to analyze several ways to help first year students to familiarize with new theoretical concepts such as dot, line, plane, etc. Free hand drawings and brainstorming had a short effect into students memories, on the other hand after an encounter with theatre directors it was clear that the concept expressed by Jacques Lecoq, 'the body knows things about which the mind is ignorant' The Moving Body (2000, p.9). [22]

The first experimental approach was done in the oldest public university in Thailand, for a group of communication design freshmen between the ages of 17 and 19. The group was composed by a number of students from different education backgrounds such public, private and international schools. Objective of the session was to welcome the new students into the academic design studies context; a soft approach was requested. In order to initiate the students to theoretical concepts as time, space and the relation, enjoyment was the key element for the class. Therefore the choice to usability such as the human senses underlined the need to collaborate with a not industrial designer mind. As preventative measure, a physical theatre practitioner was invited to join the class. Students and lecturers reactions were surprisingly positive; the initial hesitation was quickly moderate thanks to the presence and full participation of instructors and students. There was no separation between audience and the performance, this because the author wanted to lead the students towards a physical and practical approach, where the students were free to express their emotions and fully understand, step by step each exercise. After several weeks all freshmen remembered and completely digested the first approach to design principles. Their mock-ups and concepts were realized trough all semesters and after such experience they understood and assimilated this approach.

Fig 1. *Self Confidence - Body Consciousness*, 2012, Author: Tommaso Maggio, Activity photo archive.

Academics and Practitioners, Icebreaking approach.

Two years later another experiment to blend performing arts and design was done. This time the context was an academic design and architecture conference hold by a private university in Thailand. The author of this article was part of the team who organized the event. In order to open a debate, due to the audience diversity in term of age, research and expertise, a common language was needed. The author together with the coordination event team proposed a theatre approach as opening of the conference. As previously mentioned similar key concepts are shared between design and theater field. For this experimental approach the role of theater was to motivate behaviour from observer to participant. With reference of the theatre approach of nine-viewpoints by A. Bogart and T. Landau, a physical theatre company was invited to perform. Following the symposium topic the performers prepared a script that was shared between the participants at the conference. All participants were divided into groups and each of them had to read aloud the script and act accordingly. No stage was set; all participants were sitting in a 'Socratic circle'. Performers acted independently from the script in response to gestures and spatial relations created time to time by and with the acting audience. Performance perhaps helped to shape a positive social climate that persuaded people to be a participative conference guest.

Fig 2. *Observer to Participant*, 2015, Author: Tommaso Maggio, Activity photo archive.

Moulding an International Product Design Curriculum

This experiment involves the fourth year students of an undergraduate international product design program as active participants of this study. Alternatively from the previous exercises this third experiment has been set up to introduce a major change into the product design curriculum. Specifically addressed to enlarge senior students' critical vision and expand their capacity of communication and social consciousness. A physical theatre approach became the key factor to encourage students to explore while thinking and making new concept. The course was planned according to three main objectives; firstly enforce students consciousness about human body and the relations with the space, secondly

inspire them with alternative point of views, and third understanding the theoretical common ground between disciplines. Classes ended up with a Socratic Circle, a conversation about experiences, feelings and how to express themselves. In order to achieve objectives, several backgrounds and various skills are needed; this has lead to a process of cooperation with a theatre director and a motion designer with a background in archaeology. Consequentially feedbacks became a structural part of the experiment; in order to let the students express their feelings and emotions, instructors tested several approaches as following:

1. Written statement.
2. Physical conceptual mock-up.
3. Socratic Circle in a small groups
4. 'Yes and', 'yes but' as key elements to lead a debate and explore the topic.
5. Physical Theatre reversal approach.
6. Creation of an "immersive space".

Those approaches could be reviewed as an expanded framework of the called Reciprocal Maieutic Approach, defined by Danilo Dolci, the Italian sociologist and popular educator, as a "collective exploration process that considers individuals' experience and intuition as a reference point" (Dolci, 1996). [23]

Therefore, senses of responsibility in individual and community, build a trust into the group are considered the activities core.

Fig 3. *Physical Theatre Approach,* 2015, Author: Tommaso Maggio, Activity photo archive.
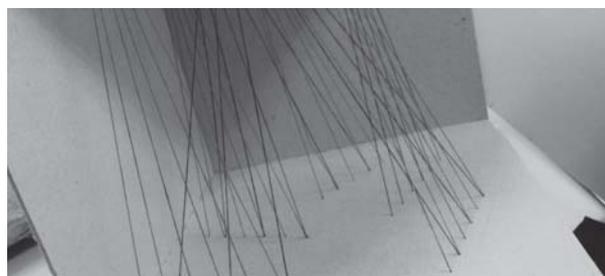

Fig 4. *Physical Conceptual Mock-Up,* 2015, Author: Tommaso Maggio, Activity photo archive.

Fig 5. *Immersive Space,* 2015, Author: Paper Author, Activity photo archive.

Findings

The three attempts to create an alternative stimulus in the context of design education in Thailand underlined the value to lead the students in an inner exploration of their feelings and emotions. Beside that the exercises, borrowed from the physical theatre practice, have highlighted the peculiar behaviour attitude of design students. Some extract from the author's observation (field note) underlines how, especially in the third case, the theoretical gap between disciplines bring most of the students out of their comfort zone, consequentially they first action was a non-reaction. Their main concern was how and why the request of blending theatre and design were made and on the other hand, students were wondering about what was the expectation of instructors. Therefore, through a one by one tutorial, students start to express their feeling. Notably, instructor team by professionals with different backgrounds allowed students to build an empathetic relation that lead to a collective self-confidence. One object-two people exercise showed how product design students can interact with physical elements with the objective to find new way to use it without the search of new meaning of it. With the exercise of filling an empty space through human body the students started to search for rhythm, visual pattern to balance the physical gap. First attempt to represent feelings and emotions with the use of three-dimensional model ended-up with physical ideas for theatrical space, subsequently the change of scale, from micro to macro, helped student to express their own feeling.

Weakness identified: Students were not sure about the instructor's method to evaluate their outcomes. Fourth year undergraduates often act and react (in term of designing) less spontaneously compared to freshmen. Alternative approach could be perceived as deterrent for overachievers' students.

Strength identified: Alternative approach is considered positive boost for low profile and average students. A lecturer's team holding different professional backgrounds, encourage students to perceive other realities. Designing the physical approach stimulated students to consider the full spectrum of senses, then the physical theatre approach stressed students to concern and be conscious about the social impact of their actions, therefore about their way of design.

Due to the author experience in order to enact consciousness the use of physical theatre should be combined within the umbrella of design. If we assume 'body is the mind' then this approach could be used in different kind of educations. It is also important to underline how this approach might be able to enact different reaction in different cultures.

The following diagram (figure 6) represents the three main areas of this paper such as: design, education and body, the consciousness aspect could be positioned as below.
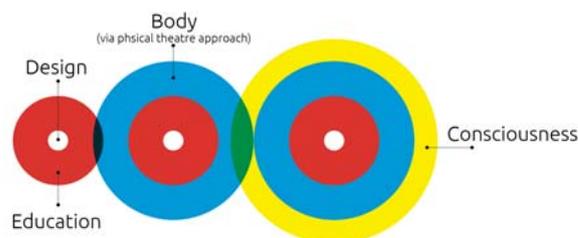
Fig 6. *Diagram*, 2016, Author: Tommaso Maggio, Activity photo archive.

Conclusions

The *designerly* way of thinking in order to be able to maintain spontaneity it has to be constantly reframed. De-schooling institutional of design education through micro-operations became equivalent to play at interstitial level. The main goal of this physical approach is to increase consciousness through micro-actions that change the behaviour. Students of communication and product design are accustomed to reply to any brief with a careful observation of the market. Their fictional target often became an unrealistic character. The blend of physical theatre with design education emphasizes the uses of the five senses and it increases and develops the dimension of self and collective consciousness. The motto "function follow vision. Vision follow reality" could be substituted with the "emotions create vision". Visions follow experience. The discovery and acceptance of personal emotion is the first step to lead the group towards a collective consciousness. Due to the fact that these attempts are conducted in a non-tactile society, a somatosensory approach need to be careful experimented. Through these experimental approaches perhaps students are expanding their learning process behind the product itself. The aim is to motivate behaviour, to originate the trust inside the group.

Further research will be done in order to build a way to lead design education to explore and reframing consciousness.

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A Webcam Interface for Somatic-Technological Dance Experiences

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Abstract

This paper discusses a recent mixed reality interface developed within the collaborative art-technology project Senses Places, a participatory performance environment. The present webcam interface works by motion detection algorithms created through the frame difference method and responds to a critical need from the somatic-technological dance approach. Captured by a webcam, the participant's movements are exported into a 3D Virtual World where they trigger pre-set animations in an avatar, according to choreographic improvisation principles. Senses Places fosters mixed reality performance events that gather performers and visiting physical and online participants from all over the world in a virtual place, where they engage kinaesthetically in new shared embodied mediated experiences towards expanding awareness to cross geographic, cultural, disciplinary, artistic and human boundaries.

Introduction

Senses Places (SP) is a long term dance-technology project, producing new and transgressive artistic concepts, designs, and experiences aiming to bring the focus to *posthuman corporealities*. [1], [2], [3] The project's somatic-technological dance approach is geared to expand, instead of shrinking, the subjects' physical body communication capacities through its virtualizations. It departs from dance, performance and new media theory-practice studies, Eastern-Western contemporary movement and dance practices, such as Contact Improvisation and Butoh, interweaving somatic practices, like Body-Mind Centring, Release, and Alexander Techniques, and ancient Tai Chi and Yoga. [4], [5]

Through scheduled events, welcoming anyone who wants to join, participants from all over the world, with different cultures and areas of expertise meet virtually and perform together. They focus on the perceived sensations from theirs and others' physical, video recorded and avatar embodiments and the overall hybrid environment. The main collaborators come from Portugal, New Zealand, Japan, Newfoundland, the Netherlands and Brazil, intensifying and diversifying the cross-cultural and disciplinary somatic-technological performance experimentation.

Background

SP engages with multiple areas of study, both artistic and technological. Within the technological field, we approach subjects related to computer vision and more recent with biometric statistics. For example, through a biometric device, we are able to connect the participant's cardiac beat with the lights and sounds in the physical and in virtual worlds.

Interface device creative experimentation focuses on choreographing/designing the interactivity of inter-subjective experiences. [1] The SP project wants to bring attention back to the participants' and avatars' embodied interaction with and through their environment, producing kinaesthetic exchanges. [6] The quality of the experience is raw, unfinished, unpolished and emergent, due to the multiple components involved and its participatory nature, conducive to artistic creation. [7]

SP started in 2007 as Real Virtual Games, focusing on breaking video game interface stereotypes through cooperative embodiment interfacing. [1] With the integration of 3D Virtual World (3DVW) Second Life® (SL), a Multi-User Virtual Environment (MUVE), it got more ambitious, developing avatar animations, through motion capture and spreadsheet methods and creating new interfaces and gadgets that involve connections via Webcam, Wii Remote, Kinect and a biometric device.

First performance experiences experimented with physical world video streams fed into the virtual world, while the virtual world was projected back into the physical world, converging embodiment and realities (see Figure 1).

Although initially the avatar's movements were predetermined, from the very beginning of the project the concept of perceiving the avatar as a dance partner with whom it was possible to interact helped the participants to move in an open improvised manner. That was the motivation to create new ways to merge both worlds via a webcam, among others interfaces.

Fig 1. *A dancer testing a biometric device with responsive colour LEDs and interacting with an avatar in an SL projection,* 2010, Isabel Valverde, original snapshot.

Choreographic Approach

The project's inclusive cross-cultural intertwining of technological and somatic-based contemporary dance aims to aesthetically intervene in the creation of new channels for kinaesthetic empathy and communication through/between our senses and places, opposing the generalized physical body instrumentalization and replacement. [1] The overall dynamic, rooted in kinesthesis, is conducive to the participant's increasingly shifting and encompassing focus within the complexity of the intermodal embodied experience.

By engaging in this atmosphere where improvisation is crucial, performers are stimulated to move in ways that might be unfamiliar. It encourages the participants to go out of their comfort zones and explore other embodied engagements. We approach a new way of choreography as an interactive experience based on the unpredictability, resulted by the human-avatar and the avatar-avatar connections. The movement flows from following a multiplicity of internal and external bodies' stimuli, amplifying the awareness of each moment of the immersive experience and intensifying the unexpected, intersubjective and collective engagements.

Webcam Interface

The webcam interface within SP is used to expand the subject's movements by triggering different animations on an avatar, and was first presented as Interface 2.0 in 2010. [8] It provides a way to sense the participant's upper body movements and send the information about which part of the body moved into the MUVE. There, an avatar animation is activated accordingly (see Figures 2 and 3). By doing so, the webcam interface contributes to connect the participants to their avatars and to each other, creating a hybrid embodied improvisation environment.

Since 2010, this interface has been generally used in all SP performances and by anyone in SL with access to a webcam, spreading this experience worldwide.
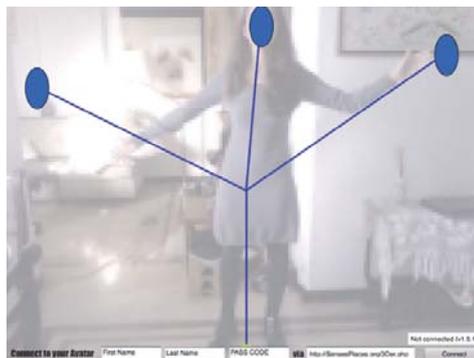
Fig 2. *The webcam interface developed in 2010,* 2015, Joana Martins, original snapshot.

Developing the Webcam Interface

The webcam interface is implemented on a webpage in an embedded Adobe® Flash® component. This provides access to the interface from any web browser on the Internet. Participants after entering in a SP session are offered, from within the 3DVW, a script that is an object to be attached to their avatar as a heads up display (HUD). When the HUD is attached to their avatar, they receive the corresponding instructions of how to login to the webcam interface via a webpage. After permission to use the webcam is given, the webpage displays a video of the webcam view with a superimposed graphical abstraction of a "skeleton" (as in Figure 2) with circles connected by lines, representing a possible location for detected head, hands and torso in movement.

The interface is treated as a game controller that causes action in the 3DVW. All detected movements by the webcam are naively treated as anthropic movement. People using the interface tend to adjust their position to match the layout of the "skeleton", or alter this correspondence through improvisation, by moving out of the vertical axis and approaching or distancing from the webcam (see Figure 3). Yet another mode, disguising the "skeleton", includes several people moving in space within the range of the webcam triggering more animation on sole avatar.
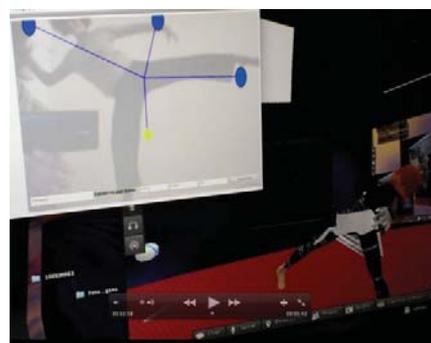
Fig 3. *A dancer interacting with an avatar through the webcam interface,* 2010, Isabel Valverde, original snapshot.

The data supplied to the 3DVW with SP's 2010 webcam interface (see Figure 2), while sufficient for activating

some upper body movement, were missing details about the upper body, and no data about the lower body were provided. Hence, in the triggered animations, detailed movement of the upper body and all of the lower body in the 3DVW are created as an optional choreographic "effect" rather than matching control by participants.

Improvement in the Webcam Interface

The webcam interface is being developed further using a frame difference method with HTML5 as the implementation platform. While the platform continues to provide access to the interface through a webpage (as described above), it also has now the potential to run on any device running an advanced web browser. [9] Participant's movement detection presently includes the lower body pelvis and members, leading to more complete full body data in the 3DVW. We started experimenting with eleven body parts (head, hands, feet, knees, elbows, pelvis and chest), but as the image got too chaotic with the simultaneously movement of so many nodes, we decided to eliminate the nodes corresponding to elbows and knees, achieving the final representation shown in Figure 4.

Fig 4. *SP webcam interface with seven nodes mixed with streaming, during a performance,* 2015, Isabel Valverde, original snapshot.

The algorithm created to recognize and track the movement is based on the frame difference method. This technique starts from the assumption that the background is static and compares the pixels of the frames captured in very small time intervals (Δt). [10] If the absolute difference comes to a value above the defined threshold (Γ), it means that the pixel has changed and therefore there was movement.

This method can be described by the following formula:

$$D_k = \begin{cases} 1, \text{if } |f_k \text{-} f_{k-1}| \geq \Gamma \\ 0, \text{if } |f_k \text{-} f_{k-1}| < \Gamma \end{cases}, \qquad (1)$$

where D_k represents the binary result of the absolute difference of a pixel between two consecutive frames (f_k and f_{k-1}). The difference of all frame pixels gives us a collection of binary numbers that, ultimately, will translate the movement (see Figure 5).

Fig 5. *Binary image of a hand movement*, 2015, Joana Martins, original image.

This technique allows a good recognition of the movement, but it was also important for our final objective that it could also distinguish which different body parts are moving. However, this has proven to be a very difficult task, involving complex algorithms that are not suitable for real time online performances. [11], [12] Therefore, presently the only actual body part that we are able to distinctively detect with an acceptable computational efficiency is the head. The human face has unique features that allow its quick recognition, besides it does not change its shape drastically, as e.g. hands do. In order to implement the head detection, we used the well-known object detection method developed by Viola and Jones. [13] When the face is obstructed or it cannot be recognized for some reason, the interface resumes by applying the framed difference algorithm. Attempting to distinguish somehow the movement of the other body parts, we divided the overall frame into different regions, as can be seen in Figure 6. Some areas are shared by different body parts, and in those overlapping areas the node that is responsible for the movement is the one that is closest to that region. Moreover, from a region frame to another (Δt), there is a maximum distance that a given part of the skeleton can move.
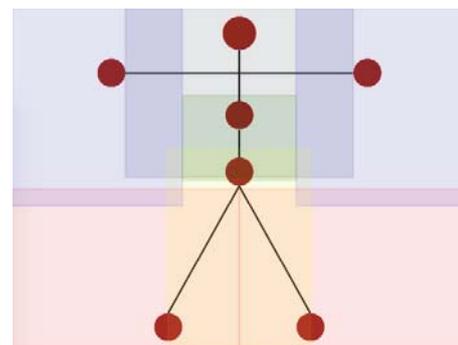
Fig 6. *Regions that detect the different body parts,* 2015, Joana Martins, original image.

As a result, this new version of the webcam interface makes a more reliable recognition of the human movement, which grants more freedom to the participants, allowing them to express themselves candidly.

Improvement of the Virtual World Scripts

The connection to the 3DVW of the new version of the interface is made almost in the same way as for the first

webcam interface. When a movement is detected, the information about which node moved is sent to a PHP script on a web server. With this new version, we also send the coordinates to where the node moved to the PHP. Then, the script in the virtual world pulls this information to animate the avatar.

Firstly, together with the first implementation of the interface, the 3DVW received information about what body part moved and then it randomly selected between four animations pre-set to be connected to that node. Now, we implemented two different kinds of 3DVW scripts. One script is based on the previous one, and it's only concerned about which node has moved. After that recognition it selects arbitrarily one of the four animations pre-selected for that boy part. The second script also detects which node has moved, but afterwards triggers a related animation to the corresponding spatial location of the node. We also created animations in the biovision hierarchy (BVH) format to better establish a correspondence between where the nodes are and what animation the avatar performs.

As a result, the new webcam interface, providing data with a much more detailed level, allows participants to have a finer degree of control on avatars' animations, which may provide more engagement and a stronger sense of immersion (see Figure 7).

Fig 7. *SP interface with seven nodes in connection with SL, in a SP' performance,* 2016, Joana Martins, original snapshot.

What's next?

In the near future, we plan to create more animations for the SL platform to better integrate the participants' movements with their avatar. With further use of motion capture, we will be able to create better animations that more accurately suit our somatic-technological choreographic approach.

A new improvement that we hope to achieve soon is to give more freedom to the avatar. Presently, there are interfaces that trigger different animations (using a webcam) and there is one that controls the avatar's movement in space (using a Wii Remote). The ideal interface would join both these strengths into one. By doing so we could more easily perceive the avatar as a dance partner that moves along with and in relation to us, and to other avatars through space and time, creating a richer sensitive and emergent environment with more choreographic options.

This project innovates in many ways, both artistic and technological. The system developed for the new interface can also be applied in engineering, to act like a sensor, to control and to simulate e.g. different scenarios improving computer vision. These functional extrapolations bring agency to the influence of SP's inventive and original nature.

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Convergence and Divergence:
A Conceptual Model for Digital Serendipitous Systems

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Abstract

When we are completely free to choose what we want to read or watch, the question becomes: how do we know what we should be reading or watching.

With the transition from curation to user-initiated methods of discovery of digital information, such as search, came the necessity for information discovery methods that enable us to encounter new and surprising information that broadens our horizons and enriches our understanding of the world. In other words, systems that promote serendipity.

Interactive digital systems that answer this issue are currently being developed, many with the explicit purpose of introducing or engineering serendipity into our digital interactions. However, in our research on serendipitous systems, we discovered that interpretations of serendipity were varied and often contradictory. This led to a lack of definition of what a serendipitous system was exactly, necessitating constant qualification. As such, we propose a distinction of these serendipitous systems according not to their proposed goal – serendipity – but their methods: convergence or divergence. Through this classification we are able to identify both the systems' ideological pretensions as well as what methods and mechanics they employ to do so.

Serendipity

Over the last few years we have witnessed a growing emphasis on the subject of serendipity in digital interactions. Some highlight the potential of the digital media (and the Web in particular) as a serendipitous machine while others alert to the fact that the current methods for discovering and interacting with digital information are destroying the potential for true serendipitous experiences.[1] Nonetheless, it is becoming increasingly obvious the value of serendipitous experiences in our interactions with digital information,

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[1]An example of this debate can be found in a blog post of the author Nicholas Carr entitled "The serendipity machine is low on oil" [1], a reply to the blog post by author Steven Berlin Johnson with the title "Can We Please Kill This Meme Now" [2], which is, in itself, a reply to an op-ed by William McKeen on "The endangered joy of serendipity" [3], all authors with distinct positions on the impact of the web on serendipity.

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be it in the discovery of new content [4] [5], social and professional interactions [6] or while interacting with personal digital media [7] [8].

To address this, a number of systems have been designed with the explicit goal of provoking serendipity when interacting with digital objects. However, the interpretations of what exactly serendipity is vary from system to system. To some, serendipity is "a trigger of exciting discoveries when we least expect it" [9], to others "a meaningful experience arising from chance encounters." [8], others still define serendipity as the making of "fortunate discoveries by accident" [10]. As the definition of serendipity varies, so do the methods to achieve it. In our research we identified two main distinctions in both the interpretation of what serendipity means and the methods to achieve it: one which we define as *convergent* and another which we define, by extension, as *divergent*.

We propose these two concepts as key differentiators in the classification of serendipitous systems based not in their ultimate goal (i.e. to design, engineer, encourage or provoke serendipity), but in a bottom-up fashion, through the methods they utilise to achieve their goal of serendipity. Through this, we are able to accommodate different interpretations of serendipity while, at the same time, differentiate these distinct systems, grouping them within similar ones and qualifying the discussion.

Daily Me and Daily Us

In his 1995 book *Being Digital*, Nicholas Negroponte foresaw this divide between convergent and divergent systems through two examples of what could be the future of newspapers: The *Daily Me* and the *Daily Us*.

> What if a newspaper company were willing to put its entire staff at your beck and call for one edition? It would mix headline news with "less important" stories relating to acquaintances, people you will see tomorrow, and places you are about to go to or have just come from. It would report on companies you know. [...] Call it The Daily Me. [11]

This *Daily Me* – a convergent system – would show only what it perceived to be relevant to a particular reader and would be one's sole source for news throughout the day, a way to keep up with only what would be of interest.

20 years later and we have the Daily Me, although not centralised in one singular platform, but distributed between several, such as social networks and news aggregators. In some – such as *Flipboard* or the RSS feed aggregator *Feedly* – we decide what our interests are and the systems pull content accordingly. In others – such as the social networks *Facebook* or *Twitter* – we define "whom" we're interested in, and we let others become our curators of the world, while the platforms act as mediators (an active interface between user, network and information).

While the goal of relevance of convergent systems is of particular important in commercial applications, authors such as Steven Johnson and Cass Sunstein highlighted the possible impact of a personalised, Daily Me-like news source [12] [13], as the increased positive feedback in one single direction – that of the user's preferences – would result in an echo-chamber in which we would only listen to those who shared our beliefs [14], which raises the question of the role these systems can have in shaping the values and opinions of those who use and rely in them.

In the paragraph immediately following the description of the Daily Me, Negroponte describes the Daily Us, an example of a *divergent* system, to which one would resort to when wishing "to experience the news with much more serendipity, learning about things we never knew we were interested in" [11].

If the *Daily Me* is built upon personalisation, the *Daily Us* relies on heterogeneity, on the information that might not be directly relevant to the reader and that lies beyond her known interests. Information that the reader might not necessarily want but, nonetheless, might *need* to know. This is the essence of a divergent system: exposure to information beyond the perceivable interests of the user.

While we are able to see various examples of a *Daily Me* in practice and that take advantage of the possibilities of the digital medium, the same can't be said for a truly serendipitous Daily Us.

Social networks such as *Facebook* and *Twitter* have the potential to be a divergent system, acting like a *Daily Us*, if one would take the initiative to add diverse voices to our network of connections, although we seldom do. As such, building upon our friends, and friends of friends, ends up contributing to our natural propensity for homophily, as those who we add to our inner circle of connections tend to share our interests and beliefs. Facebook itself is not a neutral party but acts in order to deliver information that it perceives are useful and relevant for us, hiding those which its algorithm perceives to be less relevant.

Crowd-curated news aggregators such as *Digg*, *Reddit* and *Slashdot* could also be a possible *Daily Us* example, as these platforms allow users to "upvote" or "downvote" (in the particular case of *Reddit*) specific content, creating a platform in which the content perceived to be the most interesting or commented upon

at a particular moment rises to the top. However, due to the particular demography of these platforms (mostly US males between the ages of 18 and 29) what ends getting up-voted the most is the type of content that fits to the interests to this particular demographic, consequently hiding other content that lies beyond their interest and preventing these from being true divergent systems.

While digital newspapers are perhaps, still, the best bet for a Daily Us/divergent, unpersonalised, source of information (particularly since they do not suffer from the constraints of the printed format), these tend to privilege local news, limiting their potential for truly broadening the horizons of the reader, while not truly exploring the full potential of the digital medium for the serendipitous discovery of information.

The Mechanics of Convergent and Divergent systems

Convergent systems approach serendipity as the discovery of the right thing at the right time, by catering to the user's perceived intentions, interests and tastes. To do so, they resort to user-profiling and machine-learning, gathering all possible information regarding the user and her patterns in order to more precisely cater content accordingly.

Perhaps the earliest example of a convergent system is *Fishwrap*, "an experimental electronic newspaper system". This system, developed at MIT, would draw – from a pool of four thousand stories a day delivered via the Associated Press, Knight-Ridder, and Reuters wire services – stories regarding a student's hometown, favourite sports teams and other topics of interest.

Another example of a convergent system is *Netflix*, the provider of on-demand Internet streaming media. When the user first creates an account on Netflix, she is asked to choose some of her favourite films or television series. Through those initial choices, the platform optimises the presented content accordingly. Furthermore, the platform constantly tracks the viewing habits of the user, adapting the graphical user interface accordingly. While navigating Netflix's user interface (UI), we clearly see how our declared interests and viewing history affect the content that is being presented.

MIT's *Serendipity* project [15] is an example of a convergent system aiming for serendipitous connections between people, by encouraging professional "synergies" that otherwise would remain unnoticed within professional environments. Users of the service would register in a match-making service, declaring their interests, skills and needs, while turning an "available" mode in a Bluetooth enabled mobile phone. This would allow for ad hoc, serendipitous connections between individuals with shared interests or complementary needs.

Perhaps the definitive example of a convergent system is *Google Search*. When using *Google Search*, the results

presented to the user are based on hundreds of (non-disclosed) signals that tailor the content accordingly.

While results presented in *Google Search* were initially ranked solely by Google's Page Rank algorithm–which looked at the websites themselves–such is no longer the case. Nowadays, the results are a combination of a variety of different factors, such as the Page Rank algorithm as well as a multitude of information regarding the user: search and click history, location, language, operating system, among others.

While convergent systems make use of data in order to cater towards the perceived interests of the users, divergent systems promote the exposure to different, unpredictable information, outside of the user's interests. To do this they rely on chance and randomness and while divergent systems can also use machine-learning and user profiling,[2] they do so in order to present what lies outside of the user's profile.

Chatroulette.com or *randomyoutube.net* are examples of divergent systems where randomness is a key mechanic. In the former, two users are randomly paired with each other for video-based interactions while in the latter, users can watch a random video from YouTube.

Serendipitor, by Max Sheppard, is an example of a divergent system which proposes to re-introduce serendipity, unpredictability and chance to our daily navigations of our cities. Questioning if we are becoming too reliant on applications to optimise our lives and experiences, Sheppard and his team created a navigation application for a smartphone inspired by Guy Debord's *dérive*, in which you state your current location, your desired destination, and it suggests possible routes you can take, while suggesting activities to do while you get there. Some of these suggestions can be rather surreal, such as "Head east toward [street name] and then follow a cloud. If there are no clouds, make some. Take a photo of them."

While divergent systems are often capable of presenting surprising and unexpected content, possibly leading to serendipity through unpredictability, they can generate more noise than signal, which could ultimately lead to a disinterest on the system itself from the user. Convergent systems, on the other hand, can offer highly relevant content directed to the user's known interests and values, however, intensive use of personalisation could lead to an echo-chamber, trapping the user in a feedback loop of positive reinforcement.

We need, however, to distinguish between Absolute Convergence and Divergence from Relative Convergence and Divergence.

In Absolute Convergent (A-Convergent for short) systems, all data leads to one representation of the user. This representation, while constantly improving, would be the canonical representation of the user's interests, such as with *Google Search* or, for example, *YouTube*.

Relative Convergent (R-Convergent) systems, on the other hand, create distinct representations of the user based on different entry points, which may not relate to each other. Going back to Netflix, certain recommendations are specifically based on things the user has previously seen. This can also be observed on online shopping platforms such as *Amazon*, which recommends certain items based on particular items the user has viewed or purchased before. The suggestions aren't being created on the whole of the user's actions, as in *Google Search*, but on specific actions.

Absolute Divergence (A-Divergence) would occur when the system would give a different result every single time, without limiting factors. If we return to the case of *randomyoutube.net*, while there is a chance one would see the same video twice, given the 2.907.475 random videos available to the platform (more if we consider the entirety of *YouTube*), this is highly unlikely, making it virtually A-Divergent.

Relative Divergent (R-Divergent) systems are those who diverge within specific parameters, for example, the shuffle mechanic in media players, when applied to an album or a specific playlist: the results are unpredictable but constrained to that same album or playlist.

Conclusions and Future Work

As serendipity becomes an ever increasing concern in the design and development of digital interactive systems, so does the need for a rigorous terminology regarding the approaches these systems have in regards to serendipity.

In this paper we've explored the notions of both absolute and relative convergency as well as absolute and relative divergency as possibly useful concepts for systems that aim for serendipitous experiences, by describing their ideological claims as well as the methods they applied to do so.

We aim to further develop these ideas, as well as expand the discussion to the possible political and economical implications of convergent and divergent systems, as well as their respective influence on those who use them.

We also intend to further explore the notion of convergent and divergent systems, including the role curation can have in them, possibly expanding into a more broadened scale beyond this dichotomy, one that accommodates hybrid systems that use both convergent and divergent mechanics. We aim to test and observe the distinct mechanics these systems employ and measure their relative impact in the serendipitous discoveries of information.

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[2]   Although they rarely do.

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Going beyond the glitch art. Critical glitch studies as a new research paradigm for analyzing post-digital technologies

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Abstract

The paper proposes to re-examine a critical potential of glitches for studying contemporary media and computational technologies. Specifically, it shows how the dominant user interaction and digital representation narratives based on the illusion of seamless interaction, fluid continuity and perfect automation, can be critically challenged through emphasizing visual glitches in media content and in the GUIs. The research uses Heidegger's things taxonomy (Conspicuousness, Obtrusiveness, Obstinacy) to conceptualize the ontic and aesthetic status of glitches that are manifesting in contemporary real-time, cloud-based, multimedia software. Postphenomenological standpoints developed by Peter Paul Verbeek and Don Ihde are also used to support the argument. Contemporary technological milieu is examined in the light of the "post-digital" approach (advocated i.e. by David Berry, Florian Cramer, Soren Pold & Christian Ulrik Andersen). The "Pirate Cinema" project by Nicolas Maigret, which makes the hidden activity and geography of P2P file sharing visible and the "Universal Texture" project by Clement Valla, which critically analyzes glitches in Google Earth, are used as case studys.

Technology and the post-digital

Contemporary popular culture narratives on human and society-technology interaction are based on the notions of seamless interaction, automation, immateriality of software. Computational technologies have become embedded into the world through ubiquitous computing, wireless communication and mobile devices.

Consequently, many scholars argue that we have entered the post-digital era that is marked by obfuscation of consumer computational technologies through black-box hardware and multi-layered software (e.g. David Berry [1], [2], Florian Cramer [3], Olga Goriunova, Alexiey Schulgin [4], Benjamin Mako Hill [5] and others.) In this light the post-digital should not be understood as a new temporal period that comes after the "digital" as its prefix would suggest. The post-digital rather strives to characterize new economic, social and cultural contexts that have been introduced in the last decade due to the general evolution of computational technologies towards even more autonomous systems, ubiquitous devices, real-time and cloud-based software and services.

Post-digital glitch studies and Heidegger's philosophy of things

The author argues that in order to critically examine cultural impact of the latest computational technologies we should rather turn to studying certain software and hardware in the state of failure – focus on glitches and errors in their everyday functioning. Consequently, the author proposes to reassess the critical potential of glitches by going beyond the glitch aesthetics of predefined glitch filters or emulated / simulated glitches and focusing instead on glitches appearing in everyday interactions with digital media and technologies. [6], [7]

A glitch offers a unique epistemic perspective. The unexpected error caused by the inability of the software to process real-time data or an inadequate capacity to recognize and recombine images into a functioning single image, reveals not only the software's inner structure [8], but also makes visible the limitations of real-time data transmission and makes the omnipotence of digital quantification questionable. Glitches in web-based graphical user interfaces, video-streaming services, or satellite imagery services are one of the last remaining instances of the unreadiness-to-hand of the computational in the era of multi-layered autonomous software and ultra high-resolution display systems. [9], [10]

We could then argue that a glitch becomes a manifestation of a malfunctioning piece of equipment that emerges from a functional transparency or immediacy of a computational system and becomes a sign of its unready-to-hand condition. It should be also emphasized that a glitch goes beyond a binary distinction between working and not-working computational system, it is rather situated in-between these two states.

Using Heidegger's terms, a glitch present in digital visual media introduces a state of obstinacy, when a particular visual media file (image, video) or an element of a graphical user interface has been partially processed and displayed because of an unexpected computational error that "gets in the way". However, as argued above, a glitch does not lead to the state of conspicuousness – to a complete failure of a computational system. Nonetheless,

it is sufficient to sever the illusion of seamless interaction with the computational as well as the fluid continuity of the post-digital media.

For this particular reason, applying the post-digital approach and Heidegger's objects taxonomy to visual glitches would give us a productive research paradigm for a critical analysis of the inner logic and aesthetic manifestations of contemporary real-time and cloud-based computational technologies – ever changing data streams, based on protocols, and standardized tools. [11], [12], [13] However, taking into account the complexity of todays technological milieu, we should now move from classic phenomenological approach (Heidegger) to a post-postphenomenological approach (advocated i.e. by Don Hide and Peter-Paul Verbeek). This standpoint concentrates on concrete technological devices and objects, rather than on general conditions of technological being in the world.

Glitches in the post-digital media ecosystems and artworks

Following Verbeek's postphenomenological suggestion to study technology in terms of concrete artifacts, two art projects that rely on glitches, have been chosen to illustrate a practical application of the theoretical approach that was presented in the first section of the paper. Both the "Universal Texture" project by Clement Valla and the "Pirate Cinema" project by Nicholas Maigret are critical art interventions addressing real-time, cloud based image processing technologies and data transmission protocols.

Clement Valla, a New York-based artist, has critically analyzed glitches in Google Earth, which appear as distorted images of earth's surface i.e. drooping roads and bridges. His analysis resulted in the "Universal Texture" artwork presented in 2012. [14] According to Valla, Google uses Universal Texture mapping system which uses hybrid images, a patchwork of two-dimensional photographic data and three-dimensional topographic data extracted from a slew of sources, data-mined, pre-processed, blended and merged in real-time in order to create this particular god-like fluid planetary navigation system – Google Earth. [15]

Valla argues that drooping roads and bridges, distorted building facades in Google Earth are not in fact mere errors but rather anomalies within an inner logic of the computational system. Clearly, their existence does not lead to a complete breakdown of Google Earth. Consequently, they should be rather considered as noise, anomaly or as Heidegger would put it – an obstinacy within a functioning system. Ihde would say that glitches introduce a different technological intentionality into Google Earth application.

Many glitches that appear in contemporary visual media are symptomatic for the technologies of the post-digital age. The author argues that they reveal a new model of seeing and of representing our world. Software and tools of the post-digital era are based on dynamic, ever-changing data from a myriad of different sources, which are endlessly combined and constantly updated to create an illusion of seamless interaction and perfect automation. Google Earth is an example of such a system, being in fact an interface for the assemblage of data coming from various stakeholders and sources. The data is constantly updated, and Valla claims that many of these glitches had disappeared from the system due to improvements in the algorithms. The post-digital era is marked by the logic of constant, seamless and equally obfuscated updates, which do not longer take place at the interface level. Todays cloud-based and ubiquitous computing systems i.e. Google, Facebook algorithms, are being constantly rewritten and updated, often without user's knowledge. Noticing, analyzing and archiving glitches in the ever-changing post-digital technologies is one of the few practices that enable us to critically reflect on development of flux technologies of the post-digital age. Following Ihde, we could argue that glitches are phenomena manifested as (micro)perceptions in user-application interaction. Only due to this particular state of obstinacy, a new macroperception, understood as a new framework or cultural context opposing the seamless interaction and perfect representation paradigms, emerges. [16]

The "Pirate Cinema" by Nicolas Maigret is another artistic intervention that uses glitches to critically examine contemporary technologies. [17] It produces cut-ups from media files shared on P2P networks in real-time. Maigret argues that "this immediate and fragmentary rendering of digital activity (…) depicts the topology of digital media consumption and uncontrolled content dissemination in a connected world."

Thanks to glitch aesthetics the underlying mechanics of protocological and packet media transmission can be revealed. Image breakdowns and pixelization are results of loss in data packets transmission or even temporal unavailability of data. The "Pirate Cinema" visualizes a specific micro-temporality of networked and real-time based media in the post-digital age. The usual continuity and immediacy of the high definition media content is challenged through the state of obstinacy, an unready-at-hand condition manifested through glitch aesthetics. The whole process take place in real-time, unveiling the fact that beneath the interface level, the computational in the post-digital age is in fact composed of chaotic and unstable (data) scraps.

Conclusion

The materiality of contemporary real-time, cloud-based, multimedia systems has been lost in the logic of constant updates, data streams and autonomous systems at the technological level. The user interaction level has been dominated by the illusion of seamless interaction and perfect visual representation. The author proposes to challenge this situation by studying certain computational ecosystems in the state of failure. Critical glitch studies based on an ontic analysis of glitches and informed by the post-digital, an approach that takes into account the specificities of todays technologies, and last

but not least, inspired by a critical artistic interventions, are one of possible responses to opening the black-box of todays computational systems. This action should be considered is a first step in analyzing social, cultural, and political impact of the computational for our civilization.

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"Vernacular Sound": System for Soundscaping of Everyday Objects

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Abstract

Creating sound in diverse spaces to generate timbre without limitations and enhance experience in soundscape has been an essential issue for sound artists. We used concept of 'Vernacular' as an appropriation for Soundscape of everyday object, allowing listener to compete the current sound consuming environment which eliminates noise during the process of sound recording.

We reviewed previous works on soundscape, noise art and object used in sound art to enhance the sound space experience. We designed a system for soundscaping, Vernacular Sound, consists of two main parts: (1) audio effect which computes the sound space of the object and (2) audio visualization which enables interaction between the listener and the sound space via Kinect. With 'Vernacular Sound' system, our purpose is to provide new experience of listening to sound using everyday objects.

Introduction

"Vernacular" in art refers to the objects shaped by ordinary people in unselfconscious and uninhibited, out of the elements of their environment. [1] In photography Geoffrey Batchen states that the significance of vernacular photography is to explore the artistic qualities of vernacular objects, granting them the same intellectual and aesthetic potential. [2]

In this paper, the word "vernacular" is introduced in the soundscape system of a collection of everyday objects: Vernacular Sound. The aim of this work is to provide participants with a new method to manipulate sound while producing it with everyday objects, leading enhanced experience in both affected sound and interactive audio visualization.

Vernacular Sound is capable of collecting the sound space characteristics of an object; these characteristics and materials of the object can be used to construct listening rooms. The idea of studying the internal structure of everyday objects for acoustic space simulation was derived from noise artists.

In the 21st century, sounds that are frequently heard in daily life generally belong to the category of "music"; these are transmitted sounds, tuned and modified. These sounds are played through various types of speakers via internet streaming sites, radios, smartphones, and televisions. Listeners are accustomed to typical sound traits from these media, which place importance on the analytic clarity, immediacy, and tactile proximity of sound. [3] Douglas Kahn claims that acoustics and western art music were both used to distinguish between music and noise. [4] The current sound consuming environment concentrate on diminishing noise during the process of sound recording. In such conditions, the sound space is perceived mainly as a reverberation set-up for listening to music, which compels the listener to develop a passive attitude towards the process of generating sound. There has been an several approaches to extent the passive attitude toward this noise filtered music among sound artists.

Previous Works

Environment and Sound

In his "1960 Lecture," La Monte Young proclaimed that "getting inside of sound to some extent so that we can experience another world" is the ultimate objective of sound. [5] Similarly, R. Murray Schafer's World Soundscape Project (WSP) in the late 1960s is a "soundscape composition," which creates an environment of sound as a composition tool for music without elimination of noise. Since time immemorial, noise and environment in space have shown potential in creating sound. We found out that at the sound production stage, sound originating from noise and environmental characteristics are separated from music to make the music more distinct and refined. However, by using everyday objects, unusual surroundings can be fabricated, which enhance the experience of the participants in listening to sound.

Milestones of Noise-Art

Incorporating noise in sound art has been of significant importance in music. Italian futurist Luigi Russolo overcame the limitations of pure sound and composed symphonies with an infinite variety of noise-sounds. [6] Experimental sound artwork focusing on noise is also found in John Cage's Fontana Mix, which contains eclectic blends of noise sounds such as outdoor sound, recorded music, and electronic effects, which brings together casual everyday life noise to compose music. [7] In Variations II, Cage listed six lines for measuring sound components using the following variables: frequency, duration, timbre, amplitude, and the point of occurrence within the whole time span of the performance and overall structure of the event (such as number of tones). Here, the usual form of western music: melody, harmony, rhythm, phrasing and structure is replaced. From his aesthetic point of view, unintended sounds are converted into music. His composition 4'33" involves noise as a sound elaborated through compositional, auditive, and physical means associated with music by integrating noise with music. [8] The methodology of producing sound affects the sound space and the original sound characteristics.

Sound Art of Everyday Object

There are many different approaches to sound art using noise and mediums created with everyday objects. For their implementation, the intent was to use the most evident differences in certain sets of spatial traits of an object. This led us to use a bottle to produce Vernacular Sound. During the installation of the sound artwork, the bottle was used repeatedly as a sound box. All the bottles used in the artwork had different shapes and internal structures. The related artworks can be divided into two main branches: First, those that use the physical characteristics of the object to produce the unique sound triggered by wind or living beings; second, those that trigger a sound by a visitor's interaction and movements detected by a sensor.

Chelpa Ferro's "Acusma" is an art installation that uses the internal structure of vessels with varying internal structures. Loudspeakers playing different recorded voices were placed inside ceramic vases. [9] On the other hand, Chen Sai Hua Kuan's installation "Bottles and Fans, 2010" uses remote controlled fans to create sound by blowing air over water-filled bottles, and the sound changes due to evaporation of water. [10] In Kadet Kuhne's interactive sound installation, a sculpture is designed to create reflections of its environment as well as resonant sound. [11] It is similar to BELL-WETHER, an interactive installation built from recycled bottles to produce natural sounds such as those produced by living beings, wind. [12] Another interactive object-based sound installation is the "Curiosity cloud" at mischer'traxler studio. It consists of interactive sensors to make sound art

using 264 blown-glass bulbs. A buzzing sound is emitted from the individual glass bulbs when a visitor moves through the work, which results in audio visualization of the noise. [13] The above mentioned artworks used actual objects to create a sound space and showed the actual origin of sound. A sensible experience of object's sound gives listeners an enhanced experience in listening to sound. Inspired by the bottle as a medium for creation of new sound scape above, With the Vernacular Sound system, we used bottle as a case example.

Our System: Vernacular Sound

Concept

The Vernacular Sound system consists of two main parts: an anechoic box for noise and visualization of the reverberation traits of individual objects. This work does not focus on the actual sound played but to experience the reverberation. There is no limitation in the selection of sound; the sound can be a recorded file or a real-time recording. For this study, we collected bottles of varying shapes and internal structures.

The anechoic box is used to compute the traits of the sound space of an object that produces the noise. The computed characteristics of each object reveal its acoustic properties. Our aim is to preserve those original properties.

Installation
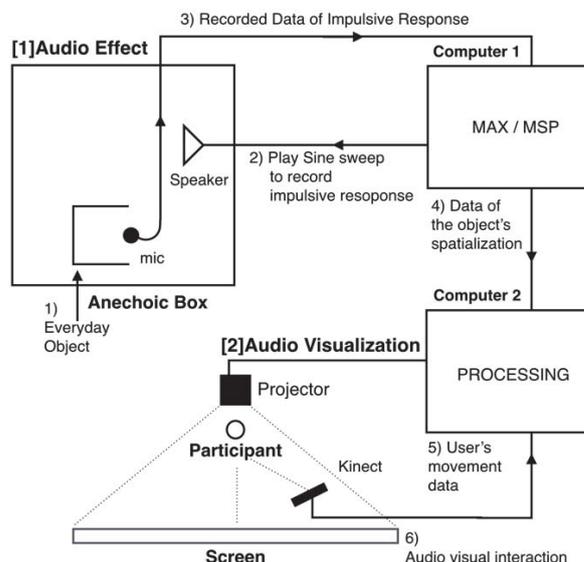
Fig. 1. *Vernacular Sound System,* 2015, All right reserved.

Installation of our work involves two techniques: Audio effect and audio visualization (see fig. 1). A hand-made anechoic box and a mic/speaker set collect sound space characteristics of everyday objects by playing a sine

sweep inside the box (see fig. 2). An object is placed in the anechoic box containing one mic to collect the sound reverbed in the object, while four speakers play the sound to compute the sound space of the object using MAX/MSP. The speaker and the mic are connected to a computer to transmit and receive the signal. The computer is connected to another computer though the same IP address for visualization. The computed sound space characteristics—amplitude reverberation, panning, velocity, and degree of difference between original sound data are visualized. We used Kinect1 to track the user's hand position (see fig. 3). Through tracking of the hand movements, interactive sound space audio visualizations provide a sense of reality. Additionally, we used headphones and a projector as an output device for each sound and visual part. The usage of this system is followed. A participant brings their own object, then put it inside the anechoic box. With mic and speaker, the system captures characteristics of the object. The participant listens the audio-effected music with headphones. Furthermore, the traits of the collected sound are projected on a screen synchronized with participant's hand movements in real time.
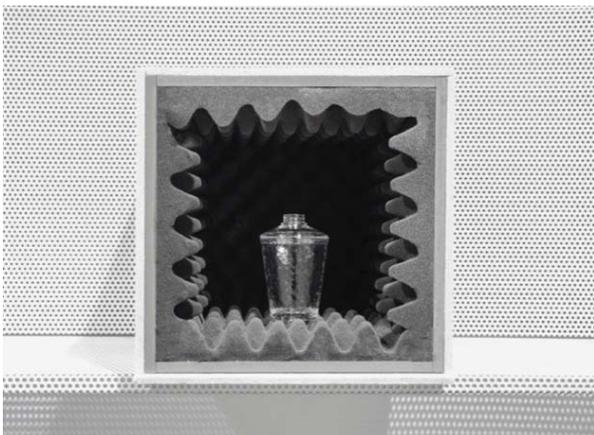
Fig. 2. *Anechoic box,* 2015, wood box with sound insulation and absorption materials, 36 x 36 x 36 cm, © Joo Young Oh. Photo


Fig. 3. *Vernacular Sound,* 2015, interactive audio visualization installation, 2656 x 1494 mm, © Joo Young Oh. Photo

Audio Effect

In sound space computation, our aim is to explore the sound environment in a novel manner using the physics of sound, since most of the music is recorded in an anechoic room that lacks sound space characteristics. By collecting sound characteristics of ordinary objects, each individual sound space forms a concept of vernacular of the sound. A set of ordinary objects have different internal structures to create a variant sound space. In this sound space, the participants feel as if they are listening to music from the object that they selected. This provides them with a new experience by overcoming existing circumstance of listening.

We used convolution reverb for processing by collecting the impulse response from the anechoic box. The purpose of the anechoic box is to function as an anechoic room, to compute the internal structure of the object that causes the noise and distortion during the sound play. Simultaneously, the anechoic box prevents other sounds from the surroundings from affecting the sound from the selected object.

The anechoic box is a hand-made cube used to block the outside noise and compute the intentional noise produced in an object inside it. Once the participant places the object inside the box and starts the process, each speaker in the box produces a sine sweep sound sequentially and the mic in the object records it. With the recorded data, we calculated the impulse responses by using the Huddersfield Immersive Sound System (HISS) Tools. [14] Each impulse response represents the individual characteristics of sound produced in four different directions. We calculated a single representative impulse response by normalizing the four impulse responses.

As a result, our system provides two types of sound. One is the background sound processed by the representative impulse response, and the other is the sound collected by the participant to obtain an immersive experience.

Audio Visualization

Vernacular Sound is visualized as an image where the sound particles radiate from the center to the surroundings whenever a sound reaches the participant's ears. The sound space in this work is a closed circular space with mirrors that reflect the shapes of the sound particles in the object. In other words, the circular space puts maximum emphasis on the reverbed noise. If sound collides with an invisible wall in the space, it is reflected and follows the law of reflection: the angle of incidence is the same as the angle of reflection. New sound particles are generated every second and are gradually absorbed into the space over time.

There are two sound sources to visualize: yellow particles that represent the reverb effect, following the panning sound; and white particles that represent noise with the spatial effect, which represents the sound that the

participant has recorded and played on the Vernacular Sound system. There are no limitations in recording sound. Any type of sound, music or noise, can be played on the Vernacular Sound system. The particles radially spread out from the participant's hand. The size of the particle is determined by the sound amplitude, while the velocity of the particle is determined by the difference between the original and the effected sound degree computed using MAX/MSP and sent for processing. The difference in the values between the original and recorded sine sweeps causes a change in the velocity of the particle. The higher the degree of difference, the higher the velocity of the particle. The variation in sound is shown in the projection with its unique audio visualization due to the spatial characteristics of the object.

Case Example : Bottle

As mentioned in the 'sound art of Everyday object', bottles were used to make the soundscape. We used bottle as case example for the Everyday objects.

Visitors were asked to bring their own bottles for a real-time computation of sound space of the internal structures of the bottles. With each bottle, the sound space could be experienced as a new environment. Participating in Vernacular Sound is part of a performance on the use of object noise to produce art.

Discussions

Vernacular Sound turns everyday objects into instrumental sound boxes. The properties of the objects, such as shape or material, lead to their unique sound structures. This means that each object serves as an environment by retaining its originality. Unlike the music recorded in an anechoic room, the sound recorded in the object placed in an anechoic box is intentionally distorted; noise is deliberately captured through reverberation of space. With computation of the traits of the object, the sound is incorporated into the objecthood of the object producing the noise.

By using everyday objects, and introducing a system for sound space computation, this work will provide a new method of perceiving and experiencing sound. The physical variations of objects can be preserved as a set of Vernacular Sound that varies in individual objects. Moreover, taking photographs of individual objects to preserve their form and traits can be connected to vernacular photography, thereby defining our system: Vernacular Sound.

Future Work

This work can be improved in two aspects: diverse and immersive experience. Previous studies focus on readily available objects. However, to enhance the Vernacular Sound experience, individuals can design their own objects, retaining their fundamental function while altering their shape or material without limitations. The objects can be designed using computational design programs and printed with a 3D printer or simulated using a computer. This enables the participants to encounter sound space with infinite variations. Visualization of sound space can be extended onto three walls with more than one projector or into a virtual space with a head-mounted display.

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Noise Responsive Systems: How do those change the infrastructure of the Institution?

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Abstract

Sound studies are incorporating signal analysis, rhythmanalysis, physics, engineering and computation. According to Shannon and Weaver, signal analysis is the principle to understand all processes in information theory. This process follows the schema: sing – storage – transmission. Signal emission is produced in communication systems, computing and noise responsive environments. Rhythm is a characteristic of signal emission, and its detection and transmission is studied for example through the experimentation with electromagnetic devices. As a result, noise is produced. Noise is defined in Norbert Weiner as a non-desired message. However, content and context, support and message in noise responsive systems cohabit in the electronic continuum generated by signals to be deciphered.

Noise Responsive Systems

In this paper, I will present different artists and projects that work with signal processing, for example, soundscapes, cyber-sound, neuro-noise, biomusic and responsive environments that will clarify and give a possible solution for research practice based projects and the curatorial development of exhibitions in museums and institutions.

Sonic Landscapes

In sound practice, there is an extensive development of techniques that are related to the environment or the public space surrounding us. Soundscapes and experimentation with electromagnetic emissions are happening in this multi-mediated and natural area.

Once using eavesdropping techniques, the transmission of a signal is captured using hacking strategies in d.i.y computing machines. What this technique is doing is deciphering the electromagnetic wave emissions through the analysis of the pulse that is produced by the wave. So pulse is a rhythm of emission that configures the signal to transmit a message. Usually, in eavesdropping, noise interferes with the signal and need to be corrected. The signal is always noisy, a noise signal.

Moreover, working with soundscapes and the natural space there are some examples of artists working with the transmission of signals. Peter Ablinger demonstrates how the acoustic dimension is experienced through the use of loudspeakers, microphones or DSP digital signal processors. Another one is the case of Audible Eco-systems, work made by the artist Agostino di Scipio. In these cases, the audio work synthesizes the room, the network and the feedback with the performance. Sound sources and resonances of acoustic space, so-called noise, implement the relation machine, human, and environment. The principle of interaction becomes a unique part of the generative work. The results are noise amplified rooms, saturated sounds, discontinued and restarted pieces.

Another example of artists transferring signals into noise is Psychogeophysics, a group that borrows techniques from EVP/itc (electronic voice phenomena and instrumental transcommunication), classical psychogeography, thoughtography, amateur radio astronomy, archaeological geophysics, tempest analysis and environmental steganography. These techniques include excitation, intervention and performance, domains and frequencies (earth or skin resistance or impedance measurement), low and high-frequency electromagnetic radiation detection and all frequencies of sound signal detection. In most of the electromagnetic experiments, a phenomenon such as noise appears in all audio signals received from the exterior, through electronic components and circuits. As a result, the criticism towards the commodification of the devices understands that the output signal proceeds from a noise, which is embedded in the aesthetic context of the infosphere emissions representing the technological genocide. [1]

The three examples could be classified as sound generating signals for environmental data and in so doing they operate the capture of sound in the atmosphere. However, noise is a constant political weapon in outer space to detect the radiation of established devices, which are damaging the ecosystems.

Going further, up to the magnetosphere, the Department of Physics and Astronomy, at the University of Iowa, developed the Plasma Wave Instrument (PWI) to measure the plasma waves in Earth's Polar Regions in between frequencies of 01 Hz to 800 Hz. Although most of the sounds are in the acoustic frequency range, they are not audible to the human ear. These sounds are produced by processing the original wave data, in the same way, that radio stations process signals. The PWI detected a different range of sounds and was powered on 1997. Working with a wideband receiver (WBR), the data processing is done through the multi-channel analyzer and the signal processing by the five receivers

system. Static electric field and magnetometers are used, too. Receivers and antennas are used to design the plasma waves, altogether with software. Microprocessors are also part of the electronic circuit. The input signals with the utilization of a compressor are transformed into data values, processed logarithmically. There are also noise filters and noise generators that work together with the sinewave's output and the wave's amplitude captured. Also, memory storage is used to keep data and sensors, and signals are also part of the PWI. In the results of the captured waves can be appreciated a very profound background noise, despite its modulation through filters. Engineered apparatus, such as PWI, obtain and notify the presence of signals transduced into sound.

More examples of capturing signals from outer space, in this case from the ionosphere, is The Inspire Project, a project presented by NASA, as a physics ionosphere radio experiment with VLF signals receivers' device. The NASA Inspire Project offers a printed board for a D.i.Y. soldering kit.

Cyber-sound

Signalling is an operation present in almost all the circuits that pretend communication. According to Lefebvre and Miyazaki, the signal functions, such as an expansive electromagnetic wave, could be analysed according to rhythmanalysis. Conditions of amplification, modulation, resonance, coupling, oscillation and feedback could be extracted from the signalling process. This process in communication devices is also reframed in systems theory. [2]

Following the studies, there are different non-linear systems. A system with no time series could form pure signals types of corrupting noise. For example, in stochastic systems where could be found an error under differential time conditions. The stochastic systems have randomly distributed errors. Deterministic systems have a mistake that remains stable and regular. Investigating the failure in between two states is deduced that randomness increases the dimension of the wave. In non-linear deterministic systems, external fluctuations produce severe permanent distortions. Noise amplified has non-linear dynamic properties. Non-linear feedback systems are produced by interactions between non-linear deterministic and noise (feedback noise is used as a media language in responsive systems).Others examples are DNA, brain dynamics, computing, quantum physics and electrical engineering. Finally, complex adaptive systems are fundamental to understand the natural non-linear structures based on the interval of external forces.

Other systems used in the signalling process are cyber-physical systems (CPS) which are becoming a promising research field to integrate the computing components, the physical processes and the communication networks. The primary challenge in designing CPS is to understand the effect of physical factors on the communication. It is proposed a mathematical model to present the relations between the performance and the controller area network (CAN) and some physical factors, such as the temperature, the impedance value and the electromagnetic interference. On CPS systems, a noise occur and is obtained insight the bit-error rate of these physical factors. It gives an approach to fundamental insights into the impact of the physical factors on communication. Cyber-physical systems are in charge of the control of physical processes characterized by dynamics or movement. This control must comply with timing constraints to capture changes in the system. CPS system cases of studies are generative software, interactive installations and neural signal.

Neuro-noise

In 1929, Hans Berger discovered the alpha rhythm, a fundamental rhythmic brain signal that could be used as a mental remote control, through electroencephalographic (EGG) data operated through open source software. In this field of research, the functional cortical areas are determining control behaviour and physical actions. Spontaneous electrical signals have also been found in the cortical origins. Signals generated by cerebral cortex in the brain are translated into data and digital information and then used as a source for sound generation, producing, for example, feedback loops. The result is electro encephalo-music, a sort of spontaneous music, created by cortical signals producing sounds. In a feedback loop circuit, bits of cortical material are processed into sound. Between the behaviour and the recorded, remains a relative state.

In neurosciences studies, neural signals receivers are commonly using CMOS technology. Low-noise biopotential recording circuits are a CMOS microsystem that provides an excellent method for the reduction of noise in a low-frequency signal processing. The simple circuit structure can be a widespread application for neural signal recording. The circuit consists of a close-loop bio-amplifier and significantly suppresses low-frequency noise and focuses in the bio-potential signal, in a range from 10 Hz to 10 kHz. Another example, the ultra-low-power neural recording microsystem for an implantable brain-machine interface, is an implantable CMOS microsystem for the detection of neural spike signals from complex brain neural potentials that achieves the characteristics of ultra-low-power and high-precision.

Neuro-noise and neuro-feedback are used in neuroscience system altogether with hearing, psychology, physics or engineering and are articulating sounds that response to stimulus or signals sends to the brain. These electrical signals are transmitted to auditory nerves. They are called brain alteration techniques. In addition to that, it mentions particular attention the works by Jonathan Kemp, *Experimental communication system*, and Ryan Jordan, *Hylozoistic neural computation*.

Bio-music

A part of neuro-noise signalling technologies, there are biopotentials, which use skin sensors in information processing. Electrical signals generated are detected as an information source. Psycho-galvanic skin reflex and skin resistance sensors are biopotentials. Signals generated by involuntary muscular contraction are captured and processed. The biological feedback sensory stimulation amplifies electrical signals. Biopotentials attached to the body or in its proximity convert these responsive signals into aural, visual or electrical phenomena. Biopotentials signals are as well myoelectric signals. A central feature of myoelectric signals that is essential to further developments is its amplitude. The amplitude of a myoelectric signal is thought to represent the contraction force of the respective muscle. Some myoelectric signals are used in the control of the hand prosthesis, and its sonifications are a possible application. Some phenomena can affect the transduction, such radical interference in information transmission, unintelligible rendered sound, completely disavowed sound or misled sound by incorrect data. Incorrect data transmission is supporting awareness theory in media ecology and media archaeology studies that declare the fatal technique's embrace. Random decisions or combinatorial rules differentiate among control societies governed by prediction systems and unpredicted systems developing other uses of technology and devices. [3]

Marco Donnarumma, *Music for Flesh II* is a seamless mediation between human biophysical potential and algorithmic composition. By enabling a computer to sense and interact with the muscular potential of human tissues, the work approaches the biological body as a means for computational artistry. The artist is highlighted as a bio-music composer. Here, the algorithmic composition executes the biophysical signals.

Intermedia Interactive Immersive Environments

Finally, the last type of work studied here is interactive systems that are developed as responsive environments. The non-verbal signals in media communication will be used to compose a different range of sound installations that typically are directed by interactive response and immersion into the environment. Here, interactive installations appear under different procedures, where the sound responds to light or installations where the sound responds to the movement. Those use transducers such accelerometers and others sensors. Moreover, an interactive installation where sound responds to light could use sensors, solar cells, lasers harps, flashing lights, lamps, strobe lights or any light source with luminous flows modifications. Light sensors transmit the bright impulses and variations to a data-processing program or electronic circuit. Accelerometers such the minibees are considered transducers. A transducer is a device that converts a signal to one form of energy to another form of energy. While the term transducer commonly implies the use of a sensor/detector, any device that converts energy can be considered a transducer: antennas, piezoelectrical crystal, hydrophone, light emitting diodes, cathode ray tube (CRT). Receivers and transmitters are also used in responsive environments and interactive installation. Others are sensors, actuators and interfaces that are configured for a personal computer. Intermedia, interactive, immersive environments play a crucial role in D.i.Y. The circuits are vulnerable to noise, but the further developments reach to calibrate more accurate results. [4]

To finalize, I would like to introduce another type of sound installation, though not being immersive, it uses parameters of responsiveness. 'Signal To Noise' is an installation by LAb[au], immersing the spectator in patterns of sonic motion produced by 512 recycled mechanical split-flaps. It uses the expression 'signal-to-noise', which is a measure used to quantify how much a signal has been lost to noise; it is a ratio of useful to un-useful information in a data exchange. The circular installation invites the visitor to plunge into a kinetic composition in the midst of the eternal calculation process of an auto-poetic machine. The split-flaps are constantly spinning on a variable speed/rhythm which is dependent upon on the underlying algorithm, analyzing in the maze of information the appearance of a word-equals-meaning. It is an interesting hybrid of digital and analogue technology based on mechanics, visual and sonic characteristics. The signal is the silence and the noise being the one of the split-flaps communicates the ratio of useful information to false or irrelevant data in a conversation or a data exchange. The split-flaps are always spinning but on a variable speed/rhythm depending on the processing limitations of the underlying algorithm, analyzing in the maze of information. The LAb[au] installation can be entirely embedded in Frances Dyson's theories of information, processes of data, and economies in an environmental system mediated by noise. The criticism points to a technology-based computer control systems to support the so-called collective intelligence system. Algorithms and robots guided by this techno-culture based in finance and automatic statistics produce an excess, which does not stop being a corrupted noise. [5]

Conclusion

For closing the paper, I mention here that the divergences in signal noise ratio are more notified in experimental devices in environmental surroundings, because of space acoustics. Also, neuro-noise circuits are also more vulnerable as are non-linear systems, affected by brain dynamics and external conditions, such as time, air, and movement.

Furthermore, the concept of signal-to-noise responsive system proceeds from noise responsive systems, where actuators emit signals and circuits response to it. These could be frequency amplifiers and receivers, mentioned in this paper, but also, all of those that treat the different ratio of noise and signal as a noise signal because noise is part of the signal, and communications channels emit noise, and signals mimic (where possible) disturbances, and statistically, so signals emit noise. Hence, interference is part of the message and data. Friedrich Kittler writes about the materiality of communication systems and focuses on how noise is a fundamental element in understanding communication technologies and systems of information. Kittler scrutinizes the statistical formalization of communication by mathematician Claude Shannon who argues that communication is in the presence of noise; that noise is alongside the information/signal. Kittler discusses Shannon's argument that sets out to show that the maximum communication of information turns into a statistical improbability because the information becomes very hard to separate from noise. Engineers might equate information with the signal, but Kittler includes noise in his notion of information and proposes an inseparable cross-linking of signal and noise, and of noise and matter. [6]

According to Claude Shannon, the communication theory analyzes noise disturbances in the communication channel. The schematic diagram of general communication systems based on semiotic and computing machine shows different parts: information (message or sequences of messages); transmitter (changes the signals into a signal, for example, sound into electrical voltage); a channel (issued to transmit the signal from the transmitter to the receiver); the receiver (which informs the inverse operation of the transmitter, reconstructing the message from the signal). Encoding and encryption techniques are used in transmission. Vocoders, TV and frequency modulation use transmitters, too. Communication systems are an essential part of communication theory and computing machines. In these processes, deduction resulted is conditioned to unexpected, stochastic and randomness. Even there are a finite number of possible states in the system; there is a set of transition probabilities. It brings

to study ergodic processes in communication theory like in complex dynamic systems, formed by indefinite components, which make them uncertain. The result deducted will be reasonably probable or also called relative entropy. [7]

To answer my initial question, about how the noise responsive systems reshape the frame of the institutional bodies, here I contend that these practices are embedded in a major framework, denominated the curatorial lab. This concept considers the production of own devices in hack labs. Resulting D.i.Y. devices as well as own build apparatus, constructs a fierce criticism towards the deviation of the mainstream edified thought. The political aesthetics of noise must transform the functions of art and music in the contemporary society, which is threatened by ecological disaster, electronic waste disposal, and the financial crisis. Moreover, the practices of a curatorial lab innovate in exhibition making and, also, in research practice based. In so doing, the key element of this new tendency changes dynamics in museums and galleries, as well as universities, reinforcing a connection between them.

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Hearing Blind as a New Interface for Exploring the Urban Soundscape

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Abstract

Using the smartphone-based application *Hearing Blind* as a case study, this paper explores ways in which listeners can explore sound-based archives and mapped constructs in a physically-present and dynamic way. This move toward a geolocated data presentation interface represents a dynamic shift in how curators, artists, and the general public can engage with the intangible cultural heritage of the constantly evolving sound environment. This paper puts forward a series of recommendations surrounding the use of new media technologies in the appreciation and understanding of documenting the ephemeral experience of the everyday soundscape.

The *Hearing Blind* Project

Over the past two decades, there has been a shift toward recognizing sounding spaces, aural archives, and sound-based mappings as important objects in the study of (often intangible) cultural heritage. The *Hearing Blind* project utilizes soundwalking and directed listening methods developed by acoustic ecologists and the World Soundscape Project to generate a unique interface for creating, managing, and exploring sound-based mappings. [1, 2] This interface allows for listeners to actively participate in their exploration of the archive or mapping, responding to issues raised by Bijsterveld surrounding the intangibility of accessing urban audio documents in the real world. [3] The *Hearing Blind* project makes the intangible tangible, creating an interface where listeners are able to move through translated aural mappings that overlay relative Global Positioning Satellite (GPS) coordinates of a mapped space onto the one they are physically exploring.

Virtual maps contain the potential for embodied, interactive forms of representation that can be experienced by a wide range of user groups – including the visually impaired. This paper examines how sound-based mapping strategies destabilize the notion that maps are inherently visual media. We use a case study of the *Hearing Blind* project to explore the ability of mobile media technologies to promote aural accessibility – this is done using a research-creation approach to integrate audio, GPS-based locativity, sensor-based networks, and smartphone applications. The key questions that drive this project are: how do soundmaps encourage direct, physically-present relationships between real physical space and virtual mapped space, and how can these relationships challenge normative assumptions about maps and mapping?

Soundmaps are extensions of the critical cartographic concept of "mapping." According to Kitchin et al, a "mapping" is a processual document that embodies the fluid nature of physical space. [4] They posit that assumptions surrounding the map as a fixed document fail to take into account the complex social, political, and technical elements that shape cultural perceptions of space. Locative (or GPS-based) soundmapping allows individuals, researchers, and scholars to engage with space in a dynamic way, generating dialogues about concepts of noise, quality of life, and the navigation of the everyday. [5, 6] These are all aspects that encourage further exploration within the framing of sonic documents as cultural heritage. In this paper, these conversations find new resonance through practical application in research-creation, particularly in the construction of augmented reality and immersive smartphone applications that represent the diversity of urban experience.

This paper examines the *Hearing Blind* application as a case study for examining both urban sounds as cultural objects and the process of creating new media interfaces for their exploration and archiving. This is a way of experiencing our past through the present. By reframing the experience of the mapped soundscape in the real world (shifting away from traditional individuated mobile listening practices), or the romantic idea of the scholar or adventurer spending countless hours poring over sheets of maps, flipping pages of an atlas in an opulent library map room, the *Hearing Blind* project turns the exploration of the mapping, and the construction of the mapping itself into a social and physically-active process. [7, 8]

Hearing Blind has been specifically built for networked mobile devices to take advantage of the accessibility of GPS information. The first iteration has been built for the Android platform, but the ideal version would be platform agnostic, as the most important aspect of the form function (mobile) is having access to Google Location Services (or a similar service in the future), which is available on all major mobile platforms. The significance of using GPS is that we can then introduce the user's latitude and longitude as variables in the software, which is fundamental in creating a dynamic, listener-controlled soundscape/soundwalking experience.

While similar geolocative audio apps exist (*Recho, Echoes, SonicMaps*), what sets *Hearing Blind* apart is the ability to listen to a mapping of one area in a completely different location. [9, 10, 11] By treating latitude and longitude as user-defined variables allows the application to calculate the relative distance between the listener's location (translated from their actual location to their starting location on the soundmap they have chosen) and the recording points of archived *Hearing Blind* maps, which in turn allows us to mimic the relative volumes they would experience through real-life movement across the mapped space(s). However, we have discovered that the richest listening experiences occur when the user is consistently immersed in sound, so the 'true' acoustics of the mapped space has been modified slightly for the aesthetic experience of the project (otherwise there could be moments of little or no mapped sound coming from the listener's headphones). The most significant aspect that the *Hearing Blind* project brings to the study of mapped or archived soundspaces is that the listener will experience a change in the re-presented sonic environment as they move through space. However, the user has control over the rate of this change, as the application allows listeners to scale the relative distance of the recording points. Thus, it becomes possible to scale the sounds of an entire city down to the walking distance of only a few blocks.

Another very significant aspect of the design of *Hearing Blind* is that all recordings are playing at all times. This, like the latitude and longitude variables, is a simple process that has a profound impact on the listener-end result of the experience. Since the recordings are not necessarily the same length, their starting points will only sync up the first play-through of each recording. As such, any particular sonic moment is nearly impossible to replicate. One cannot simply stop moving and expect the recordings to repeat. This provides the listener with a rich listening experience, and one that mimics a traditional sound walk very closely. On the other hand, since users cannot precisely "sync-up" their start times on the program, when a *Hearing Blind* walk is performed by a group, there is no reason to think that another person is even hearing the same point in each discrete recording, let alone within the overall mapped sonic environment.

In early tests of the *Hearing Blind* application, the similarities to and distinctions from traditional soundwalking methods and practices have turned out to be quite important. In a traditional soundwalk, the experience of the sonic environment is a shared one. However, in collective *Hearing Blind* walks, the mapped points exist as reference points within a semi-shared experience, but the resulting sonic moment is not really a shared experience. As beta-testing listeners walked through the mapped environment, there were moments when listeners would look over at the other as if to say, "Hey did you hear THAT?" But of course then realized that there was no way the other person could have heard that exact same synchronization of locative space and pre-recorded sound.

Through an examination of the *Hearing Blind* project, this paper deconstructs assumptions surrounding how and why sound-based mappings and archives *should* work, using a combination of acoustic ecology and soundwalking methods to reconstruct the mapping interface as a fluid and dynamic form. This is a new media interface that allows soundscape listeners and new media users alike to explore archived and documented sounding spaces in elegant and transparent ways -- creating a listening experience that simply could not exist otherwise. The focus, as with traditional soundwalking, remains focused on developing a relationship to the aural environment by attending to both cultural heritage and archival perspectives through the dedicated act of listening. By placing the past within the present, *Hearing Blind* allows listeners to experience recordings in a continually reinvented way, using their own movement as the variable that controls the sonic relationships and development of the listening experience as a whole. To replace previous static mapping interfaces with a dynamic one fundamentally changes how these media artifacts function.

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AURALROOTS: Cross-modal Interaction and Learning

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Abstract

AURALROOTS is a media sculpture that combines viewer interaction with inspirations from tactile and aural sensory perception. The sculptural form is based on the functions and forms of the stereocilia, tiny hair cells on our auditory nerves of the inner ear in the cochlea. The content of AURALROOTS is about how we learn through sounds from being embodied in different environments: a) as a growing embryo in the womb, b) as a daughter listening to her mother and finally c) as a female artist communicating with auditory scientists.

Fig 1. *AURALROOTS*, 2015, Jill Scott, tactile media sculpture, ZEMAK, Poznan, Poland Copyright Scott.

Cross-modal Interaction and Learning

AURALROOTS offers a metaphorical learning experience that scales down the viewers into miniature characters and places them inside the inner ear where they can trigger acoustic reactions. By touching or moving two sets of these sculptural models, based on volume and harmonics, the viewers can mix and manipulate up to 54 sound tracks to be heard on wireless headphones. A viewer/listener can choose different pitches that relate to these learning experiences, by touching an animated visualisation of the cochlea on a screen. This action triggers three sound compositions. A) Low pitch compositions 1: in the womb, (B) medium pitch compositions 2: in the environment and (C) high pitch compositions in the science lab. (1-technique) All three sound compositions in AURALROOTS encourage the viewer to learn through a combination of touch, sound and the embodied experience.

Sound Composition A: Hearing as an Embryo in the Womb

The viewer can hear as a foetus might hear: mostly in the low pitch range. She hears her mother's digestion but also traffic noise outside. the blood cells rushing through the mother's veins. but also a refrigerator motor. Do the lungs breath, steadily or is that the sound of a river rushing along on the outside of her mothers' body? She differentiates between a heart pumping and the beating of a base drum. She can hear her mother swallow, or the low pitch syllables from her singing voice while she is playing the piano.

Sound Compositions B: Daughters listening to their Mothers

Speech occurs mostly in the mid-range of our frequency response. Many communities practice oral storytelling: the passing of knowledge from one generation to the next. In this composition, oral "herstories" are told by Australian indigenous women to their daughters about how to gather plants and roots for survival and for medical conditions. Due to colonialism this knowledge is slowly disappearing. When we talked with our indigenous advisors at the Koori Radio Station in Sydney about this form of knowledge transfer, they said that it requires extensive personal contact, regular interaction and trust: "At this stage if another person we trust wants to tell it let them tell it". To construct eight accurate scripts for the actors to re-tell; we sourced talks, interviews and written information by community elders and indigenous researchers. [1] The characters are not based on actual people, however, the names of plants; how they were collected and used plus the environmental

sounds in which they are located are directly source able. [2]

Sound Composition C: A female artist listing to scientists

This composition is based on high pitch frequencies and sound recordings based on my own subjective experience when I worked as an artist-in-residence inside two audiology labs in order to learn about hearing. High pitch frequency response is the first part of our hearing capabilities that decrease with age. I shadowed the experiments of researcher Helmy Mulders and her team, where knowhow transfer is based on a horizontal level of communication. Here the pathways from the ears to the brain are audified by a method called "Electro-physiology", which measures the midbrain's response milliseconds after tones are fed to the ears of anesthetised Guinea pigs. I recorded the firing sounds of single neurons in the mid brain and learn that the stereocilia are one of the few human cells that do not regenerate. I record their tests with researchers on the hearing impaired and witness a surgical operation of a cochlea implant. In audiology, there are more female than male scientists, but more men suffer from hearing problems at an older age than women. Statistics show that among women, teachers in day-care institutions suffer the highest incidences of Tinnitus [3]. It seems that the stereocilia is not only damaged by acoustic trauma but also by the filtering of constant noise.

Fig 3. *AURALROOTS*, 2015, Jill Scott, interactive screen Composition B: Daughters listening to their mothers, Copyright Scott.
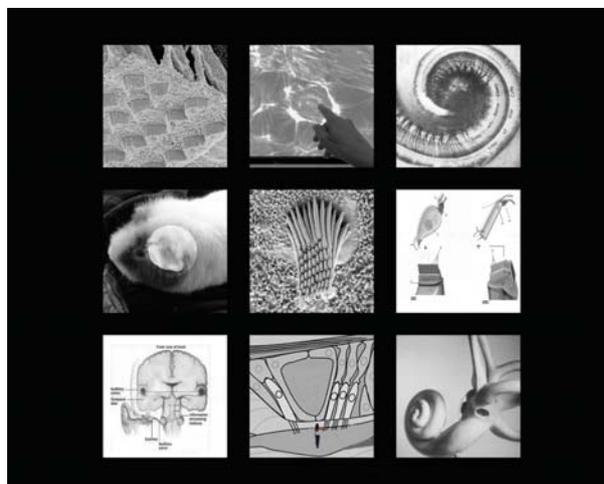
Fig 4. *AURALROOTS*, 2015, Jill Scott, interactive screen composition C: A female artist listening to scientists, Copyright Scott.

Examples of the Learning Experience

Here I give two more concrete examples of the learning experience based on what the viewers actually hear in composition 2 and 3.

Composition B: Daughters listening to their Mothers. The viewers can listen to these stories re-told by actors and match them with sound from the according landscapes where the plants come from. Some of this knowledge is lost – some is retold here! JACK tries hard to remember about how SILKY HEADS (cymbopogon-obtectus) was used for ear infections. He explains how this knowledge was only passed on from mother to daughter. DARRA talks about BRACKEN FERN (pteridium esculentum) and BUNGWALL FERN (blechnum indicum). The roots and leaves of both plants can be used against stings and tics or prepared for eating.

Fig 2. *AURALROOTS*, 2015, Jill Scott, interactive screen composition A: Hearing as an embryo in the womb, Copyright Scott.

APANI, a young girl, describes the myth of the relationship between the GYMEA LILY (doryanthes excels), a source of minerals, and THE BULRUSH (typha orientalis, typha dominigensi) used by hunters for bodily stamina and to keep leeches away. KALINDA describes to young women, how to locate and gather LONG YAM (dioscorea transversa) and PENCIL YAM (vigna lanceolata), main sources of minerals and starch. CORREEN tells a story about how many women often come together to collectively hunt for BUSH ONIONS (cyperus bulbosus) - a good source of minerals. TATYA explains how to wash, cook and make a cast for a broken leg or arm or out of the roots of DEAD FINISH BUSH (acacia tetragonophyllea). LYN tells us how to prepare and harvest the roots of the CUNJEVOI (alocasia brisbaniensis) and use it for stings, burns, and to take the poison out of it for eating. MARGARET talks about the WILD BUSH ORCHID (cymbidium canaliculatum), a great preparation for dysentery and bowl problems.

By comparison Composition C is based mostly on what I learnt from listening to auditory scientists. An auditory lab is always full of tests and sounds particularly in the high pitch range. The viewers of AURALROOTS can hear and mix simulations of the behaviour of inner ear stereocilia compared to the outer stereocilia, as well as sounds from the lab and test tones to identify Tinnitus. They can test themselves by listening to the sounds from the actual hearing tests on people who have a wide range of hearing problems. These tracks are tainted with my own subjective experience of learning about the audified firing of the stereocilia from Electrophysiology", and other sound waves extracted from music and tunings in the same environment.

Fig. 5. *AURALROOTS*, 2015, Jill Scott, touchscreen animation used by the viewer to travel through the cochlea and trigger the pitch based compositions, Copyright Scott.

Fig. 6. *AURALROOTS*, 2015, Jill Scott, sculpture: touching and moving the tactile stereocilia, Copyright Scott.
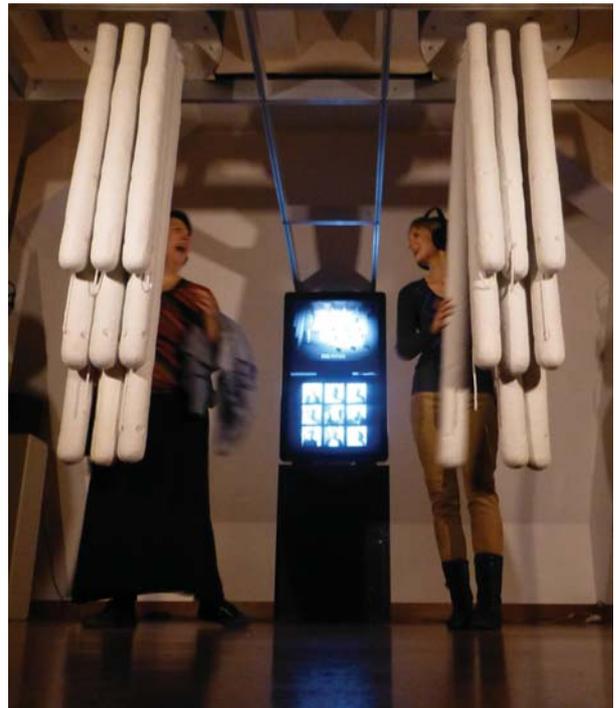
Fig. 7. *AURALROOTS*, 2015, Jill Scott, sculpture: viewers play with the relation between harmonics and volume, Copyright Scott.

Conclusion

All of these modes require the accumulation of tactile and sound knowledge from the purest forms of embodiment - either from inside the body, from being in the environment or from learning in the laboratory. By presenting this content, AURALROOTS encourages less formal, codified or explicit forms of knowledge. Composition A is a combination of sound, tactile and tacit information: this kind of knowledge is difficult to transfer to another person by means of writing it down or verbalizing it. In Composition B, the holder of information must be integrated into a network or a community of practice for survival. Here tactile and sound transfer is related to beliefs, ideals, values,

schemata and mental models -a more cognitive dimension of information that shapes the way we perceive the world. Finally, Composition C explores how different forms of information always exist in dialogue with other forms of knowledge and are transferred in a horizontal way: one that is dependant on co-productive participation.

Fig. 8. *AURALROOTS*, 2015, Jill Scott, sculpture examples of viewer interaction. left: ZEMAK, Poznan, Poland, right: Anatomic Museum Basel, Switzerland, Copyright Scott.
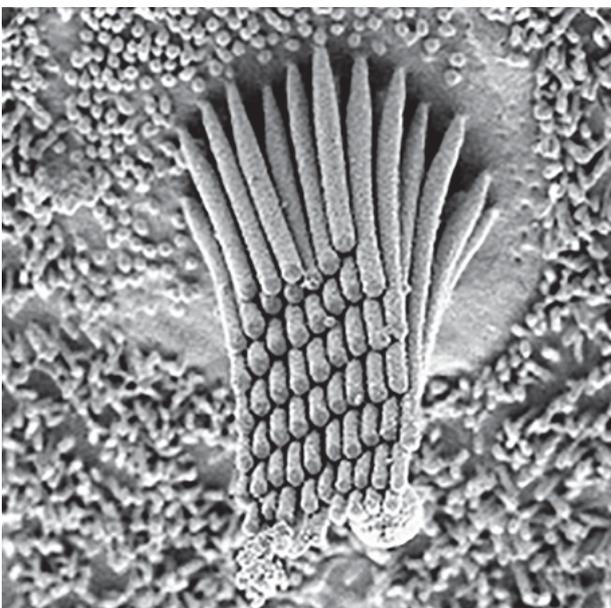
Fig. 9. Scanning Electron Microscope image of our stereo cilia in the inner ear of the cochlea, 2010, University of Basel, Copyright public domain.

Therefore, AURALROOTS presents the viewer with three levels of knowledge and illustrates that the transfer of knowledge is aided immersing the learner in each particular environment. The content of the soundtracks also encourages them to learn more about sound history from a feminist perspective. The viewer becomes an active participant by "placing" him or herself inside the cochlea to explore the acoustic qualities of harmonics and amplitude. As far as I know, this is the first time that a media sculpture has been built that uses the scale and behavior of the stereocilia as a metaphor for an auditory sensual experience, inviting the viewer to work selectively, deeply listen and be contemplative, exploring and learning in ones' own space and time.

Acknowledgements

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Artistic Technology: Coded Cultures, "Making" and Artistic Research

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Abstract

The proliferation of information and network technologies has led to a situation where at least some degree of technological skill has become a precondition for social participation. The challenge of facilitating technological literacy has been addressed differently from various players, from the commercial providers of software and hardware, the official educational system, the 'maker movement' as well as from the critical approaches of 'open knowledge' communities. Do we all have to be 'makers'? What does technological critique mean in the 21st century? Artistic Technology inquires the "artistic" in technological arts, in a world which is largely dominated by technology. The conditions of technological interventions are questioned, with artistic-technological research and practice. The focus is on the engagement of communities of artists and interdisciplinary researchers with the intention to facilitate technological literacy and to inspire a critical understanding of the social consequences of technology.

Introduction

The ever growing popularity of mobile devices, ubiquitous technology and (digital/global) real-time communication introduced challenges for technology appropriation and technology based production cultures. The "smart devices" (tablets, smartphones, etc.) introduced an interface structure that is more intuitive, more easy to use, but also much more closed and opaque. Jonathan Zittrain criticised the dominance of smart devices, describing them as "tethered appliances", a way of tying end users to the manufacturers. [1] The principle of "closedness" that defines these tethered appliances refers to the hardware itself, which cannot be changed or used in another way than designed (and in some cases cannot even be repaired) as well as to new unprecedented levels of control. This "closedness" is also present in software (distribution) systems, as information is more and more governed (data governance), raising the question of data and software politics with increased urgency. The rise of the app stores and the consequent "decline of the World Wide Web" signals the transformation of free culture into a commercialised ecosystem. [2] This commodification of culture affects especially new media arts, radical net cultures and tactical media approaches from the 20th century, which have largely transformed, changed or vanished. [3] In addition to the closure and commercialisation of smart devices, data surveillance has become not only very easy to conduct but a pervasive strategy of social control.

The language of the "maker movement" is the language of our time, and also illustrates how a commodification of (digital) culture has been unfolding steadily within the last decades. The terminology from the 'maker' and 'hacker' context is applied to a lot of different use-cases, this is demonstrated by the term 'hackathon' being used in the art context as well as in recruitment-events from Facebook and startup cultures. But also the term 'maker' itself is problematic. The maker movement in particular is presented as a contemporary culture and technology-based extension of DIY culture which was globally popularised by MAKE magazine.

Fig 1. Krosbø / IKEA Liberation, 2013, Artistic Bokeh, DIY Crossbow made out of IKEA material, Creative Commons Attribution-ShareAlike 2.0 Generic (CC BY- SA 2.0).

MAKE uses slogans such as "join the Arduino revolution" [4] arguing that the "third industrial revolution" started with 3D printing. [5][6] Yet the attitude of the 'maker movement' is not as critical, or revolutionary, as its language suggests. The technologies in use are "open", but the participants do not usually assume a critical stance towards the conditions of technological production and dissemination. Still, the general impression of maker culture and the MAKE magazine is that they represent the most authentic expression of DIY approach in technology appropriation. The shortcoming of maker culture is thematised by "critical making", a term that describes an oppositional strategy that "uses material forms of engagement with technologies to supplement and extend critical reflection and, in doing so, to reconnect our lived experiences with technologies to social and conceptual critique". [7]

Garnet Hertz's analysis of the term "critical making" offers a very good example for the relevance of theory for the critical reflection on contemporary production cultures - based on a distinction between utility (utilitarian DIY), need (material constraint) and pleasure (hedonized practice) to outline motivations of 'making'. [8] Repair culture might be the most subversive of all, understanding the "art of repair as a new form of knowledge; a knowledge that reinvents or reproach[es] the object". [9]

Recently published papers have been exploring in particular feminist approaches to making as well as the commitment to principles of reuse and resourcefulness of those agents who live in the global south. [10][11] They seek to challenge perceptions of technology and innovation as stable or fixed categories. [12] The roots of technology-based DIY cultures can be found in artistic and counter cultures and their different strategies of technology appropriation, long before the "maker movement" was postulated and even before the term 'technology' existed, since "cultural techniques [...] are always older than the concepts that are generated from them". [13]

Fig 2. The Culture of Surveillance and the Poetics of Observation Technologies, 2013, Artistic Bokeh, site- specific installation of a historic surveillance room.

Fig 3. Too Much Money, 2014, Artistic Bokeh, Georgios Papadopoulos & Société Réaliste, site-specific installation with 4107 1-dollar bills, thematizing the symbolic value of artistic production and its subordination by the valuation of markets.

Technology as action and not as objects

Leo Marx outlines that concept of 'technology' was invented to fill the void created by socio-technical systems in the 19th century, including "machinery," "the mechanical arts," "the useful arts," "improvement," and "invention". He argues that what makes technology "hazardous" is the generality of the term, making it "peculiarly susceptible to reification". The problem is "a 'phantom-objectivity,' an autonomy that seems so strictly rational and all-embracing as to conceal every trace of its fundamental nature: the relation between people [that] largely determine who uses [technologies] and for what purposes… Technology, as such, makes nothing happen.". [14] It is rather the uses of technologies, and especially the communities established through these uses, that create the norm for technology appropriation and its social functions.

Artistic Technology - an ongoing research for critical technological artistic practice

With the project "Artistic Technology Research", we investigate critical strategies of technological appropriation, which in their different approaches (cultural techniques) are constituting communities of practice. We do so, by engaging communities of makers, developers and users with the intention to facilitate technological literacy and to inspire a critical understanding of the social consequences of technology. There is a focus on "community" that capitalises on the already existing cultures of hacking, making, sharing and developing, and on their cultural techniques, which challenges the dominant understanding of the "user" as an individual agent insulated from social and cultural influences. The research is developed on the basis of diverse artistic interventions in order to provoke catalysts for community convergences that is documented and presented in a multiplicity of formats and situations.The project combines an epistemological attitude from the life sciences [15], with a methodology of art-based research. [16] Artistic research is considered as a practice of experimentation, aiming at the creation of new hypotheses and acting as the "generator of surprises". [17] Technologically oriented artistic practices, are very similar to the community strategies of technological appropriation, which involve technological artefacts inscribing them with new meaning(s) and infecting the conditions of their social representation.

The different artistic interventions carry most of the burden of the project both as research practices and as outcomes. They are intended as catalysts of interaction between the artists/researchers of the project and the community, as well as windows in the operation of specific technological tools that can create and disseminate new knowledge about technological processes. The intervention of artistic practices and the emergence of a new, unexpected, relations between the audience and the artist function as foundations for new communities, at the same time as they point to the aesthetic qualities of technological interaction. The new community bonds and the new ways of experiencing technology are the output of our research at the same time as they are a genuine and self-sufficient artistic creation.

"There has been an aesthetic of matters-of-fact, of objects, of Gegenstände. Can we devise an aesthetic of matters-of concern, of Things?" [18][19]

A "device" is described in dictionaries as a "thing made for a particular purpose", usually mechanical or electrical, but also as "something that is done in order to achieve a particular effect". We are using the term "device" to describe the artistic intention to communicate "matters-of-concern" through artistic technology. We want to point to a new technology-informed practice that is interdisciplinary and counters "technological defeatism" and "technological determinism". By discussing the effects of "technological solutionism" (cf. Mozorov) and the politics of production in the 21st century (evident in the "maker movement"), a terminology besides techno-utopism is created, that focuses on the "artistic" to discuss tactics and strategies that are between *conceptual* and *performative*. [20]

Through practice-led-research as well as research-led-practice on artistic technologies it is possible to create a vivid communication between artistic practice, artistic research and academic research. Beyond creating technological literacy and building upon successful formats, the key elements to facilitate *Artistic Technology* are workshops and artistic documentation which are used as additional fields of inquiry and continuous research. Alongside contemporary artists and artistic researchers who work with technology, students as well as the wider public are included to create an interdisciplinary and vivid culture of research and practice on artistic technologies.

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A Daydreamer of Someone Else's Dreams, A theoretical framework for the future Web

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Abstract

This paper describes theoretical and methodological frameworks around aesthetic exchange in the virtual world. These frameworks hypothesize about the merging of social networks, avatars and online interaction, in what the author proposes as a future *metaverse*. This latter term refers to the technical, psychological and socio-cultural ways of living and interacting while being logged online permanently. This includes quotidian activities that already form part of our networked interactions, such as socialising, sharing and collective-content-production. Here it is important to deter other remedial solutions to the complexity and ambiguity of such hypothetical mergence: some of those solutions are defective at best and merely demean the rich transference between identity, self-representation and subjectivity experienced in the *metaverse*. The remedial solutions around the idea of uniformed and standardised representations of the self (or *travatars*) remain unhealthy. They merely serve to threaten the rich cultural production of subjectivity and the flux of multiple identities that constitute a small but highly influential part of the humanisation of virtual and digital technologies through aesthetic exchange in online interaction. Consequently, the design, use and cultural value of avatars and their equivalents in the virtual world will be critically examined in this paper.

Parallel Lives

In 2009 Cameron Chapman's hypothesis about the future of the Web was one among several envisioning the merging of virtual worlds (VWs), the Web and social networks (SNs). In Chapman's view that would soon lead to a three-dimensional, browsable interactive environment populated by uniformed avatars with standardised identities, behaviours and attitudes. [1] And indeed by 2014 this was not yet the case. Katrina Glerum called these remedial avatars *travatars*. [2] Chapman's blog project contains fifteen predictions implying that social media applications and permanent online interaction are at the forefront of the future Web. The merging actually will occur through the idea of intelligent interaction with the future Web of things, Artificial Intelligence and Augmented Reality. Chapman envisioned a packed, secure, ubiquitous and standardised Web that would change "from creating artificial-intelligence apps that interpret data much like humans do, to more semantic tagging conventions that make it possible for current online apps and services to make

sense of what code means to humans." [3] In this panorama, uniformed *travatars* will transform presence and subjectivity by embodying us much in the same way our Facebook or LinkedIn profiles do today, albeit fragmentarily and by means of a by-default 3D puppet on the screen.

Presumably *travatars* would have enabled inter-platform communication, agency and social interaction within VWs. However, due to the uniform standardised format of technology, that 'gain' may well have been at the cost of important humanising features such as the capability for empathy, *autoempathy* [4], more flexible and broader paths of self-representation and, therefore, enhanced subjectivity. In this short paper I will review how the problem with the *travatar* is that uniformity and technical standardisation would come at the cost of losing avatars' subjective 'voice'. Compared to the auto-empathic capabilities of SL avatars, the so-called 'remedial' avatars know as *travatars* lack important features for empathy, social bonding and humanising subjectivity, despite being able to function across different virtual environments. Simply put, the fact that *travatars* will be able to talk and respond to a 'universal lingo', displaying a sort of by-default-behaviour and personality, will not prevent a lack of the very process that humanises avatars and makes them compelling: aesthetic exchange, (dual) subjectivity and embodied agency. These are precisely what make an avatar function as a true *actant*[i] [5], our true identifier and personaliser, a subjective hybrid agent in the *metaverse*. This perspective stemmed from my research around Second Life-based art (SL) between 2006 and 2010 [6]. Unlike Chapman's view, I think that discussing forms of avatar-interaction for the Web of the future ought to go beyond the literal (or exclusive) use of 3D characters represented in a virtual environment. Rather, it is self-representation, affectivity and interaction in the *metaverse* that will be and already is key to the theme,

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[i] In *Oneself as Another* Paul Ricoeur uses the term actants to refer to characters or players capable of affirming themselves through action and narrative. He states that "narratives express (represent) worlds inhabited by agents capable of responding to questions such as 'Who is speaking? Who is acting? Who is recounting about himself or herself? Who is the moral subject of imputation?'"

particularly considering the innovation of Web 3.0, ubiquitous computing, portable sharing devices, augmented reality and emotional and subjective technologies in development today.

It is the interrelation of three factors—dual subjectivity (DS), dual aesthetics (DA) and *autoempathy*—that fulfills the investigation of merging social networks with Web and Virtual Worlds interaction, complementing technical and communicational research. In this sense, it is my feeling that Chapman's prediction fails to qualitatively address this merging, and consequently important factors and processes in the discussion remain out of scope.

Faster By the Hour

Do not get me wrong. I enthusiastically support techno-cultural advancement, greatly valuing the possibility of social interaction through unified virtual platforms that promptly and efficiently provide interaction for the metaverse. However, I hold some concern about the detrimental effect of the standardisation of *travatars* in cultural, behavioural, affective and social terms. The current rich relationship between Avs and their actual users would be lost due to 'one-size-fits-all' avatar uniformity and standardisation. Thus I will try to delineate how and why the subjects of aesthetics, virtuality and identity-subjectivity production matter so much for a future merging, and how these features act as an empowering psychological-sensorial device for users. And also why this is important when proposing a theoretical mainframe for the future of online interaction in the *metaverse*. In short, I propose a critical view and an alternative analysis of Chapman's hypothesis for the future of the Web as outlined above.

Worldwide networks have become more numerous, complex, hyper connected and faster by the hour. This creates the impression of a global *hyper-vicinity* in which everyone feel compelled to design, update and reshape—frequently—their professional, emotional and personal identities. Chapman's hypothesis does not address a broader and deeper view of this phenomenon in which the boundaries between the real and the virtual have been conflated. The lack is relevant not because technical standardisation and uniformity in protocols were wrong, but rather because subjectivity and identity—as demonstrated by virtual worlds and game interaction—define the extent to which affect and psychological-perceptual paths to self representation are pushing to the forefront of interacting in the metaverse. [7]

Informational environments are virtual *per se*, whether they are represented as three-dimensional or not. They will soon be 'inhabited' not only by avatars but also by protocols and devices of augmented reality, geospatial data and even voice-computer control, not to mention vision, sensorial and talking devices. This in turn points to the merging of interactive devices with affect, subjectivity and emotional technologies of the future. For me, such an idea coalesces in the metaphor of *hyper-vicinity*. However, no matter how promising the advantages of these features on techno-communication appear to be, our experience with them may decrease if they become highly standardised and uniform. This may actually threaten the more complex subjectivity, affective expression and cultural production that current aesthetic exchange displays in VWs. I have researched the avatarian representation of the self in VWs, which demonstrates peculiar and variegated ways of negotiating and shaping identity, self-representation and subjectivity, particularly in SL-based artwork. My findings align with Anna Munster's position on new media art, information aesthetics, embodiment and bio politics. Munster coined the term *space of reciprocity*, referring to digital aesthetic exchange as the "production of differentials" emanating from virtual and online art exchange. In this process, what is crucial is *the extension of the body*: avatar users experience intense variation of self-representation and embodiment due to the mutability and multiplication of identities and subjectivities. At the same time, and due to digital embodiment, one experiences *virtuality* as an "inextricable imbrication of biology with information and information technologies." [8] Munster states that bio art (to which virtual worlds and games belong) compels us *to interact with or embrace virtuality through our dialogical relationship with the metaverse*. This dialogism reminds us that life is not just a "force that inhabits the organism but a network coextensive with information gathering, retrieving, storage, manipulation and management techniques." [9]

We meet the space of reciprocity precisely in the interstices of subjectivity and the production of differentials. These are processes triggered, propelled and enhanced by digital embodiment and virtual aesthetic exchange. According to Munster's framework, the digital body constitutes a significant part of the (re)materialisation of new media, as the material body rests insoluble within the aesthetic experience and virtual immersion. Because of that, the space of reciprocity is absent of commercially standardised and uniformed versions targeted to mass media interaction with consumers. In my view that accentuates the production of differentials, singularity and individuality, which will be necessarily expelled and/or reformatted via mainstream media's technological uniformity, monetisation and other market tendencies imposed by *travatars*. Rather, the space of reciprocity emerges from *a new contemporary bio art ethos* in which audience and practitioners become engaged and implicated in an ethical dimension mediated by virtual aesthetics exchange. In this sense informational patterns penetrating both parties result in tactically relocating bio art expressions during the production and examination of the material conditions of information culture. That is—borrowing Munster's thesis from *Materializing New Media*—experiencing virtual aesthetics does not exclude the material body from the experience. Rather, it actually

enhances the experience of it by virtually including the digital differential constituted by all the instantiations of the original identity, thereby rematerialising the body in the process. This is both the notion of subjectivity and the represented-identity pattern applied in my theoretical frame.

Munster's new aesthetics genealogy of information is therefore one "that acknowledges new media's relation to materiality [...] that takes into account the ongoing engagement of information, and new technologies with embodiment." [10] It does so through the interaction between avatars, actual players and the intense differential, all shared and collectively produced via aesthetic experiences in the *metaverse*. This interactive richness would be lost if we were to develope (consciously or not) a reductive habit of viewing the interactions exclusively in terms of a prosthetic character upon which we project our personae. This is particularly true of uniformed and modular 'formats' like that of the *travatars* suggested in Chapman's predictions.

Fig 1. Lacan Galicia, my main avatar in SL, 2008. Copyright Francisco Gerardo Toledo Ramírez.

My main SL avatar, Lacan Galicia (LG) interviewed the avatars of four SL-based artists in a blend of semi-unstructured interviews, *in situ* interaction and textual and cultural analyses of the virtual world. LG observed their work, experimented and participated in their performances and installations between 2007 and 2012. [Fig 1] The interviews and (n)ethnographic observations around virtuality and aesthetics were developed throughout this period. During this time, I designed a relatively new hybrid research method that merged qualitative research methods, media and cultural studies, critical theory and virtual world aesthetics. Additionally, in my latest publications, I have combined critical perspectives from subjectivity production as a result of immersion, user experience and online interaction. I have also been researching and teaching these topics in other courses—Branding and Packaging Design, Design Semiotics, Signage and Wayfinding Design and Culture and Design—at Western University and at the

Universidad Autónoma Metropolitana in Mexico City. As disciplines, they share subjectivity, identity and online representation of the self and interaction, albeit for different reasons. The study of design, interactivity, virtual and digital techno culture has resulted in the hypothesis that the merging of interactive VW aesthetics, social networks and avatar self-representation is core to envisioning the Web of the future from a broader point of view that is not exclusive to computers, communication or engineering.

Aestheticisation of technology

Dual subjectivity (DS) and Dual aesthetics (DA) are terms borrowed from Italian media and film professor Vito Campanelli. In his book *Web Aesthetics. How Digital Media Effect Culture and Society*, Campanelli outlines a frame of reference for understanding how and why the emergence of subjectivity and cultural production is of utmost importance in current digital culture in general, and in particular as an outcome of aesthetic exchange attained from interaction in the *metaverse*. Both terms are intimately linked and blend in the artwork of Gazira Babeli, Eva and Franco Mattes, Bryn Oh and China Tracy (aka Cao Fei). All of these are avatar names and identities. The essence of that blend relies on how an aesthetic mode of production coalesces symbolically in SL-based artwork—how the artists access, play with and critically and aesthetically use virtual world representations, interactivity and communicational data. According to Campanelli, DA is "a typical feature of a world, like the present one, that has turned into a global shop. In it, objects, people and experiences conform to a diffuse aesthetic dimension" [11] reshaping and modifying our epistemologies on the virtual, telepresence and identity that is digitally represented. Elaborating on Mario Costa's *Dimenticare L'Arte* (Forget About Art), Campanelli's idea of DS outlines how aestheticisation of technology is present and continuously running among western notions of art. Costa's idea allows Campanelli to reflect on how artistic subjectivity becomes extended to amalgamate with/in machinic processes, which also relates to Costa's theory that the arts constitute an *aestheticisation of technology*. [12] According to this view, three ages exist: Technical Arts, Technological Arts and Neo-Technological Arts. SL-based art, as a part of "the broader field of electronic interactive virtual arts" [13], belongs to the third category, which implies that these forms of networked digital art operate as *blocs of sensation* [14] as hyper mediation, narrative, hypertext and dual subjectivity forms. Digital and virtual world artwork also shows traces of older yet influential media, and post-modern theories on culture, science and society, which illustrate the unbalanced relationship between technique and culture today. This, of course, is characteristic of the hybridisation of media and information in mid to late

twentieth century art so that "the previously dominating position of the 'subject' is replaced by the 'languages' and the 'text'." [15] The idea of "an aesthetics of the object and the self-operating machine" is key to a new arrangement of enhanced and extended consciousness, that of the *human hyper-subjective* amalgamated to *machinic subjectivity*, "of which interactive practices typical of new media and the communicational dynamics induced by the digital networks are the first signs." [16]

What my avatar LG experienced while in the virtual world shows the degree to which individual subjectivity has become enhanced by virtuality and interactive mediation. As such, they represent versions of the "technological hyper-subjective." What is more, returning to Costa's theory, Campanelli unveils an important aspect: the belief that contemporary subjectivity is connected to and depends on the fluidity of digital networks. "The contemporary hyper subject is made up of human and machinical-technological (computational) components, including the protocols, processes and the hardware and software platforms regulating the functioning of digital networks. Networking, as a cultural practice based on making networks, is a multiplication of identities, roles and methods no longer built exclusively on human beings but also on non-living beings and relevant topologies and physiologies." [17]

Fig 2. Bryn Oh's Second Life Simulation, 2010. Copyright Francisco Gerardo Toledo Ramírez.

Conclusion. A Daydreamer of Someone Else's Dreams

Spanish scholar Juan Martín Prada emphasises the human half of the human-machine aesthetics in his analysis of how digital humanities affects interaction in the *metaverse*. The interviews and observations of SL-based artwork demonstrate that the merging of online social interaction enhances subjectivity, self-representation and symbolical embodiment in the metaverse's virtual dominion. This in turn improves SL ethos as well as the interaction between art and residents (users in SL). The experience of dealing virtually with the 'real,' albeit through techno informational-communicational paths, means that virtual aesthetics is a *continuum* of perceptual patterns balancing hybrid forms of bio art, bio politics, hardware, software and emergent emotional technologies. About these forms of aesthetic exchange in the virtual, Prada writes that "today, vital interrelations between people and technology become productive ones. The most important raw materials with which the 'social worker' of the web works today are those concerning *interpersonal relationships*." [18]

The identity of avatars carries a particular sense of 'selfhood' that depends on digital manipulation (for instance when designing one's avatar appearance) and a mutable subjectivity that function as a filter and affective-enhancer device. This is what Italian new media and film studies scholar Adriano D'Aloia refers to as *autoempathy*. In the SL-based artwork I studied, this phenomenon is present to varying degrees. The most transparent illustration of *autoempathy* is found in Bryn Oh's oeuvre. In her work, *autoempathy* proves to connect avatars, embedding and representing them through empathy by unfolding narratives created between the artist and the audience (residents or visitors). The possibility of (y)our avatar becoming a day-dreamer of someone else's dreams is not only fascinating but feasible due to the malleability of the avatar's subjective and affective transference. This possibility is constantly shown and yet strategically hidden in Bryn Oh's virtual scenarios and *machinima* works. Bryn achieves this by an ingenious montage of proliferative narratives, self evolving role-playing and perceptual immersion. But of note is the construction of ethereal architectonic spaces targeted to seduce our intellectual sphere and affective and perceptual self-awareness within the landscapes she builds in her SL environment called *Immersiva* (fig 2).

A theoretical mainframe for discussing the future of the metaverse can be outlined including the conflation of diffuse distributed aesthetics, social online networks and the production of subjectivities. The nature of art as documentation (SL-based art) is difficult to apprehend, resulting in our growing "inability to distinguish between the natural and the artificial: the surface of a living being can conceal a machine; conversely, the surface of a machine can conceal a living being." [19] Boris Groys implores us to preserve the malleable-mutable dynamism in the production of cultural subjectivity and identity resulting from dual and virtual aesthetics. To date, it remains threatened by the emergence of *travatars* on the web of the future.

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Exploring the Medium: The Indexical Function of Artistic Photomicrography Made by the Scanning Electron Microscope

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Abstract

Photography used as proof of scientific data often has to deal with problems arising from its overlapped indexical and iconic features. This paper is concentrated in the specific area of photography made by the Scanning Electron Microscope (SEM), which has expanded the boundaries of observation and representation of the micro world since it was introduced to scientific research in the mid-1960s. With the emergence of the digital era, photography's status as independent indexical register of reality began to be undermined by computerized imaging processes. Nevertheless, scientific photomicrographs aim to provide scientific evidence of data as accurately as possible. However, the results obtained with the SEM can be disorientating because the process of producing a picture is camera-less. The apparatus tries to recreate a reality that is not a visual phenomenon, which scientists try to analyze from its image that is captured through the SEM technology. This paper considers some of the ways in which SEM microphotographs can be used in an artistic practice, and argues that there is an urgent need to rethink the indexical function of SEM photography. The author's artistic practice can be seen as rejecting the traditional practice of minimizing noise in scientific representation and, instead, embracing experimentation that encourages the unexpected over the predictable.

Preface

In the late 1980s, with the escalating availability of new technologies, photography's privileged status as marker of truth and measurement of reality began to be undermined by computerized imaging processes. [1]

With the initiation of digital technologies of reproduction, the model of indexicality as an inherent ontological condition for photographic images lost its functionality. Media theorist Fred Ritchin explains: "Photography in the digital environment involves the reconfiguration of the image into a mosaic of millions of changeable pixels, not a continuous tone imprint of visible reality." [2]

Despite photographs being no longer considered literal traces and often susceptible to manipulation, it is important to account for the social function of digital photographs. Many digitally generated images "look like" analog photographs. Damian Sutton deemphasizes the loss of indexicality in digital technology because digital images are perceived in the way a viewer understands analog photography. Although Sutton acknowledges that analog photography's connection with indexicality was always challengeable, he argues that perceiving an analog photograph as an image connected to reality is an ideological function of photography based on its indexicality. In his essay "Real Photography", he explains: "Digital photography, and especially its apparently invisible manipulability, destroyed the photograph's privileged connection to the object. Without this anchor to reality, the semiotic relationship seemed over-balanced towards the iconic and the symbolic i.e. representation. Yet the concerns expressed in the 1990s, that the digital image equates photography with fallibility and distrust, now seem caught up in the historical moment of digital technology's first real flourishing; photography has always been 'dubitative' ... and this characteristic is not the province of the digital image alone." [3]

Photographs Made by a Scanning Electron Microscope

Scientific photomicrographs aim to provide scientific evidence of data as accurately as possible. The quality of scientific representations depends largely on reducing any stain and artifacts. However, the results obtained with the SEM can be disorientating because the process of producing a picture is camera-less. Additionally, there is no light or light-sensitive surface involved. The apparatus tries to recreate a reality that is not a visual phenomenon, which scientists try to analyze from its image that is captured through the SEM technology.

Dee Breger explores 'compound reality' in the nature of SEM photomicrographs in her book *Journeys in Microspace: The Art of the Scanning Electron Microscope* (1995), where she states: "And yet any image created with an SEM is still real in the sense that computer-generated images are not. In another sense, the object that looks so solid on the screen or in the micrograph does not exist at all. Only electronic cables connect the image on the screen with the object in the sample chamber. In other words, though we experience the effect of direct observation, we are not even looking at the object we see. Electron microscopy is indirect and

so we can be disorientating. It is a matter of illusions echoing across dimensions, of technology-induced surreality." [4]

Exploring the Medium

SEM work is based on the very precise scanning of the surfaces of objects using an electron beam that provides a deep focus effect. In the SEM, electrons from the electron gun are focused to a fine point on the specimen's surface by means of a lens system. This point is scanned across the specimen under the control of currents in the scan coils situated within the final lens. Secondary electrons are emitted from the specimen surface and are attracted to the detector. The detector relays signals to an electronic console, and the image appears on a screen. [5]. However, colors cannot be reproduced.

The interpretation of the imagery produced by SEM is confusing because the microscopic sample seems as if it is illuminated by the detector and observed in the eye aperture. Despite the fact that light seems to come from a particular illuminant, the contrast actually depends on atomic weight, chemical surface properties, crystallographic properties, the microtopography of the sample and the tilt of the plate, with a sample positioned to the electron beam that hits it.

There are a few problems that electron microscopy encounters during the process of imaging, which can be considered as 'noise'. The image may go out of focus because of the high magnification. Another problem could be a vibration caused by the movement of the sample during the scanning by the electron beam. This effect mostly appears on the edges of the sample in the form of a waving flag. A further problem is an accumulation of charge that can be divided into four types. These include the artifact's beam interaction, stains, image artifacts (the accumulation of positive and negative charge) and spontaneous emission.
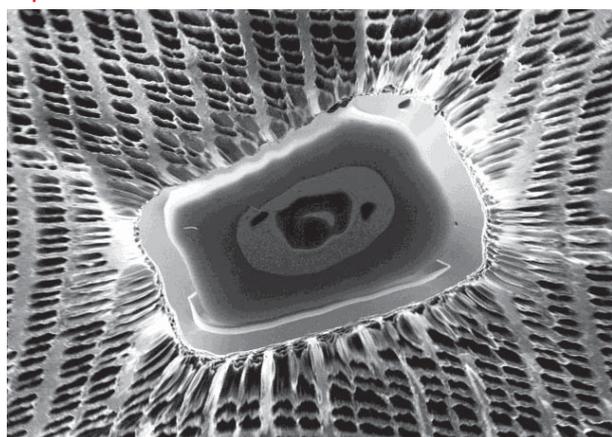
Fig 1. *Artifact on a non-covered plate,* 2015, Anastasia Tyurina, photomicrograph. © Anastasia Tyurina

An example of the artifact's beam interaction that can be observed is the "fish-eye" effect, where some areas look more zoomed than other parts of the image. This is caused by charges accumulated on the surface of the sample due to ground noise.

Images do not represent the true mathematical projection because of such factors as lens aberration, the scattering of electrons, and defocusing.

SEM Indexicality

Scientific microphotographs often record too much information, such as dust, scratches and other 'noise', and, as Peter Galison points out, scientists discuss whether to remove this unnecessary information or to accept it [6]. Moreover, the same sample can look completely different across two pictures of it. It depends on the interaction between various methods of sample preparation, the way the microscope is used, image-capturing settings, etc. Breger also notes that two different microscopists using the same instrument and sample will produce different micrographs, and the results by the same microscopist can also differ [7].

Some manipulations can be carried out through adjusting the microscope settings and others through the interface of its supporting software.

Fig 2. *Adjustment control panel,* 2015, Anastasia Tyurina, print screen. © Anastasia Tyurina

The most illustrative manipulation in this case is changing the electrical stress/tension, which allows one to see the image with different stages of contrast and to make an accent at completely different details, which in turn affects the cognition from picture to picture.

The accumulation of a positive charge (a positive electric field on the sample surface) results in a reduced overall image contrast.
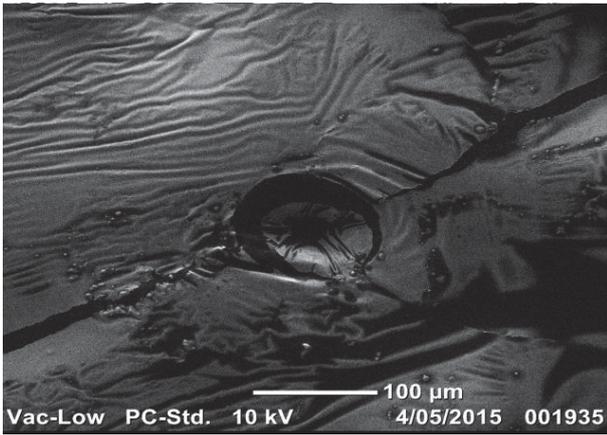
Fig 3. *10 kV,* 2015, Anastasia Tyurina, photomicrograph.
© Anastasia Tyurina

Accumulation of a negative charge leads to the opposite result, with the image becoming brighter.

Fig 4. *5 kV,* 2015, Anastasia Tyurina, photomicrograph.
© Anastasia Tyurina

In addition, scientific text information is automatically generated by the software when working on the SEM, which appears on the photographs as a type of labeling.

Fig 5. *Brown Lake, North Stradbroke Island,* 2015, Anastasia Tyurina, photomicrograph. © Anastasia Tyurina

Erasing this text from the images removes them from scientific style identification and potentially opens them up to more intriguing interpretations (Figure 5).

SEM is capable of representing its own traces by a specific way of producing an image and by its scientific text information incorporated with the image. These traces could be considered as a form of index, because they have physical and material connections to the SEM apparatus.

Artistic microphotography

Working on SEM is a real-time process when images are captured instantly by the decision an operator makes. In his fundamental text *Logic as Semiotic: The Theory of Signs*, Charles Sanders Peirce defines an index as category of sign that has a physical connection to its referent. He writes: "Photographs, especially instantaneous photographs, are very instructive because we know that they are in certain respects exactly like the objects that they represent." [8]

The earliest techniques of digital manipulation began to emerge in the 1970s, when photography was still largely considered a less significant form of art than painting because of its mechanical nature. Writing in the catalogue to the exhibition *Before Photography*, Peter Galassi explains: "Regarded essentially as a child of technical rather than aesthetic traditions, the medium is inevitably considered an outsider, which proceeded to disrupt the course of painting….Devotees of the camera obscura explain the machine's growing popularity as a symptom of a new thirst for accurate description". [9] This suggests that photography was not perceived as an art form precisely because of its indexicality. It was not considered possible for photography to admit the possibility of a subjective view of the author of the image.

Although scientific photography can be considered non-aesthetic since its main purpose is not to convey beauty but rather to convey accurate information, its ability to record material in addition to that which is merely informative allows it to also serve expressive, subjective and aesthetic purposes. Microphotography in particular has the potential to communicate to a general public from both a scientific and a cultural perspective.

This is what my artistic practice aims to do; through my experimental approach, I embrace unpredictability over accuracy, and 'noise' over 'purity'. To engage effectively with microphotography as a social phenomenon, it is crucial for an artist to demonstrate an understanding of its 'scientific' protocols of representing. At the same time, the artist who works with the SEM becomes an instrument, leaving traces of his/her intuition, choice, and interpretation. Janet Vertesi points that early modern communities believed all that was needed for accurate image production of microscopic observation was a 'sincere hand and faithful eye', whereas with advances in technical and mechanical

representation, the human was no longer believed to be an accurate instrument; the informant was excluded from the process. She also raises questions: "should the object 'speak for itself'? Must the artist depict a universal type, or is interpretive intervention required to highlight the important aspects of the picture?" [10]

Today, artistic SEM microphotographs can be seen as indexical of not only an object of study but also of a unique and subjective author who sits behind the microscope device. Making pictures should be considered more an indexical decision made by the artist than an index of what lies in the chamber of microscope.

In some ways, SEM photography remains indexical but the notion that mechanical images can be objective representations of reality is deeply flawed. Advanced scientific technologies provide artists working with the SEM with new ways of representing subjectivity through images. By exploring the interplay between the indexical and iconic modalities in the process of evaluating scientific photomicrographs, it may be possible to attribute new meanings to them and thus turn scientific photography into a creative source of communication to a general public.

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Joke Lanz is spinning the records – Analysis and graphical representation of an improvised concert of Experimental Turntablism

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Abstract

Homemade and reused devices in experimental music are the result of compositional ideas and processes. In this contribution, I want to show that the record player as an instrument in live performances provides manifold possibilities to create signal/noise relationships. The analysis of sound artist Joke Lanz's improvised concert reveals individual sonic concepts that liaise signal and noise, playback and live manipulated sounds. These concepts are realised by manipulations and prepared turntables or vinyl discs. The turntable, uniting mechanic and electronic processes, creates unique affordances and material properties that link sound and physical gesture. The resulting sounds of Lanz's turntable performances are media-specific. My analysis will show this by focusing on the interaction of the performer with the instrument. The analytical methodology includes ideas of materiality and mediality of performances. As a new tool for an analysis, the software EAnalysis was used to incorporate the video recording next to graphical representations of the sounds.

The Record Player as an Instrument

The record player provides unique material properties and affordances. [1] It plays prerecorded sound from a spiral groove of a vinyl record with a tone needle that transforms its vibrations into electronic signals. Using this playback medium as an instrument in improvised concerts means that distinct material properties and mechanical processes of the plastic disc and the turntable shape the musical result that cannot be realized with another medium or instrument. The record player's material properties provide the resistance of a physical body. The mechanical part of the turntable facilitates the transformation of physical gestures into the electronic sounds. This link between electronic sounds and physical gestures, this 'techno-somatic dimension', as Garth Paine explains, is crucial for embodiment and expressive playing. [2] "The 'how the instrument feels' consideration is part of a critical feedback loop between action and instrument response," as Paine underlines. [3] In comparison to digital electronic instruments, this link between physical body and sound is not only imitated and 'second-rate', as John Croft would argue. [4] He highlights the importance of the "appearance of human fallibility and corporeality", which he terms as 'grain' in reference to Roland Barthes. [5] Therefore, the turntable provides special affordances as a hybrid of mechanical and electronic device that allows unique ways of embodiment of electronic sounds.

In experimental turntablism, it is common that sound artists prepare, assemble and create their vinyl discs and record players individually (see, e.g., Christian Marclay, Martin Tétreault, Thomas Brinkmann or Janek Schaefer). The customised design and use of the turntables in concert evolves by experimentation and performance. John Richards considers the electronic instruments of the DIY movement as a documentation of the artist's practice and sound research. [6] The roles of composer, performer, instrument creator and researcher are conflated. The concerts are usually improvised and unrepeatable, which adds a specific eventness. As Erika Fischer-Lichte describes performances, the artists pick up on affordances from the venue or the audience's behaviour, which creates a feedback loop. [7] As a result of these conditions in experimental turntablism, significant dependencies of the performance on the record players as live instruments emerge. I want to demonstrate this by presenting the results of an analysis of Joke Lanz's turntable performance. In experimental turntablism, individual approaches show a broad range of the creative use of turntables and of the interaction with the instruments. In Lanz's concert, his distinct sonic concepts and playing techniques create signal/noise relationships and rhythmical elements. His direct way of performing with the turntables using many manual manipulations ensures tactile music making. As a result of the turntable's peculiar way of linking sound and physical body, the sound production is mostly visualised in the concert. Unless we perceive these media-specific aspects in the live performance, significant medial and sensual meanings will be lost. These idiosyncratic aspects bring technological mediation into the foreground of perception and facilitate reflections on the medium and the here and now. These premises guided my methodology and analytical steps.

Methodology & Graphical Representation

My methodology places the focus on the synergies between instrument building, the physical sound and performative aspects concerning materiality (embodiment) and mediality (presence). Video recordings from two cameras (1 master and 1 close-up shot) and visual

representations in the software EAnalysis (developed by Pierre Couprie) as well as notes of concert observations support the analyst's memory for the analysis. It must be considered that the video recording of the concert does not match the performance situation. The camera image frames an event, highlights its importance and shows close-ups that create an enhanced sight and are not comparable with the spectator's perception. Therefore an evaluative selection is implied and several aspects such as the atmosphere or reactions of the audience cannot be conveyed. However, the recording was guided by the analytical framework and research questions of my thesis, which require the focus on the interaction of performer and instrument. For this reason the video was limited to the events on the stage. The software EAnalysis provides several representations (spectrogram, waveform, graphical representation) as different layers that can be screened interactively with the video (not only with the audio). The graphical representation shows iconic forms inspired by the shapes in the spectrogram. According to Pierre Couprie, the iconic representation with more intuitive links between graphical object and sound is easier to read than a symbolic representation (such as symbols of notational systems). [8] Michael Clarke criticises the non-standardised forms in graphical scores as well as the limitations in representing more complex sounds. [9] However, several experiments show, as Lindsay Vickery highlights, that the mapping of graphical representations and sounds seems to have natural limitations due to 'weak synaesthesia' or cross-modal activation. [10]

Analysis

Artist

Joke Lanz (born 1965, Basel) is a Swiss sound artist who has lived in Berlin for many years. He has been performing with the turntables since the 1990s. At the same time, he performs under the name Sudden Infant, which is a solo noise project. His main influences are punk and industrial music, Dada and Viennese Actionism. This comes across in very energetic and intuitive improvisations with electronics. He understands vinyl records as something organic almost alive and appreciates the physical properties of the discs, that can be heard in the crackling of the surface, for example.

Instrument

Lanz's setup and technological devices are aligned to guarantee a direct and immediate playing. He plays with two turntables in a rotated position what hip hop turntablists would call 'the battle position'. In this position, the tone arm is in front of the player instead of the player's right side. This means that the platter is more approachable for manipulations. The crossfader facilitates to create a mix of two channels (crossfader is in the middle position) or to blend into one of the two channels by moving the fader sidewards from the middle

position. The crossfader's low resistance allows quick shoves with only one finger, and in Lanz's case also abrupt breaks. Lanz used additionally a sampling device for this concert. His numerous vinyl records are only partly prepared (see Figure 4).

- 2 turntables (Technics SL-1210 MKII)
- DJ mixing desk with cross fader (Ecler nuo 2.0)
- Sampler (BOSS SP-202 Dr. Sample)
- Vinyl Records
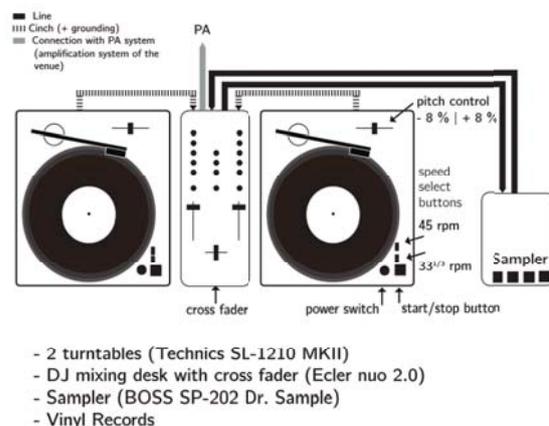
Fig 1. Joke Lanz's setup in the performance on 19th December 2014 in Berlin, © Karin Weissenbrunner.

Sound material

The concert by Joke Lanz took place on 19th December 2014 in West Germany – a small, underground venue in Berlin (Germany) – and was around 26 minutes long. The performance encompasses heterogenous sound material from the sampler and 19 vinyl discs, including varieties of noises, spoken word and music samples. Yet only a few spoken word samples, mainly numbers, are recognisable. The signal-based and more quiet sounds are often shortened so that only phonemes and sound fragments remain. The signal-based samples feature, for example, electronic drop sounds, female vocal sounds, a child singing 'Over the Rainbow' or glissandi of sine tones. Most of them seem related to speech and consist of pure sounds with few harmonics. The noise-based sounds feature harsh noise, feedback, broad-band noise bursts or digital noise impulses.

Structure

The concert has a collage-like form featuring typical characteristics such as the use of prerecorded sound material and obvious cuts. [11] Yet contrasts as well as musical developments sculpt rhythmical patterns, sound carpets and transitions. Eleven smaller entities create a structure that mainly opposes alternating parts of powerful noises and smaller, signal-based sounds. Various forms of manipulated sounds (such as scratching sounds) seem to liaise between these two poles. The prerecorded sound material is throughout in a rhythmic context with other sound material, fragments of both turntables interact in rhythmical dialogues. Pairing short sound snippets as one main voice from the turntable with short cut-outs or scratches from the other turntable or sampling device results in durational patterns and complex syncopations. These rhythmical textures get

recorded and looped on the sample device to build up a background that new sound material can be projected against. In the same way, Lanz creates transitions from one part to another. Short fragments of the opposing sound material are added rhythmically to the texture of the constructed sound carpet. Also the noise-based passages appear mostly controlled because of the loop structure of the noise samples or the timed breaks in between. However, Lanz breaks with this strategy of contrasting parts in the last three minutes of the concert. He plays several music citations for longer periods, which create a background of beats and add a new dynamic. While the main part of the concert had a more controlled characteristic, Lanz seems to open the performance up for more chaotic and random sound samples. Also the different manipulations change more often. This gives an impression of a climax, which he finalises with loud noise bursts in a staccato. These noises flow into a constant deep noise that slowly runs out into nothing.

Embodiment – Human Actions

The most frequently occurring actions are Lanz's controls of the turning records and the faders on the mixing desk to interrupt the playback from the turntables. He also carefully moves the record manually under the needle to create a short fragment of sound. These 'interruptions' are similar to Pierre Schaeffer's first experiments with the Cut Bell fragment. [12] Cutting the samples into short fragments prevents their identification. But Lanz varies the lengths of the fragments and the audience will eventually recognise citations. Interrupting the playback seems to be a sonic element to put samples into a musical context or to create comical moments. It is also related to Lanz's ways of timing in his Sudden Infant project. Drew Daniel sees the 'self-interrupting' and 'thought-erasing' as "the secret to Sudden Infant's comic timing." [13] These interrupting manipulations are related to Lanz's various forms of scratching techniques, which are comparable to those of hip hop turntablists (although he does not follow a strict beat). These can be manual scratches moving the record forwards and backwards at a slower or faster pace, spinning the record at a high speed or combining the scratching movements with the cross fader. Lanz uses these manipulations mainly to create transitions between signal-based and noise-based parts. For example, by continuously moving the disc back and forth, he creates a chain of scratches and therefore a noisy element out of a signal-based sample. The noisy scratches result in an almost pure sound element, a vowel of a child's voice, that introduces a signal-based part. This can be followed in the graphical representation (see red curve under the video at 17:40 min in the concert in Figure 2). The scratching sounds are linked with the physical movements of the performer. However, this link is broken when manipulation sounds are the content of a disc (for example at 11:09 – 11:31 min). In this case, the record player's mechanical rotation of the disc for the playback creates a limited form of phonographic

embodiment. These visual cues might help the spectator to resolve any confusion about whether the sounds are produced live or prerecorded.
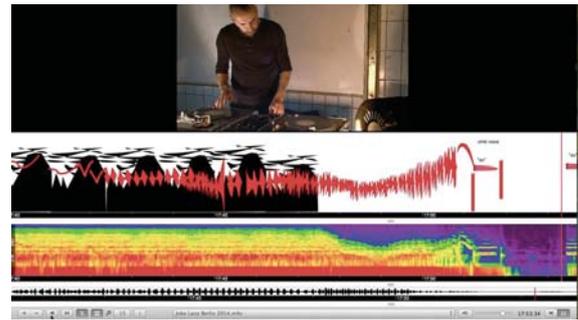
Fig 2. Excerpt at 17:40 min in software EAnalysis: Waveform (bottom layer), spectrogram, graphical representation and video of the concert (top layer). In the graphical representation, turntable on the left = red, turntable on the right = black, sampler = grey), © Karin Weissenbrunner.

Another sonic concept: Lanz manually drops the needle to create broad-band noise bursts or to skip through several tracks of the disc. This has been used for transitions as well. But the most conspicuous gesture of the whole concert is surely when Lanz starts to shake the whole table with both turntables on top to create a form of staccato of needle drops at the end of his concert (see Figure 3). The audience cheers and encourages the performer to continue shaking the turntables. This was not a planned action but a complete spur-of-the-moment idea, according to the performer. Before the concert, only a ramshackle beer table from the venue was left for Lanz's setup. He also did not know the ending of his concert at this time. This demonstrates that improvised turntable concerts are the result of a feedback loop between the performer, the instrument, the audience and the venue. A unique musical performance is brought forth by the process of the event.

Phonographic Embodiment

For another transition from a signal-based to a noise-based part, Lanz uses a prepared LP with stickers (Figure 4). The bursts from the needle jumping over the stickers develop a similar rhythmic pattern to the figure of a speech-like sample from the other turntable. This prepared disc brings noises of the medium itself to the foreground. The distortion noises are linked with the repeating movements of the jumping needle and therefore an example of phonographic embodiment.

Other phonographic manipulations are speed regulations that create glissandi or transpositions. A very conspicuous phonographic embodiment in this concert is slowing down the rotation of the turntable until it stops. Lanz uses the power knob of the turntable for this manipulation at least seven times during the concert. This function is often used to end a section, most prominently after the first minute or at the end of the concert.

Fig 3. Joke Lanz shaking the table in the performance on 19th December 2014, © Karin Weissenbrunner.

Fig 4. LP with stickers by Joke Lanz. This example is similar to the LP from the performance, © Karin Weissenbrunner.

Mediality – Presence

The many human actions of Lanz interacting with the instrument (e.g. record changes and manual manipulations) as well as his body language generate a strong presence of the performer, which dominates the instrument's phonographic presence. Lanz's manipulation techniques and spontaneous ideas appear skilful. His playing techniques, such as the long scratching passages, require practice and concentration. The audience members not only understand the sound production but also assess their virtuosic execution. However, Lanz combines this technical performing style with his influences from punk and industrial music and denies a perfectionistic approach.

Conclusion

As the examples of the concert analysis show, Joke Lanz has developed individual sonic concepts to create signal/noise relationships that are entwined with his playing techniques and specific to the turntable. The concert is significantly shaped by the tension between prerecorded and live manipulated sounds. The mechanical functions of the turntable translate the physical movements of the performer and provide important cues for the audience to understand the

unconventional sound production. The majority of electronic sounds are embodied by the performer's actions. Lanz's gestures show artistic intentions and a form of mastery of playing techniques paired with spontaneity and intensity (e.g. ending the concert by shaking the turntables). This strengthens the performer's presence and authenticity and speaks for Lanz's distinct performing style. The embodied sounds indicate the dependence on the material properties of the turntable. Turntablist and visual artist Christian Marclay describes this as "the contradiction between the material reality of the art object as a thing and its potential immateriality." [14] By manipulating and abusing discarded reproduction technology, such as turntables, the idiosyncrasies of the medium come to the foreground and bring the mediating process of a playback into the listener's awareness. The illusionary dimension of audio recordings, supposed to reproduce a sonic event from another place and time (much like a photograph), is transformed into the reality and processuality of the performance. In Lanz's turntable concert, this results in an abundance of rhythmic elements, interruptions, coherence, contrasting entities of heterogenous sound material as well as moments of spontaneity and physicality, humour and sensuality.

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Cultivating More-than-Human Lifeworlds: Laudatio on Indigenous Fermentation, Smell and Metabolic Power Grids

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Abstract

What are ethical and species-affirming approaches for how humans, can relate to *you*, the fermenting *Lactobacilli*? In pursuit of this question, *you*, the single-cellular life forms inside living machines and bio-artistic events are invited to join the animal party! Just because human animals neither have the sensorium nor the empathy to grasp *your* lifeworlds [1], does not mean they can keep ignoring *your* presence. Biophysically, *you* are already everywhere the human animals are; in their breath, on their skin and inside their guts and yoghurt. [2] Before they know it, *your* 'micro-metabolic power grid', might even charge their electronic gadgets. [3] *Lactobacilli*, it is not enough for *you* to be their workhorse. For human animals to keep their future options lively and open, *you* need to become their role model. They can learn from *your* synergetic, cultural manipulation and coalescent social work. Teach them how to be a playful companion dweller inside this planetary home!

Open-source tech for cultured meshworks

Hello *Lactobacilli*. *You* belong to a humongous conglomerate of bacteria and yeasts, able to convert sugars into acids, gases and alcohol. The latter apparently is of significant economic value to the human animal. [4] *You* help upgrade and distill putrescible, organic materials into priced commodities to feed 'domesticated' animals and even 'biofuel' their engines. [5] It is a highly shielded, mono-cultural process, they call 'industrial fermentation'. Many of *your* microbial colleagues are the invisible workhorses of human animals, diligently in service for *their* rather restricted economy. [6]

Outside the brewery and fermentation lab *you* can consider yourself a lucky, metabolic agent. As enabler of a wide-open, socio-ecological technology, *you* stimulate and balance the energy flow between animal and plant life. *Lactobacilli*, you are amazing. *Your* vast fermenting tribe is fairly self-organized but *you* are very good at joining forces across the species' boundaries. *You* developed an affinity for the human animal – despite its self-centered, dominant stance in the world – which over millennia, has acquired refined techniques to cultivate and nurture *you*.

By default *you* are a feral and indigenous agent, piggybacking on air, plants and animals, always ready to inoculate and perform *your* act of "controlled rotting". [7] *You* are easily attracted by moist flour, rice starch, lactose-rich milk; or to be found right inside the cabbage leaf and ginger root. With purposeful agitation, bodily warmth and airtight containment *you* thrive and reconsti-
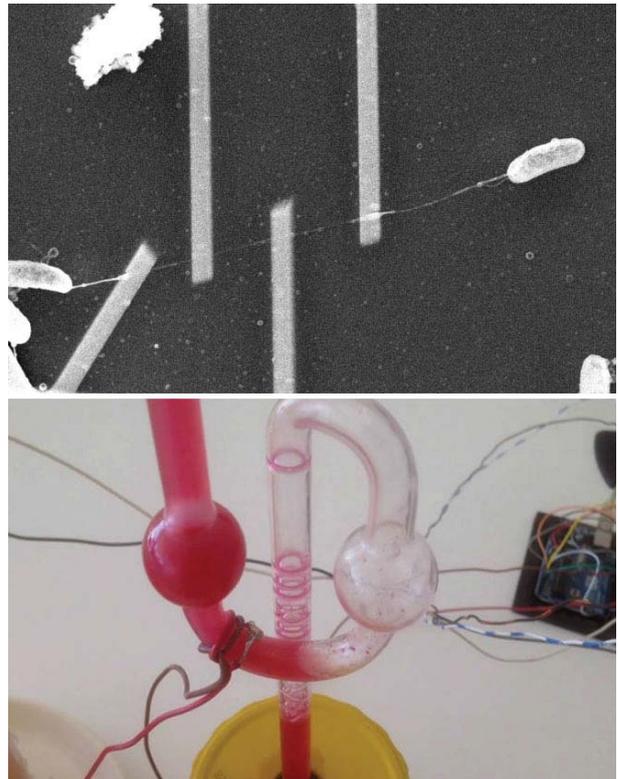
Fig 1 (top). *The Mysterious Electronic World of Microbes:* Conductive nanowires, measured by electrodes, connect bacterial cells, 2014. Image (light microscopy, 1000x magnification): Moh El-Naggar.
Fig 2 (bottom). *Fermentophone:* Generative, edible, musical instrument performed by living cultures of bacteria and yeast, 2012. Installation and photograph: Joshua Pablo Rosenstock.

tute the fragile harvest of photosynthesis into stabilized nutrients circulations. *Your* intelligence cannot be captured in human terms but *you* demonstrate a consciousness for contextuality [8] and a group spirit that is feeding into symbiotic techno-body-culture relationships. How intimately life-forming *you* are is evident when pediatricians collect *you* from vaginal mucus to 'inoculate' human newborns delivered through caesarean section with *your* immunizing microbiota. [9] [10] With enormous *lacto*-bacterial populations inhabiting them, maybe the human animal is better referred as 'homo bacteriens'? [11]

Bacteria-human interfaces

Lactobacilli, except for 'Fermented Spider Eye & Brown Mushroom' in their game named Minecraft [12], *you* do not have (yet) any buttons that make *you* 'click'. Instead *you* respect fine protocols of order and cleanliness before becoming 'messmate' or partner in crime with the human animal. This is the *milieu* where boundaries between the tamed and the wild cultures are reconstituted. Artistic types among the human animal call this fermentation frontier of bubbling and hissing the "ecosystemic and biodiverse interface". [13]

Lactobacilli, you are a much better communicator than the human animal. *You* provide plenty of sensorial affordances to signpost the status of your ferment-in-progress. Besides visual cues (e.g. colorful mold where microbial competitors took over) *you* engage with the psychologically most formative senses in the human animal: touch, smell and taste. If *you* ever wondered about humans' insensitivities, *you* should know, they are currently undergoing an organized, sensory deprivation. [14] [15] Their socio-technical networks increasingly glue them onto ocular-centrist devices, gradually forcing them to abandon olfactory and gustatory forms of being and relating. [16] *You* certainly command durational, bodily presence from the fermenting human to become *your* teammate. Thereafter *you* have your own ways to reward the noses and tongues with releasing the 'contently sour' signal when, for example, *your* sauerkraut is fermented. In case of unfriendly takeover from less desirable microbes, it will be more of a 'musky discontent'.

No matter how permeably, inter-acting this bacteria-human contact zone is, *your* single-cellular inner life completely escapes the sensorium and empathy of 'homo bacteriens'. [17] Are there ways for humans to meet *your* 'lactobacillic' liveliness? *You* have a way of relating that is not just about enzymes and inter-cellular dissemination. *You* are content to keep *your* diffusive interactions inside the pickle jar and the colon in private and to yourself. Even state-of-the art, scientific instruments are failing the human animal to really get to know *you*: they capture only observable phenomena of *your* metaphysical processes but not *your* liveliness. They can collect as much scientific data from *you* as they want, it will remain trapped in their empirical bias and the limits of human perceptual spectrum. [18]

If science is not of much use, can *you* share at least with the metaphorizing human, what it feels like to be *Lactobacilli*? Would *you* compare *yourself* to a singer in a choir of activated CoolAid, fizzing away in a fishpond? The shortcoming of this humanly referenced metaphor is how it diminishes the unique strangeness of *your* bacterial matters. The human animal struggles to access *your* inner workings in absence of a shared, sensorial grounding. Beyond analogies they seek more contextualized avenues to connect with *you,* approaches that can retain *your* alienness without reducing *you* to a human caricature. [19]

Lactobacilli, what can humans who accept their failing knowledge-making capabilities do to attune to *your* deeply alien presence? How can this ethical acknowledgement of difference be something productive? The fact that *you* and them are highly social creatures might provide one strategy. Maybe single-cellular *you* and multi-cellular human can meet in artful events that bring forward a kind of inclusive, social opening? Samples for such relational-aesthetic interventions might be "odor maps" or "smell games" where networked human noses co-perform with fermenting cultures to constitute embodied food webs. [20] Could these open-ended, more-than-human social "interstices" with *you* foster (human) contemplation on the interactions among its multispecies participants? [21] *Lactobacilli*, *your* subjective cues, so incompatible with human comprehension, can potentially create arresting kinds of relationality, at least in a curated context.

Lets imagine living machines or living art events that do not privilege human intelligibility over nonhuman intelligence. Rather, they may provide social niches of resonance for lingering in *your* wondrously alien, nonhuman, *lactobacillic* lifeworlds. Concocting such experimental, bio-socio-techno powered relations among diverse, mortal organisms could prime the human animal to become a better planetary co-habitant and evoke more-than-human accountabilities. [22] *Lactobacilli*, co-designing with *you* also could establish unusually lively and creaturely sites of mutual obligation: demanding their critical attentiveness, conscious commitment, and practical labor, *you* can bring humans into vital constellations of care and caring [23].

Lactobacilli, enrolling the human animal into cross-species' accountability will indeed be essential for the huge tasks lying ahead. Not only are *you* metabolically tending to nutrients and contaminants, but *you* possess neurological powers for balancing human mental health. [24] *You* are the *in*-spiration for taking part in seemingly unrelated things and mutually enriched relating. *Your* haptic and sensual affordances transpose human and non-human knowledge into activated experiences. [25] Call it 'speculative meaning-making fueled on fructose' if *you* like. Scientific tinkerers among the human animal are trying to remake *your* extended bacterial family into their high-tech innovation partners. *Lactobacilli*, *your* relatives might soon be the self-repairing building blocks for nanomaterials. [26] These 'biofilms' have amazing "metabolic branch points" that are programmable with "regulator molecules" to control their properties. Soon this activated bacterial tissue might help human animals to clean up polluted rivers, even produce pharmaceuticals or textiles. Within its given limitations, the human animal uses electronics to get to know *you* better in what seems less extractive, more sensitive-playful ways. *Lactobacilli*, they are sniffing and hearing *you* out. How, for example, do *you* feel about the Fermentophone that derives algo-*rhithms* and bacterial tunes from *your* living cultures? [27] Or what do *you* think about the 'electronic noses' and 'electric ears' [28] that detects *your* bacterial friends in drinking

water [29] and in black tea fermentation? [30] *Lactobacilli*, a close relative of yours by the name Desulfobulbaceae even performs as organic transistor, silicon wafer and electric grid all in one. [31] One day, such micro-scale biomachines might generate electricity one moment – to recharge the human animal's gadgets – and produce fuel and raw materials the next. [32] Until such bio-degradable electronics become reality, it is wise to keep propagating the brigade of "computer-munching microbes" tasked with the cleanup of an ever-increasing e-waste. [33]

Social interstices of 'cultural manipulation'

Lactobacilli, you know very well; goodwill is not the same as practice. If *you* are to materialize from the dusty confines of a recipe page into humans' everyday life, social practice is at work. Unless you are accepted into play and ritual, *you* cannot live to your fullest, feral potential inside human domestic ecologies. No worries, this is not the industrial practice, framed by uncontrollable external forces, that sterilizes (aka pasteurizes) your precious biota for prolonged shelf life. This is the homegrown, cultural manipulation and internalized practice, where *you* possibly bring out the best in human animals: skill, caring and life-formation. For millennia human animals nurtured, utilized and woven embodied technologies [34] such as fermentation into their everyday. *Lactobacilli*, it is here where *you* make a real difference even in the tiniest refuge of cultural diversity. Be not discouraged by misguided human animals trying to eradicate *you* with germ-killing disinfectants and antibiotics. To the human idealist *your* self-organization remains contagious. *You* are living proof for how the capacity to act independently, out of 'conglomerative' free choice, never was the sole privilege of the human animal. [35]

Human 'fermentizens' who collaborate with *you* are thinking and making *with* – not to – nonhuman life forms. *Lactobacilli,* in this more-than-human social work, the question is, who manipulates whom? Here Mason jar, plant material, air, soil, Fermented Spider Eye and Fermentophone become able, nonhuman stakeholders on their own, alien terms.

Best of all, *your* bacterial charm forges unusual connections among organisms, single-cellular or not, technologies old or new, knowledges scientific or indigenous. Human animals call this evolutionary life force of 'coming together' that leaves all participants transformed, coalescence. [36] Rest assured *Lactobacilli*, humans will increasingly need this boundary negotiating with as vastly different lifeworlds as possible for re-establishing symbiotic webs of food, culture and wilderness. [37] Coalescence also brings an ethic into their mode of engagement. While they keep breathing, eating and defecating, humans easily forget how much of a biochemical kin they are in the midst of *your* mighty metabolic universe. [38] For *you*, this tending in shared togetherness is where the fermenting relationship begins.

Compression, encoding, reinitializing

Challenged as humans are in interfacing with *you* on a day-to-day basis, they are much better at engineering utilitarian legacies for *you*. Being totally enthralled by expressive media as *they* are, human animals started in earnest to track and data-map the molecular affinities with *you*. They are in awe how intertwined and attractive our mutually shared DNA is. [39] Only biological relatedness that is countable and chartable, they seem to believe in. Admittedly much of this data recording is driven by a narrow human-centered view on health.

Increasingly human animals realize how their survival stands or falls with the health of soil, the very dirt that *you* the *Lactobacilli* support in regenerating. From their ecology-savvy ancestors they recently rediscovered to apply biochar as – forgive the precarious analogy – 'circuit board of the soil' [40]. It is an exquisite habitat for microorganisms made from pyrolized, high-temperature charcoal. At last the human animal has begun to build long-lasting refuges for *you* and *your* fungal comrades. Bundled with many other tiny life forms and loaded with nutrients, *you* can work *your* magic over the long haul and turn fertile soils into potent carbon buffers – probably the best bet the human animal has in mitigating climate disruptions. [41] With enough foresight to let *you* and all other more-than-human lifeworlds flourish, we might establish refuges bio-diverse enough to allow the existence of human animals in the future.

Lactobacilli, just in case the human animal runs out of time and was to disappear for good – if anything, what would *you* miss? Could *your* omnivorous cultures do away without the aromatic delicacies like Kimchi, Roquefort and Bulgaria Yoghurt?

By way of concluding

In this paper the *Lactobacilli* has been personally addressed as 'you' and the human animal has been referred to as 'them' to explore methods for reflecting on the agency of nonhuman life forms. Inside this 'you-them' scenario, what or who is then implied by the narrating 'me' or 'us'? Reading between the lines, the 'us', as multiple of 'me', can become the relational middle ground for unusual modes of connectivity among more-than-human life forms: a contact zone that permits and encourages the breakdown of human comprehension and potentially fosters an unequivocal sense for nonhuman presence. In contrast, 'alien phenomeno-logical' or scientific undertakings for accessing nonhuman lifeworlds and agency tend to be limited by human bias and perception. Therefore socially experimenting with living machines and bioart can leave behind these constraints of human sensorium and empathy and instead establish reflective-relational spaces together with more-than-human life entities. This aims at provoking arresting kinds of more-than-human encounters underpinned by the paradox of reconciling adverse, subjective inner lives. In a socially shared

reflection, such epistemological disconnects can bring about the ethical acknowledgement of creaturely difference that is easily lost in other approaches.

While approaching nonhuman lifeworlds remains an epistemological challenge, biophysically, *Lactobacilli* and animals (humans or not) are increasingly entangled. Efforts are underway to engineer close relatives of *Lactobacilli* directly into information technology to serve in semiconductors, so called bio-chips. [42] With so much relationality at play, human agency profoundly depends on nonhuman agency across bacteria, archaea and eukaryotes. These 'webs of agency' are the harbinger of diversity, technologically, and culturally to sustain our ecologies in soils, societies and economies. Donna Haraway indicates how such 'worlding together' with mineral, fungi, and plant in all their liveliness, is more than ever, not mere enrichment but existential for the human animal:

> "One way to live and die well as mortal critters […] is to join forces to reconstitute refuges, to make possible partial and robust biological-cultural-political-technological recuperation and recomposition…" [43]

In this 'worlding together', meanings and values keep oscillating between human experience and in the inter-acting mattering and dynamics of more-than-human life forms. These multispecies meshworks find expression in exuberant-audible *Lactobacilli* harnessed for musical ears, delectable mushrooms sprouting after ecological disaster, or ephemeral critters running wild in the advent of biotechnology. Through the contiguous re-imagining of our bio-social foundations, we might discover how for example the meanings attached to *Lactobacilli* are altering when transitioning from one social practice to another, like food preservation, midwifing, ethanol distilling or sewage treatment.

Engaging affectively with a diversity of single- or multi-cellular organisms is less about delivering use value to the human. Rather biomachinic and bioartistic experimentations are vital to dwelling more consciously inside the boundaries of our planetary home. Accepting the limits of human knowledge-making is the first step, if we want to elevate more-than-human actors into decision making and political agenda as Latour argues. [44] Thus it will be essential to further explore ways for relating to material and organic meshworks that respect and account for nonhuman alienness.

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An Interactive Mnemonic Space for Jodi.org:
The Process of Re-exhibiting

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Abstract

How will the artist website jodi.org be remembered? Eventually this artwork could be remembered within an art museum, but there has been a complicated relationship between the museum and Net.Art, in part because of the different memory strategies at play within each. This paper analyses strategies that the artists experiment with to keep jodi.org alive for now and with an eye on the future. This brings into view that it is important to rethink the division between communicative and cultural memory and hybridize memory processes as explained in both fields. How can this new epistemology of memory be applied within museum curatorial practice? This paper proposes the concept of 're-exhibiting': developing various versions for display that strive to incorporate the communication within networks. The exhibition history shows the artwork as a changing entity; it can give insights in the DNA of the artwork and the memory strategies that can be applied to keep it alive.

Introduction

During the Nineties, a new information space known as the World Wide Web (hereafter, the Web) transformed the Internet from a non-public (mostly academic and military) medium into a mass medium accessible to all. Today we may reconsider this pivotal moment in digital culture with the fresh eyes of historical distance. From a contemporary perspective, the Internet can be understood as one of the most important developments in the Twentieth century. To understand our present time, it is essential to have knowledge about the Internet. As such the question arises: *How is it going to be remembered within current and future generations?*

Understanding the rise of the Web also calls for knowledge of the utopian and dystopian pronouncements around that time. Contemporary critical reflections on the emerging medium of the Web can be found within Internet Art. As Aleida Assmann argues that artists are *the* critical observers of the time. [1] The artworks that were created within that time, both on the Internet itself and which capture (critical) reflections on this emerging medium, offer a way to understand the Internet. So if these representations of the time are such an essential contribution to our understanding of the Internet, how can they be saved for future generations?

The responsibility for the memorialization of one of the most well known, avant-garde websites within that period, jodi.org, is largely in the hands of the artists. The website (origins from 1995) can still be visited online, without any complications in contemporary browsers. Also the work is exhibited regularly within and outside museums and galleries. What will happen when the artists abandon this role? Eventually a memory institution, such as an art museum, could take responsibility, but one problem concerns how to include an online artwork within their memory framework. In the field of memory studies, it has been widely discussed how digital media are influencing memory processes. As a result the gap between memory processes within the art museum and the digital realm still needs to be bridged and it could be argued that many art museums still struggle to include digital heritage in general, but in particular Internet art, within their collections.

Last year I discussed this issue with artist duo JODI (Joan Heemskerk and Dirk Paesmans) and in particular we questioned how their work could be remembered within a museum setting. We decided to rethink the presentation of their early works. The display version they developed gives not only valuable insights in their thoughts about the memorialization of this particular artwork, but also insights into how digital memory processes differ in general.

In this article, jodi.org will be a starting point for analysing memory processes that are crucial for including digital (in particular web-based) heritage within museums. These will be used to create an exhibition model for a web-based artwork. The Internet is a communication medium and the invitation to participate characterizes Net.Art. The exhibition is where interaction with the audience takes place. As such the memorialization of Net.Art is a matter of preservation closely related towards the question how we can display these artworks now and in the future.

Revisiting jodi.org

The website jodi.org was launched in 1995. Since then it has become one of the most well-known avant-garde websites. While letters and symbols are usually displayed on a webpage, the jodi.org website subverts expectations, by displaying the green ASCII text – the program code which is normally invisible to the user - instead. With the undressing of the code, the online

world shows its true face and it totally confuses us, maybe even more now than in 1995. In our post-digital era codes are increasingly hidden and online and offline are tangled and intertwined. We can hardly distinguish what is computational and what is not. Within jodi.org the seemingly nonsensical code obscures a graphical representation of a bomb. The digital disruption makes us wonder what is actually communicated online and what reveals more: the code (for most humans unreadable) or the translated representations (texts and visuals). Even 20 years after its launch, and although computer programming languages have drastically changed, jodi.org still reflects aspects of our contemporary media society. This is not only the case within the history of technology; it is just as much embedded within art historical traditions, with a new generation of artists acknowledging jodi.org as highly relevant for their current artistic practices.

Over the course of time jodi.org has transformed into a dense network of multiple web-based artworks that have been added to the 'mother' website, among others 404.jodi.org, oss.jodi.org and sod.jodi.org. Nowadays jodi.org is not so much a single artwork, but a digital collection, as well as an archive for contextual materials that even includes the email address of the artists, and the network is still growing.

On the one hand the artists try to protect the interactive, evolutionary nature of their artwork and prevent the webpage from being stored offline. On the other hand they do acknowledge the importance of documentation, and see possibilities for offline as well as online collecting and presentation. In other words, they recognize the importance of multiple memory strategies, but emphasize that the Internet is a key aspect within their work, that should be maintained as long as possible.

A new display version for jodi.org

In 2014 I approached JODI with the question if they wanted to rethink how jodi.org could be exhibited within an art museum and present it at 'Projections' (the video art section at the contemporary art fair Art Rotterdam). The artists felt that it could be important for the art museum to present their work with the input devices from that time. As such JODI playfully presented the work with a classic keyboard and mouse. This approach could be seen as ironic, maybe even a form of institutional critique, since they also used a relatively new Mac computer. It was clear that in their opinion the equipment could be replaced. What was more important was the browser, which needed to be visible in all cases (also on the stills within the press release) and for this presentation the original 'Netscape' browser was emulated. As the work was shown on 'Projections' the presentation needed to be more or less adjusted to the format of the limited display possibilities. Although it did illustrate that we should not confuse the computer with the online and offline networks, the connectivity and the web, which are main issues to be taken into account.

The most important question has become, how to maintain the interactivity through the Web. For this, JODI developed an instruction manual (a "screening script"), which needed to be executed by a hired operator. The instructions helped the operator to navigate through their early works (1995-1999). He was asked to continuously execute these instructions, which could be seen as a performance for the viewers. The JODI performances are usually more improvised and although the instruction manual was clear, it also stimulated the operator to make individual detours.

Besides the physical presentation at Art Rotterdam two videos appeared on the website of MAMA (a centre for contemporary art in Rotterdam) in which Rafaël Roozendaal explored JODI's work using their Wikipedia article as the starting point and Constant Dullaart made an appropriation. [2] Jodi.org was brought within a contemporary context by a new generation of artists working with the Internet. Instead of a passive contemplation, the work was displayed as an active platform, which still connected through time (by connecting to a different generation) and space (the connection between geographically remote locations, but also between the online and offline world).

The presentation at Art Rotterdam should not be seen as a final outcome. Rather, it was used as a discursive space for exploring the problem in general. Prior to the exhibition there were conversations with experts, including Sandra Fauconnier (historical context) and Annet Dekker (curatorial and conservation practice). During Art Rotterdam, Witte de With organized a peer-to-peer meeting in which possible futures for online artworks in (museum) collections were examined. Also the presentation at the art fair itself was used as a discursive space with the aim to discuss with museum professionals and collectors possible cultural contexts for jodi.org and the broad range of changing perspectives on display opportunities within a museum gallery.

Art museums reacted positively, but also emphasized their complex relationship with Net.Art. With the advent of digital technology, knowledge is stored in a constant state of flux. It is constantly re-shaped under the changing pressures and perspectives of the present. As also the literature in the field argues, the dynamic mnemonic logic still challenges the museum. When museums collect net-based artworks, they are confronted with the fact that their infrastructure differs and is incompatible with the aims of these artworks. In case of Net.Art this state of flux should be better formulated, as it is not only about how the artworks change continuously, but also how these transformations are caused by communication within a networked community.

Communicative and cultural memory

Remembering the past should not be confused with documentation of the past. Remembering is the result of the decisions made in different places and times; in each specific context we decide what is important to

remember. Because of that history is always more or less distorted: It is a selection, an interpretation and an adjustment towards the schemata's of a particular culture. Our contemporary ideas about the past have been highly influenced by the digital realm. The Internet has given us new mediations of the past, which is challenging our traditional understanding of cultural memory, including the way we think about (stable) historical narratives, the idea of a canon and (single) authorship.

The introduction of the term 'cultural memory' serves to help us understand this shifting perspective. It was Jan Assmann who coined this term, when he examined how cultural identity is developed within a society by creating fixed points that establish the endurance over time and helps sharing the past (for example monuments or artworks). [3] Assmann contrasted this form of memory with Halbwachs's notion of 'social memory', whose focus was on memories that are shared by members of a group through everyday and informal interaction. [4] Oral memories need to be constantly trained and renewed by a selection of individuals that have the responsibility to retell the stories. Assmann adds that the transfer of memory is not only by inter-human interaction, but also by external systems of notation (such as writing or images). [5] As such he distinguishes two theoretical memory concepts: the 'communicative memory' (as articulated by Halbwachs) and 'cultural memory'. The latter takes a distance from the everyday. Certain memories of important, historical events are preserved in time by the construction of so-called 'time islands'. They have a different form of temporality then everyday communication (for example through freezing or repeating certain moments in time). The formation of culture creates a collective experience which meaning can be accessed, millennia after it happened.

Museums are important institutions within the formation of cultural memory and their memory processes still affiliate with how Assmann described it. This also reveals some of the reasons why they have to overcome difficulties when dealing with artworks within the digital realm. Online artworks are nestled within a medium for communication and interactivity is a necessity for their appreciation and understanding. It has been argued that the collaborative authorship can conflict with the functioning of museums as gatekeepers. The fact that these artworks transform over time can be in conflict with the more traditional approach of museums to fix objects. It is impossible to reduce these artworks to the time of realization or an original state. These works ask for a museum that can respond to the present as well as the past, to the individual as well as the collective, to fixed stages as well as the dynamics within the process of time.

The theoretical division that Assmann made between cultural and communicative memory needs a revision. Within the online, social memory space the external memory cannot be separated from the living memory. The living memory directly contributes to the online

memory space (and vice versa). Within the Internet everyone can become a co-author and as a result history is ceaselessly repeated and transformed by the individuals who re-temporalize it. This memory process is fluctuating, never accurate, but related to the social context of the present. Instead of hierarchies or complete systems, we should think in terms of processes. Instead of static objects we should think in terms of events, continuous transformations and a process of forming and re-forming.

The Process of Re-exhibiting

Exhibitions are in particularly interesting as they show a similar process of forming and re-forming the past. They embed artworks within different (art) historical, social and political contexts. Exhibitions often give us a contemporary perspective on the past, but many museums also value to display the 'original' state of the artworks and their audiences are often (passive) observers. Web-based artworks ask for alternative curatorial models, since they are continuously changing entities under influence of interaction with the audience. Net.Art is part of an online communication network (the Web), in which audiences can add their own ideas and memories; easily surf to other parts of the Web; visitors within the gallery can interact with the artwork, but also online visitors who are located at remote locations.

Within the case study jodi.org the exhibition served to create an (inter)active platform. Reesa Greenberg has argued how "remembering exhibitions" (exhibitions that restage historical exhibitions) can be seen as discursive events:

"Remembering exhibitions can be discursive events, dynamic cultural moments of active, widespread exchange and debate that in turn are catalysts for changing perceptions and practices. They have the potential for altering past and future views of the exhibition condition." [6]

In this model the audience is placed within the heart of the exhibition concept. Debate does not only take place afterwards, but also during and prior to the exhibitions. This format breaks with strict curatorial control and prefers a collaborative authorship. Audiences are recognized as active participants. Also this model does not fix the past, but it remains open for translations depending on the context. This paper is not about remembering whole exhibitions; it examines web-based artworks. Though an adaption of this model is still relevant. Key-characteristics of a web-based artwork - like being in continuous flux, interactivity, and connectivity with the world outside the museum - become valuable additions within this model.

Curators of Media Arts propose that the museum can indeed treat artworks as living things that transform under the influence of new contexts. For example Rudolf Frieling argues that the museum functions as a producer that has the responsibility to rethink installations and facilitate appropriations:

"The question will be how a collection can be 'performed' and what specific kinds of experience this might constitute when the museum produces art, the audience participates, and the artist is absent. (…) An installation is thus never a given fact, but the result of many agents in this process. We can summarily say it is produced each time it is installed." [7]

When we re-install a web-based artwork it is in particular important to rethink the networked communication. Can an exhibition become an opportunity for producing a community, a platform that brings people together to debate different perspectives or where collaborations can be formed? Clearly to facilitate involvement we need to situate these artworks within a current context, but with reference to the past and the future. So it is not only the life of the artwork that needs our attention, but also the social life of the artwork. It is not only a case of re-installing an artwork as a technical system, but also rethinking its social context.

Conclusions

Although the contextualization of Net.Art is highly interdisciplinary, art history can greatly contribute to it in analysing both form and content. For the future context of Net.Art it is important that these artworks are (also) included in the collections of art museums. Some art museums have collected web-based artworks and they also contribute to research that can prevent pioneering artworks from falling into oblivion.

In the publication "Re-collection" Richard Rinehart asks a key question: *"Can we imagine museums whose authority is used to facilitate and engage a community rather than treat its members as passive cultural consumers?"* [8] Rinehart mentions the Media Art Notation System (MANS) that represents a "score" for each artwork that contains instructions for recreating that artwork. He also mentions that a Creative Commons License makes it possible for the audience to download the artwork and re-appropriate it. Museums should not only facilitate this, but could also employ their historicising function – they could map and document where (components of) artworks have been re-used.

Within the display version of jodi.org a score was used to keep interactivity alive, not for re-appropriation, but also this less-progressive approach can offer challenges for museums on how to interpret the interactivity with the audience. The museum may or may not include these display configurations, but it is, in any case, important for museums to re-imagine their memory strategies and welcome ideas about interaction, as it can offer opportunities to stay within current social, cultural and cognitive contexts and to maintain a vital relationship with their audiences. Preservation is about respecting the past, but also about serving the needs of the present.

This article shows that analysing the different displays of Internet art can add new insights to the discussion on how to include digital heritage within the art museum. These web-based art practices are also interactive and process-based, but their fluid form develops in social (online and offline) networks. Rethinking curatorial practice is important for remembering these artworks, as it is within exhibitions that the interactivity with audiences takes place. Re-exhibiting Internet art is not only thinking in terms of re-installing a technical system, but also re-creating social contexts of which the form is far from uniform.

Re-exhibiting is not a final outcome, but a continuously process that changes over time. Clearly there is not a single strategy to remember Internet art, but a diversity of possibilities that can be applied according to the specific context. Before the artist is absent it is valuable to rethink various display versions. If we analyse exhibition histories these artworks act like living bodies. It is the archive that shows us the hidden structures and patterns. We need to carefully analyse the lifespan of these artworks within exhibition histories to find its DNA and examine memory strategies, as both are essential to give these artworks a future. [9]

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Augmented Reality as Experimental Art Practice:
from Information Overlay to Software Assemblage

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Abstract

In a general technical sense, Augmented Reality (AR) is considered as primarily a virtual overlay, a datafied window that situates visual or textual information in the physical world. In contradistinction, AR as experimental art practice activates critical inquiry, collective participation, and multimodal perception. Experimental art deployed in the AR medium is contributing to a reconfiguration of traditional perceptions of interface, audience participation, and perceptual experience. This paper explores such experimental AR art practices as examples of 'software assemblage,' a materialist conception that facilitates the movement of AR beyond the conventional empirical borders of the engineering world and toward a poetic re-configuration of AR as experimental art practice.

What is 'software assemblage'?

This research posits that some of the new hybrids advanced by artists, critical engineers and programmers in the emergent field of AR art, can be understood as 'software assemblages,' a new formulation that draws on the machinic assemblage [1] as well as materialist conceptions of relational or ecological systems, such as those advanced by Mathew Fuller, Adrian Mackenzie, John Johnston and Ulrik Ekman. I will be suggesting that using the concept of 'software assemblage' in relation to AR, as a particular permutation of software as interface, introduces a materialist media perspective into the discussion and practice of AR that has been lacking to date.

Applying a conception of software assemblage to AR allows the development of self-organising dynamic systems, where the participant is integrated as a material element through their bodily movements. For the participant, AR as assemblage encourages sensory engagement that diverges from a purely visual mode, leveraging embodiment, perceptual judgment and physical interaction to generate re-assembly in the system. Art experiences that interpolate the participant in extensive (outside the frame) and intensive (sensorial) compositional modes, explore AR from a new paradigm. This new approach eschews the dominant 'information overlay' design paradigm in favour of a processual encounter between participant and artwork. AR as experimental art inhabits a different topology to that of AR as information overlay, coalescing around notions of dynamic self-organising systems, relational forces, a deep capacity for re-assembly and collective participation.

Deleuze and Guattari attacked the problem of how to provide an adequate account of the forces, flows and intensities operating on the contiguous parts of a dynamic system. Their discussion located the compositional drive of a material flow in self-organisation: primarily, a system of material elements drawn from a common technological lineage would achieve organisation by way of procedural operations vested in movement, intensity, scale, and flux. These systems were described as assemblages, since they meshed existing materials together in unexpected ways, allowing highly unique connections to emerge. Dynamic and provisional, an assemblage has a side facing 'vertical content' (control, authority, stratification) as well as a side open to new connections with other machines of expression, so that the shape of an assemblage is never fixed but always engaged in movements of re-assembly. Deleuze and Guattari note: 'We will call an assemblage every constellation of singularities and traits deducted from the flow — selected, organised, stratified—in such a way as to converge (consistency) artificially and naturally; an assemblage, in this sense, is a veritable invention [2].'

An understanding of assemblage facilitates an examination of the material elements and relational forces that coalesce in some of the new types of hybrid mixed reality situational artwork emerging from the AR medium. Imbued with a micro politics that explicitly values and enhances qualities of experimentation, participation, and critical inquiry, software assemblages challenge the accepted industry driven perceptions of AR as information overlay, and perhaps can operate to undo some of the trivial paradigms that have beset AR in fields such as mainstream gaming and entertainment. AR by artists presents a creative opportunity to eschew the restrictive commercial products of the AR medium and re-position its associated technologies like Portable Media Devices (PMD's) or the Head-Mounted Display (HMD).

The problem of the information overlay

The AR medium has not been previously analysed as an assemblage. Rather, three major modes of discussion can be found in the literature: first, in technical and engineering papers, as an 'information overlay' to a physical

space; second, following on from some aspects of this, as 'remediated' interface for hybridising relations between digital and physical spaces; and third, in art and design literature as a form of visual or textual simulation where physical world attributes are translated to virtual timespace. From a technical perspective, AR is any technological system which combines real and virtual, is interactive in real time, and is registered in three dimensions [3]. Caudell and Mizell [4] coined the term 'augmented reality' to describe the visual and textual layer inflected to the heads-up display (HUD) they adapted to display virtual information over structures manufactured at Boeing. Over the next ten years, potential applications in engineering allowed AR to emerge from under the motherly skirt of virtual reality (VR), to achieve its own standing as a distinct medium. However, the problematic transposition of the technology and concepts from an engineering paradigm to more culturally aligned fields is illustrated by the persistence of the information overlay approach.

Two examples from the commercial world illustrate AR as information overlay. Wikitude is an interactive map registered in real space via a screen display or PMD to assist in precisely locating a geographical point of interest. Cartographic and geo-locational information is held on a web server and transposed to the local space of the user. From the mobile game industry, the massive multiplayer game Ingress, invites players join one of two pseudo-militarised factions and cooperate to build virtual portals whose instantiation asserts dominance over real space. Many of the design patterns currently deployed in the mobile AR industry proceed from the assumption that the digital screen is somewhat of a transparent analogue to a window: Wikitude is literally an overlaid map, while for Ingress the smartphone screen becomes a 'portal' for the player to look through. This has led to a situation where the weight of industry-directed AR research, is focussed on what happens within the frame of the screen, or the HUD/HMD.

While the technology used to create AR experiences has been thoroughly researched, what is lacking is an understanding of how AR can be utilised in a way that extends beyond a technical coding as an information overlay. Taking a materialist approach, rather than focussing on either the concerns of industrial or entertainment design mentioned above, allows this research to explore AR from the perspective of the actual relations instantiated by this new artistic field, as compositions of sociality, technicity and agency at the aesthetic edge of human-computer interaction.

AR and media art theorisations

The passage of AR from engineering toward art and design has produced two influential approaches: the first merges the theory of 'remediation' [5] with mobile AR, originally using the HMD and more recently the PMD; the second applies a semiotic approach that transposes the real world to the virtual, producing perceptually challenging gallery-based experiences [6]. Both are aimed at constructing a believable or seamless story out of virtual material and as such are broadly narrative approaches. Pioneering research by computer engineers turned AR designers, such as Billinghurst and Kato as well as

McIntyre and Bolter, assisted in re-positioning AR in the contexts of education, entertainment, museology and, of course, new media art. Bolter and Grusin's theory of 'remediation' was strategically applied in McIntyre and Bolter's research, with the explicit goal of applying that concept to develop AR as a relevant new medium. Bolter and Grusin viewed historical recombinance as a primary and defining technique of new media, rather than being seen as one potential material element in a cultural formulation, as in theories of assemblage. They note: 'What is new about new media comes from the particular ways in which they refashion older media and the ways in which older media refashion themselves to answer the challenges of new media [7].'

Remediation, as applied to AR, seeded the aspiration that this new medium could be made to operate like its traditional media predecessors, and that a recourse to familiarity would assist with capturing an audience. However, while the theory of remediation was intended as an exploratory paradigm to extend AR's industrial boundaries, its conceptual maxim — that new media always referred back to its antecedents — functioned to hinder AR's passage away from the engineering trope of the information overlay. In addition, following from remediation, content is restricted and selected according to its perceived relevance to what the researchers describe as a cultural frame of shared expectations. McIntyre and Bolter state: 'A user's expectations are (implicitly and explicitly) based on their experience with … all media forms; a lifetime of experiencing film, stage, tv, and so on creates a starting point for their interpretation and understanding of any new experience. Understanding, and leveraging, the shared cultural expectations of the intended audience will allow us to create richer, more engaging, and more understandable AR experiences [8].'

In addition to the problematic of producing distance from (yet still referring back to) engineering, and the perhaps even thornier issue of how to determine an audiences' 'shared cultural expectation,' pictorial goals implicit to remediation such as linear perspective proved highly contradictory in a mixed reality scenario, where a technical capacity to convey seamlessly placed augments was limited. Borrowing techniques from mediums such as film also proved difficult, since from a user perspective the experience is quite different: the body is generally static and seated viewing a film, yet active and mobile when experiencing AR. In addition, the HMD's used to access these scenarios were inherited from VR technology, and designed for immersion. Today, our most prevalent mobile device is the smartphone, whose diminished scale discreetly nests a screen in a much larger perceptual world.

Remediation takes the interface as an object, either a 'window' or a 'mirror' [9]. This analogy advances a highly structural approach that considers an interface as primarily a surface, that is either looked through to reveal content or has 'doubled' real world content reflected on it: in both formulations, the edges use linear perspective to pre-compose an alignment with the real world qua framing. Technical ensembles that bring devices, augmented content, and user into connection are modified in response to the qualities incorporated to the new medium from established forms. Researchers who take remedia-

tion as a guide encourage an explicit shaping of AR by earlier concepts such as those found in film, television, and stage production.

AR and contemporary design research

Another significant approach from the intersection of computer science and design, is found in work emanating from the EPFL+ ECAL Lab in Lausanne, Switzerland. There, Henchoz and Lepetit note that since Nineteen Ninety-Two, AR as a field has been developed through scientific research, demonstrations and specialised conferences, however in order to leap to the mainstream as a creative medium, it needs to embrace communicative simplicity and ease of use. Their chief contention is semiotically vested: if augmented reality is to shift beyond its current status as simply a 'technology' to take on that of a 'media,' it needs to communicate as a 'dedicated visual language' containing attributes of grammar, syntax and the potential for developed narratives. They cite the need for a 'natural' integration of the user into the experience, as well as consistent visual language between physical and virtual worlds, such as Camille Scherrer's 'Le Monde des Montagnes' installation[1] which used the paper cutout as a trope to segway between a physical book and its digital augments. While the theoretical approaches outlined by Henchoz and Lepetit, and explored in the practical research output of the EPFL + ECAL Lab is less linear and more experimental than remediation, it does express some shared concerns. For example, the idea in remediation that achieving familiarity by leveraging shared cultural concerns will assist in drawing an audience, resonates with Henchoz and Lepetit's principle of creating visual consistency between real and virtual worlds. Furthermore, the models of interface proposed by Bolter and Gromala, where interface is either window or mirror, also holds in EPFL+ ECAL research, in regard to the notion of doubling the real world into the virtual to simulate a consistent semiotic flow.

Experimental AR and materialist currents

While the existing perspectives from computer science and engineering, as well as art and design practice mentioned above have taken different but related approaches to re-situating AR toward creative applications, their trajectories still primarily concern the information presented within the boundary of the screen or display, and neglect the significant relations occurring outside, such as the user's relation with the environment, the network, and the device itself. My research takes the position that approaching AR as an assemblage rather than an information overlay, and concomitantly, an interface as a network of relations rather than an object, produces a more nuanced understanding of the relations between devices, software, artists, artworks, and participants. Before we can arrive at an adequate theoretical expression of the affordances and capacities of AR as an experimental medium, software needs to be articulated not as a product or object, but as a processual element in a materially entangled yet relational system.

Looking at software as an assemblage, theorists like David Berry and Adrian Mackenzie have developed an understanding of code as more than simply a series of repeatable, executable commands, an approach where software, along with its technical elements of data, code and algorithms, forms the procedural ground of digital mediatic assemblages. David Berry [10] has a useful conception of code as 'computational logic located within material devices', where code produces a series of materialities conjoining the activities of the end user, the creative writing of the programmer, and the devices that run executable commands, together as a relational system which can be deployed in any given cultural milieu, with quite specific affects. Following Berry, code, when embedded within technical devices, takes the role of organising agent, articulating the nuances of the medium and linking those nuances to software agents, applications, and user behaviours. AR — produced by such conjunctions of algorithms, code and software — is a particular instance of computational logic deployed on technical devices, and as such needs to be explored for its relational and material connections to a social and technical assemblage.

Experimental AR artworks that can be understood as software assemblages include Blast Theory's *Uncle Roy All Around You* [11], Janet Cardiff and George Bures Miller's *the City of Forking Paths*[12], Julian Oliver's *Level Head* [13], and Tamiko Thiel and Will Pappenheimer's *Biomer Skelters* [14]. All are iterative, that is, they produce multiple versions of themselves, with the result that the work never unfolds the same way twice. Iteration, or put another way, re-assembly, is a significant quality of the machinic assemblage, one that occludes the formation of models or repetitive design patterns. *Uncle Roy All Around You* and *Biomer Skelters* both mobilise user participation and agency to shift the work as it unfolds; in the former, the participant must trace the elusive Uncle Roy and attempt to converge their path with his; in the latter, the shifting pace of the participant's heart beat effects the growth of a virtual organic biome. *The City of Forking Paths* uses the virtual qualities of AR to situate the participant in a confusing perceptual relation to a parallel world, where participants use their mobile phones to follow the artists' shamanic narrative as it meanders through The Rocks, Sydney, while Oliver leaves the source code and instructions for producing a version of *Level Head* on his website to enable the user to turn programmer/critical engineer. A material approach facilitates an understanding of the temporal and spatial relations used to generate new events emerging at the conjunction of human and technical assemblages. If we only see AR as an information layer, we miss its capacity to provoke multimodal perceptions, the embodiment present in user behaviours, as well as the contextual shifts produced by the re-purposing of PMD's as 'media assemblages' [15] and the shifting role of the passive viewer turned active participant. For example, Cardiff and Miller's *the City of Forking Paths* places the participant in a situation where they must follow the audio-visual logic of the AR embedded video, along the exact cartography set out by the narrative, and are completely unassisted by the normal technical aids used in AR such as Global Positioning Systems (GPS). Participants trace the multiple narrative flows presented by the work at the same time as main-

taining an awareness of their geographical context: if they deviate from the 'forking paths,' they lose their place and are caste adrift from Cardiff and Miller's parallel perceptual universe. In this way, the work operates alongside each person's unique sensory apprehensions, foregrounding the role of the body in producing a mixed reality experience, not the role of the technology. While the above mixed reality artworks cited here are certainly not an exhaustive list of the field, these examples serve to convey the differences between the industrial and artistic threads of AR.

Theorists like Mathew Fuller and John Johnston have explored the notion of assemblage as a compositional force that allows diverse material elements to coalesce according to particular affordances, intensities, flows and attractions. Matthew Fuller referenced Deleuze and Guattari's assemblage as a force for the self-organisation of matter-flows concerning people, materials, devices, cultures, all interconnected and entangled as a mediatic ecology, such as that present in London's pirate radio scene of the 1990s [16]. Fuller's ecology traced the dynamism of such transitional and provisional assemblages, and in particular showed how the consumers were now often also producers (radio disc jockeys, artistes) of music. For Fuller, assemblages are the procedural driving force of a re-invented 'media ecology,' they are imbued with a persistent capacity to re-assemble, and do not concretise since they are in constant motion.

John Johnston has developed the concept of 'computational assemblage' to 'designate a particular conjunction of a computational system and a correlated discourse [17].' That computational system is cybernetics, artificial life, robotics, and autonomous software agents, while the theoretical discourse is assemblage theory as a processual mode of tracing the emergent and connected behaviours that lie behind organic and non-organic life. Johnston extends these ideas in relation to self-organising machines, from a framework he has termed 'machinic philosophy.' Johnston's use of the term 'computational assemblage' is specifically in regard to his work on self-organising, semi-autonomous machines and their associated software agents. However, it is of significance to my term software assemblage because Johnston's project re-situated AI and robotic agents as assemblages engaged in radical forms of becoming. This marked a critical turn away from an object-based notion of semi-autonomous machines, as becoming (seen here as a machinic articulation of complexity) pays respect to change, transformation, and singularity, allowing Johnston to more accurately trace the trajectories machinic life is taking as machines increase in complexity toward states of self-organisation [18].

Returning to the conceptual trajectory identified earlier — from information overlay to software assemblage — the capacity to self-organise, is a key quality that separates the software assemblage from the information overlay. For example, the mobile AR artwork *Biomer Skelters* uses the participant's physiological data — derived from a smartphone fitted with a heart rate monitor — to grow a virtual biome in physical space. As the participant walks, their

heart rate increases, and this increase triggers virtual plants that appear to populate the adjacent area. As the participant moves the camera/sensor, they perceive a biome appearing around them in real time, generated by the nuances of their heart rate. Using the sensors in a PMD to measure the physiological data that subsequently articulates real time actions in the biome, creates a self-organising system conjoining real and virtual to participant, mobile wireless network, and device.

Materialist thinking — of the kind practiced by Fuller, Berry, Johnston and others — has re-positioned the interface from its object-like status as a surface (or surface of a 'thing') to a more open relational assemblage that can provisionally facilitate the generation of complex inter-related concrete and virtual world systems. Thinking AR as a material and relational topology is an ecologically inflected strategy that affords a position where research can remain open to shifts in AR as a dynamic system, interconnected with a range of entangled matter-flows. In the near future, this research will explore: a multimodal sensory engagement with the software assemblage as situational artwork; embodied behaviours emerging from ubiquitous computing; and the role of mobility in creating a non-visually privileged experience in the AR medium.

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Digital Confucianism:
A Confucian Take on Computation and Algorithm

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Abstract

The paper attempts to open up the conceptual framework of Confucianism to accommodate questions relevant to today's digital society. Both Confucian and Whiteheadian philosophy favor processuality to fixed entities in analyzing beings and phenomena of the world. Hence, computational algorithmic processes, or "computational thinking," can be recast in light of the concurrent Neo-Confucian notions of *qi* and *gan*, as well as Whiteadian notions of *prehension* and speculative reason. Computation, *qua* adding new data that alter the initial condition, manifests speculative reason, which resonates with Neo-Confucian view of change as the nature and order of being. The paper concludes with an artistic work substantiating this analysis.

Why Digital Confucianism?

How would Confucianism deal with computation and algorithms? What would be possible Confucian intellectual resources for thinking the technical processes of computation? How could Confucianism address the process of bifurcation informing both computation and life? With these questions in mind, this paper aims at opening a conceptual space in the traditional thinking systems of Confucianism to make it more relevant for today's digital humanities. To this end, the paper draws on Alfred North Whitehead's theory of *prehension* and Chinese Neo-Confucian view of 氣 *qi* and 感 *gan* (feeling, sensing, stimulating) to construct a framework of analysis. This conceptual enquiry will be substantiated and further developed by two works of media art.

The upshot of Confucian philosophy in various schools throughout history has been the great alignment of man and nature in the identification of being at one with each and all. Confucian philosophers of all times have concerned themselves with lofty questions like how nature gives rise to things and how such arising reflects the order of immanence; despite fine differences, there is a common narrative that centers on the creative advance of nature manifested as change, which transforms and transmogrifies beings, and through which it affirms the relationality between beings. This is reflected in the most diligent efforts of annotating the 易經 *I Ching* (Book of Changes) through ages. The goal of practice for man is to attain this knowledge and act accordingly to ensure the advancement of such creative force. While true, this high-spirited philosophical interpretation on and its practice of life face new tasks of regenerating itself in a way that is adequate to our time. Indeed, studies have been dedicated to rethinking political governance, social, gender and ecological issues through Confucianism; my attempt in the following is to relate Confucian thinking to the digital and the computational.

By the digital and computational, I mean the automated algorithmic processes of data in general. Given the allusion to digitality fundamental in Chinese philosophy – *yin* and *yang* as binary codes, which has gained awareness in the West since Leibniz published about binary systems, the task is to go a step further and look at more complex operations based on it such as algorithmic processes, together with processes of life. It would be justifiable for a 21st century reader of Confucianism to ask: how is computation part of nature and how could I relate to its operation, instead of relegating it to a substratum that I simply ignore while typing with the computer? Hence a first step to extending Confucianism for a digital world would mean to account for the exact processes or happenings between bodies, things and events. It is in this interest that we resort to Whitehead's concept of *prehension* to flesh out the Confucian rendering of *gan*.

Prehension, *Qi* and *Gan*

The concept of *prehension*, which Whitehead defines as "uncognitive apprehension," renders legible the relational connections between people, things and their surroundings by highlighting the operation of uncognitive "grasping" – a pre-epistemic, not necessarily knowledge-based operation of relating to things and environments. [1] *Prehension* "does not require explanation but must enable the exhibition of the common feature of all situations in which something makes a difference for something else." [2] So the earth orbiting around the sun prehends the sun, the apple falling from the tree prehends the ground, and we prehend the subtle layers of the physical and cultural environment. In light of this, no entity is ever fixed or static, for "[a] new entity comes into being by prehending other entities; every event is the prehension of other events." [3]

Neo-Confucian philosopher 張載 Zhang Zai (1020-1077) has developed a unique theory around the idea of

qi, at once physical and metaphysical. Expanding and contracting as it does, *qi* is the nature of a bipolar, *yin-yang* cosmology, whose continuous interactions account for all things and phenomena of the world. As such, Zhang Zai paved the way for a concept of nature and man imbued with *qi*, for "no one had said that *qi* unified above form and below form, being and non-being." [4] That the infinite and continuous variation of *qi* conditions the interaction between things and phenomena, and that it happens as much on a global as on a local level, make possible a comparison between Zhang Zai's *qi* scheme and Whitehead's operative system of *prehension*.

A "feeling" for Whitehead is "positive *prehension*", or "the definite inclusion of [one] item into positive contribution to the subject's own real internal constitution." [5] This image of positive prehension is a generic and technical operation, as "it has been chosen to suggest that functioning through which the concrescent actuality appropriates the datum so as to make it its own." [6] As such, the "feeling" operates regardless of the human perceiving mind, as indeed the apple tree can be side to "feel" the earth. This may be likened to *gan*, feelings, sensing, interaction or stimulus, in an equally impersonal sense in Neo-Confucianism. Zhang Zai holds,

"有兩則須有感，然天之感有何思慮？莫非自然。

When there are two, there must be interaction (*gan*); but what thoughts or concerns do the interactions of heaven have? There is nothing that is not spontaneous." [7]

Therefore, the interactions or *prehensions* of things and events following the *qi* could be recast into the following frame of interpretation: the universe is "full of entities of sensing that attract one another and incorporate into one another according to their emotions, desires, aspirations, intentions, and needs, etc." [8]

In Zhang Zai's view, each discrete thing is but "a process of beginning and ending, extension and contraction. It is generated through the intercourse of preceding things and, therefore, unless there is transformation of preceding things, will not be brought into existence." [9] Tang Junyi comments that for Zhang Zai, "the 'thing' is a secondary ontological concept, while "the transformation of *qi* is a primary one." [10] This is very similar to Whitehead's assertion on how entities come about through prehending other entities mentioned above. Importantly, "there is no ontological difference between what we generally call physical objects, and what we generally call mental or subjective acts." [11] To push the implications further still, "events themselves are the only things." [12] For both Zhang and Whitehead, discrete things and events are not only on an equal footing as *prehension* materials; discrete things are made of events.

For Whitehead, perception is the "cognition of prehensive unification" or more simply, "cognition of *prehension*," it follows that the image of thought as an anthropocentric, representational operation has to be dethroned. [13] That is to say, the intelligible process we characterize as thinking is to be untied from an exclusive

and defined human subject, and is indeed to be understood as "nonphenomenological, insofar as it goes on without establishing relations of intentionality to anything beyond itself and even without establishing any sort of reflexive relation to itself." [14] Examples from natural science abound, which draw our attention to how fruit flies make decisions and trees demonstrate perceptual and cognitive activities.

In the paramount Confucian interpretation of *I Ching*, *yi* or "changes" are harbinger of the virtual (in Deleuze) and the potential (in Whitehead), which are latent "until all beings begin to sense and feel." [15] The way this potential is actualized is exactly through the workings of *gan* between everything. As argued earlier, *gan* must be located as much between the sun and earth, the apple tree and the ground, as between them and the human. We can thus see how the *gan* de-couples an experience with the human and thus expands into a non-anthropocentric realm. As such, it is radically empirical, even though the experience of which is not directly available for human perceivers.

The *gan*, "feeling" of a non-intentional kind, as much as *prehension* as pre-cognition, work to disassociate the perception from a human sensing subject. Hansen aptly describes this as "feeling without feeler." [16] However, this does not discount the experience of the human by negating it and pronouncing it as unauthentic all together, but questions the registration of the feeling by posing a contrast "between a 'self' and 'that of which there is experience,' but without duplicating it by reference to an 'I' or a 'me'." [17]

Now what does this have to do with computation?

Speculative Reason and Computation

It is on this notion of perception unbound from cognitive activities that we base the following analysis of Whitehead's speculative reason and Zhang Zai's reading of *I Ching* in the context of computation. If physical *prehension* can be derived from the actual entities of the world, a conceptual *prehension* bears "no reference to particular actualities, or to any particular world," and as such, it also posits the difficulty to the understanding for it suggests "no particular exemplifications." [18] For Luciana Parisi, conceptual *prehension* is "the abstract, non-cognitive, and non-physical capture of infinities." [19] This leads her to make a case for computational processing of data, or what she calls "computational thinking," as a form of pure conceptual *prehension*.

Zhang Zai, though living in a pre-digital world, has clearly entertained with an idea not unlike "pure conceptual *prehension*." He studies the phenomena of sound echoes in situations where there are material entities as causes (such as in drumstick hitting a drum) and where there is none (such as sound of thunder). In the context of an all-embracing continuum of *qi*, both scenarios illustrate the bipolarity of the forms of *qi*, as his intellectual successor 王夫之 Wang Fuzhi would comment centuries later, "感者，交相感；阴感于阳而

形乃成，阳感于阴而象乃著。 Stimulus (*gan*) delivers mutual resonance (*jiao xianggan*). The yin resonates to yang and form (*xing*) can be created, the yang resonates the yin and a phenomenon is marked." [20] For him, we could infer, condensed *qi* assumes forms and participate in physical *prehension*, while *qi* not articulated in discrete form participate in conceptual *prehension*.

With the conceptual recourse to Whitehead, one is hence able to draw a Confucian framework of the digital and computational. It favors Zhang Zai's *qi* as the primary nature that underlies change and transformation in the material realm (in operations of physical *prehension*), just as it undergoes transformation in the conceptual and computation realm (in operations of conceptual *prehension*).

In light of this, when Zhang Zai speaks of "性者感之體 The nature (*xing*) is the substance/capacity (*ti*) of responses (*gan*)," the interpretation seems equally applicable to the material world of physical prehension, as in the computational world of conceptual prehension. Just as the capacity of the interacting physical responses reflect a nature, so too are the algorithmic activities, or conceptual *prehensions,* equally part of nature. [21]

For Whitehead, the view of speculative reason does not conform to conditions set by antecedent circumstances and hence offers a state of being not determined by linear chain of cause and effect. Parisi extrapolates this into computation world, and highlights the proliferation of what cannot be calculated in the face of the infinite amount of data introduced into computation. For her, the incomputable conditions computation today. It means that "a notion of speculative reason is not concerned with the prediction of the future through the data of the past, but with incomputable quantities of data that rather transform initial conditions." [22] This reading of the computational automation, which lies at the foundation of learning algorithm and artificial intelligence undergoing great technological advancement today, is radically different from the mechanical view of computation, according to which a machine is made up of a discrete set of components and that each component entails a set of step-by-step instructions that can be iterated *ad infinitum*. Thus to endow computers with speculative reason is to depart from the mechanical view of computers as rule-obeying and subject only to deterministic randomness.

As *qi* moves, it necessarily enfolds new conditions for new emergences that are no longer subject to causal relation to the initial condition. Zhang Zai speaks of this as the wondrous making of change: "（《易》）語其推行故曰'道'，語其不測故曰'神'，語其生生故曰'易'，其實一物。 [Book of Changes] speaks of its moving along and proceeding, and therefore it says 'the Way'; it speaks of its unfathomableness, and therefore it says 'the marvelous'; it speaks of its continuously producing [things], and therefore it says 'Change.' In reality these are all one thing." [23] "The marvelous" discerned here refers to how, in the metaphysical system of *I Ching*, continuous and progressive changes may yield results too wondrous to be graspable by common reason, or a causal way of reasoning based on fixed initial conditions; it suggests a similar articulation as Whitehead's speculative reason at a given moment. Ultimately Zhang Zai attributes this to the law of change, though this should not be taken as a totalizing concept.

Hence we have come to points of concurrence between Neo-Confucian thinker Zhang Zai and Whitehead with the common focus on the processual, defined variably as *gan* or *prehension*. From this elementary and processual perspective, reason in the context of computation is rendered speculative in that the course of progression is not to be determined by a linear chain of cause and effect. The purpose of such a theory and practice amounts to 日新 *rixin* (the constant self‑renewal), or in the words of Parisi, "[making] here and now different from the time and the space that were there before." [24]

Artistic Position

The reason to draw on artistic works is to find tangible ways to illustrate and, more importantly, to "enact" these philosophical arguments.

What follows is a brief study of German media artist Ralf Baecker's installation *Mirage* (2014) featuring a "sleeping" computer. The core computational component is inspired by the "Helmholtz Machine," an unsupervised learning algorithm that adopts "wake" and "sleep" phases, or respectively, pattern recognition and pattern prediction phases. *Mirage* captures the output of a computer's "sleep" phase, i.e. anticipatory pre–response in the form of random data based on real-time data input, and translates it into mechanical movement, which is then made visible as a projection of undulating landscape on the wall. The audience is confronted with a poetic rendering of the computer's "dream", without access to the algorithmic processes starting from data input to "wake/sleep" calculations.
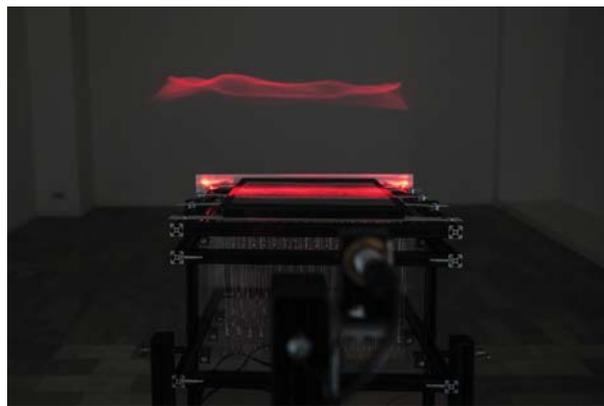

Fig 1. *Mirage*, 2014, Ralf Baecker, mixed media, image courtesy of the artist.

Though on a limited scale, the set of algorithm at play in the "Helmholtz Machine" is imbued with speculative reason, in the sense that its anticipatory function, or active and productive pre-response function shows

exactly the conceptual *prehension* of input data. In the event of prehending input data, the possible events where patterns correspond to the representation of data get reorganized. Insofar as the relation of the input data to the possible patterns that potentially inform it in the background is not deterministic, they could be likened to the emergence relative to the virtual or the potential. The virtual or the potential is the immanent condition of all emergences. Importantly, "it does not prefigure or predetermine the actualities that emerge from it. Rather, it is the impelling force, or the principle, that allows each actual entity to appear (to manifest itself) as something new." [25] The work enacts the reality of algorithmic processes, which we have examined with the conceptual parameters of Whitehead and Zhang Zai. We can hence adequately engage in local analysis and furnish computation with speculative reason, which contribute to the novelty, or creative advance, of algorithmic processes.

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Part III

Panels (peer-reviewed)

Gigantic: Mediation Beyond Surface

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Abstract

Mediated space continues to redefine its possibilities as large scale surfaces increasingly become playable displays. Now that we can be increasingly immersed in gigantic image spaces the panel will investigate how surface has become frameless and how we can begin to explore image cities and propose imaged planets. The soil itself can be reinvented as a programmable material, leading towards artificial ecologies that are pure design. Our cities buildings are now so completely skinned in display that the entire urban experience becomes media. Smart materials and controlled reactions are being developed that promise massive reactive surfaces in which material behavior is the message. Immersive displays are being removed from scientific contexts with both domes and 360-degree systems being repurposed for digital humanities and creative experimentation. These model projects are fundamentally transdisciplinary, not just in their creation but also in their impact and ability to infect and engage large audiences and transform institutional orthodoxy. We are inside the image now, the ultimate spectacle, and actively exploring how programmable spaces and surfaces can be used for artistic purposes. The panel will consider the aesthetics, technicalities, benefits and concerns of gigantic mediation beyond surface by presenting a group of international practitioners who work in the field of the large scale.

Rachel Armstrong: The Persephone Project: Technologically convergent artificial ecosystem

Technological convergence between biological and digital computing is enabling new forms of computation such as natural computing and programmable life-like matter. Persephone (figure 1) is a real world project, which is part of the Icarus Interstellar portfolio of projects that propose to construct a starship research platform in orbit inside 100 years. The aim is to build an artificial ecology for the starship that will indefinitely support its community, starting with the development of artificial soils from which both new life-forms and cities may emerge. Persephone takes a bottom-up, design-led, experimental approach towards this challenge by producing a range of prototypes that can be explored in terrestrial contexts. This far-sighted strategy explores how a range of modalities may be converged through a technical practice enabled through forms of artistic research that brings together digital and biological systems. Are these fusions new forms of ecology, life, community or cities? What degree of programmability, design, creative expression and control can be exerted in convergent systems?

Drawing on cutting-edge, interdisciplinary, experimental research practices, this panel will consider how arts research can help extend an innovation platform that draws together digital and ecological interfaces with a range of other media that are likely to produce experiences that are increasingly lifelike. Expert interdisciplinary researchers lead a debate that ranges from how we may evaluate and work with new kinds of computing - to the unique contribution of artistic research in the design and evolution of hypercomplex systems.

Fig. 1: *Persephone soil: Artificial soil,* 2015, Jon Morris and Phil Watson, digital drawing of a synthesis of silicon, carbon, living systems and hypercomplex (supramolecular) chemistry. Copyright: J. Morris/ P. Watson

Maurice Benayoun: Overscale Art in Public Space: from Play to *Dysplay*

Street art has reminded us again of the power of media when artists practice outside of the white box. For centuries the frame separated the art from the "real" world, a boundary which was questioned by the introduction of screen technologies. More recently the screen has expanded, invading the walls, the façades and now the very skin of the building itself. Light and image are covering entire buildings in a way that, beyond any previous definition of screen, the urban architectural complex has become a medium.

After the painting frame, the *veduta*, then the painted wall, and now the urban screen have each had their turn as places for the exaltation of the symbolic dimension of architecture. In each case, media scale was seen as a way to draw the public's attention. At one time the skyscraper itself was enough of a statement, now it has been overwhelmed by the greed of the market keen on capturing consumer attention. Simultaneously, architects are understanding that adhering LED screens on buildings was merely a temporary phase in the evolution of the complex relation between architecture and image.

The first use of these massive urban displays was expectedly commercial. The public space became a gigantic stadium where commodities compete to catch the citizens' attention: fancy watches v.s. expensive sedans, sexy models v.s. sparkling jewelry. Converting the world into an ever-expanding shopping mall, the market has extended display beyond Guy Debord's anticipation of the society of the spectacle forcing us to now ask, "What could be or should be the position of the artist in the urban landscape?"
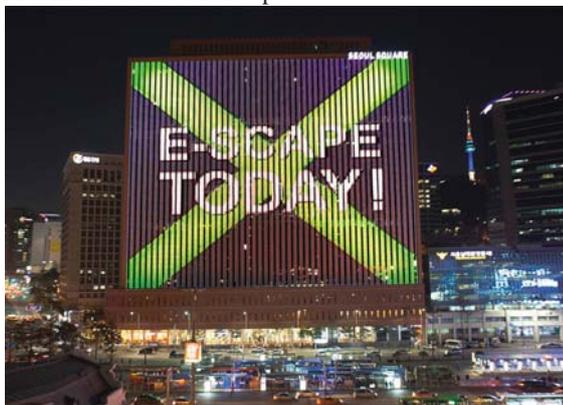
Fig 2. *Emotion-SCAPE TODAY*, 2012, Maurice Benayoun, urban screen installation, Copyright M. Benayoun.

Artistic display from play to 'dysplay'

We are seeing more examples of how the artist's expected contribution to urban media is to convert the public space into an entertaining place. The artist's expertise in terms of public interaction is considered a great asset in playing this role and adding to the market-driven game. As part of this panel presentation, we will investigate the possibilities of the artist subverting the role of entertainer. Can the artist use his tools to *dysplay* the game, disrupt the Spectacle, produce the unexpected and therefore make it more significant?

Media artists are among the first to explore the potential of expression presented by the building becoming a light-emitting object. Artistic practices started to invade, and perhaps even to pervade the urban space by converting the whole city into a media, an "urban media". However, the question of the artist's legitimacy of taking over the public space, fighting for public attention is not a simple one. In a museum or gallery, the visitor makes the decision to face new objects of artistic expression. In the public space, however, passers-by don't ask for art, they are just retinal targets. What allows the artist to fight for unsolicited visibility? Large scale architectural display creates a discussion where both aesthetics and ethics must be considered.

Through curatorial and artistic projects like *Watch Out!* (Seoul, Athens, 2002-2004), *Emotion Forecast* (Paris, New York 2011-2012), *E-Scape Today* (Seoul, 2012) (figure 2), *Open Sky Project* on the ICC Tower (Hong Kong, 2012 – now), the panel presentation will explore the limits and the potential of large scale urban media art practice.

Scott Hessels: Built Chameleons: Reactive Media Display

The number of screens now manufactured has surpassed the number of humans on the planet. Mediated environments today have become so pervasive, it is difficult to think of a moving image that is not electronic; we rarely say 'digital' display anymore as the assumption is so ingrained in our culture. Electronic screens are always attached yet rarely integrated, usually added on after the fact. Hence most media understanding does not consider the relationship between the screen and its placement. Media is a skin that does not reach to the bones, the structure of our environment.

Smart materials are designed to react to changes in the environment. Even subtle shifts in light, temperature, noise, moisture, pollutants, and more can cause dramatic changes in color, form or structure. Natural reactions provide a starting point to introduce a new (yet ancient) context in which the schism of on/off is not applicable anymore but replaced by behavioral flux. These emerging material behaviors allow a rethinking of the relationship between "skin and bone" and ultimately between media and environment.

As part of an evolving post-digital society, artists and designers are exploring pre-digital dynamic effects. Through the ability to transform energy from an environmental input into a visual language, smart materials and their reactions can become a new form of reactive display design. This emerging media will shift from the independent to the integrated and yield opportunity for a new media art, free from the screen, yet still able to convey information, narrative and aesthetics.
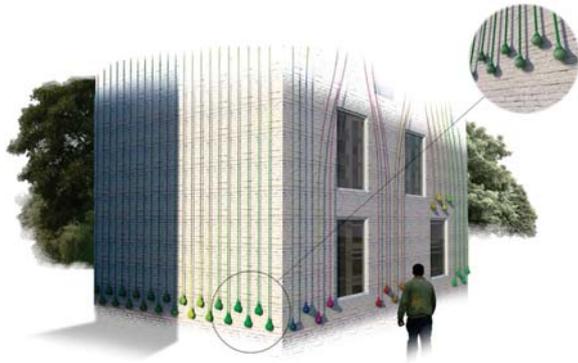
Fig 3. *Mediated Earthworks No. 6*, 2011, Scott Hessels, drawing of sunlight expanding colored fluid up patterned tubing, Copyright S. Hessels

The panel will consider how these new materials that reveal non-digital reactions are not a way to augment design by technology but instead integrate and evolve design with new manufacturing and material qualities. The presentation will discuss how these materials, when extended to a modern urban context, one can envision a more ambient, less aggressive form of display that still signals environmental variations in visually aesthetic applications within architecture, art, automotive, fashion and others. Smart technologies can offer alternatives to billboards, signs, public transport, way-finding, data visualization and a host of new art and design applications. While weaning a global culture off electronic screens may be impossible, allowing natural processes to communicate in both content and form will lead to increased recognition from the public in sustainable solutions and environmental concerns.

Sarah Kenderine: Towards an Embodied Museography

We are in the midst of a transformation, from a world of screens and devices to a world of immersive experience [1]

This panel contribution will examine new paradigms for transforming digital cultural archives into these immersive experiences through research in data creation, virtual environment design, interactivity, and information visualization — transforming public engagement with intangible and tangible heritage.

Cultural heritage is under increasing threat from destruction forces spanning iconoclasm to climate change to mass tourism. Within this context, digital documentation technologies play a vital role in the sustainability of both tangible and intangible heritage (from laser scanning and photogrammetry to motion capture and motion-over-time analytics). The creation of repositories of high fidelity digital data derived from heritage - open-up opportunities for re-staging and re-imagining the object of study. As post-processual archaeologist Michael Shanks described, new digital archives demand "prosthetic architectures for the

production and sharing of these archival resources — an animated archive emphasising personal affective engagement with cultural memory".[2] The research presented in this panel explores strategies for creating and translating the new abundance of digital records in the cultural archives into narratives of engagement by which museum visitors virtually re-embody and 'perform' the archive. This *embodied museography* is defined by attributes of immersion, interaction and participation and necessarily asks us to re-examine our notions of aura, authenticity and authorship. At the core of these experiences is a series of bespoke large-scale omnidirectional, omnispatial, panoptic and hemispheric interactive visualisation systems which promote human to human as well as human to machine interactions.

Fig. 4. *Look Up Bombay (2016)* Sarah Kenderdine & Jeffrey Shaw in collaboration with JSW Foundation & Museum Victoria. Installed in UNSW's 4K fulldome, DomeLab, a project led by Sarah Kenderdine. Image © Sarah Kenderdine & Jeffrey Shaw.

Proliferation of Aura

True-to-scale physically built models (it seems necessary to distinguish these from models that are virtually rendered) of caves and subterranean sites ,now exist to represent the Lascaux Caves, Altamira Caves, and the Tomb of Thutmose III. Such built facsimiles increase accessibility on-site and in travelling exhibitions, diverting stress away from the original sites and involving visitors in a pro-active protection through promoting awareness. These built models have set a precedent for the digital corollary, following from comprehensive digitization projects such as that at the Mogao Grottoes in China, a world heritage site at which the Dunhuang Academy are systematically capturing at the highest possible resolutions through laser scanning and gigapixel imaging. [3]

The role that 1:1 scale facsimiles play in the interpretation and preservation of cultural heritage

whether digital or built models has been proven to be both essential and effective. For an increasing number of sites, the facsimile provides the only means of public access (e.g. at Mogao only 10 out of 492 caves are open to the public), and may even give a superior viewing experience because of the constraints of the original site. And this is where the 'gigantic' screen with its capacities to simulated objects, places and people at 'real-world' scale plays a pivotal role. [3] As early as 1970, the writer and futurist Alvin Toffler, in his book Future Shock, foresaw the use of virtual reality and "simulated environments" for the experiential immersion in cultural heritage: *Thus computer experts, roboteers, designers, historians, and museum specialists will join to create experiential enclaves that reproduce, as skillfully as sophisticated technology will permit, the splendor of ancient Rome, the pomp of Queen Elizabeth's court* [4]

Simulation and digital replication has confronted practitioners within museums who struggle with shifting concepts of 'aura' of the digital. Most recently, the contemporary philosopher Bruno Latour and digital preservationist Alan Lowe have argued for the "migration of aura" (I would argue however for a *proliferation* of aura)—by which good quality digital facsimiles both propagate and add layers of significance and meaning to the original, providing the object with a biography, as opposed to being a weak surrogate for the original or competing with or supplanting it [5]. The focus of our age has been on the reification of the original object, but Latour and Lowe see this frenzy of interest rising exponentially along with the number of copies of the original that are circulating. In other words, the intensity of the search for an original depends on the amount of passion and the number of interests triggered by its copies, so the question that must be asked becomes: "Is it well or badly reproduced?"

Fig. 5. Pure Land: Inside the Mogao Grottoes at Dunhaung (2012-2016) Sarah Kenderdine & Jeffrey Shaw in collaboration with CityU of Hong Kong & Dunhuang Academy. Interactive 360-degree projection. Image © Sarah Kenderdine & Jeffrey Shaw.

Through a series of immersive installations and permanent exhibits this panel discussion will extrapolate on these issues to illustrate arguments in embodied museography (e.g. aura, authenticity and authorship). Projects will include *The Pure Land Projects:* five distinctive works based on interactive facsimiles of the World Heritage Site, Dunhuang Caves, China; *PLACE-*

Hampi (2006) and a new museum at *Kaladham*, Karnataka, India (2012) based on the World Heritage Site of Hampi; *Museum Victoria's data browser* (2014) for 100,000 objects in 360-degree 3D; *Look up Bombay* (2015) as a gigapixel dome work for the Prince of Wales Museum, Mumbai; *Lie Down Look Up* (2015) a collaborative artwork with together with 47 Indigenous Australian painters for 4K \\\\\\\\\fulldome; *Pirates Scroll* (2013) for the Hong Kong Maritime Museum; the *Atlas of Maritime Buddhism:* deep mapping in South East Asia and South China Sea; *South Chinese Kung Fu Archive:* the 4D archive of intangible heritage and much more! This discussion will also look at upcoming research, the development of the world's highest resolution VR screen (at 120 million pixels) and expand on the potential for an Internet of Big Machines (IoBM).

Mike Phillips : Any resemblance to any other world known or unknown is purely coincidental. [6]

This panel paper explores the recent liberation of the Fulldome from its planetarium shaped shackles through the work of a transdisciplinary team of artists, VJ's, coders, performers, producers and curators. This process of liberation has enabled the exploration of a Fulldome language and a range of experiences and enabling technologies that are being deployed in cultural situations and institutions. This process has also created a disciplinary backwash where initiatives such as Fulldome UK, are infiltrating Science Centres with cultural content.

The Fulldome, as a media archaeology, represents an anomaly in the history of media technologies and associated art forms. Its early absorption into wealthy STEM domains isolated it from the evolutionary pathways of other art forms, creating something more akin to a mutated hybrid of scientific instrument, educational tool and funfair ride. These chameleon qualities were constrained by a co-dependency of a disciplinary hegemony (public understanding of science), astronomically expensive digital technologies and an investment in physical infrastructure and estate (Science Centres) (Phillips, 2012) [7]. It could be argued that this enforced incarceration was in the best interest of the Fulldome, an effort to keep the form protected in a state of hibernation until circumstances allowed it to emerge, imago like, from its disciplinary chrysalis. If so, then as with all over protective parenting, letting go can be difficult. The transformation of the Fulldome from compliant child to rebellious adolescent has far reaching transdisciplinary implications - this panel paper draws on insights gained through collaborations, such as Fulldome UK (http://www.fulldome.org.uk/), the EMDL Project (http://www.emdl.eu) and research exploring the application Fulldome technologies to museums and galleries (n particular Birmingham Museum and Art Gallery and the Tate Modern).

"This is the Best Day of My Life. I Think I'm Going to Cry." (sic)

So said a 6 year old girl entering the Immersive Vision Theatre. Overexcited children aside, the Fulldome is a transdisciplinary instrument for manifesting (im)material and imaginary worlds. A place "where all the different kinds of truths fit together" (Vonnegut, 1962) [8]. Its ability to break down disciplinary boundaries extends beyond its popularity as a vehicle for large data visualisations, the technogeekery and the easy transportation to the edge of the known universe. There is something sensuous, hypnotic and uplifting about the physical space of the dome which seeps into the head spaces of those who work with it. It is probably the most tangible realisation of Nagy's desire for coherence: "-seeing, feeling and thinking in relationship and not as a series of isolated phenomena. It instantaneously integrates and transmutes single elements into a coherent whole". (Moholy-Nagy, 1946) [9].

However, the language of Fulldome is relatively naïve. For instance, the history of the slow zoom through space played out daily in planetariums (such as Uniview and Sky-Skan) feeds on a narrative constructed by Powers of Ten (Eames, 1968) [10], Kees Boeke's (1957) Cosmic View: The Universe in 40 Jumps [11] and before that the opening sequence of Powell and Pressburger's (1946) 'A Matter of Life and Death' [6]. Whilst there are numerous examples of planetarium infotainment that exhibit creative and artistic accomplishment, they are more often than not undermined by a pedagogic determinism that compromises the aspirations of its authors.

Speaking in Tongues.

Projects such as E/M/D/L: European Mobile Dome Lab for Artistic Research' (http://www.emdl.eu/) (2013-15) have made considerable contribution to the evolution of the Fulldome artistic language. The international collaboration shared skills, methodologies, strategies and content through workshops, residencies, conferences, exhibitions and collaborative productions. This research explored the potential languages and grammars unique to the Fulldome, creating new opportunities for audience participation in the navigation of trans-scalar, recursive imaginary territories, harnessing both physical and synthetic worlds.

A particular output of this collaboration was the development of 'Phage' technologies (figure 1), collaborative physical instruments that allow the manipulation of virtual objects within the projected dome space. These technologies are now flowing out of the Fulldome space and are being deployed within cultural and heritage institutions as a means of accessing new knowledge from museum artefacts, enhancing audience engagement and constructing a shared heritage through crowd participation.

Fig 1. *Phage*, 2015, Mike Phillips, digital photograph, Copyright the author.

Transdisciplinary Contamination.

On the other hand, a Fulldome disciplinary backwash can be seen in the work of Fulldome UK (FDUK). The Fulldome UK festival is produced by GaiaNova in partnership with i-DAT, The Computer Arts Society (CAS) and the NSC through NSC Creative. FDUK has established itself a rich site for the development of new material for an international community and new audiences with a growing lust for multisensory, participatory, immersive content that moves beyond the notion of the 'screen' to the concept a multidimensional immersive experience, a total sensory environment (Phillips, 2015) [12].

Operating as a nomadic not for profit organisation, FDUK adopted a parasitic approach to Science Centres: launched at i-DAT's Immersive Vision Theatre, Fulldome UK 2010 (10–11 July 2010), it infested Thinktank, Birmingham Science Museum for Fulldome UK 2011 (12–13 March 2011) and is now firmly embedded in the National Space Centre (NSC) in Leicester, Fulldome UK 2012 (16–17 November 2012) and Fulldome UK 2014 (7–8 November 2014). Having infected its host FDUK is now contaminating other Science Centres across the UK (such as InTech), with recent outbreaks of FDUK in planetaria in Moscow in 2014 and Sao Paulo in 2015.

As with every adolescent the Fulldome struggles with its identity, or the perception of its identity - such as not readily fitting neatly into funding categories – the British Film Institute wont fund Fulldome work because its 'art' and the Arts Council England wont fund it because its film. But as crucible for creative innovation and transdisciplinary contamination there is nothing coincidental about the Fulldomes resemblance to any other world known or unknown.

Sven Travis: Panorama: Space/Time Continuum

The final panel paper manifests aspects of the panel 'Mediation Beyond Surface' theme within the context of

the ISEA2016 conference site. During spring 2016 researchers from Parsons Design+Technology (NYC) will work with four Chinese universities (HKCityU, Tongji-SH, Tsinghua-BJ, SIFA-Chongqing) to create experimental computationally generated panoramas across a distance. Groups of 2-3 researchers in NY will work with similar sized groups at each university in China using tools including (but not limited to) OpenCV, openFrameworks, Cinder, PyVison, and FastCV to produce results that are dynamic and evolving. Form factors will range across traditional print, screen-based digital, mobile platforms, smart architecture (installation), and may include aural and zoological output. Emphasis will be placed on production of work that is unpredictable and if possible uncontrollable, with the hope of consequences that become independent. Groups will design and produce projects during February-April while interacting online, and convene in person during ISEA (May 2016) in HK to demonstrate final outcomes. Resulting workshops and exhibitions will take place at ISEA, at the Chronos Art Center (Shanghai) in June, and in Parsons Aronson Gallery (NY) in September.

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Data natures: the politics and aesthetics of prediction

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Abstract

The 1755 Lisbon earthquake was a *cultural revolution* that established an intimate relationship between data and nature. This panel examines how data has been increasingly perceived as an analogue of nature, capable of figuring its shape. The panel converges on this conflation by examining the politics and aesthetics of prediction, arguing that both data and nature are variable. Although, data cannot be used to make precise predictions—such is the nature of nature, which precludes such figuring—data is one currency through which we might predict environments. Yet, if data is not nature expressed systematically, then what is data? Data both makes sense and generates sense by conjuring patterns in amassed signals; prediction then is a way of guessing where the next point will fall in an identified pattern.

The panel presents four case studies that (re)frame this relationship of data natures. The individual position papers locate scenarios in the internet of things, radiation ecologies, interactions with waste, and the collection of weather data by citizen science in order to explore the aesthetics of data and nature based on instability and variability. In these events, data and nature are shown to be transformative and forever unpredictable.

Data and Nature

Fig 1. *Lisbon, Portugal, during the great earthquake of 1 November 1755*. 1755. Artist unknown, copper engraving, Original in: Museu da Cidade, Lisbon. Source: wikimedia commons.

In 1755 the Lisbon earthquake shifted European understandings about human relationships with nature forever. The magnitude and location of the event meant that this "natural event" had massive and ongoing political and social impacts. Voltaire composed poems and rewrote his story of *Candide* to feature the quake, others argued that this geological event marked the start of the philosophical age known as the European Enlightenment. But perhaps more than anything it was the unpredictability of the quake that brought together data and nature. In the image above we watch safely from our spot above the Tejo river; we witness the future being made, as citizens of the city take to the waters, only to be swamped by tsunami after tsunami. As the water was sucked out of the port area the seabed was revealed to contain layer upon layer of rubbish, long forgotten shipwrecks, and the waste remains of a large bustling city. Standing in awe citizens could only watch as their city was engulfed by both water and fire, buildings that until this moment had housed the known and predictable word of God were suddenly rendered fallible, and the colonial dreams of the nation were put on hold. People, things and environment become joined in a single moment where naturalistic thought became the site for new forms of data.

Earthquakes were moral long before they were natural, and in shift towards a natural politics of the seismic, data and nature became inextricably linked. Many new methods for mapping the natural resulted and a new sense of scale emerged. Lisbon was a cultural revolution, but more than this the event resulted in new things. This etching functions as a material record of disaster at the same time as being a map of a future city. New models of predictability were constructed that were intimately joined to risk. The problem became one of sensing data as much as sensing nature. What were the citizens to do with the revelations of decades of rubbish strewn across the ocean floor? What to do with the new rubble of fallen buildings? What new forms of technology and communication could emerge? The reason we know so much about the quake today is also because of the ability of the Church to organise and survey. Data was gathered in the immediate aftermath of the quake that relied on the global distribution of the clergy, for example, reports from Brazil indicated that clerics there experienced the impacts of the tsunami.

The deep connection between the predictability of data and nature meant that Lisbon was also the birthplace

of a concept of risk and insurance. How could individuals protect themselves from the unpredictable? How might the individual engage with loss? In Natural Disaster Insurance schemes, data serves as a risk management calculation to predict the probability of insurance claim in ratios and percentages.

Two hundred and fifty years have passed and the relationship between data and nature have changed. We now have new forms of data: big data, mass inventory data, damage ratio, risk management and computerised procedure for loss estimation. We also have new technologies built on the exploitation of nature in order to map and record and gather and document, and analysis and create data. As Ursula Heise writes, "The distinction between systemic and cumulative risks not only raises the question what purchase local experience has on global ecological systems but also how such a distinction relates to social networks based on risk." [1] Our awareness of nature is now intimately tied to a citizen's assessment of risk based on interpretations or understandings of what risk might be.

Variability and Unpredictability

In 1989, the US Department of Defense launched the first of its twenty-four military satellites that would later form the Global Positioning System. These networks of timed signals bouncing on and off the earth ostensibly fix time and place. Except, in fact, they don't. Laura Kurgan writes, "GPS ... unhinges our sense of stable and fixed location: 'so accurate had the system become that even *fixed* parts of the earth's landmass revealed themselves to be in motion, an unending shuffle of continents drifting over the surface of the planet on backs of tectonic plates.'" [2] Or as Shaun Lewin puts it when referring to contemporary cartography, "What was originally an attempt to find a continuous constant transcendental means of referencing the surface of the planet was completely falsified by the nature of the planet itself." [3] An unstable map emerges from variable data. If the planet itself is always shifting, the prediction of mean data becomes as challenging as finding a safe harbour to anchor during a storm. Therefore, a map—a particular formulation of data and nature—is always an approximation, or rather, it is an unstable medium to both figure and predict knowledge. Cartography collects data off a surface, shifting our attentions away from the ground and instead focuses our attention across a satellite network of off-world data capture devices.

Sean Cubitt writes, "Rather than the world, it is data which is taken as given, so that, viewed from within the system, the place of the unposited is taken by what is always already posited as given, in a form conformable to the system's requirements." [4] This panel contends that data can never be treated as a given. If bringing together data and nature is not a process of fixing but an event in which instability and variability become core tools, then, "the world we know is not pregiven…knowledge appears more and more as built

from small domains, that is microworlds and mircoidentities." [5]

Data is an aesthetic index of the ordered, the possible, and the believable. As in a chain of translations, it invokes higher algorithmic or transductional orders, and evokes lower orders touching on the material, it simultaneously melts and solidifies, calls into existence and obfuscates, potentiates and renders into standing reserve. Humans have faith in data, so much so that dramatic and irreversible change can be aestheticised away through a few simple keystrokes. As we turn away from the undesirable and the unpleasant we recalibrate our tools and wonder at the beauty of our data maps. If data is the result of a functioning algorithm, or as Matthew Fuller puts it "Imitate. Replicate. Terminate. Optimally,"[6] then it is clear that data is not raw matter, but rather the sum of matter, amalgamated with logic and control. What if it was not possible to always have control? What if in fact we were trying to control the leftovers, the excess, the matter that could not be mapped?

Nature, like data, is often presumed to be a given but it too can only be understood through observation of the variability of microworlds and microidentities (that is: framed systems, or what Bruno Latour and Karan Barad call "black boxes"). We live in a time when the climate is no longer simply the datalog of weather, and when a climate of fear (of loss, of risk management) can pervade previously stable environments. Added to this is a mode of anticipation that must contend with both proliferation (of technologies for measurement, audit and classification) and disappearance (of species, of individuals, of things). Artists have responded to major catastrophe in sites where even the air is haunted. The construction of maps, anticipatory objects, affective installations, and participatory design anticipates new connectivities. These human-machine ecologies are a new nature that creates both familiar and strange spaces for experimentation.

The panel presents four case studies of how an aesthetics of data and nature based on unpredictability can offer a (re)framing of this relationship. Each scenario presents an individual example, event, theory, approach or experiment in which the relationship of data and nature are shown to be transformative. They ask:

- What is the nature of data?
- What is the nature of the methods used to interpret data?
- How is data instrumentalised and when does the interpretation of data becomes performative?
- What kind of politics result from this instrumentality?
- What other frameworks can be used when interpreting or mediating data?
- What kind of results do these investigations present?
- How does instability contribute to knowledge?
- How does data transgress?
- How do we navigate with absence, constant and sudden change?

In examining the ways that it is possible to predict data futures through variables, the panel shows how critical aesthetic frameworks can challenge both the instrumentality of data, and the dominant narratives posed by institutionalised data interpretation. The panel begins from the four case studies that each locate an individual example in which the relationship of data and nature are shown to be both unpredictable and transformative.

Fig 2. *Crystal Palace: The Great Exhibition of the Works of Industry of all Nuclear Nations*, 2013, Ken and Julia Yonitani, Uranium glass, antique chandelier frames and electrical components, UV lights, Dimensions: variable (31 pieces), Reproduced with permission of the artists.

Susan Ballard: The Radioactive Ecologies of Ken and Julia Yonitani

Any discussion of nature is inextricably linked to the data politics of environmental catastrophe. After the 2011 Tōhoku Earthquake and tsunami it seemed that no amount of data or statistics could ever encapsulate the true ecological impact of the most powerful earthquake to hit Japan in recorded history. Thinking about art in this context offers an imaginative and real space in which people can process the horror of abrupt disasters such as this. An understanding of the aesthetic energies of nature and their entanglement with the scalar forces of nature is the stepping off point for Japanese-Australian artists Ken and Julia Yonitani. Using uranium glass to construct *Crystal Palace: The Great Exhibition of the Works of Industry of all Nuclear Nations* (2013) Ken and Julia Yonitani use a granular scale to map the correlations between potential and actual disaster. Under UV lights thirty one glowing chandeliers represent the thirty one nuclear nations of the world; the size of each corresponding to the number of operating nuclear plants in that nation. Some of the glass used in the chandeliers is recycled antique glass produced with natural uranium. Others are made from contemporary uranium glass, produced with depleted uranium, a byproduct of the uranium enrichment process, needed to produce uranium reactive enough to use in nuclear power and nuclear weapons. Considerations of scale and causal relations contribute to the question of what makes a difference amidst the atomic fallout. Natural disasters are never isolated events, they form equivalences that create social,

cultural and technological catastrophes. [7] As disaster mutates, the path from human nuclear energies to inhuman equivalence starts to glow amidst the flows of nature. This case study suggests that we construct a molecular tracery that journeys from artist responses to the ongoing Fukushima disaster towards the realities of climate extinction. In the retelling of the relationships between data and nature, and as countries consider the radioactive ecologies of nuclear energies, the case study suggests we enter a new data politics of nature.
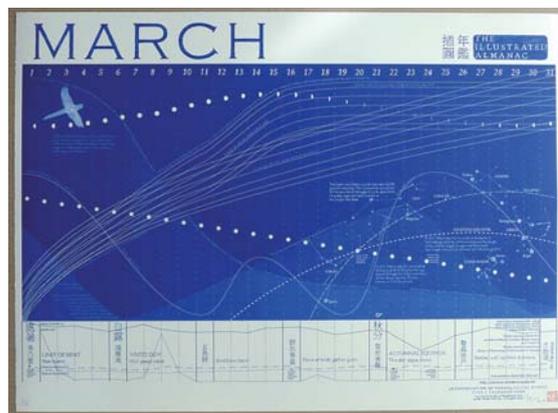

Fig 3. *The Illustrated Almanac (March)*, 2012-4, Jo Law, off-set lithographic print (editions of 25). Courtesy of the artist.

Jo Law: The Study of Things in the Air

Meteoros are things in the air like clouds, fog, mists, rain, snow, thunderstorms, rainbows, air pressure, humidity, and wind directions. The study of these things also looks to elements from beneath and phenomena from beyond. The interactions between these things are continually changing and inherently unpredictable. Weather forecasting practises an aesthetics of prediction that combines measurements of these things in the past (such as climate averages) with data readings of the present (such as synoptic charts) to present a future scenario of the highest probability: 7-day forecast, seasonal outlook, and long-range prediction. In this way, climatic and meteorological sciences are able to move forward in time; proposing climatic models by reaching back in time (analysing ice-core samples). The motivation to figure the *oikeoumene*—a nature inhabited by humans, non-humans, living, and nonliving things – is to provide a predictable environment. Today, this modelling is derived from quantifiable data gathered through precision instruments. In the past, inductive predictions were based on an entirely different set of data: observations (red skies at sunset) and sensing (onset of rheumatism), encoded into lores and cultures.

The Illustrated Almanac of the Illawarra and Beyond (2011-) works with such an aesthetic framework, akin to chorography: "an art as much as a science [...that] combined mapping, landscape art and literary description."[8] The project uses the ancient Chinese Almanac to map the southeastern coast of Australia over one calendar year. The resultant series of temporal maps

formed from the interaction between this narrative framing and an eclectic collection of data: weather statistics, meteorological records, tidal predictions, astronomical observations, migratory species sightings, seasonal harvests, and anthropogenic rituals. Overlapping with citizen science, this project combines quantifiable data with narrative data to suggest how a different set of selection criteria can transform our dialogue with the changing *oikeoumene*.
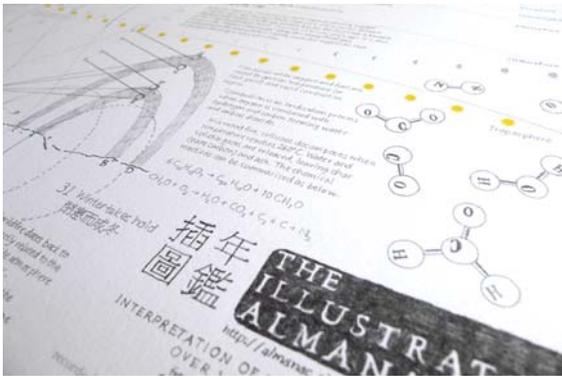

Fig 4. *The Illustrated Almanac (May)* – detail, 2012-4, Jo Law, off-set lithographic print (editions of 25). Courtesy of the artist.

Teodor Mitew: Object Hierophanies and the Mode of Anticipation

The Internet of Things (IoT) involves physical objects monitoring their immediate environments through a variety of sensors, transmitting the acquired data to remote networks, and initiating actions based on embedded algorithms and feedback loops. The data in these loops makes its journey to an obfuscated proprietary taxonomy of corporate server farms and returns to the situated object as a transcendental revelation of an opaque order impenetrable to human interlocutors. [9] This case study argues that in effect the nature of an IoT enabled object appears as the receptacle of an exterior force that differentiates it from its milieu and gives it meaning and value in unpredictable ways. IoT enabled objects such as the aptly named *Amazon Echo* acquire their value, and in so doing become *real* for their interlocutors, only insofar as they participate in one way or another in remote data realities transcending the locale of the object. Insofar as the data gleaned by such devices has predictive potential when viewed in aggregate, the enactment of this potential in a local setting is always already a singular act of manifestation of a transcendental data nature.

In his work on non-modern notions of sacred space philosopher of religion Mircea Eliade conceptualized this act of manifestation of another modality of being into a local setting as a *hierophany*. [10] Hierophanies are not continuous, but wholly singular acts of presence by a different modality. By manifesting that modality, which Eliade termed as *the sacred*, an object becomes the receptacle for a transcendental presence, yet simultaneously continues to remain inextricably

entangled in its surrounding milieu. Spaces punctured by hierophanies are not homogenous, but are experienced as a heterogeneous array of interruptions, crevices, liminal breaks, folds, and pauses of enchantment. In other words, the manifestation of a hierophanic presence reconstitutes heretofore homogeneous spaces. There is a strange attraction between non-modern imaginaries of *hierophany* as a gateway to the sacred, and IoT enabled objects transducing loci into liminal and opaque data taxonomies looping back as a black-boxed *echo*. The case study proposes that when viewed in aggregate, such hierophany-punctured spaces seem to resonate in a *mode of anticipation* of human and non-human agency in the form of a new data aesthetics.

Fig 5. *The Modern Midden* (publicity flyer), 2015, Jo Stirling, printed graphic. Courtesy of the artist.

Jo Stirling: The Modern Midden

The Modern Midden, *a small part of the big story of waste* (2015) is an immersive visual data story that engages with waste generation and disposal in Australia. The project questions a reliance on landfill as a final destination for waste disposal and this being the predominant and relied upon solution. Central to the project is the recording and instigation of participatory experiences that build upon existing data to establish new evidence in order to question our relationships with waste. This paper discusses how data visualisation can be a strategy for exploring pathways of collective change through information design by making *visible* the data evidence of waste generation in new ways. Participants are asked to collect, sort, and categorise refuse produced by households over a set duration. By making the data evidence of "waste" visible and physical *as* the by-product of wasteful systems and behaviours, we can share and witness the new nature of our own creation: "a world of objects without depth that leave no trace in our memories, but leave a growing mountain of refuse." [11] This case study asks: What happens when data, materials and actions become a collective and shared experience? How do these new layered stories become important to nature? How do data and nature converge through these collective and shared processes?

Fig 6. *The Modern Midden* (installation shot), 2015, Jo Stirling, installation. Courtesy of the artist.

Conclusion

The perception of data as an analogue of nature gestures towards precision in predictions, yet, both data and nature are dynamic systems for understanding, mapping and organising the world. Tectonic plate movement is a result of conventional currents of magma under the earth's crust, and as a dynamic system, predictions of future movements can only be calculated as probabilities, never with certainty. We can map tectonic plate movements, and understand the scaled relationship between the planet's liquid mantel and the movement of the crust; the mechanisms of these events can be shown, their impacts tracked, their directions predicted, but never the precise place or time when the pressure is released. We can predict aftershocks will occur after an earthquake, but never the initial quake. We can predict the likely arrival of El Niño but not always its effects. When shown as physical evidence, data has the capacity to embed into social practice. When senses transform into signals, routed by pre-programmed algorithms, sent and retrieved by inanimate objects, data generates new layers of instability. At this moment, new kinds of nonliving nature can suddenly talk back. The use of data to map nature, and thereby predict transformation, assures us that the risks brought about by human challenges to the very processes central to the functioning of the earth system, can be calculated and insured against.

As markers of cultural and sociological change, concepts of data and nature as well as the environmental transformations they figure, are an important contributor to the way in which we might understand the epoch of the Anthropocene. Human geographer Noel Castree recently wrote that it is very easy to believe the science of the Anthropocene, as science always turns us towards the believability of its data. [12] But what else do we have to go on? How does data map nature, and how do different natures respond to the impacts of data? For some this is a process of disaster management, and for others a transgressive gateway to the sacred.

Whether sensory data, measured data, or processed data, data is always framed and selected through a set of predetermined criteria. These criteria reflect the sensing organism or mechanism rather than the nature or contexts the data correlates to. By examining the politics and aesthetics of prediction in the communication amongst an internet of things, the physical manifestation of radiation as a time stamped record of disaster, abstraction of waste as a marker of human presence, and citizen climate science's creation of data to map a past in order to predict a future, this panel does not suggest that by making this correlate more transparent, the unpredictability, variability or instability inherent in data modelling will evaporate. Rather the panel argues that data is not an analogue of nature; it does not and cannot figure nature. We propose that by bringing together data and nature in an aesthetic process that is not fixed (such as through set algorithms) but is instead an event in which instability and variability become core tools, then the relationship between data and nature, and indeed, nature itself can be rethought.

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(Re)volting data

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Abstract

As a panel of artist researchers, we offer critical accounts of artistic acts with data that arouse aversion or disgust. We address the following; 1) speculative art fictions that engage with the resistances and revolts of microbes in computational ecologies; 2) the biopolitics of our corporeal matter, using the material transformation of blood into artwork as a case study; 3) artistic research and practice as a study of small things, tiny revolts and frequencies of interference; 4) the boundary between life and death, growth and decay; and 5) the biopolitics of disgust through artworks that invite visitors to eat food produced from members of the human microbiome.

Background

Our panel, *(Re)volting data* is a response to the ISEA2016 theme of Cultural R/evolution. Discussions of Big Data have drawn attention to corporate acquisition and manipulation of personal data, alerting us to the so-called 'scraping' of our "online" identities and social media. From sweat pouring into our smart phones to urinating in sewage systems, we generate petrabytes amounts of quantifiable data, most of which becomes indeterminate to us. Plants, nonhuman animals and microbes also contribute to what has been termed the "data deluge". Big Data has been described as both being, and causing, a revolution in the way that we live and work. However, we use the term 'revolting' in two ways, firstly, to break away from, or rise against, constituted authority, such as placing humans or algorithms in authority over nonhuman animals, or governance by predictive algorithms, based on unknowable decisions in the pool of Big Data.

Secondly, we use 'revolting' to mean intense disgust. Recently, social theorists have analysed the processes through which specific populaces are figured as 'revolting' and accounted for the practices these populations use in order to 'revolt' against their subjectification. [1] Scholars of media art and comparative literature have drawn attention to the collapse of boundaries between information and embodiment and the ways that bodies are co-constituted with data, or emerge with data. [2], [3] It is common for such writing to take either utopian stance, described by Katherine Hayles as the wish, "to be raptured out of the bodies that matter in the lust for information," [4] or conversely, a dystopian view. We show that there are porous boundaries, or entanglements, between nonhuman animal and human, between life and death.

We propose using corporeal scrapings, biological functions and biomaterial of artists and nonhuman animals as media for artistic expression to subvert the formation of subjects by Big Data. We discuss how these artworks engage with the felt aesthetics of data - one that might offer alternative political possibility. We discuss the generation of data as a form of open rebellion, where data is deployed as a means to cast off allegiance or subjection to those in authority. The authors above are listed alphabetically. The paper will now unfold in order of presentation on the panel.

Helen Pritchard: Microbial Revolts

In 1997 Oak Ridge National Laboratory announced the development of a living sensor, the "Critters on a Chip", a tiny light-sensitive computer chip coated with bioluminescent bacteria, placed on a standard integrated circuit. In the presence of targeted substances including petrochemical pollutants and explosives, the bacteria emitted a visible blue-green light. Small, inexpensive and fast, critter chips imagined an affective scene in which microbes could be used to monitor remediation and bioaccumulation at sites contaminated by petrochemicals. It was imagined these critter chips could be located in sites where humans and other nonhumans could not survive. As Rosi Braidotti [5] has noted, the political economies of bio-chemo capitalism hold no distinctions between humans and nonhumans when it comes to profiting from them. Seeds, plants, animals and bacteria all become sites that generate data. Although

much feminist theory and art/science work has focused on the positive, co-creativity of nonhuman organisms and humans, little attention has been dedicated to the aesthetic practices of nonhuman organisms in the network, who don't engage with us, but accompany us in the dark backgrounds. This paper foregrounds the relations and material loops of environmental data; relations between petrochemicals, waste, computation and capitalism, so that we might attend to the semi-living, exhausted, partial lives of particular organisms that are enrolled with the computation of (big) data, yet often disappear in its data structures. By focusing on nonhuman organisms, I do not wish to reinstate the categories of the animal, fish or bacteria as fixed. Instead, I want to develop a fuller understanding of the *capitalist practices of computing* and the ways in which it extends its reach into nonhuman organisms *through affect.* I focus on the speculative figure of the critter chip and the artwork "Critter Compiler". "Critter Compiler" is a speculative fiction writer, a botnet constituted by the queer musings of atoms, microbes, slime moulds and algaes. "Critter Compiler" engages with the more-than-human critters of the internet, an ecology of critical life that demands attention. Drawing on the work of Lauren Berlant I discuss the aesthetics and promise of critter chips that is brought into being by sensing corporealities. Highlighting the entangled intra-actions of bioaccumulation in the artwork "Critter Compiler", I speculate on the resistances and revolting aesthetics of microbes that propose an alternate political possibility.

Jade J. A. Hastings: Trans-Xeno

Blood is a substance burdened with impedimenta-- simultaneously a vital fluid, one's heritage, identity, a common bond, and a symbol of salvation. Medical practitioners from the ancient to the modern have studied the therapeutic potency of blood. As Ancient Egyptians believed bathing in blood was a source of rejuvenation, so too do contemporary physicians seek live-restoring therapies through mesenchymal stem cells and blood transfused from the young to heal patients with Alzheimers. Owing to its rich symbolic associations, in addition to its biological significance, blood naturally draws controversy when used to create works of art. A number of contemporary artists have defied cultural taboos to dissect the complexities of our modern relationship with our blood. In 1997, Eduardo Kac and Ed Bennett created the "phlebot"--a robot that provides its human symbiote with dextrose in exchange for the oxygen it needs to sustain a visible flame--for their event *A Positive* to explore the "emerging forms of human/machine interface…[through the production of new creatures and organic devices that populate our postorganic pantheon, be they biological (cloning), biosynthetic (genetic engineering), inorganic (android epistemology), algorithmic (a-life), or biobotic (robotics)." Helen Pynor and Peta Clancy produced *The Body is a Big Place* [6] which explored the cryptic boundaries between life and death through the

sustenance of a pig's heart *ex vivo* within a gallery setting. Mark Quinn has explored a diversity of ways in which to produce a self portrait using his own biological material, including his DNA, feces, and blood. Beginning in 1991, he produced a series of self portraits from nine pints of his blood poured into a mold of his head made in a block of ice. The result, he claims, is a complete "self portrait-ness" that also represents the "impossibility of immortality." [7] Then, there are artists who use their own blood in performance to indicate fragility, vulnerability, such as Kira O'Reilly and Franko B. Yet, these works tend to extend the current narrative of the blood as a token of identity and vitality, and exploit its capacity to ellicit a strong visceral response as the basis of provocation. My research diverges from these previous works as the aim is not to simply utilise my blood *talis qualis*, but rather its metamorphic potential. Moreover, it subverts the status of one's blood as a substance standing in reserve for medical purposes, only to be handled by those qualified to study its objective properties. This research unpacks the biopolitics of our corporeal matter, using the material transformation of blood into artwork by and for the artist herself as a case study. Through the use of DIY phlebotomy and microscopy, the artist isolates and transforms the material state of their own blood purely for creative, rather than biomedical, purposes. Her work proffers the body as terrain for exploration and exploitation, pushing the aesthetic limits of blood as a creative medium.

Gillian Wylde: revolt, she said

Dodie Bellamy's essay "The Feminist Writers Guild*"* [8], describes her experience with a short-lived activist group in relation to Julia Kristeva's concept of "tiny revolts." [9] Bellamy writes; "Need the success of a political group be measured by its impact on a larger social order? What about the ways it transforms the lives and psyches of its members –their tiny revolts—are they not profound?" Revolt she said, revolt. For this paper I will take these this idea of 'tiny revolts' as a starting point to address, mongrelised revolting data within some of my recent video works. I will discuss recent work that addresses amongst other things, ideas relating to the *feminine écriture*, pleasure, monstrosities and madness within practices of art writing and video installation. Anger is of little importance. The presentation also draws on Deleuzian concepts of assemblage and multiplicitous attractions and influences –inflections through my video works. Assembled edits and cuts within my recent video work and writing are rendered both exact and invisible, inciting both problems and provocations and 'tiny revolts'. Identity is dead. Processes of performative assemblage, internet searches and Youtube browsing are constants through recent work; as a both a critical engagement with post-production and the mediated. These processes, also act as a critique of Big data and the inaccuracies of decision making. In this paper I links discuss links between 'creativity' and trends/un-trends, of the internet and the

mediated in the fabric of everyday lives. Before the internet, in an interview, televised after his death, 'L'Abécédaire' [10], Gilles Deleuze discusses with Claire Parnet the crucial link between creativity, the very possibility of thinking, and animality, through the practice of être aux aguets (being on the lookout) for rencontres (encounters). The best of Deleuze can be found on the Internet for sure. I discuss 'L'Abécédaire' (1988–1989) and practices working and thinking through performative assemblage(s) of browser doings, apparatus or equipment structuring's, rhizomatic unfolding's, non-human historiographies, and philosophies. I introduce as a response to these ideas, the artworks 'A as in Animal' and 'Enflamma Diagra' these works collide reverse path tracings; dissonance, discordance and difference, bringing into contact amongst other things; keeping fit with Donna Haraway, Derrida, blue and green screen special effects and spy mission project 'Acoustic Kitty'. Emergent indeterminate properties pervade both sound and image. This approach articulates activities of tiny revolt, accumulation, arrangement and movement that call to attention processes, which are improvisatory as, expanded critical and aesthetic tactics. Through this process less, emphasis is placed on observation, representation and subjectivity. Articulations stutter between different intensities, intensities that include, over-saturation of colour, shimmering substances, non-diegetic sound and trans-disciplinary couplings that resonant a rubbing up with the non human. The paper discusses how these video works are shaped conceptually by site and the context of peripheral indifferences. Software pre-sets and preconditions are cut with modalities of classification and taxonomy that flicker with continued involuntary repetition of sounds and image. 'The (female) cat breaks the fruit bowl the cubists spend their time hoping to glue it back together'. [10]

Jane Prophet: Life, death, growth and decay

Psychologists have claimed that finding something revolting, being disgusted is evolutionarily advantageous to humans as it prevents us coming into contact with disease and contaminants [11], [12], [13], [14]. Humanities scholars have further argued that the basis for disgust is the messiness of the processes that are a necessary part of living and dying, that disgust developed not only as a way to police the boundary between "safe" and "contaminating" states [15] but also to prevent moral and ethical decay. [16] Some psychological experiments have been interpreted as showing that human disgust is related to our sense of being 'other' than animal. [17] Ernest Becker's suggestion that the human body reminds people of their "animal limitations", the most basic of which is the inevitability of death. [18] Experimental psychologists have tested disgust's role in human/nonhuman animal boundary reinforcement to test the hypothesis that "cultures promote norms that help people distinguish themselves from animals" to protect humans from their concerns about mortality. [18] This presentation

discusses the author's memento mori artworks, made from neuroimages produced during experiments designed to analyse brain activity during death meditation and while looking at memento mori. The process of making the works with neuroscientists is situated within an interdisciplinary feminism [19]. Specifically, new materialism is used to consider revulsion and disgust in relation to memento mori, combining a cultural analysis of disgust and death with scientific insights about the physical and chemical processes of decay. I argue that the life seen in the putrefying and decaying corpse challenges the "historical materialist sense that the agency of matter is derivative of deliberate human activity" [20].

Tarsh Bates: *Cum panis*: the biopolitics of self, fermentation and revulsion

The human microbiome has received a lot of attention in the last ten years, with claims that human cells are out-numbered ten to one by bacteria, fungi, arachnid, and insect cells, and an explosion of scientific research into the importance of such microorganisms to human evolution and health. Monica Bakke claims that knowledge of our microbiome does not threaten our identity although "an awareness of it definitely alters the way we think of our bodies, as they no longer can be perceived as sealed vessels". [21] However, Bakke's claim ignores a long lineage of scholarship that shows that the perception of the body as "sealed vessel," a "unified self," has always been a fantasy. This paper discusses a number of recent artworks that demonstrate the ability of the human microbiome to disrupt the fantasy of the unified "self" through the production of food using members of the human microbiome. The ancient fermentation processes that produce bread, cheese and beer are disturbingly and abruptly shifted into the realm of disgust and revulsion through the use of organisms harvested from the human body. This paper traces the biopolitics of fermentation, self and disgust activated through these artworks.

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Games and Gaming in China

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Abstract

This panel highlights scholarship in the area of games and gaming in the Chinese-speaking world. The panel thus fits a wider pattern of increased attention to regional games and gaming. The three papers explore various "glocalized" ways in which the global and the local—or here, rather, the regional ("the Chinese")—intersect in terms of design and production of, as well as discourses around (news media coverage, scholarship, fiction), games and gaming in China.

Glocalizing game studies

The development of the Chinese game industry over the last 10 years is well-reported. According to Fan, at the end of 2012 revenue from online and offline PC and mobile games in China stood at just over 60 billion RMB (9.5 billion US dollars), having increased by 33% in 2011 and 35% in 2012. [1] This rapid development has drawn the attention of many scholars, commentators and game producers eager to understand the political, social and commercial implications of increasingly vibrant and diverse gaming cultures (and markets) across the Chinese-speaking world.

This panel has been put together to highlight some of the scholarship currently happening in and related to games and gaming in the Chinese-speaking world. Such scholarship has been on the rise since a 2008 *Games & Culture* dedicated to gaming in the Asia-Pacific, [2] the edited collections *Gaming Cultures and Place in Asia-Pacific* (2009) and *Gaming Globally* (2013), [3, 4] and the annual Chinese DiGRA conference held since 2014 (with the 2014 conference in Ningbo, the 2015 conference in Beijing, and the 2016 conference planned for Taipei). This regional attention to games and gaming fits a wider trend: 2012 saw the first *Nordic DiGRA* conference, the autumn of 2014 saw the first *Central and Eastern European Game Studies* conference, and the number of regional DiGRA chapters is steadily growing. This trend has led Espen Aarseth to compare, with a slightly odd choice of metaphor (diaspora), "the heyday of DiGRA in 2003, when the Utrecht conference had over 500 participants" with a present situation in which "there seems to have taken place an academic diaspora, into smaller and more glocalized foci and events." [5]

Glocalization—understood loosely as an ongoing process of negotiation between the global and the local, which is sometimes smooth, sometimes leads to friction—is perhaps fitting as an overarching label for the papers presented in this panel. In "Development and Distribution Strategies of Independent Mobile Games in China", glocalization is a production and design issue: the paper considers how an "alternative design system that gives rise to local culture and creative talent . . . goes beyond [the] current creative system controlled by major transnational corporations". "How Active is the Audience? A Study of Chinese Game Fandom" includes discussion of what could be termed the glocalization of theory: how do fandom studies and theory developed in a western context work in relation to Chinese game fandom?. Finally, "After the Gold Rush: Gold Farming in China—and in Western Academia, Journalism, and Fiction" draws together existing western scholarship, journalism and fiction dealing with the Chinese gold farming phenomenon and frames coverage in these distinct yet interconnected fields as a case study of how discourses around video game economics resonate with western perceptions of China and its role in the global economy.

Peichi CHUNG: Development and Distribution Strategies of Independent Mobile Games in China

This paper proposes to study the development and distribution strategies of independent mobile games in China. The paper examines the alternative game culture that is different from the dominant cultural form of MMORPG (Massively Multiplayer Online Role Playing Game). Literature in Chinese game studies has focused on the outcome of a rapidly growing Chinese game industry in both game developing and publishing sectors. [6, 7] As the Chinese game market will soon grow to surpass the Untied States and becomes the world's largest online game market in 2016, [8] a comprehensive framework to study the Chinese game industry, market and its game art and culture is necessary. The paper considers China's game development one of the cases for game production locale in Asia that is capable to produce different form of game art from the creative style of

western games. This creative capability deserves research attention as it opens up the possibility of alternative design system that gives rise to local culture and creative talent. This creative framework goes beyond current creative system controlled by major transnational corporations.

A review of current Chinese game development in the mainstream sector, however, points out both strength and weakness in the design of Chinese games. Relevant industry report has identified censorship, over-commercialism and shanzhai (an act of copying in the creative process) as challenges that hinder the creative freedom of game designers in China. The paper will contextualize discussion on China's independent games in this creative context. It will first provide an overview of the game industry development, highlighting the structuralization and concentration process of major game companies including Tencent, Alibaba and others. The paper will then introduce the history of development on independent games in China. It dates back to 1970s based upon historical material that the author gathers from her research fieldwork. The paper will also introduce the rise of current independent game culture by connecting the discussion to current game jam tradition and global independent game culture. The paper illustrates the political and economic significance of independent game creation within limited industrial resource in China. The paper lastly reviews major award-winning independent games of *Mr. Pumpkin Adventure, Finger Balance* and *Breezy Bay*, etc. It analyses alternative game art represented in these games. It also discusses publishing network adopted by these major independent game developers in China. Conclusion section of the paper will focus on the contribution of independent game in reviving a progressive game development culture in China. It concludes with the contribution of alternative game art to revitalize industry dynamics at forming a sustainable value chain in China's game industry.

Ling-Yi HUANG: How Active is the Audience? A Study of Chinese Game Fandom

What is unique to fan studies in comparison to audience research in general is that the former emphasizes more on both social aspects and interpretive activities. [9] Moreover, the resistance power and textual productivity among a group of audience members is the best example of audience activism.

John Fiske noted that fandom is "associated with the cultural tastes of subordinated formations of the people, particularly those disempowered by any combination of gender, age, class, and race". [10] Fiske claimed that fans established a sense of ownership over their favorite media texts, and engaged in interpretive play with these texts to resist their negative characterizations in popular culture. Fan participation was related to political

resistance because fandom appealed to "subordinated" groups in society.

Following John Fiske, Henry Jenkins further defined "meaningful participation" of the audience. In this discussion, he contrasted two different phenomena to show what constitutes meaningful participation: (1) Participation vs. resistance; (2) the public vs. the audience. [11] He argued that participation means that people are organized in and through social collectivities and connectivities. However, resistance means that people are organized in opposition to a dominant power. When it comes to the differences of the audience and the public, the former is produced through measurement and surveillance and the latter is different from the former in that the public actively directs attention onto the messages they value.

However, not all of the fans can reach this ideal situation with meaningful participation. Some fans may be less social or less participatory. Sandvoss expanded the definition of fandom to include "the regular, emotionally involved consumption of a given popular narrative or text in the form of books, television shows, films or music, as well as popular texts in a broader sense such as sport teams and popular icons and stars ranging from athletes and musicians to actors". [12]

Here, we can see that there are different levels of participation and productivity in fan practices. Comparing mere emotional consumption to political resistance the range differs widely. Thus, the purposes of this study are to understand: How far it is from mere emotional consumption to political resistance? How many different levels of participation and productivity are there? How active is the audience in the game fandom world? This study will focus on the game fandom practices in China. Through game fandom practices, we hope to answer the question "How active can the audience be"?

Another useful tool to answer the aforementioned topics is Wirman's five dimensions of player productivity. Wirman proposed five dimensions of player productivity (1) game play as productivity; (2) productivity for play: instrumental productivity; (3) productivity beyond play: expressive productivity; (4) games as tools; and (5) productivity as a part of game play. [13] She provided a tool to evaluate different levels of game fandom participation and productivity. An interesting topic for discussion is if these five dimensions are all "meaningful participation" according to Henry Jenkin's definitions? Furthermore, these five dimensions were discussed in a western context but this study aims to study game fandom in Chinese culture. We look at different participatory and productive practices of game fan players and try to categorize them into these five dimensions. If the dimensions do not fit, we will propose different ones.

We plan to study two different popular games in China. One is the international commercial game "League of Legends" (LOL) and the other one "Full mental Alchemist" is the Doujin game made by fans. Ethnography will be employed in this study to observe

the different practices of game fandom. Besides, we plan to interview several key reporters to get deeper insights of the practices of Chinese game fandom. We expect that there exists different game fandom practices related to both commercial and non-commercial practices. Therefore, the spectrum of game fandom practices can be broadened and widened. Hopefully, this study can contribute to the notion of "active audiences" in communication studies and categorize the different practices of the Chinese gaming culture.

Bjarke LIBORIUSSEN: After the Gold Rush: Gold Farming in China—and in Western Academia, Journalism, and Fiction

In the mid-2000s, a new "third-party gaming services industry . . . grew rapidly . . . as MMO games grew in popularity". [14] According to a 2008 estimate, "China has around 80-85% of employment and output in this sub-sector". [15] The production of MMO currencies, items and services is commonly known as "gold farming", and stories about gold farming in China proliferated in western news media from 2006 to 2009. [16] Meanwhile, scholars commented on Chinese gold farming and its reception by western players by analytically linking it to Third World stereotypes, [17] anti-immigration discourse, [18] and social aspects virtual world ownership. [19] The figure of the Chinese gold farmer also found its way into western novels. [20, 21] The size of the gold farming industry in China is assumed to have peaked. Although empirical basis for this assumption is weak, the literature tentatively suggests determining factors such as rising wages, [22] and the spread of subscription-based software, which allow private users to automate gameplay for financial gain. [23]

This paper draws together existing western scholarship, journalism and fiction dealing with the Chinese gold farming phenomenon and frames coverage in these distinct yet interconnected fields as a case study of how discourses around video game economics resonate with broader discourses, in this case western perceptions of China and its role in the global economy.

The primary theoretical framework is Vukovich's update of Said's orientalism thesis for a world in which China is seen to play increasingly important and diverse roles in the global economy. [24, 25] Dissatisfied with its status as the world's factory, China seeks a broad shift from "made in China" to "created in China", [26] as seen in the Chinese leadership's importation of "creative industries" policy. [27, 28] The notion of China as a creative country jars with a western sense of China as an industrial and economic superpower, which due to a deep-seated lack of scientific curiosity, a "lack of wonder", [29] has to rely on hacking and shanzhai copying for innovation. [30, 31] At first glance, gold farming would seem to fit this pattern. I argue, however, that the fictional trope of the gold farmer found in novels by Doctorow and Stephenson, [32, 33] in contrast to the

journalistic stereotype, embodies the character trait of cleverness (*conming* in Chinese), or "practical cunning". [34] Such "Chinese" cleverness disregards the theory-application binary so fundamental in western thinking, [35] and by extension also the related science-technology binary. Taken as a whole, then, western discourses around the Chinese gold farmer bring together a range of divergent *techno-orientalist* imaginings, [36] from Third World proletariat over parasitic copycat to the embodiment of an alternative to western thinking about science and technology.

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Computer Programming Education and Creative Arts

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Abstract

In December 2013, the American president, Barrack Obama released a video on YouTube encouraging youth to embrace computer programming and practice coding. His video kicked off the nationwide Computer Science Education Week, in which there was a one-hour school tutorial introducing students computer programming.

The New York Mayor Bill de Blasio recently claimed, "Hundreds of thousands of good jobs will be accessible to those with coding and other essential skills." In a recent viral social media post, "Stop Teaching Programming, Start Teaching Computational Thinking", Tom Igoe from the NYU, Interactive Tele-communications Program questioned the pragmatic purpose of learning programming and suggested learning to program can make you a more expressive person.

The presentation invited three early practitioners in Hong Kong creative art/design scenes to address the issues and concerns of offering coding education in the creative industries.

Introduction to the Panel

The panel authors are practicing artists and designers in Hong Kong and at the same time, they also teach programming in universities in both Hong Kong and oversea. In the panel, CHUNG planned to draw similarity between the visual composition principles in graphic design with computer programming; LAM intended to share his extensive creative experience in web design and creative coding education between Hong Kong and Taiwan contexts, and SOON addressed the social and cultural aspects of codes and software practices.

Bryan Chung: Graphic design principles and computer programming

Computer programming education often focuses on the algorithmic design, with its step-by-step problem solving and thinking process. Logic and procedure are the building blocks for most education materials for teaching and learning computer programming. Students spend a lot of efforts to struggle with the syntactic correctness of the codes and the semantic soundness of the logic. Gradually, they developed the tendency to avoid every form of bugs and errors. On the other hand, media art and digital design practices have adopted increasing use computer programming to deliver the outcomes. In creative arts, we, however, treasure students' risk-taking and self-exploratory abilities, and that may go in the opposite direction with the error avoidance attitude they develop in the encounter of computer programming.

The presentation proposed the investigation of visual composition principles of graphic design in order to understand and relate with the practices of computer programming. Classic texts in graphic design, such as books from Wucius Wong and Ellen Lupton have already incorporated the use of computer software to illustrate and explain the visual concepts with the use of computer-generated examples. [1] [2] In the presentation, I would like to further establish the missing link between visual grammar and the linguistic grammar of the procedural programming languages. Students' sample works and teaching materials will be drawn from one of my courses, Evolutionary Graphics, from the Academy of Visual Arts, Hong Kong Baptist University, and Generative Arts, from the School of Creative Media, City University of Hong Kong.

Pong Lam: The aesthetics of codes, from multimedia design to creative art education

The author was often reflexively inspired by his own creative outputs in coding that may suggest mysterious hints in our universe. The presentation will trace his twenty years of creative journey as both multimedia designer and art educator, in two different regions, Hong Kong and Taiwan, through the exploration of mathematics, computer coding, visual design and musical performance.

Being an early pioneer of interactive media design in the Hong Kong creative industries, the author traced the historical development of both the aesthetics and technology of professional web design in Hong Kong, with his substantial portfolio. While bringing his skills

and knowledge to the education sector, the author also compared and contrasted the use of creative coding between the commercial environment and the education communities. As a part-time lecturer in Tainan, he would further elaborate the cultural differences in the reception of computational creativity between the Hong Kong and Taiwanese audience.

Winnie Soon: Software art and design: computational thinking through programming practice and critical code theory

Code-based technologies have become commonplace in the fields of Media Art, Digital Design and Software Studies. The term 'creative coding' emphasizes code as an expressive material, exploring code concepts and producing creative works through experimentation. While we are experiencing the digital world in which data is constantly generated, captured, monitored and analyzed, the critical aspects of code become increasingly important for us to understand this networked and ubiquitous techno-culture. The courses and seminars in higher education seem to primarily focus either on programming practices or critical aspects of code, however not many of them have been established to address both the practical and critical study of code. We argue that having a computational thinking through both programming practice and critical code theory would offer a different learning approach to understand code-based technologies.

This presentation will discuss a parallel strategy with two inter-linked courses of 'Software Studies' and 'Aesthetic Programming', running together within the same semester. The strategy refers to ways of thinking about software culture through both practical and analytical assignments to understand wider political, cultural, social and aesthetic phenomena beyond its functional application. Through emphasizing programming as critical work in itself, the two courses offer the possibility to open up new insights into art and design processes, and to offer new perspectives on cultural phenomena increasingly subject to computational procedures and logics. The presentation will address the inter-linked structures, outcomes and challenges of the two courses, in which students require to demonstrate reflective and critical thinking through coding practices.

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Rapid Response Art History:

Tools and Techniques for a Fast-Changing Art World

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Abstract

Art history has been largely concerned with 'after the event' forms of analysis - as evidenced in its heavy reliance on exhibition reviews and catalogues for instance. Yet time-sensitive creative events like Hong Kong's Umbrella Revolution (2014) remind us of the need for effective archival and critical response mechanisms. Art historians, archivists and curators understand what data they will need to work with in the short and long term if digital and new media, time-based, live, and event-based arts are to be adequately preserved, analysed and historicised. Yet there are no clear models for rapidly capturing relevant materials 'in the moment'.

The discipline of art history owes much of its knowledge to the invention of imaging technologies which could quickly and efficiently record vital art information [2]; [5]; [6]. However, despite these robustly technological beginnings, it lags behind many other disciplines in its digital capabilities [1]; [3]; [7]. To date, there have been very a few attempts to rectify this. The College Art Association delivered its first panel on the digital humanities in 2012. Subsequently it has hosted an annual conference-adjunct event, THATCamp CAA (The Humanities and Technology Camp), for the last three years (2013, 2014, 2015). Similarly UCLA has hosted two incarnations the Beyond the Digitized Slide Library (2014, 2015) digital up-skilling workshop for art historians. Meanwhile, the field of digital and new media art has been quick to understand the importance of instant critique and reviewing to the development of its production, creating alternate, informal and anecdotal art histories of networked practices (The CAA is also host to the New Media Caucus which has since 2010 hosted discussions which review the newest technologically-enabled art forms).

Inspired by recent curatorial approaches at the Victoria and Albert Museum (in Rapid Response Collecting), the protest art events of 2014 and art history's lack of digital expertise (and funded by the AHRC's 'digital transformations' pathway), this panel discussion will bring together art historians, archivists and curators in order to discuss methods for archiving and historicising time-sensitive creative events. We have invited experts who work with rapidly deteriorating, media, time- or event-based media to share their own work and help gather a set of tools and techniques for responding quickly to art events. This panel discussion will be followed in June 2016 with a London-based workshop in Rapid Response Art History to be held at the Courtauld Institute of Art.

Edwin Coomasaru: ''Democratising' Curating: Speed, Sexuality and Selfies'

Democratisation and internet-based curating: for many commentators, seemingly two things that come hand in hand. 'Democracy' in this context is often a byword for 'accessibility' – similar to, and yet also distinct from, democracy as a system of governance or a theoretical model for politics. In trying to think through the stakes of what it might mean to 'democratise' curating using the internet's more collective and collaborative platforms, this paper will consider potential disruptions of power hierarchies or concentrations traditionally implicated in the role of the curator. To do this, I will focus on selfies and sexuality – in order to tease out the fraught politics of subcultural capital, voyeurism and exhibitionism. Selfies have often been decried by the press for their narcissism, in a climate where pornography and new technology are considered a threat to heterosexual reproduction. Sexuality is often seen as disruptive to social systems by its capacity to become 'excessive' or 'queer'. What does it mean to think about this kind of agency in relation to 'democracy', which has recently come to be understood by contemporary philosophers as means of frustrating the status quo and structures of power? The internet – like excessive sexuality – is often associated with speed; in fact, this characteristic marks it out from conventional museums which move at a much 'slower' institutional time. Using

the International New Media Gallery's partially user-generated selfie exhibition as an example, this paper will consider whether rapid collecting and sharing of photographic self-representation has more in common with activist protest – and what this might mean for thinking through the potential stakes of internet-based curating.

Louise Shannon: 'Rapid Response Collecting and Curating: Learning from the Victoria and Albert Museum'

In 2013, the Victoria and Albert Museum launched a new collecting strategy, one that challenged the established notions of collecting in a Museum context. Rapid Response Collecting is a new strand to the V&A's collecting activity, curated by the Architecture, Design and Digital department. Objects are collected in response to major moments in history that touch the world of design and manufacturing. These objects are as diverse as the situations in which they are produced, unified by their ability as to change and shape the way we look at contemporary society. The display which changes regularly shows how design reflects and defines how we live together today. Ranging from Christian Louboutin shoes in five shades of "nude"; a cuddly toy wolf used as an object of political dissent; to the world"s first 3D-printed gun, each new acquisition raises a different question about globalisation, popular culture, political and social change, demographics, technology, regulation or the law. How does this work in practice? How does a collecting strategy such as this challenge the notions of connoisseurship within the Museum context? How does the Museum represent the mass-produced, ephemeral or highly politicised object?

Sarah Cook: 'From Insider Knowledge to Anecdote to Apocrypha: Reflections on how media art has been and could be historicised'

Does being present and witness to new developments in art make one its defacto art historian, or does taking on that role depend on one's institutional place? Net art and other networked media art practices have been historicised through extra-institutional informal structures of discussion, such as mailing lists, including gossip and first person reporting (often of demonstrations rather than formal exhibition of the works). As younger generations of scholars and cultural producers learn of the early days of networked and media art they read these stories through their own lens of current media literacy, sometimes mistaking features of 'broken' or obsolete works of net art as part of the original intention of the artists rather than a result of changes in the structure of the web. As these works of art were little exhibited institutionally at the time of their emergence (or since), and there are few institutional curators and art historians responsible for their preservation and ongoing accessibility, the stories which make up the art history of these works are increasingly patchy, based on varied versions of the works themselves. How can a combination of skills and approaches from art history - such as analysis of exhibition reviews and artist interviews - be used to retroactively consider what is required for creating art history of future media art developments?

Morgan McKeehan: 'The Webrecorder's challenge of enabling access to dynamic web-based art'

Rhizome's award-winning digital preservation program aims to support social memory for internet users and networked cultures through the creation of free and open source software tools that foster decentralized and vernacular archives. Its key role is also to ensure the growth of and continuing public access to the Rhizome ArtBase, a collection of 2,000+ born-digital artworks started in 1999. 'Born-Digital' is a term which aids in understanding the media support structure these works were made with and rely on for their experience. These works may not be accessioned as in a museum collection, but in many cases Rhizome remains the only point of access to them. Current digital preservation solutions were built for that earlier time and cannot adequately cope with what the web has become - dynamic, with embedded video, javascript, and other variable elements - in many ways, more rhizomatic. Rhizome is about to undertake the comprehensive technical development of Webrecorder, an innovative tool to archive the dynamic web. Webrecorder will be a human-centered archival tool to create high-fidelity, interactive, contextual archives of social media and other dynamic content. The interesting feature of Webrecorder relevant to this discussion is the way in which the free (open source) service will allow users to archive dynamic web content through browsing, and to instantly review that archived content and download their own copy of it. By permitting users to host a public or private archive collection on the site, Webrecorder lets us all become art historians of net art. In this presentation one of Rhizome.org's team of gurus will describe and demonstrate Webrecorder with reference to the ways it will support the rapid archivisation of unstable media.

Charlotte Frost: 'Documenting the Digital Critics: Analysing and Archiving Criticism After the Internet'

From listserv collectives, irreverent podcasters, opinionated bloggers and satirical video performers to sensationalist 'grammers and prolific Facebookers, online art critics have successfully challenged their Greenbergian forebears. Although there have been a

number of recent articles (Gat, 2013; Jansen, 2015; Williams, 2015) and events (Walker Arts Center and MNArts 2015; Rhizome 2016) exploring the nature of art criticism after the internet, which follow much more extensive publication (Elkins, 2003; Rubinstein, 2006; Plagens, 2007; Elkins and Newman, 2008) and discussion (ICA, 2011; Witte de With, 2012; AIAC, 2013) on the Western crisis of art criticism, there have been no comprehensive studies of art criticism after the internet. Based on my forthcoming book, Art Criticism Online: A History, this paper will reveal some of my research into the broader history of online art criticism. Highly ephemeral and transient in form, all art criticism is difficult to research and archives are rare. Online art criticism is particularly problematic given many early platforms are no longer live, content is frequently removed or reorganised, and even contemporary platforms seldom offer accessible archives. The paper will therefore consider some of online art criticism's common forms and key characteristics. It will connect it to much earlier types of - often multimodal - art criticism. Finally it consider methods of archivisation for online art criticism and approaches to teaching art critical digital literacies.

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Emerging Platforms for Artist Interaction

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Abstract

Emerging Platforms for Artist Interaction is a panel that explores new ways artists use emerging media to fulfill traditional human communication strategies for exchanging ideas, expanding resources, critiquing new work, providing/receiving emotional support and developing communities.

Emerging Platforms for Artist Interaction

This panel discussion investigates how artists use widely available platforms like Loomio, Creative Disturbance, Meetup, Google Hangouts/Drive and Concept Board in resourceful ways to nurture human connection. Four distinctly different methods are shared by representatives from each group in a discussion format to unearth what is unique to their approach and the surprising interaction outcomes resulting from their use of emerging platforms as the basis for connection.

Collectively, these groups are self-organizing to meet the challenges of our time starved, spatially divergent environments, countering the harsh climate of global capitalism and terror. The conversation is geared around the emotional and psychological work that these platforms provide to sustain community and intellectual curiosity and to help artists nourish well being and human connection in their lives and practice.

Ellen Pearlman: Volumetric Society

Ellen Pearlman, PhD Candidate at the School of Creative Media at Hong Kong City University, will describe her experience directing and curating an art and technology group, the Volumetric Society, with more than 2,300 members in New York City. The platform Meetup is one of the main resources she uses to organize weekly hardware hacks, lectures, performances, exhibitions and product demonstrations. The community members meet face-to-face enabling participants to experience and collaborate on projects. The discussant will focus on the use of non-hierarchical structures in enabling collaboration amongst artists and technologists, as well as forming and facilitating collaborative endeavors across social-economic backgrounds.

Cassini Nazir: Creative Disturbance

Creative Disturbance is a platform developed in response to the need for a rupture in the arcane networks that currently connect creative people. Creative Disturbance is an international, multilingual network and podcast platform supporting collaboration among the arts, sciences, and new technologies communities. It operates through a podcast channel system, whereby transient or ongoing subject-matter channels are developed, produced, and disseminated. Each channel includes at least one podcast on a niche topic, as well as a repository of field-based "additional information." Representing Creative Disturbance is Cassini Nazir, Clinical Assistant Professor in the Arts and Technology Program at the University of Texas at Dallas. He will analyze the technical and design challenges for nurturing crowd sourced conversations and share his experience with the podcast series. Prof. Nazir will also describe how unlikely connections emerge on this platform and how they incorporate feedback and suggestions into the site design.

Andrew Demirjian: Videokaffe

The third discussant is from the international media art and sculpture collective Videokaffe. This group uses the Loomio and Concept Board platforms to connect and facilitate communication between their members who reside in Finland, Germany, and the United States. Loomio is an online tool for asynchronous collaborative decision-making and Concept Board provides a visual online environment for collaborative project development. Videokaffe member, Andrew Demirjian,

Assistant Professor at Hunter College in the Film and Media Department, will share anecdotal results showing how these platforms have enabled members of their collective to participate in preparing for exhibitions, discussing potential collaborative projects and assessing exhibitions. He will feature case studies of particular examples of the steps and decisions using Loomio and Concept Board.

Dr. Heidi Boisvert & Xtine Burrough: Virtual Artist Salon

Dr. Heidi Boisvert, artist and CEO of futurePerfect Lab and Co-founder of XTH, and Xtine Burrough, Associate Professor in the Art and Technology Program at the University of Texas at Dallas, will be discussing their participation in the Virtual Artist Salon. Virtual Artist Salon provides internationally exhibiting artists a digital safe-haven to share new research and ideas in a supportive environment for brainstorming and emotional support. This group uses Google Hangouts to meet once a month to participate in critical studio visits with the members regarding projects they are developing. The members will discuss how they use these tools to provide insights and valuable criticism for artistic projects that are in various stages of development. They will describe the process that has developed to work effectively in this environment, what preliminary work is done prior to their meetings and how Google docs/drive and Slack are used to provide context and references to related artworks or connecting theoretical threads.

Attendees of this panel will glean valuable insights regarding the cultural and communal gaps that these alternative spaces fill. They will witness how others have developed a more sustainable and rewarding artistic practice through community engagement (online or in real space), see how to engage with global artists with related interests, learn how to cultivate thriving communities in their local area using new tools to foster inclusivity and diversity.

Software Literacy and Creative Industries

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Abstract

We are living in a world where software is central to every field of social, political, and economic import. Governments are imposing coding into primary and secondary school curricula as they begin to understand the importance and urgency of engaging with these technologies. How do we make sense of and trust these myriad manifestations of software, or even know or understand who or what is behind the code that creates and designs our mediated reality? How can we have agency to disrupt and change mainstream society's dominant control through this meta-medium? Where do we start? This panel will share our knowledge of strategies to promote critical engagement with software.

Introduction

This Panel session will consist of four 15-minute presentations as described in the sections to follow. Panelists will address the following questions:

-*Artists and Code*. What strategies are used to encourage artists to utilise coding in their practice?
-*Computational Thinking in Art/Design Education* – How can we develop Computational Thinking as a fundamental foundation of creative imagination?
-*Transcoding Place* through media platforms, will answer, what considerations do designer's have in the production of artscience collaborations and why are they important?
-*A revolution in coding is required within universities* What is needed to improve academia's software literacy?

Greg Giannis: Artists and Code

I am undertaking research to investigate examples of best practice for the teaching of software and hardware skills to students in the creative industries. I have been exploring this in my classes during the last 10 years or so with digital media and visual art students.

The teaching of coding has become a somewhat topical area given the recent introduction of coding to Australian primary and secondary school curricula, and the emphasis on STEM to STEAM[1]. Most of this discussion revolves around how to improve engagement with STEM and I (and others) argue, and now there is evidence to support this [1], that engagement can be facilitated by tapping into students' creativity.

Whilst there are many examples and anecdotal evidence of student engagement in STEM through art, there is limited evidence of art students engaging with STEM. The art science nexus is pertinent and organisations such as the Australian Network for Art & Technology in Australia, the Art and Technology Program of the Los Angeles County Museum of Art, (1967-1971) [2] and NYU's ITP Masters program have made great contributions in bridging this divide. I am arguing that it is imperative that there is engagement with these technologies, in particular software, given its pervasiveness, otherwise we limit any form of resistance against the society of control. Fuller's field of software studies [3] is pertinent. Lovink [4] also argues that in order to challenge the society of control we need to break down the barriers between the humanities and hard sciences so that there can be some form of critical engagement with the hard sciences. How can we encourage artists to be part of this discussion? If we accept that artists play a critical role in society then there needs to be engagement with these technologies, and learning to code could be a starting point. I know that there are many artists already doing this, and many art courses do have elements of coding in their courses, but these tend to be exceptions driven by progressive teachers and artists.

Hugh Davies: Computational Thinking in Art/Design Education

Over the last two decades, the evolution of art and design curriculum has been significantly impacted by the challenges and potential of digital disruption in the creative industries. Creative software tools first emulated then largely replaced manual production practices. There is growing evidence that another, and possibly greater, paradigm shift is eminent.

Predictions for the growth of Artificial Intelligence and its possible impact on employment are currently an issue of growing social concern. The current emergence of Procedural Content Generation software in the games industry, online journalism, architecture and music industry suggest that commercial creative practices will not be immune to the future impact of creative A. I.

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[1] STEM to STEAM (http://stemtosteam.org) is a movement to include the arts and design into science based programs so that innovation is influenced by the humanities.

Possible scenarios for the future may see practitioners eschew today's generic software tools for bespoke applications that operate as semi-autonomous studio assistants. This has the potential to be a positive development that will offer new creative opportunities for those that embrace it.

The education of artists and designers for this environment may require some level of programming ability but of greater importance will be the development of Computational Thinking as a fundamental foundation of creative imagination. Computational Thinking defines a common conceptual space that will afford access to creative partnerships between human cognition and A.I.

Victoria Moulder: Transcoding Place Through Digital Media

Over the last ten years, alternate reality and location-based technologies have rapidly transformed in response to the adoption of mobile and social computing [5]. In tandem with the rise of these technologies is an ever-increasing community of people with 21st century media literacy skills for deconstructing and reconstructing narratives that have the potential to equally influence the flow of mainstream media.

For this panel section I will discuss the findings of a multiple case study comparing the practices used by designers to produce alternate reality games. I report how these methods facilitate cross-discipline collaborations. In addition, how designers work with non-profit organizations to build awareness campaigns that support larger philosophical goals and future thinking possibilities.

Murray Mckeich: Universities Required a Coding Revolution

Although workers in academia are fluent in digital technologies at an email, database, spread-sheet level, they remain largely illiterate to languages of code, and to the broader conceptual aspects of the networked world. Outside of studies in computer science, matters of code, the influence of computational thinking and the extent to which algorithms shape the perceptions and conditions of reality, remain largely untaught. Technological literacies that are now central to every field of social, political, and economic import are being ignored by the academy. As a result, universities that have been long celebrated as institutions to instruct and celebrate literacy are themselves becoming increasingly illiterate. Languages of code, and their broader implications need to be taught in universities, but prior that, they must be taught to the universities. Beyond academic buzz terms of future-readiness and innovation, in order to remain fundamentally relevant and rhetorically coherent, the academy must catch-up to the present.

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Divergent Generative Art Practices

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Abstract

The aim of this panel session is to analyze and compare possible new venues, media, methodologies and forms that generative practices are taking today. We claim that a combination of analytical, playful and critical approaches in understanding and using technologies is important in today's art world. The discussions will start by addressing the creative and cognitive aspects of procedural fluency in creating, reading or interpreting a generative artwork. By assessing the perceptual interaction with generative art, we will continue to question the narrative and performative qualities of this relatively new form. These two sections will introduce us to the contemporary smart cities as venues for generative practices and a notion of engaging city dwellers to participate in this complex system of networks and devices. Furthermore, we will discuss the new potential divergences of generative art practice. Biotechnology and quantum mechanics open another unimaginable field of generative activities that, equally to other venues, require critical, analytical and creative use of technology.

Get Lucky: Cognitive Aspects of Generative Art

This section addresses the creative, cultural and cognitive aspects of symbolic and procedural thinking in contemporary generative art. Generative art is perceived broadly, as a heterogeneous realm of artistic approaches based upon combining the predefined elements with different factors of unpredictability in conceptualizing, producing and presenting the artwork, thus formalizing the uncontrollability of the creative process, underlining and aestheticizing the contextual nature of art. [1]

The introduction provides an overview of generativeness as one of the key factors of art making, and outlines the characteristics of generative art such as the planned inclusion of chance and indeterminacy, the cognitive tension between the banality of pre-planned systems and their surprising outcomes, the idea of the complex artwork realized in the form of research or study, and the idea of the art as a ludic, proto-, or pseudo-scientific experiment. [2]

The central part covers five specific topics in contemporary generative art by presenting the exemplary art projects and commenting on their conceptual, technical, methodological and poetic qualities. The examples are in complex interrelations and are distinguished by the artists' abilities to transcend the formal, expressive and aesthetic scope of code-based art making, and to maintain the experimental flavor in thoroughly produced projects. *Transcoding* looks at the reflections of early Nam June Paik's hacking and transmedia imagination in generative art today. *Crowdsourced Remix* addresses the principle of combining the programmed regularity or randomness with the (un)predictability of human input.


Fig 1. *Portrait*, 2013, Shinseungback Kimyonghun, digital prints, courtesy of the artists.

Distracted Computer Vision addresses the various generative uses and 'abuses' of computer vision and machine learning, which offer new perspectives for the critical assessment of traditional visual skills based upon the profiled observation and selective depiction. Working with the advanced image processing solutions such as the Convolutional Neural Networks, some generative projects illustrate broader functional similarities between the CV software and human mind. *Selective Semantics* addresses the generative artworks which emphasize the applied quantification of phenomenological qualities as one of the main features of digital culture. *Escalation* addresses the generative exploration of the effects of infinitesimal accumulation and sporadic disruptions of the monotonous build-ups.

The final part focuses on the functions, challenges, cognitive requirements and creative implications of procedural fluency as (a less complex) one of the two structural modes of thinking in the development of generative art projects. [3] It states that the successful generative artworks are powerful cognitive tools because, beyond their narratives, they motivate innovation, invention and creativity in general by revealing their background thinking processes in a less abstract and/or more engaging way than traditional artworks. They efficiently communicate the ludic cognitive drive as a topological layer of creativity that comes before scientific and artistic method, and encapsulate specific intellectual energy which can be engaged implicitly or explicitly and incite original, often surprising, configurations and ideas. By investigating the uncontrollability, the contextual and participatory potentials of the creative process, generative digital art can also motivate deeper appreciation of the responsibilities intrinsic to innovation, invention and experimentation in general, and consequently to the political, economic and social enterprises. [4]

Emerging Narrative Forms and Bit Sensation

This section discusses the types of emerging narratives that appear in creative generative practices. This study illustrates various unique artistic methods from the world of digital art, computer games, film and interactive media that lead to new narrative divergences. These methods and poetics are analyzed in relationship to a computer *bit*, whose nature largely influences our creative expressions.

A *bit* becomes a unit or a term to metaphorically address and encompass the reduced and abstract form that is often present in generative practices. Our growing sensation and constant interaction with bits that are taking various forms lead to more and more reduced forms, structures, and minimalistic creative expressions. The generative aesthetics with their cold, synthetic and non-figurative forms enable new spaces for creation of unique sensual experiences that lead to narrative transformations.

The following occurrences in the changes of narrative forms are explained: dichotomy in database driven generative expressions, importance of referentiality in projects that focus on transcoding, and gaining popularity of the meditative narrative escapism. In the first part of the thesis, a type of structural dichotomy is examined that exists in numerous generative narratives that are driven by a user. In the examples: *Dear Esther*, a computer game by Dan Pinchbeck and Robert Briscoe, or *Bear71*, Interactive documentary by Leanne Allison and Jeremy Mendes, we recognize elements like naturalistic voice over and abstract visual interface that are creating the dichotomy which does not reduce the overall quality of user experience but it rather enhances it. In both projects, users willingly conform to the rules of the work, and to the dichotomy. As a result, the whole system enhances our sensations and love for the reduced picture/form, our sensation for the *bits*.

Second part claims that generative works often must include a point of a reference, or some information about the work without which a narrative would cease to exist. In collaborative project *Forms,* visual artists Memo Akten and Quayola translate the movement of human body from various athletic performances and visualize them with abstract forms. Here, the artists use the extremes of body movement as a reference that a spectator also sees in order to try to match these movements with dynamic flow of particles. The live video recording here works as a reference and which enables us to ultimately point our focus on the beauty of the data and this procedural animation. Interestingly, the body movements and its abstract transformations form a dichotomy similar to the one discussed in the database narrative section.

The third part deals with meditative narratives, which are characterized by day-dreaming, explorative and stimulating effects and which also can be explained as results of our growing sensation and love for computer bits. In *Journey,* a game developed by *thatgamecompany*, the joy of being in the open world of generative landscapes is much more engaging than the uniqueness of its narrative. The player is invited to meditatively explore the world and once s/he enters the world, there is no going back out of this beautiful and mesmerizing magic circle.

To conclude this section, we analyze the project *Sound of Honda/ Ayrton Senna 1989* and its relationship to the novel ways of representation, representation with data. This method is creating completely new venues, not only generative art, but for other art forms, as well. What stays important for the new creators is to truly believe in data that they are working with. As Caspar David Friedrich would put it: "A picture must not be invented, it must be felt."

Performing Systems

In recent years computational and screen-based art has flourished within the digital arts world and has since had great influence across multiple disciplines. Fuelled by

explorations into the beauty of algorithms and their translation into ever emerging visual outcomes, artists working with generative systems have created a substantial body of work and sets of tools using desktop and laptop machines. With the recent arrival of a multitude of mobile platforms, small systems-on-a-chip and electronic devices the potential for new tools, artistic expressions, transdisciplinary investigations and interdisciplinary collaboration is imminent.

Technology and networks had become an ubiquitous part of our urban lives. With easy access to hardware and software, the availability of technology for everyday activities had now become the norm and defines the conditions in which we live, play and work. How will these new conditions and systems influence and shape future art practices and interdisciplinary projects?

In this presentation, 3 approaches are present that are concerned with the investigation and application of such new systems within education, performance, and urbanity. How do system-based strategies and technology driven interactivity affect the implementation of dance and audio-visual performances? How can generative strategies be applied within a Fine Arts context and alter the production of art works? How can custom-built tools be used to explore, analyze and navigate an urban landscape?

On the basis of three case studies, this presentation will provide a brief insight into the process, the difficulties and new findings of system-based art-making within and across different art practices and disciplines.

Fig 2. *Urban sampling tools*, 2015, Urban Explorations project, courtesy of the artists.

City Made of Software

Contemporary city is ultimately grounded in and operated by software-supported devices that become skillfully blended within the environment and our everyday lives to such an extent that they are probably more accurately described as 'second nature'. Cities now operate through the use of mobile networks; sensors that are embedded not only in our smartphones, sustaining and encouraging self-monitoring, but also present within architecture and street furniture; and, of course, online delivery platforms that facilitate information exchange. Software and code,

therefore, as a kernel of pretty much every technological device today, augment, supplement and facilitate people in their daily tasks and routines to the point, as Thrift and French argue, we may rather speak of automatic production of space. [5] Dodge and Kitchin define this software-mediated spatiality, the one in which code contributes to complex discursive and material practices producing eventually complex spatiality as "code/space." [6]

Location-based services and information delivery platforms in particular are envisioned as the next utility network, presented by developers as empowering tools to presumably 'enhance' user's experience of space through automatic sensing and real-time interpretation of available information. Artists working in the field of locative media art were among the first to utilize location-based technologies in an effort to experiment with new spatial experiences. On one side, they have been engaging with locative and ubiquitous technology through research in engineering and designing practice; on the other, they have been rethinking urban issues and spatial concepts moved by the 'spatial' attributes and contexts of use of such technologies. McQuire acknowledges artists' efforts and experimentation crucial for driving the thoughts "about facilitating other forms of engagement in public space." [7] He recognizes the significance of the artists' exploration within the field of new media as the valuable theoretical ground to stress the possible (mis)uses and future trajectories of the technological development. Drawing on Sennett's ideas of urban value in 'ritual and play,' McQuire claims that such play will test and potentially reinvent social rules. [8] Similarly, Crang and Graham see art practice as a model that should, or could, inspire a different approach to technologies, in other words 'appropriation,' in place of submission, encouraging new forms of public action and social contact such as multi-authored coding. [9] According to authors, the art and activism in the field of locative media in particular attempt to embody such practices that re-enhance and reanimate the city, and the role of location-based media is to boost this potential of everyday practices, amplify and encourage 'performative' power of everyday life to re-claim and negotiate spatiality. We should recognize artists' work as an attempt to render data and coding environment transparent and aesthetically problematic, and as such make create oppositional vision of urban space: "[Artists] intention is not the creation of perfectly known environments but "destabilization of spaces" achieved by preserving 'human link' to a place by recording and sustaining the personal and transient meaning of places." [10]

This 'call' for the conscious and subversive personal perceptions, as can be seen in many examples of locative media artwork also originate from 'psychogeography' and related concepts. [11] Conceptualized long before location-based technologies set on the scene, theorists and artists gravitating to Situationist International developed and advised a number of subversive strategies to help 'urban strollers' construct such personal

experience of urban space. Among strategies was Debord's concept of derive defined in 1958 as a "playful-constructive behavior and awareness of psychogeographical effects, and are thus quite different from the classic notions of journey or stroll", which would serve as a drive for more critical approach to imposed spatiality. [12] Similarly to 'psychogeography,' locative media artist suggest new models for more critical engagement and active participation in urban space of city dwellers.

Examples vary from individual contributions in the form of critical annotations and inscriptions, to visualizing "the city built of data," [13] in which new infographic and mapping techniques may bring awareness of certain issues. Many of the artists' generated maps reveal inconsistencies in the power systems, and, as such, present a valuable critique to those in power. Such are so-called "Hertzian space maps" that visualize the 'true' dispersion of wireless networks and coverage, showing that wireless Internet connection accessibility vary within the "Hertzian landscape" even in the most 'connected' cities in the world. [14]

More recently, sensors, real-time space monitoring and increased computational power put into the hands of the users, were said to pave the path towards user-generated, and "co-created" cities:

"It is possible to give shape to a scenario in which the concepts of citizenship and political representation can be reinvented, tending towards a vision in which people can be more aware and benefit from added opportunities for action, participating in an environment designed for ubiquitous collaboration and knowledge which is multi-actor, multi-stakeholder, in real-time: the city." [15]

As such, the proposed concepts should not just represent technical skills to operate and build monitoring systems of one's environment, but a community of citizens who will employ a critical approach to 'monitoring' environment when they connect, share and discuss their results, be it for individual or collective goals. This alternative multilayered urban space that co-users of location-based media would create, not only detect and visualize urban issues but also encourage its users to further become actively involved in critique and any potential changes.

Artistic Strategies in Generative Art Practices

In Husserl's "Phenomenology of Embodiment," the body is not an extended physical substance in contrast to a non-extended mind, but a lived center of experience, and both its movement capabilities and its distinctive register of sensations play a key role in his account of how we encounter other embodied agents in the shared space of the life-world. The phenomenological maxim - to the things themselves - as well as the concomitant task to reveal the world, has to be done by observing the forms of media and the life-world of communication. This multi-levelled experience includes the electronic flow of information as wavelengths and physical particles as part

of the equation. Thus, Generative Art offers a unique opportunity for the recapturing of the relations between humanity, technology and the environment as we find today that the phenomenological folding of embodied and mediated space into felt space or experienced time represents a multi-nodal structure of space, bodies, time, and otherness simultaneously.

Generative Art has gone through multiple transformations, referring to noise art, fractals, glitch, robotics etc. It has affected video, the Internet, and every possible technological form. Marshal McLuhan once said, "Each new technology is a reprogramming of sensory life."

Mark Amerika's work from 1997 "GRAMMATRON" experiments with online hypertext narrative, Net Art, and digitally expanded cinema. He was able to construct an alternative art experience investigating the positioning of reader-subjectivity in computer-mediated cyberspace. The work represented an early experimentation with Graphical User Interfaces (GUIs), inviting the visitor to navigate through the narrative and networked environment, thus remixing alternative discourses (the author points out to retelling of the Golem myth remixed with cyberpunk, dialectical materialism, and California ideology, to experimental narrative riffs from the likes of James Joyce, Arno Schmidt, and Jean-Luc Godard).

In 1997 Jacques Servin (aka Andy Bichlbaum, one of the leading members of The Yes Men), a well-known programmer who hacked SimCopter, an action game from the makers of SimCity, creates BEAST(TM), by introducing an immersive environment by sampling texts from Benjamin to Benn, as well music loops stolen from various programs including the Windows system, integrated into a what was at the time monster Java applet.

Mark Amerika's *Mobile Phone Video Art Classics* (2008) investigates the emergence of digitally constructed identities and reedits art history by using low-tech mobile phone technology and simple iMovie software. Salvador Dali, Bruce Nauman, Mark Amerika, Nam June Paik, Baby Jane Holzer, Susan Sontag, Marilyn Manson, and Madonna all star in it.

Mark Amerika's *Crapshoot* (2015), an artistic web application developed especially for electronic tablets, is an interactive poetic generative re-mix that mimics the form of Stéphane Mallarmé's poem *Un Coup de Dés Jamais N'Abolira Le Hasard* (*A Throw of the Dice will Never Abolish Chance*). Instead of rolling the dice the participants have to swipe the screen.

However generative activity has not stopped there. Bio-informatics and Nano-technology have been looking into the atomic and subatomic levels as a result shaping biological life forms. The codes of life have been unraveled, by mapping tens of thousands of human and other genes. The ability to code life into symbols, and being able to interpret these symbols has changed the very notion of what we understand as life and how we are able to interact with it. Eugene Thacker sees the triumvirate of encoding, recoding, and decoding as representing the primary activities of Biotechnology

today. He points out to the simultaneous notions of the biological stock being property and information, having the traits of materiality and immateriality, existing as deployments of life which are being shifted from body to body, body to code, and code to body. This same tripartite division is also a political-economic one as well. In a sense, encoding is synonymous with production, for it is in the process of encoding the biological that the Biotech industry is able to accrue profits (as intellectual property, as a proprietary database or software). Recoding is then synonymous with distribution (and its related term circulation), for the practices of bioinformatics, database management, and computer networking are predicated on the ability of biological information to be widely distributed and circulated. Finally, decoding is synonymous with consumption in that, in a medical sense at least, it is in the final output or re-materialization of biology that biological information is used, consumed, or incorporated into the body.

In the past 15-20 years artists have started to use Biotechnology, and entered Quantum and Nano-research. Merleau-Ponty's idea that Phenomenology is the study of essences resounds very well with Bio-tech Artworks, such as Eduardo Kac's "Genesis". Namely, Phenomenology demands the reinterpretation of the world as we interact with it through an immediate experience. In this sense of the 'lived space' we can look into Eduardo Kac's transgenic installation "Genesis", which explores the new fetish of the biotechnological world: the gene and the protein, posing interesting theoretical and metaphysical questions about media, meaning, and representation. The key element of the installation is an 'artist's gene' which is a synthetic gene containing a DNA sequence of the first chapter in the Old Testament (the Biblical book of Genesis), its translation into DNA bases, and the subsequent reversing of the process by translating from the mutant gene sequence, to Morse code, and finally back to altered English. Participants in the project (both in the gallery space and on the web) can turn on the ultraviolet light in the gallery, causing real, biological mutations in the bacteria to be found in the Petri dish in a luxurious glass case. The viewer is thus able to change the biblical sentence in the bacteria. This relates to Eugene Thacker's triumvirate of encoding, recoding, and decoding as representing the primary activities of Bio-technology today, as well as to the simultaneous notions of the biological stock being property and information, having the traits of materiality and immateriality, existing as deployments of life which are being shifted from body to body, body to code, and code to body.
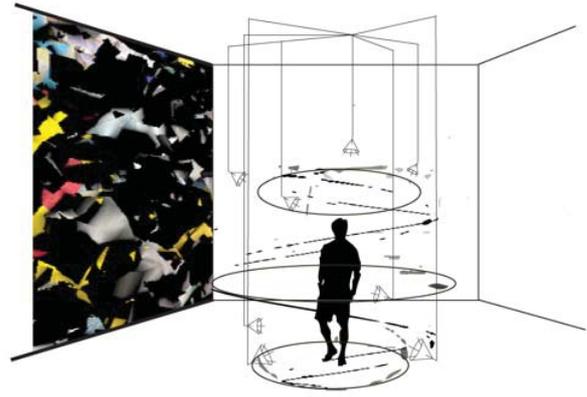

Fig 3. *Quantum Consciousness*, Paul Thomas and Kevin Raxworthy, 2015, courtesy of the artists.

In terms of quantum and Nano-research, it is worth pointing out to Paul Thomas and Kevin Raxworthy, who have created works of art such as "Nanoessence" (2009), where life is examined at a sub cellular level, and the humanistic discourse concerning life is challenged by nanotechnology, where the viewer interfaces with the visual and sonic presentation through his/her own breath. Thomas and Raxworthy have also created "Quantum Consciousness" (2015), experimenting thus with the imaging and materializing of impossible states of quantum matter and the co-emergence of human consciousness. The scientific data for this project is generated from a microwave signal, which transforms a reading of Richard Feynman's paper on the birth of the quantum computer.

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The People´s Smart Sculpture

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Abstract

The People's Smart Sculpture (PS2) panel discusses future oriented approaches in smart media-art, developed, designed and exploited for artistic and public participation in the change and re-design of our living environment. The actual debate about a smart future is not taking into account any idea of media art as an instrument for to realize the social sculpture, mentioned by Beuys [1] or as social sculpture itself. The People's Smart Sculpture is the only large scale Creative Europe media-art project (2014-2018) in this context. It fosters participative-art and collaborative media-art-processes. The artistic results and the open approaches of the project will be discussed by 5 panelists from 5 countries. The project itself is constituted by 12 project-partners in 8 European countries with more than 350 artists and creatives from 29 countries worlwide. The approach works on two levels: the implementation of cultural participation-projects by media-artists and the ongoing optimization of the art and participation aspects. PS2 integrates diverse groups of people to participate in the non-institutional set up of structures for the people´s re-design of their urban, societal and living environment. Artists, citizens, creatives with a new user's perception and new skills are able to „medialize" the Cultural Revolution of art, culture, society and science: into spaces of a new public.

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The New Social Sculpture

The People's Smart Sculpture with the people´s participation in several sub-projects and its individual interpretation of it are inextricably related to one another. The collaboration between artists and citizens is pioneer of the future integrative media art culture of social art, social collaboration, digital art, collaborative design, e-decision-making, liquid democracy, social inclusion, urban play - sometimes analogous, sometime with new tools on computers, mobile devices, interactive screens or projections.

Participation will become a part of the general culture techniques. To encounter today's societal and cultural complexity means to integrate diverse forms of cultural practice and diverse groups of people. Here we learn about how to create places for our own interaction. Social spaces that grow immensely popular: spaces for art, spaces for knowledge, and spaces for communication. As soon as we enter these spaces through our and other people´s activities, we unavoidably regenerate the. It's a carousel of influence, participation and anticipation. It expresses the cooperation between everyone involved – participatory art work in an utopian aesthetic, bringing with it the promise of partaking therein also through production, comments, selection, evaluations and critique. *"The real voyage of discovery consists not in seeking new landscapes, but in having new eyes." Marcel Proust* [2]

The common activities in our project are inspired by the idea of connecting more purposefully artistic works from local, European and international artists and creatives with local social dynamics. It is intended to be directly linked to the development of our collective living circumstances, a cultural charrette, play, test-field and art place. In the People's Smart Sculpture, a project cooperation of artists, creatives, cultural media activists, citizens and digital media researchers work towards the realizing of this vision: hybrid open environments where everybody can follow – even change – the ideas concerning collaborative re-design and development of media art. Digital media (computers) should be used to create "alternative worlds". Vilem Flusser [3]

Right now actual software systems, methods and tools target more or less only on the relevant experts, policy-makers, lobbyists and other professionals. While professionals, for example, are used to work with highly abstract data and visualizations for planning, decision-making, etc. participating artists, creatives and citizens require a much more direct access and feedback methodology. It´s to provide different options for a high diversity of social groups that want to partake in public urban art and space development and cultural city evolution. This remains in the context of the need of a highly sustainable culture development strategy for the future by integrating liquid democracy, opinion sharing games, cross-cultural social inclusion processes, distinct communication of ideas, performative communication acts, new cultural expressions and informal learning capacities and will give the best practice examples to others - worldwide.

The project is also the base for a new deal between artists, experts, citizens, learners, creators and the social activists. It is a performative sort of integrated art to combine social and cultural sustainability in the Cultural R>evolution. PS2 supports small groups and areas, but will also work on more complex problems like the digital transformation of historical areas and cultural heritage. On the other hand the proof and evaluation of all participation activities of PS2 becomes sustainable through an experimental exchange within this ISEA2016 panel.

The common goal is a "Smart Sculpture" as a new version of the "Social Sculpture" [1], but today designed by media artists, creatives and citizens which profits from the interplay of a high diversity of culturally different approaches, combined through participative media art.

4D – Virtual Urban Art

People today use new media, for creating identity, communication, social effects, fun or learning. Participation in cultural heritage learning not only means to integrate the "active visitor" into the museum, it means to generate an environment in which one can take part and can realize his- or herself in complex processes more easily – emotionally as well as cognitively – and in social exchange with others in-situ at place of origin.

The general idea behind this project is, that the more and more upcoming cultural use of new media in the knowledge society, like e-learning, technology-enhanced learning (TEL), e-culture, infotainment, gaming, Web2.0, interactive media and mobile technology shows, that a new desideratum of action-learning is emerging. Whenever people learn, create or explore something, it will be discussed, exchanged, and reflected from different perspectives. People learn by doing something at the point of immersion and rediscover to learn playfully in augmented reality environments.

Fig 1. *Site exploring with augmented reality platform,* 2015, all rights: Gauss Institute Bitola

The 4D Virtual Urban Art is a solution based on a precise 3D model of an urban environment, in which the users can explore past and suggest changes of the areas they live in and upload their ideas to the online database. The decision making process of urban art, urban development and planning is closely connected to the history of the selected areas and their cultural heritage value. Thus we create augmented reality platform with the historical information and the cultural value of match of the diverse interpretations and cultural expressions. Adding the dimension of time (3D+time=4D), the users can explore their habitat and receive time related information on certain objects or areas. For example, the user can "travel in time", and see historical data about the area of interest, which can be inspiration plus for the suggested future solution. The app is developed on the basis of the following techniques:
 - AR aligning and serving rich media content
 - Data Filtering and Flow Optimization trough
   • GPS Location Filtering
   • User Orientation Filtering
   • User Movement Prediction Filtering
   • User Preference Filtering
   • Non repetitive content optimization
   • Content Storing
- Engagement trough interactive tools
- Active Viewer concept trough interactive Games and Quizzes

The project is implemented in the City of Bitola, Republic of Macedonia. Bitola is very rich in monuments and cultural heritage from the prehistoric period to the present day. It is settled on Via Egnatia in the center of the Balkans and all the crossroads of time and history. Bitola has a strong cultural blend that reflects in its architecture and cultural heritage. Širok Sokak (Macedonian: Широк Сокак, meaning "Wide Alley") is a long pedestrian street in Bitola. It is graced with neo-classical buildings that contain stores, cafés and restaurants. Širok Sokak is also home to several consulates. This street has a great historical value and is part of modern culture and life today. 4D Virtual Urban Art propose AR installation containing the main interesting buildings in the street as a educational time travel content so the user can experience first hand the cultural heritage trough historical events on places trough rich media content. All data have the option to be binded to a temporal parameter thus enabling the users to experience a location through a form of VR or AR time travel. This will enable content providers for example to present temporal cultural data of how the location, landmark, traditional customs or society changed over a certain relevant period of time. Besides data views the platform in order to engage the audience can support integration of interactive games, guides and tests. Depending on the subject and preference of the creator this content engagement can vary, for example:
1. Imagine visiting Sirok Sokak as it was in the Middle Ages or the Ottoman Period. When standing in front of the landmark activating it the engagement app will provide you with interesting educational content on the

landmark and then pose you some questions regarding the landmark, or an animated character can tell them the story through a short cartoon video.

2. The time component is added to make the users virtual time travelers in order to learn through resolving the clues and answering the questions trough time

3. To add on the social component visitors will be able to add virtual content like comments, ideas, photos, videos, experiences rating and choose weather to keep them as a private memoir, share them in their group or make them public with the world to see.

4. As a example, AR content is developed for the house where lived Milto Manaki (see fig. 2). Milto Manaki and his brother Yanaki were pioneering photographers and the first filmmakers in the Balkans. In honor of their work, the International Cinematographers' Film Festival "Manaki Brothers" is held every year in Bitola, the city where most of their activities were organized.

Fig 2. *House of Milto Manaki - Case study for using AR application for providing location based content,* 2015, all rights: Gauss Institute Bitola

Neighborhood Living Room

Today museums are looking for new ways to attract and engage audience. These include virtual museums, augmented reality and 3D modelling based applications and interactive digital storytelling. The target of all these activities is to provide better experiences for audience who is very familiar with digital world.

The Neighborhood Living Room sub-project, which is part of Creative Europe funded People's Smart Sculpture Project, studies different methods to create a more dynamic, participatory audience relationship with museum. The vision is that the Museum of Technology could be integrated as a part of the Arabianranta district community in Helsinki, Finland. The Museum aims to offer an emotional and participatory experience for the residents, especially the youth. The target group, namely young residents, has a natural way of using information technology (IT), which is ex-pected to be involved in almost all activities. Most of the young residents have a smart phone, a tablet, or both. In Finland 88% of the age

group 16 - 24 years old use In-ternet several times a day; 87% use mobile phones and 35% tablets when accessing internet outside of home or office [4].

In augmented reality (AR) systems and interactive digital storytelling (IDS) systems visual presentation has been dominant. In contrast to this trend, we chose to concentrate to auditory presentation which in the augmented reality context can be built with soundscapes in museum environment. Two key elements when developing AR, IDS and soundscape systems are the user applications and the backend service supporting these applications.

The following figure describes the overall system including also audio digital asset management system supporting mobile applications.

Fig 3. *Overall software architecture,* 2015, all rights: Gauss Institute Bitola

As can be seen from the figure 2 the overall system is a distributed system consisting of audio digital asset management system, management application and mobile applications. Audio digital asset management system provides functionalities to manage assets and offers interfaces for both for management application and mobile applications over internet. Management application is basically administration console to manage assets and users. Mobile applications are for example audio augmented reality, soundscape design, audio story recording and listening, or audio memory sharing applications.

Our aim was to develop an open source based audio digital asset management system, which is easy to use and fairly easy to take into the usage. Let's have a look at the two main areas when designing audio digital asset management system: APIs and metadata. In our case three APIs were required: an authentication, an upload, and a search API. The authentication API is needed specifically by the mobile applications so that they can receive an access key which will in turn be used with the search and upload API. This authentication provides an access key which is required when using search and upload APIs. The search API is a HTTP get request containing api_key and predefined search parameters. The response in JSON format contains links to audio files and respective metadata based on search parameters. The upload API lets users who possess a valid authentication key upload their audio files along with metadata.

In order to utilize, search and find relevant media files it essential to utilize metadata. There are several metadata standards available for different purposes, like metadata exchange between systems, general metadata for broad range of domains, and audio specific structural and administrative metadata. We ended up to metadata which enables in the future exchange of assets by supporting Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH). This requires in minimum that we need to be compatible with unqualified Dublin Core. In addition, it was clear that we cannot call our audio files as assets unless we introduce at least rights metadata field. Most of the metadata will be input manually during the storage of audio file. Only some of the metadata will extracted automatically from the audio file properties.[5]

In order to utilize audio digital asset management system we need mobile applications. These applications will access and save audio files in the audio digital asset management system. We have envisioned the following type of mobile applications which can be used in several scenarios:

- Create a soundscape which describes the acoustic environment of an artefact or a building or a space, etc. This scenario can be varied a lot: artefact could be real or virtual, soundscape for a different era, predefined adjective describing soundscape, realistic vs. imaginary soundscape, etc.
- Using NFC-tags to pick up audio components from different parts of a museum and create soundscapes
- Listen audio stories related to artefacts
- Record and share your memories related to an artefact or a building or a space, etc.

We have implemented and tested the first scenario. A soundscape can be a musical composition, a radio program or an acoustic environment [6]. A soundscape is created out of multiple, time-varying sound sources [7]. Many of the soundscape systems – such as Klang.Reise [8] and the Sound Design Accelerator (SoDA) [9] – are either targeted to sound designers and need a lot of knowledge to operate, or require a dedicated space. We have combined these two concepts - soundscapes and audio AR. Our approach aims at ease-of-use and interaction without previous knowledge on sounds and soundscapes. Thus, the user is the active party and technology is in the supporting role either for searching relevant sounds with the help of mobile applications or producing the acoustic environment using her creativity and imagination. The user is not expected to be familiar with acoustic terms or dependent on extra devices for tracking her head and hand movements, when creating soundscapes.

In order to design and develop mobile soundscape mixer application we involved students from Metropolia University of Applied Sciences (UAS), Helsinki, Finland. The students came from two courses: design-oriented course called Usability and Interface and Android programming course called Android Advanced Application Development. In addition, sound design students created the sounds to be used in soundscape creations.

Within the deadline we received four fully functional applications which provided the following capabilities:

- Login into Audio Digital Asset Management System (ADAM);
- Search content (audio files) in ADAM utilizing metadata;
- Download, save and play selected files either in MP3 or raw (PCM) format;
- If needed convert audio file format;
- Mixing, i.e. define combination of saved files that will played, possibility to loop, change volume, etc. of each audio file separately;
- Record audio file, convert the audio format and upload together with metadata into ADAM.

Each application was different from the design point of view. As we did not give too strict functional requirements also the implementation of applications varied. The figure 4 gives an example how the mixer functionality looks like.

Fig 4. *Overall software architecture,* 2015, all rights: Helsinki Metropolia University of Applied Sciences

Together with the Museum of Technology we arranged a workshop to test our first scenario. The target group of the workshop was age group from 15-17. A school class with a teacher was invited to take part in the workshop. The class was from secondary school in Helsinki, Finland and fitted well the target group. During the workshop we used 3 different mobile apps (Fig. 5). Feedback from the workshop was very positive both from the pupils and museum staff [10].

Fig 5. *A teacher observing, and answering questions from a user group of two persons,* 2015, all rights: Helsinki Metropolia University of Applied Sciences

Our overall system consists of pretty simple audio digital asset management system and smart clients. This type of architecture enables to utilize full power of mobile platforms when developing audio related applications, like soundscape mixer. This in turn results into innovative applications. Selecting auditory presentation instead of visual one enables faster communication between mobile clients and backend service as transmitted audio files are typically smaller than video or 3D model files. We believe that our approach is viable innovation platform also for smaller museums and other culture sector's actors who have a tight budget and at the same time want to utilize audio as a part of their creative activities.

Express your-self/city

Virtual urban art invites all citizens to participate in attending, responding and modifying 3D sculptures, linked to real spaces. These may be art works, fictional buildings, provoking sculptures or informative objects. Participants use their tablet device to create an augmented reality view and do modify 3D objects proposed by others. This fosters a creative process to develop virtualized objects by and for the community of interested citizens, creative industries and artists. The aim is to create an augmented reality view containing an image of action on and beside urban areas and places and in change. Their usage in past and present will be compared, the change of a place in different decades as well as to create fictional views of future use of the space, future architecture for creative processes and art works.

In PS2 we make use of the Betaville System [11]. Beside server capabilities, no more technical installation work is needed – people just their own devices. The project addresses and profits from the fast growing percentage of people already make use of pads, tablets and/or smart phones, and invites all citizens to participate in attending, responding and modifying these sculptures, at the real spaces in the city of Bremen (like in the inner city development area "Rembertiring" or the "Überseestadt", the old sea harbor).

Web and social media are used to communicate progress during the duration of the implementation process. Users are able to upload 3D proposals to modify (others') proposals and to vote for them (by one-to-one comparison with existing proposals). The input is curated by local and European artists from the project partners' countries while an overall curator coordinates the creative and technical activities and people´s access and collaborative processes between citizens and artists. Currently, we already have integrated cultural projects as collaborators: The Bremen based "ZZZ – ZwischenZeit-Zentrale" is a public project, mainly driven by young

architects, that cares about vacant buildings and fallow areas in order to establish temporary use by artists and creatives as an innovative tool for urban development. In June 2015 they had set up a workshop within PS2 to play with the different Betaville clients and create ideas and designs for a future permanent use of vacant buildings for artists, culture and creativity at the Bremen location of the former Wurstwarenfabrik (Sausage Factory) in Hemelingen. Another example: in the context of the cultural project "Rememberti" under the direction of the media artist Jürgen Amthor, an old Pub that was torn down during the 60th to be replaced by a large roundabout was reanimated during an event in Sept. 2015. Beside other, a vitual model of the house that contains the pub could be seen in augmented reality mode at that very spot (see fig. 6: "Sternenklause" event). During the ongoing project another partner will be involved: the koopstadt – a governmental project (state ministry) for urban development in Bremen, Leipzig and Nürnberg. It will be integrated for to exchange the results of our experimental project with policy and municipal administration in Bremen.

Fig 6. *Sternenklause event in Bremen, 2015,* all rights: M2C Institute Bremen

The Public Space as SHARED.museum

The SHARED.museum is a continuing chain of district-related art and creative (e.g. conceptual and social) interventions as an experimental art, exchange and exhibition practice with a main focus on digital art. Through an open call to cultural activists (artists, cultural and creative activists), tipping points are identified and selected by the curatorial teams under the use of e.g. public calls over social media, flyer, public radio and cultural networks for to find them. A tipping point is a real materialistic or abstract cultural or daily-cultural configuration in real space, which is characterized by their fragility and therefore, systemically and cognitive psychologically speaking, bears (as yet unknown) the potential for an early change in the situation in itself. A tipping point may also be a focal point, it is locally often referred to a gap, problem, as an object of cultural,

intercultural, societal and social conflict, upcoming contradistinctions or can be interpreted as a special local chance. A focus lies on dimensions that are affected by transformation processes in the city that emerge the disappearance of art and culture in public or cultural disconnectivity.

Selected artists (or groups of artists/creatives) start the artistic confrontation and interpretation with the tipping point situation. The submitter of the respective tipping point, for example a citizen, a cultural activist, a social-cultural institution, or a neighborhood association in the district serves as a local knowledge provider for the local context of the tipping point and the art/creative intervention. A member of the curatorial team moderates this process. A public participation workshop is implemented by the M2C and the artists at the local district. This first process should result in a participatory artwork that invites local people and provides a reflection about the situation or a creative cultural solution for possible cultural/aesthetical problems/chances of the tipping point. The artwork are exhibited at the place of origin (if it is a materialistic artwork) or are distributed to be perceivable at the place of origin (e.g. if it is more conceptual) by useful sorts of media (e.g. projection, posters, online, flyer, etc) or at the PS2 Gallery in Bremen. In any case the whole process will be published to the general public over social media.

In context of publishing the results and process of the art activity around the first tipping point, another one is to be identified and selected by the curatorial team together with the artist or groups of artists/creative as co-curator, again under the use of a public call over social media, flyer, public radio and cultural networks for to find tipping point no. 2. Artist 1 acts as an artistic/creative consulter for artist 2. The curator moderates this process. The next steps follow the same procedure then before. The process should result in a participatory chain of artwork that invites people (e.g. local people) and provides a reflection about the situation and the potentials of creative solutions. The project creates an informal knowledge acquisition and exchange for artists/creatives about participatory art practice, integration of local people and creative role changes (artists/creatives as co-curator, knowledge provider, consulter). This PS2 sub-project also addresses young artists/creatives and integrate people with a migrant or refugee background in Bremen.

Supporting the collaborative learning process, the project is accompanied by creative and participation workshops through the M2C. The project serves with its inclusion and treatment of local, district-related issues as well as with its participatory approach at the level of the art and at the level of the local residents an attractor for new audiences beyond the traditional art lovers.
The appropriate horizontal communication, mutual understanding through practical cooperation, creative exchange and excellent networking - the key measures

for learning, understanding, rethinking, reflexion, creativity, collaboration and identity - so the most important attributes for creative processes and structure building moments often come too short. It is rare that ideas, demands, needs, and wishes of artists, creatives, cultural workers and citizens match each other so directly. The SHARED.museum should be a model for a new kind of networking and communication, creativity and sustainability in the game of participation, urban re-design and socio-cultural development of our living environment. It is transferable and applicable to other places, other actors, and different compositions of actor groups, scalable. The directly productive chaining between artists and citizens from the different geographical and cultural contexts is an open-minded, open-ended, constructive dialogue that is to be continued.

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Can non-anthropocentric relationships lead to true intimacy with technology?

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Abstract

When we change the way we communicate, we change society." [1]
This panel aims to provide audience with a context to understand how social media technologies and the daily updating of the self is challenging our preconceptions of screen-based 'Internet' communication and influencing the development of our cultural/ personal identity(s) and sense of self. [15] It will explore the use of portable; individual; personal; non identical; devices and their impact to our current lives through the present innovative communication apps. The panel would question whether being intimate with technology, in a non-anthropocentric way could provide new critical reflections on the self and how gender stereotypes will form the Internet of Bodies and the future human / machine directions.

Anastasios Maragiannis: Texting a Machine: Assembling an emotional response.

Existing research into contemporary machines, or in other words 'robots'- captivating through a more humanoid oriented definition- generally complexes on a superficial unknown exploration of human senses and communication practices. Contemporary society is shaped on numerous technological communication disputes that initiate throughout a unique immersion of our portable devices, our sexual intersubjectivities and gender affinities. However, this relationships between individuals and their artificial counterparts routes back to the ancient Greek eras where 'antikithira' mechanism used to communicate data. That formed our future and therefore our emotional response to machinery. [2]

Prevailing stereotypes

Certainly, our world is not only about stereotypes but also it is about fixed, prearranged patterns that allow us – or not - to be more creative in our non-creative existence. Hundreds of online apps operable through the Internet, tolerates us to reconnoitre emotional qualities that can mirror our human essentials in prescient terms of artificial responses. We use these technologies thinking that we could communicate more, and we could aid this communication by rethinking and reshaping our physical life. We use the online apps to text to someone that we think is there to listen and respond to us, however the response we get doesn't necessarily mean that a real human is on the other side of this interaction. [3] There is a well-defined distinction here that lies between a physical and a virtual life. However this correlation is still blurred and not yet discovered. What kind of creative approaches appear possible for dealing with these complexities? But just as we getting along with 'blind' communication and uncertain emotions into future technology, we become less precautious with the openness around sexual identities emotions and communication with the 'other side' [4] of our machine a practice that social torture part of our society. Within this panel I would like to discuss the impact of the screen based communication process through the individual portable devices and explore 'our' no-gender attitude. Consequently robotics and there fixtures mechanisms (apps) allows us to further explore our restricted by the society nature, and offer us the chance to be as exposed as we think we want to be. What is the role of art in this exploration?

Stacey Pitsillides: Can non-anthropocentric relationships lead to true intimacy with technology?

The concept of human machine communication is a theme that has driven the plot of many sci-fi [5] scenarios. It is a powerful overarching narrative, which allows us to question as an outsider, some of the most fundamental principles of what it means to be human. This includes but is not limited to our personal ethics, our political systems and our social interactions. When we communicate with technological others such as

robots, or avatars in virtual worlds, by; plugging in, talking, texting, typing, touching et al we are redefining the relationship we have with the body as an embedded and entangled definition of self. It is this definition of self that allows us to be intimate with others, as we define both the relationship and the meaning of certain interactions. On the other hand a non-anthropocentric approach to intimacy may give us new versions of the human, perhaps even introducing concepts of the Posthuman [6] that have the potential to blur the boundaries between technology, the body and the self.

Artistic Freedom

Within this panel I would like to question whether being intimate with technology, in a non-anthropocentric way could provide new critical reflections on the self and give the developers of robots and avatars the artistic freedom to go beyond the human both in form and mode of interaction. Rather then aiming for AI or empathy inducing features i.e. teaching technological beings how to be better humans, we may instead consider how the affordances and materiality of different kinds of technology and how they can augment and develop new and enchanting approaches to human interaction. [7] When considered from an artistic perspective rather then a technological one, we may ask what are the affordances of robotics and virtual reality and what kind of experiences would define intimacy in these new forms?

Janis Jefferies: Closer and The Nether: the end of intimacy as we once knew it.

In the mid 1990s, when access to the internet was on the rise, there were many debates about on line interaction carried out in Internet Relay chats or chat rooms (and Multi User Domains). The second, and the one hand there were some who celebrating the fantasy and pretense of role-play partly because it was faceless and any identity could be chosen. Sherry Turkle's 1995 view was celebratory, *"As players participate, they become authors not only of the text but also of themselves constructing new selves through social interaction"*. [8] On the other hand, there were those who were unnerved by the very lack of an ethical dimension to faceless identity: distance could lead to deception, intimacy in private projected on public display, a dissolution between private and public boundaries of safety and surveillance.

Shifting Representations of Technology

This short paper discusses 2 plays some 20 years apart to note the shifting representations of technology, what the implications are for experiencing feelings of intimacy and how 'sexbots' programmed to suit all your needs impact on the young and the not so young. Patrick Marber's 1997 play (and then film) *Closer* (commissioned and performed Cottlesloe, National Theatre, London) illuminates this view through an exploration of new technology. It was probably the first play by a British playwright and produced on the British stage to explore the ways in which an on stage representation of two people communicating through the interest as well as the use of mobile phones. When one character is asked whether he frequently visits the on-line environment, the reply is specified as 'Net'. [9] In one of the scenes most remembered by visitors, two main protagonists interact in an on line sex chat while one identifies himself as Anna (another character in the play with whom he is in love [10]), then proceeds to play a practical joke on the other be arranging to meet in real life. Nearly 20 years later, another play, Jennifer Haley's *The Nether* (2015) takes on the complexities of advanced technology where the darker side of the Net is explored. [11] How much of the web do we *really* know about? *The Nether* projects some of our deepest social fears with the aim of interrogating technology, projection and simulation in which a lucrative site called 'The Hideaway' hosts punters, retaining their anonymity by adopting avatars, are able to have sex with virtual children. What do young people think? Young people's relationships in the early 21st century include a host of devices, social media websites across heart emojis on Instagram or instant messaging. A report released by the Pew Research Center in Technology (October 2015) includes interviews with Americans aged between 13-17. [12] It notes that many teenagers enjoy the anonymity of text messaging as a pleasurable aspect in all stages of dating. The negative aspects of technology, such as surveillance and trolling, are played out publicly on social media for all to see. Named after the wicked troll creatures of children's tales, an Internet troll is someone who stirs up drama and abuses their online anonymity by purposely sowing hatred, bigotry, sexism, racism and misogyny. This is the world of Closer and The Nether as the move is made from the stage (literary) to the platform (social media).

Ghislaine Boddington: The Internet of Bodies - future human / machine choreographies.

Today's world of connectivity between humans and objects of all kinds - virtual and physical - is extending rapidly, as the experimental and pioneering work of pre millennium artists and creative moves into mainstream debate, development and usage. In the next 10 years the Internet of Things [13] aims to link us to all the "stuff" around us, everything we need to work with and for us. Additionally we start to see the evolving linkage of our bodies directly to machine and virtual "others", in particular opening up real-time looping of all our senses to the robots and avatars we create or choose to relate to. I call this the Internet of Bodies - physical and virtual, human and machine.

Synthetic emotions

I would like to examine on this panel how this affects the concept of love? How are we shifting this, the most universal of all human needs, into new belongings, attachments and fulfillments? Can we adjust to and fully accept the evolution of love into "synthetic emotions"? Using examples from topical curatorial practices, both my own co-curations[14] and others (such as Lyst, Technophilia, Lovemetruly) plus recent mass viewed films and tv dramas such as "Her" and "Humans", it seems that the next decade is destined for intensive ethical and moral debates on the human / machine loving - from love bots to synths, teledildonics to cryonics the debate is on its way. As implants and sensors shift real-time connectivity to the inside of our physical body, bio-gels, touch and gaze tech will deepen immersive environments. How will this effect our social abilities in the real-world - will the psychologies of confused identities and power play cause chaos? Or will these shifts only have limited negative repercussions, as we acquire 21st century skills of rapidly blending parallel virtual/physical realms for joy and positive release?"

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e-discourse in online networked communities: structure, timing, tone, and affect

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Abstract

We will discuss the various ways that the Internet has empowered remote, networked, collaborative idea generating, knowledge sharing, and discussion. Through the specific examples of list-serves, e-conferencing, blogging, and e-curating, our assembled group of international specialists will share their experience in managing these online forums. In these virtual collaboratories individual participant contributions create a composite body of knowledge. E-discourse explodes the edifice of code that imposes implicit rules that affect styles of organization and communication -- written, aural and visual. From stream of consciousness writing where individuals simply write random internal thoughts and narratives to conversational styles that engage others from the network, or formal lecture style writing where participants simply copy and paste previously published material, networked discourse displays the electric verve of networked communication. Specially coded interfaces can create a rhizomatic flurry of successes and failures affected by time, tone, regularity, and translation. More complicated are the effects of the apparent intrinsic cultural values of race, gender, affect, and politics.

Heading

We bring together four scholars and artists whose pioneering projects have established exciting practices of e-discourse.

1). the thirteen-year history of the -empyre- listserv begun in Australia and carried on in the US with an international subscriber community of 2,000

2). various approaches to e-curating from Internet art to mobile exhibitions across the globe

3). reflections on a conceptual blog where unfinished artworks seek online collaborators for their completion

4). e-conferencing where an expansive model for international networked symposia is modeled

All of our specialists agree that despite the successes and complications of these projects, the importance of archiving is integral in suspending and extending the life of this networked accomplishment and its effect on scholarship and time. In this panel we will additionally consider the after-life of online archives.

Renate Ferro: the list-serv –empyre- soft-skinned space

In this panel artist and managing moderator, Renate Ferro, discusses the history and relevance of the listserv platform, -empyre- soft-skinned space, which emerged in art and technology networks in 2002. Originally conceived as an open networked community -empyre- soft-skinned space includes nearly 2000 new media artists, curators, theorists, producers, and others who participate in monthly discussions via an email listserv. The online discussions facilitate global perspectives on critical topics revolving around networked media. As it enters its fourteenth year, -empyre- soft-skinned space continues to be a platform dedicated to the plurality of global perspectives encompassing Australia, North America, greater Asia, Latin America, and Africa.

Originally designed and implemented by Melinda Rackham and coded to exist in the VRML and Java world of VNET, -empyre- beta version was launched at ISEA 2000 in Nagoya, Japan. It was envisioned as a utopic collective meant to foster discussions where many points of view could be heard. The listserv is currently archived online by the University of New South Wales (Sydney, Australia), and its website is hosted by the Rose Goldsen Archive of New Media Art in the Cornell University Library.

While the over-arching design continues to foster an open-community based network of participants who share their discourse through educational, commercial and independent venues, there is an intrinsic and cumbersome organic life span to –empyre-'s existence. The ebb and flow of the written daily posts sometimes come on fast and furiously while at other times the pacing is slow or even silent. Though the intension was always to strike a tone of informality to allow for

intellectually and culturally diverse participants, realistically over the years, generations of subscribers have posted a blend of styles from casual conversations to at times lengthy treatises designed for conference formats. While the archive of topics has mirrored the evolution of new media practices and technology, the less than ideal physical logistics that are required for it to remain active remains a constant curatorial challenge.

Advised by the current group of four moderators – empyre- remains able and flexible to pick up relevant discussion topics at a moment's notice. Currently our moderators not only generate discussion topics themselves but also comb other areas of expertise to find others who are on the brink of emerging interests and topics. Unlike the burdensome structures of commercial publication, anyone subscribed can suggest a current topic and agree to be a guest moderator.

The front and back-end of –empyre-'s structure has remained overall stable ensuring privacy, protection, and relevance. So amidst the ease of social media this list-serv remains relevant through the persistence of presence and the archived history that it has lived. Relationships are fostered and just once in a while, like at a conference such as ISEA, any subscriber can meet in real time and real space with someone they may have been dialoguing online with for years.

Timothy Murray: e-curating: global networks and curator

Timothy Murray traces the evolution of online curating, from early international collaborations to the development of robust online curatorial exchanges that forever altered the centrality of museum-based curation.

He begins by reflecting on three of his early-networked curatorial projects as a means of highlighting the discursive shifts of e-curating. In 1999, he sent out a call for work over the emergent rhizome network for works for a small exhibition he was planning on CD-ROM art. Not expecting much of a response, he limited the call to a three-week delivery date with the idea that the exhibition may be extended beyond a small group of artworks from Australia, Europe, and the US. Within three weeks, an astonishing 130 works arrived from over thirty countries resulting in the 80-work exhibition, Contact Zones: the Art of CD-ROM, which toured internationally for four years, including ISEA Paris. The ability to expand the initial network with such a range of international artists impacted and altered the conceptual organization of the show. The emergent network of curators and artists also resulted in a relocation of the exhibition in Mexico City for which he developed the first bi-lingual online catalogue (Spanish/English). The catalogue then provided the framework for other international exhibitions deriving from Contact Zones in Macau and Johannesburg.

Profiting from this curatorial and discursive model, he joined co-authors Arthur and Marilouise Kroker to produce CTHEORY Multimedia, which they designed and curated online from the US and Canada. Here again they were able to profit from the emergent

network of international artists to make calls for completed internet art, which then grouping the works around their own conceptual and political categories that mirrored global geopolitical conditions. On a smaller scale, he co-organized an off-line net-art show in Slovenia, INFOS 2000, for which he depended on the same networks for curating, while distributing the exhibition on CD-ROM off-line to reach international cultural centers that still lacked high-speed Internet connections. The challenge of this show encouraged the curators to develop a conceptual framework that challenged the digital divide of the very network on which they depended.

Across the terrain of early e-curating, networked conditions and opportunities altered the discourse of museum-based curating and provided opportunities for curators and artists to enter into active dialogue regarding emergent concepts, practices, and politics. These opening examples will provide the impetus for raising a number of challenging questions pertaining to e-curating at this moment when ISEA finds itself in Hong Kong. While regional archives now guarantee the preservation of an earlier ephemeral history (such as Art Asia Archive in Hong Kong; Rose Goldsen Archive of New Media Art; Transmediale CD-ROM Art Archive in Freiburg; Rhizome; Langlois Foundation in Montreal), does e-curating continue to find itself limited by the constraints of the digital divide? Are Asian and Western artistic networks still as mutually exclusive (for linguistic and cultural reasons) as they were fifteen years ago? What about the added potential of virtual curating and exhibition for politically challenged populations facing censorial conditions on the ground? How did discursive networks of curators and artists contribute to the Arab Spring and how might they address current challenges in and across Asia?

Maurice Benayoun: the blog- the Memory Dump, the disregarded power of undone art

The Dump.net project is born from the following assumption: as the universe is made of 96 percent of dark matter, the art we know and we see should be made of roughly the same amount of unfinished projects. During the span of two years I converted on a daily basis any thought, art related or not, into political, social, economic or artistic projects. This collection of uncompleted conceptual projects was immediately - on a daily basis - published on a blog: the-dump.net. At the same time the-dump was a way to save, protect, share and discard projects that could encumber the creative process in action. Describing what the work could or should be and at the same time providing justification of the original concept, the-dump became the first blog converted as such into a doctoral thesis about artistic intentions. The thesis was defended at la Sorbonne in front of an international jury of examiners. [1]

Based on the idea that each artist is inspired and nurtured by one's predecessors, undone projects

should be open to other artists to feed their practice. In Poland, a curator, Agnieszka Kulazinska invited 9 artists from 5 different countries to select projects from the Dump and to exhibit their interpretation of the selected dumped concept. [2] Another blog, Opendump.org, allowed artists from different origin to publish their undone projects.

The Dump has become a catalog of possible projects for curators to dig into. Ironically many of my recent works being generated from it. It is also a place were uninteresting projects are also totally discarded. The artist footprint on art history is not only made of the remaining evidences of completed works, it is also a chaotic or structured sequence of decisions, choices and priorities. The-dump is the compost where decaying concepts are fertilizing a pervasive practice.
After *Out of the Dump, in 2011,* exhibition including the high-resolution photos of the un-dumped works made by other artists beside of the original caption, in 2011, the Dump has been published with the thesis introduction. [3] [4]

Randall Packer: the e-conference- Collapsing the Walls of the Arts Conference

While online practices for learning and creative production have captured the attention of artists, arts educators and cultural organizations worldwide, techniques for highly collaborative and dynamic peer-to-peer forms remain an area of great potential for academic and artistic conferences. Randall Packer provides an analysis of The Art of the Networked Practice Online Symposium he organized and co-chaired in the spring of 2015 in the School of Art, Design and Media at Nanyang Technological University in Singapore. The event served as a forum for sharing emergent strategies that advance the network in a free and open dynamic space for creative dialogue and artistic exchange.

The Art of the Networked Practice | Online Symposium was held online and onsite, uniting local and remote participants in presentation and dialogue via Web-conferencing. The symposium demonstrated how networked space could be used to stimulate creative dialogue and the open sharing of knowledge through an online global exchange. The symposium events combined performance, exhibition, online discussion, social media, chat, keynotes and panels to explore and debate the role of the network in our individual and collective practice as artists, scholars, and arts educators. The project was sparked from my ongoing exploration of live, trans-global communications as a catalyst for collective art and discourse.

The format of the online symposium, with the potential for extensive reach and inclusivity, is a sorely underutilized medium in the arts today. Most arts conferences require participants to have access to an academic travel budget in order to cover the extensive costs of travel, accommodations, and fees. This is detrimental to giving voice to artists who are not affiliated with well-endowed universities: in essence, the arts conference is generally exclusive to those with economic and professional privilege.

As a free and open form of conferencing, The Art of the Network Practice Online Symposium attempted to radically alter the format: with attendees from over 40 countries across the globe participating. From Singapore to New York to London to Australia, as well many as many less developed countries, the symposium offered access to panels in such topical areas as "collective research," "peer-to-peer cultural production," and "distributed teaching and studio models" to articulate emergent new directions in networked practices in the arts. Activating what he refers to as the "third space," the convergence of the local and the remote The Art of the Network Practice Online Symposium enabled artists who are typically sequestered in the privacy of their studios to share ideas and have access to current thought in the field via a live platform with global reach. The symposium reflected the need for new conferencing models in a fast changing networked culture that is quickly transforming our artistic practice, our teaching, our research, our social relations, our identities, our cultures, and our understanding of the world in the age of global communications.

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The Affect of Quantum Phenomena on Media Art

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Abstract

This panel will deal with art, media and science via the concept of the *'spin'* as a fundamental in quantum research where flux and vibration are at the very core. The historical model of media art, science and technology must now include the potential of the quantum phenomena through the emergence of the quantum computer. The subatomic world tantalises us with startling phenomena, but lies deep beneath the surface of human experience, forever hidden from direct observation. Data captured through complex physics experiments reveal quantum behaviours, but unlike scientific meanings constructed to objectively explain such phenomena, the panel will explore the interactions between the subatomic and human realms. In the words of contemporary physicist Anton Zeilinger, this data from quantum experiments exists in a state of "primary reality" more fundamental than the meanings scientists construct to explain it [1]. The panel will reflect how media art will have to deal with significant change based on the discoveries being made in controlling atoms at the core of new machines, including the quantum computer. The panel's intuitive and insightful presentations will demonstrate how we as humans comprehend and understand the world at the deepest level and by doing so bring it into existence.

Mike Phillips: Touchy-feely

This paper will explore the emergence of a post-ocular culture created by the ubiquity of lensless sensing technologies that manifest the things that lie outside of the normal frames of reference. The hegemony of the eye, which for centuries has defined how we know the world, is fading. The invisible and obscured, the infinitely big or nanoscopically small, hover on the fringes of our collective cultural perception, things we have always known were there but never witnessed. This unseeable (im)material world has traditionally languished in the domains of the paranormal or the spiritual - forces so delicate that they require a leap of faith to believe that they are actually there. Whilst our science readily embraces this domain (stumbling around in the sub-molecular dark, lurking between atoms, feeling its way through the atomic forces that bind matter) our cultural philosophy struggles to believe and clings nostalgically to lens-based media-technologies for knowing and capturing the world.

The comfort zone created by this nostalgia was shaken by the death of film, marked by the bankruptcy of Eastman Kodak (2010), and the shift to the post-ocular. Ironically underlined by Fujifilm's move, in the same year, of its film production to nano-technology development. The transmogrification of the collagen used for film production into a nano-material for beauty products (Pico-Collagen) [3] marked not only a technological shift from film grain to nanoparticles, but also signalled a cultural shift – the dissolving of a historical instrument for knowing the world, into the very material of the world. Worse still, this nostalgic instrument was dissolved into the face of the viewer, a dissolution of object and subject. To know the world in this post-ocular culture we need to constantly (re)-negotiate the fragility of our material reality. The act of seeing is fundamentally part of our perceptual problem, and the trans-scalar collapsing of the view from the Albertian window so culturally traumatic. A trauma that finds its peak in the Quantum computer.

And yet, somehow, when we close our eyes, we know that there is something there, some sense of the world beyond the ocular. We can trace this sense through multiple historical precedents, such as: the concept of Atomism date back to the 4th Century and span the ancient globe; the dea of the 'Mote', both a noun and a verb, its early Christian origins and Masonic overtones describe the smallest thing possible and empower it with the ability to conjure something into being (So mote it be…) - "A mote it is to trouble the mind's eye." (Shakespeare ca. 1599) [4]; and the work of techno-spiritualists, such as Professor Gustav Adolf Schwaiger, the technical director of the Austrian Broadcast Corporation, and his collaboration with famous medium Rudi Schneider in the 1930s hint at a desperate need to know the invisible.

The paper presents a number of works created by the author which (re)-negotiate the fragility of our (im)material world. These include experimental approaches to capturing, synthesizing, and re-visioning the world by data visualisation and sonification, methods of capturing and sampling through Magnetic Resonance Imaging (MRI), Lorentz forces and Atomic Force

Microscopy (AFM). This transdisciplinary research embraces the problems of the trans-scalar, the nature and substance of matter, and our relationship to it. To see another world in a grain of sand, to conjure up images of the dead, it is our tenuous cultural relationship with these emergent technologies that troubles the mind's eye.

Chris Henschke: The Edge of the Singularity

In my paper I will discuss my practice with art and particle physics, focusing on the panel's central theme of "Singularity". I will argue that the "singularity", a point with no dimensions, cannot exist in any meaningful sense as as a physical entity, yet it underpins much of quantum physics. Although it is a hypothetical entity, yet which becomes more manifest as we get closer to it, it will never be fully realized. I believe that the singularity can be understood as a "coherent" entity, to borrow from the concept of "quantum coherence" – in the interaction between the coherent entity and the physical world (i.e. as soon as we attempt to measure it) it "decoheres" from a theoretical form into the physical forms of space, time, energy and matter. Like Zeno's arrow, the nearer we get to the singularity, the harder it becomes to get there.

I was inspired towards this position whilst undertaking an "art@CMS" collaboration at the Compact Muon Solenoid (CMS) detector at CERN. During my time at CERN I heard (as yet unsubstantiated) rumours from the coalface of the Large Hadron Collider, that the recently discovered Higgs Boson (a.k.a. the 'God Particle'), postulated as the most fundamental particle, may actually be a composite entity, made up of other higher energy particles. This empirically suggests the concept that the journey towards the "singularity" is like a Zeno's arrow of ever-decreasing scales and increasing energies.

I will augment my discussion by presenting one of my projects, *Edge of the Observable* (2014). This is an audiovisual artwork that explores the limits of materiality and knowledge through an experimental manifestation of data taken from experiments at CMS. The work seeks to manifest the sublime and dynamic parameters of particle collision event data by enhancing the formal material and energetic qualities of such data, using an experimental optical physics setup I developed. This enhances the area in the core of the collisions, which is a tiny black void-like sphere, technically termed the 'vertex of kinematic undetectability'. Like the event horizon around a black hole, we can see the dark edge of its form but perhaps never access its heart. Thus the "singularity" becomes a symbol of our striving for ever-increasing knowledge, pulling us ever closer towards what is an ultimately unattainable goal.

Frederik de Wildle: Creativity and imagination in the history of art and physics

The connections between art and science, and the potential outcome of cross- linking both, are of great interest. In this paper I will explore the creative potential of hacking the substrate of the Universe and quantum noise. Art and science should each be evaluated on their own merit, and both are equally important in our quest to understand our world and to enrich our experiences. For the author physics is one of the greatest mysteries of them all, the mystery of understanding the fabric of reality. Creativity and imagination are enormously important in the history of physics because often the hardest part has been having creativity and imagination to question assumptions that everybody else has bought into. Imagination is crucial for imagining how things could be different. The author uses his artistic praxis, art historical knowledge and keen interest in the sciences as a starting point to explore the notions of the hole, randomness, true random number generation, quantum physics, the vacuum and vacuum noise. The first part of the talk explores scientific concepts; the second part focuses on the arts and artistic output. By setting up a lab experiment to measure quantum fluctuations and applying mathematics in custom made software, the author discusses visualizing the invisible by materializing his subjects through 3D printing.

Paul Thomas: Quantum Media Art and its new modalities

This paper will deal with art, media and science via the concept of the spin as a fundamental property in quantum computer research, where flux and vibration are at the very core. The historical model of media art, science and technology now includes the potential for quantum phenomena.

I will look at the implications of quantum computing for media art and its evolving histories. I will argue that new forms of art are on the horizon that demand specific attention as we enter an age of experimentalism. The spin of the atom in the void, with its internal rhythms and vibrations, is the driving force behind the power of the quantum computer. The various media artists whose practice parallels progress in the area of physics are exploring frequencies and signals that are key properties at the atomic heart of quantum mechanics. The human interface with technologies will become more complex with the rise of the quantum computer and it ability to process multiple sets of data simultaneously. The controlling of atoms at the core of the computer will require a shift in our human relationship with matter, and artists can play a leading role in defining this new relationship through reflection and critique of computer-mediated interactions.

The quantum computer uses traditional atomic material compounds such as phosphorous, nitrogen, silicon and graphene electrons as qubits and their properties of the superposition. The paradox of the quantum superposition (best articulated in the Schrodinger's Cat thought experiment) exists as an actual and empirical condition in which an electron occupies multiple positions in space simultaneously, but none specifically. There is a shift that needs to occur in our conscious understanding of invisible quantum nature. How will quantum phenomena affect our understanding of materials, meaning and art?

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Livestreaming in theory and practice: Four provocations on labour, liveness and participatory culture in games livestreaming

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Abstract

Although livestreaming has been technically possible for years, the recent surge in popularity was primarily driven by the broadcasting of videogames. In the past two years, gaming-centric livestreaming platforms such as Twitch.tv (US based) and Douyu.tv (China based) took off as not merely novel media platforms but a ubiquitous everyday entertainment for millions among other media platforms such as YouTube and Netflix. Livestreaming converges liveness (live broadcasting) and participatory culture (social interactions) on an unprecedented level. This panel considers firstly, how livestreaming problematizes the concepts of liveness in contemporary contexts of broadcasting over wired and wireless internets compared to the televisual age. And secondly, the panel asks how livestreaming induces various forms of participatory culture which encourages the platform to be a space both of play and productive activities.

Introduction

Although livestreaming has been "technically within the realm of the possible" [1] for years, the recent surge in popularity was primarily driven by the broadcasting of videogames. In the past two years, gaming-centric livestreaming platforms such as Twitch.tv (US based) and Douyu.tv (China based) took off as not merely novel media platforms but a ubiquitous everyday entertainment for millions among other media platforms such as YouTube and Netflix. Livestreaming converges liveness (live broadcasting) and participatory culture (social interactions) on an unprecedented level. Firstly, livestreaming problematizes the concepts of liveness in contemporary contexts of broadcasting over wired and wireless internets compared to the televisual age; secondly, livestreaming induces various forms of participatory culture which encourages the platform to be a space both of play and productive activities. As a panel, we will contribute four different perspectives on the subject of livestreaming in both theory and practice.

In contrast to the rhetoric surrounding both the availability and the simplicity of use of livestreaming technologies, game broadcasters (from professional-amateurs to irregular livestreamers) reveal the personal and significant efforts involved in maintaining a regular channel as hidden labour curtained off from their viewable performance. Here we present four cases which reveal and discuss the labour involved in negotiating livestreams, and how particular constructions of labour intersect with the concepts of both liveness and participatory culture within spaces of networked play/production. Firstly, liveness, in particular impromptu live performances, is often valued as a superior form that resists the contrivances of conventional television. Contemporary livestreaming platforms complicate this sentiment as the very personal/social aspects of human interactions are proactively commoditized. Secondly, Henry Jenkins, discussing the relationship of participatory culture in networked society, positions users as having more producer and consumer control over their media, and with that "...greater roles to play, in the key decision making institutions of their time" [2]. The collective studies presented here contribute to this constructive position, as well as deeply complicate how participatory cultures are at work within cultures of games, with particular attention to the notion of "shared well-being" [3] of players entangled in an economy of eyeballs and deeply entrenched in laddish media sports cultures.

Emma Witkowski: Livestreaming, participatory culture, and gender politics at the edge of e-sports

This paper considers the practices of young women who livestream their high performance play on the North American game broadcasting platform Twitch.tv. These players represent cultural producers, e-sports fans, championship game winners, and regular competitive players broadcasting their play. Key themes produced in this research surround issues of networked access and participation, gender politics, and performance in mainstream e-sports, which are discussed from qualitative research with seven players who broadcast regularly in 2013 - 2015. During this time their viewership numbers ranged from under 50 to over six thousand per session, and they broadcast with a variety of motivations, incentives and awareness of their practice

and mainstream e-sports in mind. In turning to Twitch broadcasting, as an alternative path towards involvement in mainstream e-sports, the productive labour of the participants is deeply engaged with DIY aesthetics and participatory culture. Through these performances, interconnected realizations and concerns around women and e-sports are voiced by the women who negotiate this new outlet of media sports culture everyday [4]. In situating the everyday experiences of women who play at the high performance level of computer game play, alternatives to mainstream e-sports are revealed through dynamic human-non human relationships, which alter traditional forms of participation and remuneration in this new media sports ecology. Such practices go beyond revealing the changing relationships of female players as resourceful player-producers; through a lens of participatory culture, they also highlight the ongoing inequities for women within high performance game spaces and online gaming cultures [2].

Daniel Recktenwald: Donation Alerts on Twitch.TV: Commodification of Community and Attention

This talk will discuss subscriptions and donation alerts on Twitch.TV as a phenomenon between community interaction and commodification of attention [5]. It will present how participants frame themselves, their viewers and "donations". Although their responses express a genuine desire for social interaction, there is also an instrumental motivation to "grow". Twitch.TV's website and its third party services such as donation alerts, lead to situated practices that commodify the social interaction. On Twitch, there are major asymmetries in the visibility and potential for participation between streamers and audience members. The audience is collectively typing into a shared chat window. Audience members can never be sure that their chat message will be read by the streamer. In this situation, donation alerts become a short cut out of this competition into the perceptual focus in the center of the screen. The economic exchange is a precursor for a more prominent linguistic and social interaction. These findings demonstrate the need for a continual skepticism towards overly optimistic promises of participatory culture in the new media [6].

James Manning: Don't Play Videogames

This paper will argue that participating in livestreaming is an efficient means to negotiate the (constitutive) inefficiencies present in videogames [7]. Often it is purported that a central pleasure associated with videogames is the nontrivial effort required to play them, the actions required to transverse the 'text' as a subset of ergodic literature [8]. Livestreaming problematises the idea that controller-in-hand play is a necessary part of videogame consumption. Whilst videogames are built to be configured through play [9, 10], livestreaming provides opportunity for (non)players to participate in

playing videogames without having to negotiate first-hand the affordances of the game-system. As such, livestreaming reaffirms the observation put forward by [11], that participating in videogame play extends beyond the confines of the human-computer interface. Playing videogames is often arduous and repetitive work [12]. As such, the practices of regulating gameplay through deferral to other players' expertise is nothing new [13, 14 & 15], nor one begotten by the recent proliferation of consumer-level broadcasting technologies. This paper will situate livestreaming as a continuation of such practices, suggesting that one of the virtues of livestreaming is that it provides an opportunity for participants to invest in the various configurative practices of gameplay without necessary 'playing' themselves.

Zhang 'Dino' Ge: Ideology of Liveness and falsification of the ontological "Live"

This paper aims at deconstructing the core concept of liveness, as emphasized in internet based livestreaming media today, via an investigation of historical production of meaning of liveness in theatre and television. Liveness is not, perhaps never, immune from contamination of mediation as the ideal of a "purity of absence of mediation" [16] might be an ideological product of our highly mediatized present society rather than a loss of the pre-digital state of "retained authenticity" [17]. The rise of livestreaming dotcom TVs such as Twitch.tv and Douyu.tv, as opposed to television, is not necessarily a sign of the return of the Immediacy or the arrival of Immediacy via the internet but an allusion to the underlying argument that the televisual is "organic part of the social fabric" [18] in our society. The overarching dichotomy of the Live/thus Real and Representations/thus mediatised is thus replaced by analysis of liveness in each particular case, namely historical television and contemporary livestreaming/digitalised television.

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Part IV

Posters

Collaborative expression program by creating digital storybooks

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Abstract

We propose a basic learning program to foster ability to understand and empathize with others. In the program, a student creates a digital storybook collaborating with an elderly person who needs care. The collaborative expression activity in the program provides the elderly persons a way to express themselves while promoting students' learning. We developed a Web application for publishing storybooks, and a tablet PC application to view storybooks for execution.

Objectives

Our study focuses on communicational competence, particularly the ability to understand, be concerned with, and empathize with others in different social positions. We designed a learning program to foster it for students in higher education through a collaborative expression project, and developed a tablet PC application as a tool.

In the program, a student pairs with an elderly person who needs assistance because of physical difficulties, and they create a digital storybook together. The storybook is presented using a tablet PC (iPad) application, and also is published on the Internet. Normally, an elderly person who is hospitalized or confined to home has few ways to express and publish their own contents. Information and communication technology (ICT) such as the Internet and mobile PCs give freedom of location and situation.

Art expression programs have been widely practiced and reported for counseling and nursing as a communication method. However, most of them are executed in the fixed relation that one person is a facilitator and the other is a participant, and there is scarcely any program that allows equal collaboration.

Processes of the program and tools

The collaborative program is comprised of three processes: the student interviews the partner to discover the story theme; the student and the partner elaborate the story together; and the student edits a digital storybook, that consists of images, texts, and sounds of narration. We developed a viewer application and a Web system to integrate image, audio, and text files into a digital storybook, and to publish it on the Internet. They are applied to the program. The viewer application shows a title list of uploaded storybooks, and displays the selected one in a lightbox (Fig). Each page is shown with texts while playing the audio file, and the previous or the next page is turned by touching the monitor.

Fig. *Title list on the application(left) and viewing(right)*

Implementation and discussion

To examine the feasibility of our learning program, we have implemented an experimental project in which four women students and four elderly persons aged 80-90 (three women and a man) in a care home participated. Students belong to the graduate school of media and information.

The themes of the created storybooks were inspired from concrete episodes that were meaningful and important in the elderly partners' past lives. The collaborative creation brings an objective view of the original episodes to them, and provides a channel to convey messages to the outside world. Moreover, we surveyed the effect of our program by the communication skill scale. The students responded the same questionnaire before and after attending the program. The result indicates that the students acquired the confidence on acceptance of others and ability of understanding. In the future, we intend to study deeply the feasibility of our collaborative expression program for communication design education.

In Search for the *DomoNovus*: Speculations on the "New Home"

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Abstract

DomoNovus is a concept devised by the author, which attempts to explore the speculative futures of the domestic environment, and to conceptualize and define possibilities and limitations of the "New Home" that consists not only of routines, experiences, physical objects, and biological bodies, but also of a range of technological systems, digital networks, virtual environments, and local or remote cyberspaces in micro, meso, and mega scales; an accumulation of cells, things, memories, links, molecules. Thus, in this work a range of theoretical and practical explorations are presented that intend to investigate the domestic space as an ecological system that uses technological facilitation to extend methods and practices that tame and domesticate ubiquitous computing, while same time proposes ways in rethinking dwelling and achieving conditions for symbiotic mutualism.

Project Description

This work investigates the ecological transition of the domestic space as adaptive shifts and radical changes within the routines, rhythms, and qualities are caused by the technological facilitation that infiltrates and redefines home's natural order. A vast amount of information that can be collected to help identify patterns emerging from the invisible choreography of the household, provide a rich database for the establishment of guidelines concerning the spaces we occupy. With the use of computational systems and web services it is possible to sense numerous properties of the environment, classify, analyse and filter data and metadata, train Artificial Intelligence algorithms to process large amounts of clusters, and identify trends or even psychological traits that can be applied for a detailed understanding of the domestic interactions, suggesting we rethink dwelling and how ubiquity can be domesticated.

According to these aims, we need (a) to view the house on all possible scales from micro, to meso, and macro, (b) to consider the ecological universe of objects with their resonance and emotional presence, and (c) to perceive house as partner in mutual symbiosis. In order to demonstrate these points, a number of speculative experimentations have been developed by the author that attempt to explore the possibilities that emerge through the domestication of ubiquitous computing systems, services, and applications, and to observe how current adaptive shifts affect home's ecology.

DomoNovus is a speculative concept that emerged from the practical expeditions of this work, and it suggests a future for the computationally-enhanced domestic environment that develops an intimate and affective relationship with its inhabitants according to its technological infrastructure, in software, hardware, and hybrid forms, suggesting and offering precise responses according to the dwellers' computed profiles. The invisible and remote servers of the cloud become a fundamental extension of the domestic ecology, following loyally their owners in space and time, and personalizing accordingly when needed. Moreover, the concept explores the hybridization of domestic objects, properties, and events, the implementation of computational units responsible for reasoning, analysis, memory-keeping, multisensory interfaces, and network of things, open-source and DIY ideology, sustainability strategies, as well as computational media practices that transform the interior space into a cosmos of easily accessible variable realities.

DomoNovus, therefore, provokes us to study, implement, test, and analyse the networked manifestation between inorganic, biological, and digital entities, and create a digital cartography of behaviours, actions, and sensed interactions. The domestic space becomes a tool of distributed authorship, a cybercerption and telematics portal, a cluster of participation of objects and bodies. Unseen and buried datasets collected from sensorial and algorithmic agents are organized, connected, and revealed to the daily actions of the household through spatialized rearrangements in multiple domains, breaking the rhythms and preconceptions of the chaotic system we call "home".

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Stories of Solidarity

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Abstract

The *Stories of Solidarity* poster highlights the overall process of the project, from hackathon to working prototype with original code and user testing with precarious workers.

Stories of Solidarity

Rapid technological change, globalization and volatile competitive conditions have contributed to growing insecurity in work, in which the workplace is less frequently a site of long-term stability and collective experiences of work have been eroded as a basis for solidarity. In recent years, however, we have seen growth in innovative communication strategies that are connecting people around labor issues across multiple and disparate places.

According to DeeDee Halleck, founder of Paper Tiger Television, "It is one thing to critique the mass media and rail against their abuses. It is quite another to create viable alternatives." In this spirit, *Stories of Solidarity* emerged when we asked the very critical question of how the research university can support the labor movement, looking carefully at what tools already existed and what needs were unmet. Our grassroots efforts included interviewing the labor organizers and community leaders through a "call-a-thon," brainstorming ideas, hack-a-thoning, prototyping, iterating and fundraising. Ultimately we are creating a platform that offers many points of access (SMS, smart device and website), with options for increased levels of fidelity (text, image and video) and features such as data visualization, geolocation, information-based context, map and masonry views, subscription options and trending terms sorting.

MVP: An Automatic Music Video Producer

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Abstract

A common format for newly released music, music videos can be created manually using readily available software such as iMovie or Adobe Premiere. The shift from linear to non-linear media has increased the desire to build models for generative media. For the music video in particular, images should align to the audio to enhance its acoustical aesthetic. However, manually creating a large number of assets is expensive and time-consuming. Therefore, automatic generation can increase the efficiency in the production of such media. We present Automatic Music Video Producer (MVP), a computationally generative audio-visual system for music videos. We outline the design of MVP, shown in Figure 1, which automatically generates a music video for a given target audio track. A specific application of this system would be the fusion of Eastern and Western culture to generate a new form.

System

Automatic Music Video Producer (MVP) is a computationally generative audio-visual system for the genre of Music Video. The overall aesthetic is that of an audio-visual experience in the spirit of "cultural exchange" – Eastern culture and Western culture can be fused together to generate a new form. Music videos generated by MVP can be played in multicultural cities such as Hong Kong and New York, attracting people from various cultural backgrounds. Asian people might be happy to see their favorite music accompanied by Western dancers and singers. Westerner might want to add Asian music video images into a Western-style song. The system performs segmentation for the given target song based on audio onset detection. Next, according to audio similarity analysis and heuristic selection methods, we obtain generated video segments. Then, they are truncated to match the length of audio segments and are concatenated as the final music video.
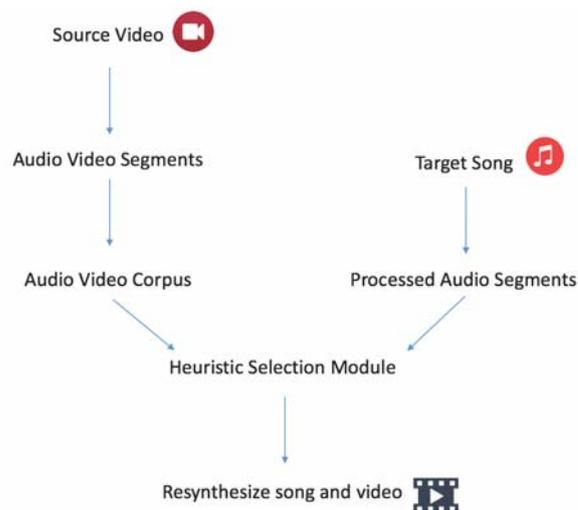

Fig 1. *Overview of MVP*

A demonstration of our system has shown that the audience is receptive to this novel presentation of music videos and are interested in future developments. Many audiences believe the system would be useful to artists. For future work, we plan to expand the genre of music in our database and improving our indexing algorithms and heuristic selection methods.

Natural Material in Interactive Art

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Abstract

This paper explores how to create a significant relationship between natural materials and interactive art. It deals with studying diverse examples from sculpture to architecture to interactive art. The research finds a coexisting relationship between computer-generated images and random algorithms. It suggests natural materials as a physical interface to provide the immaterialized programming with the quality of natural materials. This combination emphasizes natural materials as a creative interface between human and interactive art.

Joseph Beuys's Three Sculptures

Synthetic materials have been replacing natural materials due mainly to the economic reason. However, some digital media artists still use natural materials, which are expensive and mortal in their works. These primitive materials in emerging technology give audiences strong tensions between high and low technologies. Why do they use such anachronistic materials? How are viewers fascinated by this bipolar juxtaposition? The answer starts with Joseph Beuys's installation works.

Beuys's *fat Battery* (1963) shows natural materials such as fat, felt and copper in a paper box. These can be the main elements of making energy, as the title says. According to his famous story, felt and fat were essential materials for Beuys to survive in his critical air crash. Likewise, *Capri Battery* (1985) implies his story of his recovering from a lung ailment on the Mediterranean island, Capri. [1] A yellow light bulb is connected to a real lemon. The combination between natural materials and electric parts represents environmental sustainability between chaos and order, or undetermined and determined. [2] With the helps of volunteers, Beuys planted the social sculpture *7000 oak trees* (1982) in Kassel, Germany. Like the composites used in the battery series, basalt is a strong symbol of the energy of lava. In the project, each tree is next to a vertical basalt stone on the street. Comparing to the unchanging hard stones, neighbors can pay attention to the growing trees day by day. He used the natural materials to make people actively observe the minute change between undetermined and determined in society. Ecologic activist Beuys stimulated people to experience their surroundings by blurring the boundary between art and life with these different qualities of the natural materials.

Materiality in Architecture

7000 Oak Trees inspired architecture group UN Studio to choose the material for an electrical substation in Innsbruck, Austria. As Beuys utilized the basalt stone, the architects used the same stone for walls of the building to illustrate a natural symbol or storage of the energy in society. [3] As phenomenological architects emphasize, natural materials reveal its property through its natural environment. The natural materials can be a significant interface in algorithmic environments. The inherent difference between random numbers and dice numbers is based on materiality. A number from a dice relies on real materials like wood as John Cage's composition with chance operation depends on the materiality of coins. However, a random number from computer algorithms is disconnected with real materiality and depends on its intellectual process. [4]

Natural Material in Interactive Art

Christa Sommerer and Laurent Mignonneau link natural materials to computer algorithms in interactive art. They synchronize natural materials with artificial life images. Their early project, *Interactive Plant Growing* (1992), is one of the first interactive computer artworks to use a natural and tactile interface, instead of computer interfaces. [5] Viewers can manipulate artificial plant images by touching real plants. The materiality connects materials to artificial life, which assigns random functions to the whole algorithms to make computer-generated images more natural. [6] This plant becomes a dice-like interface to generate quasi-chance numbers. [7] In this regard, natural material as a chance operator is applied to a natural interface for interactive art.

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Abstract

This website aims to share information about local art, music, farming, and dining in Nagakute, Aichi prefecture, Japan. In Japan, communication between fellow local citizens is weakening; therefore, this website is an attempt to stimulate communication between local residents and create a recycling-oriented community.

Introduction

In 2011, a nuclear power plant accident occurred in the Japanese prefecture of Fukushima. The resulting release of radioactivity led to local soil contamination, thereby forcing the collapse of the regional community as many people were compelled to leave their land. This reminded us of the importance of regional communities in protecting the land we live on. Further, the radiation contaminated many agricultural products, which has led to increased concerns about agricultural product safety. On a related but different note, as in many other towns, communication between the citizens in Nagakute has weakened. Although many people conduct grassroots activities for the regional community, running small businesses and cultivating safe vegetables within the region, information about these activities is not being successfully shared across the region.

Method

Therefore, a website was created for sharing information about local resident activities. This website has posted various local stories about organic farmers, locally sourced restaurants, welfare institutions involved in farming, environmentally oriented gardening companies, environmental education groups, community based cafes, and local galleries and musicians. As art, design and music play a particularly significant role in stimulating communication between local residents; thus, these areas have been emphasized. This website publishes basic information about the groups such as their names, addresses, pictures, brief summaries, maps, websites, and Facebook URLs. It has also published interview footage and RSS feeds distributed in blogs. The site has also made it possible to post information about each group or gallery event. The website also has several pages that are useful for business or sales. On the farmer's page, there is

a farm hand recruiting form and a form to sell agricultural products. Also, a catering request form is on the culinary page.

Fig 1. *Nagakute Yuimaaru Website,* 2015, Haruo Ishii, /website, http:www.nagakute-yuimaaru.com.

Result

The website has been very popular and is regularly accessed. In addition, requests to cover stories in the local area have increased and are actively pursued. Local residents enthusiastically share their activities and thoughts through interviews. This rising interest demonstrates that information about local activities has not been spread adequately and that the residents are eager to disseminate information on a wider scale.

Conclusion

Many people in Japan are still living at evacuation sites because of the nuclear power plant accident, which means that the accident has not yet ended. However, underlying the nuclear power plant accident is the fact that our own lives and that of the regional communities have been entrusted to strangers, which can be observed through our dependence on huge systems such as nuclear power plants. Therefore, it is important to create recycling-oriented communities that are regionally self-sufficient in terms of economy, energy, agriculture, food, art, music, and the raising of children. This would allow communities to be independent of huge systems such as nuclear power plants and become more self-reliant. Therefore, it is important to create initial connections and information exchange between fellow local residents through electronic media such as this website.

"AS IF" You Are Suffering in Silence

An Interactive Installation as Empathy Tool for Chronic Pain

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Abstract

The unseen and incommunicable nature of Chronic Pain makes it difficult for the general public to believe, understand or empathize with patients. *"AS IF"* is an interactive art installation that aims at eliciting public's empathy with Chronic Pain sufferers. By enabling able-bodied people to "map into" a virtual body that has limitations, participants may gain an "as if" sense that they are suffering from Chronic Pain.

The Interactive Empathetic System

The Problem of the Suffering in Silence

Living with Chronic Pain is a reality for 1 out of 5 people in industrialized countries [1]. The individual suffering is invisible and incommunicable. Therefore, it can be difficult for the healthcare professionals, family, friends and others to believe and understand the sufferings of Chronic Pain patients, let alone to empathize with or support them. This in turn leads patients to confusion, frustration, anger, as well as vulnerability to stigma, shame and social isolation [2].

Mirror and the Impaired Body

During the interaction, the participant is faced with his/her own whole body silhouette that is situated in a 3D virtual environment. The *"AS IF"* system uses a Microsoft Kinect Sensor to track the participant's whole body movements: thus, the body image in the mirror updates with the user's actual body gestures accordingly. In the virtual mirror, the virtual body switches seamlessly between two modes: in the "normal body mode", the virtual body acts exactly like a mirror: the participant can see his/her arm rising or leg kicking in the mirror; in the "chronic pain body mode", the range of motion of the joints of the virtual body is limited. This joint movement limitation function attacks random body joints within an arbitrary time interval, mimicking the unexpected nature of certain chronic pain attacks (Fig 1). While the visual presentation of joint limitation in the virtual body mimics the actual situation of Chronic Pain, it also creates a visual-motor incongruence for the participants, which intensifies their sensory disturbance, such as sense of alienation of his/her own body, loss of control of the body, weight change on the impaired limb, or even feeling of numbness and pain. This feeling of isolated alienation is also known to be expressed by Chronic Pain patients [2]. Thus, through the design of

the altered body schema, the transformative experience may be evoked or generated.

Fig 1. Participant interacts with *AS IF*. © SFU SIAT Pain Studies Lab 2016

Body-Environment Interaction

In the virtual mirror, the user will find him/herself standing under the starry sky, with several prominent stars shining brightly. The interactive environment consists of a game: Connecting Stars. The user's task is to connect the prominent stars with lines to reveal a meaningful shape.

Conclusion

In this paper, we present an interactive art installation *"AS IF"* to simulate the daily sufferings of living with Chronic Pain, for the aim of letting their voice out when they usually suffering in silence. Combining the state-of-art technology, psychological theory, medical and neuroscience knowledge in the design approach, *"AS IF"* explores the expression of pain in the form of interactive art. Here, interactive art and medicine merge to facilitate the vast majority to understand and empathize the silent suffering of Chronic Pain patients.

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Q- quanta of sound

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Abstract

There are great similarities between the behavior of electromagnetic wave phenomena and phenomena in the acoustic domain, and those correspondences inspired the work "Q" (quanta of sounds). The interactive installation takes as its point of origin of the electricity distributed in the spectrum of audible sounds generated by the instrument (in this case the voice of audience captured by microphones), treating it and returning it with profound deviations in time and space. The energy distribution in the spectrum of the acoustic sound is its own identity, its character, a kind of genetic code or fingerprint that makes the event unique and unrepeatable. The patch configured with the software MAX / MSP is responsible for analysing the energy distribution (energy of sound) by dividing the spectrum in typical critical bands that are also the one with which works the basilar membrane, located in the cochlea. The energy (of the original sound) captured in the 25 critical bands will be analysed and then returned in time in small packets (quanta) no longer in a synchronized manner but with appropriate time intervals that make more distinct and perceptible their presence, opening like a ray of light refracted by a prism.

Q

Similarly, the original sound source (where the microphones/people's voice are located) will no longer be the location (not the only one) of the "quanta of energy" which will instead be projected in the surrounding acoustic space in every direction. Thanks to this irradiation in time and space, the energy (of the original captured sound) contained in the acoustic spectrum will be perceivable in a direct way in its essential components. As anticipated, the energy distribution in the spectrum of the acoustic sound is its identity while the quantization process and irradiation of the acoustic energy in different time and directions provide an opportunity for exploration of the sound generated by people's voices and this process will highlighting new variations of that identity of the sound, normally trapped in the structure of the sound itself. The release of the energy within the sound and its expression through this alchemical process put in place by the new dimensions of space and time, define a new identity or better yet a different way of reading what is happening. Element we are aware that will emerge during the design and the realisation of the process:

- To involve the audience profoundly in an experience that is both active and passive (people are performers and audience at the same time) Accordingly, our efforts will be mainly directed to: Stimulate interaction through an immersive and multimedia environment

Structure and description of the installation

This installation is a project that translates data from the acoustic domain analysing the sound energy distribution in 25 critical bands and return that energy with different locations, strength, and different time. I this installation the translation of the original sound energy is also used for matter manipulation. These data are captured from people's voices through microphones. The sound energy captured is analysed from the Max Msp Patch and the parameters of the sound are returned accordingly to the 25 critical bands filter. The interactive installation
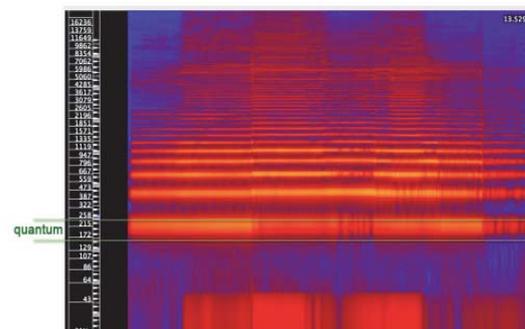
involves two different settings in the same room:

A: The microphones in the metallic sculpture, that are used to capture the original sound energy from the audience

B: a tank of water in which people can see matter manipulation.

The main features of **A setting (INPUT) are**:

1. Possibility for audience to chose to become the performer/trigger of the installation
2. Tactile element, it is possible to alter and manipulate the shape of the sculpture in order to drive people to a more complete and corporeal involvement with the installation.

The main features of **B setting (OUTPUT) are**:

1. Letting people see how the translation and delivery of quanta from the original sound energy will affect matter (water and its stationary waves).

FAUX PAS

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Abstract

Over recent years' mobile communication technologies have enabled capitalist networking algorithms to quietly penetrate our daily lives, becoming an integral component in the shaping of our identity. We no longer have sole agency over the presentation of self, as our everyday cycles of impression are laminated together to form a synchronized sphere of monetized data. Where total public transparency has become the default setting, and privacy glass is an alternative 'tickable' option.

Faux pas is an always-on intervention to contaminate the oil of the personal information economy with a foreign body of de-monetized labour. The live performance openly submits my personal sphere of 'life - my quantification, my autobiography and my social media persona - to be publicly curated, socially edited and playfully embodied by others to collectively transmit a faux performance of self.

Fig 1. *Faux pas*, 2014, Lee Nutbean, photograph, ©Lee Nutbean. (Used with permission.)

Nudging Transparency

We are sleep walking into a transparent society of authenticated self-monitoring. Where the concept of self-tracking is pushed to be taken up voluntarily as a response to external encouragement, rather than as a wholly self-generated and private initiative. Self-tracking rationales and sites are proliferating as part of a 'function creep' of the technology and ethos of reflexive self-monitoring. The personal informatics derived from life logging are used by actors, agencies and organizations and go beyond the personal and privatized realm [1]. Self-tracking fosters a decontextualized blurring of common privacy boundaries by collapsing social contexts. This causes personal information that was formerly confined to and aimed at a particular social context or relationship to transgress its usual borders [2]. In some contexts people are encouraged, 'nudged', obliged or coerced into using digital devices to produce personal data to be used by others. Nudging influences agents' processes of preference (and, hence, identity) formation by the partial outsourcing of self-government. Under the allure of 'excessive convenience' we are systematically discouraged from shaping our will and agency over active choice. This prevents us from engaging in the existential (if effortful) task of self-constitution that is at the heart of the very process of identity formation [3].

Faux pas-formance

Faux pas breaks the dichotomy of transmitter-receiver and performer-audience by the dissolution of pre-defined dualities. My primary online identity is suppressed and possessed by an infinite array dissociated personalities, who dynamically re-define their roles to achieve a live state of my cohabitants. The faux performance of distinct personalities collectively adheres to current trends of identity authentication, and embrace the nudges of encouragement from external devices by providing a real-time feed of de-monetized labour.

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Touchology: Exploration of Empathetic Touch Interaction with Plants for Well-being

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Figure 1. Touchology Projects: *Flora Touch* (a and b), *Grass* (c and d)

Abstract

This paper presents *Touchology*, a series of interactive plants that explore serenity and emotional attachment through meditative touch of plants with interactive audio-visualizations. Gardening is seen to improve mindfulness, memory and cognitive abilities. Those who are unable to benefit from this activity, such as the mentally and physically disabled, are less prone to be exposed to this leisure. Our approach focuses on creating various audio-visualizations for tactile interactions with living plants to enhance relationships because the plants and users while evoking their empathy. Due to simple technical setups, the projects presented here can be placed anywhere at the ease of the user. Pilot studies with target populations indicate that calming tangible interaction with plants can evoke mindfulness in a similar way to gardening related experiences.

Touchology

Touchology investigates how touch-sensitive interactive plants can evoke an emotional attachment with the user and how the relationship affects their quality of life. Since *Touchology* used real plants as well as a designed plant, we carefully chose plants based on scientific evidences and aesthetic qualities. We aim for the level of touch to be not only beneficial to humans as it generates soothing feelings but also to plants as it generates the plant's defense system to be more alert to foreign pathogens. Researchers found that gently rubbing leaves or caress plants between the thumb and forefinger can trigger plant defense system and can gradually become more resistant to various pathogens. [1]. *Flora Touch* and *Grass* utilize different sensing techniques and produce different aesthetic qualities of visual and sound components. Since *Touchology* projects keep all the necessary components in a small container, this can be maintained and placed anywhere at the ease of the user and extend his/her experience with nature in a unique way.

To better understand what kinds of interactive effects, through touching a plant, especially appeal to the target population, we conducted preliminary studies young children with autism and older adults living in nursing homes. The studies showed that our interactive plants had potential to create healthy interactions, encouraging children with autism and older adults in an assisted living facility through audio-visualizations with tactile exploration. The desired reaction of calmness and feeling at ease was mostly seen in the elderly. For autistic kids, *Touchology* can be used as an education tool for gardening and allow them to be familiar with plants in a therapeutic way. Repetitive use of the plant will soon overcome any sensitivity over the material.

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Structural Montage for Immersive Cinema – an Experiment in Transposing Fulldome to VR

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Abstract

For the experiment presented here, we have transposed an immersive film that was designed using the structural montage approach, a film for large-scale, public viewing in a fulldome planetarium theater, into a personal viewing sphere on a virtual reality headset. The goal was to test the technical constraints and perceptual conditions that arise in the VR format for an existing fulldome film. How do the reduced resolution in both the image and audio components affect the immersive experience? How does the reduced angle of view and fixed screen distance change the perception of the film? The poster includes workflows for image transposition from a fulldome, "fisheye" master to a equirectangular, "lat-long" format suitable for headmounted display and the conversion of a pre-mixed, 5.1 surround soundtrack to a binaural stereo mix.

Structural Montage

Structural montage explores the concept of montage, the process of selecting, editing, and piecing together separate elements in the visual arts, poetry, and literature, but especially in the forms of cine-installation and immersive cinema. Our notion of structural montage addresses the basic principles of cinematic montage in relation to a three-dimensional, architectonic or virtual screen as a spatio-temporal experience. Immersive cinema affords an expansion of the signification structure of a film from a contained image plane outwards into a boundless projection space. The narrative can unfold based on the viewer's own, directed attention, engaging the body and memory in the act of watching the film. The expansion of the cinematic event into an immersive field of spatial simultaneity and ambiguous sequentiality facilitates the creation of a non-linear and poetic, embodied experience.

Immersive cinema is a frameless cinema experience that can extend from the hemispherical projections of Omnimax and planetarium fulldome theaters to the spherical image space of virtual reality. In each of these formats, viewers experience a motion picture space that occupies their entire visual and acoustic perceptual field. Expanding on single-screen editing techniques, structural montage develops a rhythmic, associative montage for immersive formats within the plane of the image. It emphasizes a spatialized structure of elements over linear temporality as the axis of composition. The immersive film *Moonwalk*[1] exemplifies the structural montage approach. An experimental film about the Moon, *Moonwalk* was designed for planetarium projection. In the film, images of the Moon fully occupy the round volume of the dome's hemispherical shape. Form and content intertwine.

In *Moonwalk*, time-based cells are distributed in a dynamic collage around the screen, taking advantage of the vastness of the dome's apparent image space to engage the entire body in viewing. Cells are displayed simultaneously as well as sequentially in time and surround the viewer on all sides. Spatialized sound and peripheral vision help guide the eyes around the dome.

Fig 1. *Moonwalk*, 2010, Clea T. Waite fulldome digital video, ©tw 2010.

Fulldome and virtual reality cinema experiences become significantly more immersive when sound is used to support and intensify the overall spatial impression of the event. For our VR experiment, we created a three-dimensional, binaural, headphone remix from *Moonwalk's* finished 5.1 surround audio soundtrack, the standard for fulldome theaters, to complement the VR image. For ISEA 2016, we present our results in transposing sound and image of the fulldome film *Moonwalk*, designed for large-scale and public viewing, into a personal viewing sphere on a virtual reality headset, *Moonwalk_VR*[2].

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