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Young, Michael (2014) Piano_prosthesis. [Audio]

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Sound and Video Anthology: Program Notes

Media Compositions and Performances: Doug Van Nort, Curator

Curator's Note

It is with great pleasure that I have curated *Computer Music Journal's* 2014 Sound and Video Anthology. I decided upon a theme of distributed agency in digitally mediated performance. In particular, my interest here is to showcase a multiplicity of ways in which shared agency manifests between human performers, as well as between human and machine performers. The collection begins with "Part A: Distributed Composition"; this section presents audio/video documents that highlight five unique approaches to distributing and sharing expressive voices between composer-performers. In these works, the resulting compositional voice does not reside in one central location, but rather is a product of collective co-creation, at varying levels of spatial and temporal remove. This set includes a work by Chris Chafe and colleagues, wherein large-scale compositional qualities are influenced by global sea levels as well as by a live audience, resulting in a piece that is not only artful but consciousness-raising at the same time. In contrast to this "outsourcing" of the details of compositional form, the works by Pedro Rebelo and The Hub both present two very different takes on "network music": Rebelo's work defines a global feedback network whose sonic character and overall shape are the product of a large-scale interconnection of disparate acoustic spaces and performers, whereas The Hub—the fathers of "computer network music"—present us with a canonical example of their ever-groundbreaking approach to composing for shared, living network structures. The piece

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by CLOrk (the Concordia Laptop Orchestra) eschews the classically calculated and precise world of the laptop orchestra in favor of the messy and risky world of interdisciplinary improvisation. The result is a work whose shared agency is a product of listening for gestural engagement across forms (kinetic, sonic). Finally, Bill Hsu and Chris Burns present a piece that intersects this world of cross-media improvisation with shared control at the level of their interactive performance systems, resulting in a document that demonstrates the possible richness discovered when sharing gestures across media, between human performers, and with the system itself.

This sharing of system-level gestural and compositional forms is the focus of "Part B: Musical Metacreation." This section highlights cutting-edge machine improvisation systems in performance with two top-level human improvisers: Paul Hession on drums and Finn Peters on flute and saxophone. Hearing these disparate systems at play with the same performer begins to hint at the stylistic differences of their composer-designers, as well as the virtuosic flexibility of the human players. In order to bring focus towards listening to these differences, I have decided that this section should be audio-only. Each of these excerpts comes from a single concert of the same name that took place at Cafe OTO in London in July 2014. The curation of this concert was the work of Ollie Bown, and so the excellent selection of the included systems is purely to his credit. Aside from being privileged to take part in the concert, from a curatorial point of view I simply had the good sense to incorporate these works into the in-progress curation of this collection, both because they fit so nicely with my chosen theme and because I could feel the strong improvisational musicianship on the evening of performance. I will leave the description of each system

and piece for the program notes; taken as a whole, I feel that these works create an excellent counterpoint to Part A by virtue of their cohesion as well as a concentrated focus on both stylistic engagement and sonic gestural forms (as compared with the expansive and organic crossing of media and expressive types found within the first set). As a collection, I hope that you will find the diversity and quality of these works as compelling as I have, and that they might provide for a moment to reflect on the creative insights that may be gained when one "loosens the reins" on one's own artistic control, instead distributing it among a collective of listening and expressing performers, be they present or tele-present, musical beings or meta-musical machines.

Part A – Distributed Composition

1. *Polartide*—Chris Chafe

Polartide started as a project for the 2013 Venice Biennale Maldives Pavilion. A team of musicians and artists banded together at UC Berkeley's Center for New Media (bcnm.berkeley.edu) to create a sound marker that tracks sea water levels in coastal cities. A sound marker is an alarm of sorts that sounds out to all members of a community within earshot of a bell tower. The first version worked with simulated bells, and this version, *Spillover*, works with a live audience and a carillonneur.

The carillonneur plays a fixed score that is a "musification" of global sea-level data. The audience, using the *Spillover* Web app, controls the speed or tempo at which the carillonneur plays the score. The audience controls how fast the music plays from note to note, and metaphorically explores how our actions affect the rise of global sea water.

The *Polartide* team includes:

Chris Chafe, Composer, Stanford University Center for Computer Research in Music and Acoustics (CCRMA)

Rama Gottfried, Musician, Berkeley Center for New Media

Perrin Meyer, Sound Designer, Meyer Sound

Tiffany Ng, Musician, Berkeley Center for New Media

Greg Niemeyer, Artist, Berkeley Center for New Media

The *Polartide* team would like to thank the following people for their support: Monica Lam, June Holtz, Sharon Eberhart, and The Open Source Community.

Chris Chafe is a composer, improviser, and cellist, developing much of his music alongside computer-based research. He is Director of Stanford University's Center for Computer Research in Music and Acoustics (CCRMA). At IRCAM (Paris) and The Banff Centre (Alberta), he pursued methods for digital synthesis, music performance, and real-time Internet collaboration. CCRMA's SoundWIRE project involves live concertizing with musicians the world over. Online collaboration software including JackTrip and research into latency factors continue to evolve. An active performer both on the net and physically present, his music reaches audiences in dozens of countries and sometimes at novel venues. A simultaneous five-country concert was hosted at the United Nations in 2009. Chafe's works are available from Centaur Records and various online media. Gallery and museum music installations are into their second decade with "musifications" resulting from collaborations with artists, scientists, and MDs. Recent work includes the Brain Stethoscope project, *Polartide* for the 2013 Venice Biennale, *Tomato Quintet* for the transLife:media Festival at the National Art Museum of China, and *Sun Shot* played by the horns of

large ships in the port of St. John's, Newfoundland.

2. *Netrooms: The Long Feedback*—Pedro Rebelo

Netrooms: The Long Feedback is a participative network piece which invites the public to contribute to an extended feedback loop and delay line across the Internet. The work explores the juxtaposition of multiple spaces as the acoustic, social, and personal environment becomes permanently networked. The performance consists of live manipulation of multiple real-time streams from different locations that receive a common sound source. *Netrooms* celebrates the private acoustic environment as defined by the space between one audio input (microphone) and output (loudspeaker). The performance of the piece consists of live-mixing a feedback loop with the signals from each stream.

Visuals by Rob King.

Pedro Rebelo is a composer, sound artist, and performer working primarily in chamber music, improvisation, and sound installation. In 2002, he was awarded a PhD by the University of Edinburgh, where he conducted research in both music and architecture.

His music has been presented in venues such as the Melbourne Recital Hall, National Concert Hall Dublin, Queen Elizabeth Hall, Ars Electronica, and Casa da Música, and at events such as Weimarer Frühjahrstage für zeitgenössische Musik, Wien Modern Festival, Cynetart, and Música Viva. His work as a pianist and improviser has been released by Creative Source Recordings, and he has collaborated with musicians such as Chris Brown, Mark Applebaum, Carlos Zingaro, Evan Parker, and Pauline Oliveros. Pedro has recently led participatory

projects involving communities in Belfast and *favelas* in Maré, Rio de Janeiro. This work has resulted in sound art exhibitions at venues such as the Metropolitan Arts Centre in Belfast, Espaço Ecco in Brasília, and Parque Lage and Museu da Maré in Rio de Janeiro.

His writings reflect his approach to design and creative practice in a wider understanding of contemporary culture and emerging technologies. Pedro has been Visiting Professor at Stanford University (2007) and senior visiting professor at Universidade Federal do Rio de Janeiro, Brazil (2014). He has been Music Chair for international conferences such as ICMC 2008, SMC 2009, and ISMIR 2012. At Queen's University Belfast, he has held posts as Director of Education and Acting Head of School in the School of Music and Sonic Arts and is currently Director of Research for the School of Creative Arts, including the Sonic Arts Research Centre. In 2012 he was appointed Professor at Queen's and awarded the Northern Bank's "Building Tomorrow's Belfast" prize.

3. *Multiple Issues*—The Hub

Multiple Issues is a composite video constructed of legacy video shots from video footage that Hub member Scot Gresham-Lancaster made onstage during various American and European performances over the last 25 years. The soundtrack—made from Hub pieces such as "WaxLips", "Stuck Note", etc.—drives the jump shot editing decided algorithmically with the Movie.Py python program set to trigger at various auditory thresholds. This editing technique reflects the egalitarian and cooperative nature of all Hub collaborations.

The Hub, an American "computer network music" ensemble formed in

1986, consists of John Bischoff, Tim Perkis, Chris Brown, Scot Gresham-Lancaster, Mark Trayle, and Phil Stone. The Hub was the first live computer music band whose members are all designers and builders of their own hardware and software instruments.

The Hub grew from the League of Automatic Music Composers: John Bischoff, Tim Perkis, Jim Horton, and Rich Gold. Perkis and Bischoff modified their equipment for a performance at The Network Muse Festival in 1986 at The Lab in San Francisco. Instead of creating an ad hoc wired connection of computer interaction, they decided to use a hub—a general-purpose connection for network data. This was less failure-prone and enabled greater collaborations. The Hub was the first band to do a telematic performance, which took place in 1987 between the Clocktower and Experimental Intermedia venues in New York.

Because this work represents some of the earliest work in the context of the new live music practice of networked music performance, they have been cited as the archetypal network ensemble in computer music. The Hub's best-known piece, "Stuck Note" by Scot Gresham-Lancaster, has been covered by a number of network music bands, including the Milwaukee Laptop Orchestra (MiLO) and the Birmingham Laptop Ensemble (BiLE). They have collaborated with the Rova Saxophone Quartet, Nic Collins, Phil Niblock, and Alvin Curran. They currently perform around the world after a seven-year hiatus that ended in 2004.

4. *Dancing with Laptops*—CLOrk

Dancing with Laptops is an improvisatory collaboration between

Concordia Laptop Orchestra (CLOrk) and the dance group Le Collab'Art de Steph B. Twenty laptopists and three dancers improvised freely without prescribed compositional or technological restrictions and without an assigned leader. This performance was a first in a series of interdisciplinary, non-hierarchical improvised performances designed to develop listening, dialogical, and performative skills in collaborative settings, which are typically democratic in the synchronous (performances) and the asynchronous (planning, realizing, researching) time frames. After two *Dancing with Laptops* rehearsals, CLOrk members decided to improvise in response to (rather than leading) the dancers. Though arguably a hierarchical entrance strategy, it proved to be effective in generating a conversational setting in which all participants had opportunities to lead or respond to others.

The **Concordia Laptop Orchestra (CLOrk)** is an ensemble of 20–25 laptop performers that operates in the framework of a university course for electroacoustic music majors at Concordia University in Montreal. It was established by Eldad Tsabary in 2011 with a curriculum built around highly participatory planning, production, and realization of interdisciplinary and networked laptop orchestra performances, including collaborations with a symphonic orchestra, jazz and chamber ensembles, other laptop orchestras, dancers, VJs, actors, and various soloists. CLOrk performances are typically used as opportunities to investigate and explore new aesthetic, performative, conceptual, technological, social, and educational possibilities. Every performance serves as a research-creation platform for advancing the practice of digital music performance and our understanding thereof.

5. *Xenoglossia/Leishmania*—Bill Hsu (interactive animation), Christopher Burns (live electronics)

Xenoglossia/Leishmania is a structured audiovisual improvisation, utilizing live electronics and interactive animations. Video is projected on stage, above and behind the musicians. The musical and visual performances are highly interdependent, guided together through the actions of the performers, automated real-time analysis of the audio, and the exchange of networked messages between the audio and animation systems.

The *Xenoglossia* audio software facilitates high-level control of complex polyphonic output. The performer initiates multiple simultaneous generative processes, each with distinct gestural and textural content, then controls their continuation and development. The software provides the ability to alter and reshape the ongoing processes along dimensions including pitch, rhythm, timbre, and rate of evolution. The performer can also clone and reproduce the behavior of interesting sonorities and textures, and shape the large-scale form of the performance using tools that generate contrast, variation, and synchronization between processes.

Leishmania is an interactive animation environment that visually resembles colonies of single-cell organisms in a fluid substrate. Each cell-like component has hidden initial connections to and relationships with other components in the environment. The colonies evolve and "swim" through the substrate, based on a combination of colonial structure and inter-relationships and flows in the fluid substrate that might be initiated by gestural input. Protean, organic-looking shapes emerge and evolve in the system in a highly

unpredictable manner; the colonies alternately congeal into relatively well-defined forms, or disperse into chaos. The system resembles an abstract painting environment; a gestural interface sets the fluid substrate in motion and influences the behavior of the colonies of cell-like components.

These two systems communicate with one another in a variety of ways. The animation is influenced by the real-time analysis of audio from *Xenoglossia*. High-level tempo, spectral, and other features are extracted and sent via Open Sound Control to the animation environment. Simple and overly obvious mappings of sound to visual parameters are avoided, but, as can be observed in the video clips provided later, the audio clearly affects the overall coherence and behavioral trends of the colonies.

The systems also exchange messages over a network interface. *Xenoglossia* conveys information about phrase-level timing and formal evolution to the animation environment. In turn, *Leishmania* sends visual descriptors regarding the density and position of cell clusters to *Xenoglossia*, influencing the rhythmic density, sonic character, and the coordination of audio layers. The result is a closed loop of high-level descriptive information between the two systems. Hence, we are improvising with our respective generative systems; in addition, each system monitors and is influenced by the behavior of the other.

Bill Hsu works with electronics and real-time animation systems. He is interested in complex generative systems, inspired by natural processes, that interact with live performers. He has built systems, tools, installations and compositions in collaboration with Peter van Bergen, Chris Burns, John Butcher, James Fei,

Matt Heckert, Lynn Hershman, Paula Levine, Jeremy Mende, and Gino Robair. He has recently performed and presented work at the Blurred Edges Festival 2014 (Hamburg), Zero One Garage (San Jose), Yerba Buena Center for the Arts (San Francisco), San Francisco Electronic Music Festival 2013, ACM Creativity and Cognition 2013 (Sydney), and NIME 2013 (Daejeon and Seoul). He teaches and does research in the Department of Computer Science at San Francisco State University.

Christopher Burns is a composer and improviser developing innovative approaches to musical architecture. His work emphasizes trajectory, layering and intercutting a variety of audible processes to create intricate forms. The experience of density is also crucial to his music: His compositions, which often incorporate materials that pass by too quickly to be grasped in their entirety, present complex braids of simultaneous lines and textures. Several recent projects incorporate animation, choreography, and motion capture, integrating performance, sound, and visuals into a unified experience.

Burns' work as a music technology researcher shapes his work in both instrumental chamber music and electroacoustic sound. He writes improvisation software incorporating a variety of unusual user interfaces for musical performance and exploring the application and control of feedback for complex and unpredictable sonic behavior. In the instrumental domain, he uses algorithmic procedures to create distinctive pitch and rhythmic structures and elaborate them through time. Burns is also an avid archaeologist of electroacoustic music, creating and performing new digital realizations of music by Cage, Ligeti, Lucier, Stockhausen, and others.

His recording of Luigi Nono's *La Lontananza Nostalgica Utopica Futura* with violinist Miranda Cuckson was named a "Best Classical Recording of 2012" by *The New York Times*.

A committed educator, Burns teaches music composition and technology at the University of Wisconsin, Milwaukee. Previously, he served as the Technical Director of the Center for Computer Research in Music and Acoustics (CCRMA) at Stanford University, after completing a doctorate in composition there in 2003. He has studied composition with Brian Ferneyhough, Jonathan Harvey, Jonathan Berger, Michael Tenzer, and Jan Radzynski.

Burns is also active as a concert producer. He co-founded and produced the Strictly Ballroom contemporary music series at Stanford University from 2000 to 2004, and has contributed to the sfSound ensemble in the San Francisco Bay Area since 2003. Since 2006, he has served as the artistic director of the Unruly Music festival in Milwaukee.

Part B – Musical Metacreation

Curator's Note The "musical metacreation" concert event was recorded by Cafe OTO, and received funding from the Design Lab at the University of Sydney. It was further supported by NIME 2014 (Goldsmiths) as a satellite event, which fed into a musical metacreation workshop presented at NIME by Brown, Eigenfeldt, and Philippe Pasquier.

1. Paul Hession—drums, Isambard Khroustaliov—software

Being inside this cyclotron of atomized information from my

own vantage point produces a palpable sense of vertigo. A feeling that it could be anything in any order by anyone at any time for any reason. Everything pointing in all directions quaquaversally but arriving at no destination. And its effect is a cancellation of affect. A feeling like Baudrillard's screen stage of blank fascination has reached its terminal phase and all previous depths are collapsing into an endless vista of dazzling surface play.

—Eric Lumbleau of Mutant Sounds, quoted online at www.theawl.com/2012/11/the-rise-and-fall-of-obscure-music-blogs-a-roundtable. The piece employs a computer model of a penguin, some cellular automata, and analysis-driven concatenative synthesis to manifest and interrogate this *mal d'archive*.

2. The Indifference Engine versus Paul Hession (software by Arne Eigenfeldt)

My software is often built around the concept of negotiation, in which virtual musical agents attempt to come to some understanding in terms of what they want to achieve musically, and how they try to get there. This can be translated into the notion of desires and intentions. In this particular work, the virtual agents have to deal with a Paul Hession, who has his own desires and intentions, unknown to them. The agents must decide whether to try to follow the live performer, or continue with their own plans. To make things more complicated, each agent is given only a short "view" of the outside world (a quarter second, every two seconds) in order to form their individual beliefs of what

the performer is doing. Since these beliefs will often be contradictory, the agents end up spending a lot of time arguing, resulting in the occasional indifference to the live performer.

3. Paul Hession—drums, Doug Van Nort—FILTER system

This piece presents the Freely Improvising Learning and Transforming Evolutionary Recombination (FILTER) system, in an improvised duo with percussionist Paul Hession. The project explores themes such as sonic gestural understanding, stylistic tendencies, textural shifts and transformations of the lived episodic memory as it develops in the moment of performance. The work was born from a desire to reflect upon, and perhaps model, my own human performance practice with my Granular-feedback Expanded Instrument System (GREIS), wherein I often capture and transform the musical streams from other performers on the fly.

4. Zamyatin (software by Oliver Brown) with Finn Peters (sax)

Zamyatin is part of an ongoing study into software systems that act in performance contexts with autonomous qualities. The system comprises an audio analysis layer, an inner control system exhibiting a form of complex dynamical behavior, and a set of "composed" output modules that respond to the patterned output from the dynamical system. The inner system consists of a bespoke "Decision Tree" that is built to feed back on itself, maintaining both a responsive behavior to the outside world and a generative behavior, driven by its own internal activity. The system has been evolved using a database of

previous work by the performer, to find interesting degrees of interaction between this responsiveness and internal generativity. Its output is "sonified" through different output modules, mini generative algorithms composed by the author. Zamyatin's name derives from the Russian author whose dystopian vision included machines for systematic composition that removed the savagery of human performance from music. Did he ever imagine the computer music free-improv of the early 21st century?

5. Finn Peters—sax, Nick Collins—FinnSystem

This is the second outing for FinnSystem, a live musical agent originally born on 14 April 2012. The agent was educated on a corpus of Finn Peters' sax and flute playing. While Finn will have developed new techniques in the intervening two years, the system remains frozen on an earlier version of himself, so Finn will be encountering the agent at an interesting remove via a previous iteration of himself.

6. Finn Peters—sax, Shlomo Dubnov and Greg Surges—software

This work explores a novel type of interaction between a live musician and a computer that was pre-trained to improvise on a known, different piece of music. While each partner in the human-machine duo is free to improvise on its own materials, they both listen to each other, coming in and out of sync and creating a human-machine musical dialog in a dynamic and often unexpected mechanically driven plot. This piece is the next step in the development

of the Audio Oracle method that adds a “listening” component to the improvisation process. The Audio Oracle analyses repetitions in music and uses them to create variations in the same style. Moreover, during the improvisation, the computer tries to match its choice of improvisation materials to those of the live musician. From time to time, the computer also imitates the live musician by mirroring the ambiguity of his or her style, thus altering between sections of contrasting dialog and a machine-augmented “imitative” solo performance.

[This work is based on research on stylistic modeling carried out by Gerard Assayag and Shlomo Dubnov and on research on improvisation with the computer by G. Assayag, M. Chemillier, G. Bloch, and Arshia Cont (aka the OMax Brothers) in the Music Representations Group at l’Institut de Recherche et Coordination Acoustique/Musique (IRCAM).]

7. piano prosthesis—Michael Young

This is one of a developing series of duos for a human and a machine performer. Both “musicians” adapt to each other through mutual listening (i.e., via audio only) and response as the performance develops. The human’s improvisation is encoded by the computer through statistical analysis of extracted features and by cataloguing these in real time. Each observation made by the computer is assigned to a set of musical output behaviors. Recurring features of the player’s improvisation can then be recognized by the computer. The machine “expresses” this recognition by developing, and modifying, its own musical output, just as another player might.

8. Finn Peters/Paul Hession/the Matt Yee-King simulator

The Matthew Yee-King simulator attempts to model and reproduce the improvisational behavior of Matthew Yee-King. The performance begins with the real Matthew manipulating two sampling machines and a set of effects implemented in the Super-Collider environment, controlled via an Akai MPD24 MIDI controller. A probabilistic model of the sequence of control data he generates is built in real time. When Matthew is satisfied that he has demonstrated a range of interesting and appropriate control data patterns to the system, he flicks the system to “generate” mode and steps away. The model is then used to autonomously control the samplers and effects for the rest of the performance.

Part B Bios

Paul Hession (drums) was born in Leeds in 1956. He took up drumming at the age of 15 and since then has played and broadcast in many European and Scandinavian countries as well as Argentina, Mexico, Cuba, the USA, and Canada. He has played with many of the major figures on the free music scene, such as Peter Brötzmann, Derek Bailey, Evan Parker, Lol Coxhill, Sunny Murray, Marshall Allen, Frode Gjerstad, Peter Kowald, Joe McPhee, Borah Bergman, Otomo Yoshihide, and his old friends Alan Wilkinson, Simon Fell, Mick Beck, Hans-Peter Hiby, Petter Frost-Fadnes, and Rus Pearson. Collaborators from a different scene are Squarepusher and DJ/producer Paul Woolford. He is known to relish the interaction of collective music-making, but also responds to the challenge of solo performance.

Finn Peters (sax, flute) has worked with such pioneers as Frederick Rzewski, Bill Frisell, DJ Spinna, Sam Rivers, and Sa-Ra creative partners. He has been involved in upwards of 200 recordings for other artists, and has released a number of his own recordings. In the words of *Straight No Chaser* magazine, he is “the blazing definition of a seriously heavy player.” Awards and recognition include the London Young Jazz Musician Award, the BBC Jazz Awards Best Band, the Jerwood Rising Stars program, a nomination for the Paul Hamlyn Composition Award, and the Radio 1 Worldwide Awards “Best Session” category. Throughout 2010 Peters worked on a new electro-acoustic project entitled “Music of the Mind” which deals with brain waves in music and new forms of algorithmic composition and improvisation. The album was described by the *Independent* (London) as “nothing like you have ever heard before.”

Isambard Khroustaliov is the solo alias of electronic musician and composer Sam Britton from the groups Icarus, Fium Shaarrk, and Leverton Fox. Britton trained as an architect at the Architectural Association in London but took up music after securing a recording contract as an undergraduate. Since 1997 he has recorded and released music for a series of independent electronic music labels in the UK and the US (Output Recordings, Temporary Residence, Domino and The Leaf Label, among others) and performs internationally with his various groups, solo, and in collaboration with numerous improvising musicians and ensembles. In 2006 he completed a masters course in electronic music and composition at IRCAM in Paris and in 2011 worked with the London Sinfonietta as part of their Writing the Future commissioning scheme.

Arne Eigenfeldt is a composer of live electroacoustic music and a researcher into intelligent generative music systems. His music has been performed around the world, and his collaborations range from Persian *tar* masters to contemporary dance companies to musical robots. He has presented his research at conferences and festivals such as ICMC, SMC, ICCM, EMS, EvoMusArt, GECCO, and NIME. He teaches music technology at Simon Fraser University and is the co-director of the Metacreation Agent and Multi-Agent Systems (MAMAS) lab.

Doug Van Nort is a sonic artist and researcher whose work is concerned with the complex and embodied nature of listening, improvisation both with and by machines, and the phenomenology of time consciousness and of collective co-creation. His research takes the form of scholarly writings on these phenomena, composed and improvised electroacoustic music, pieces of sound-focused art, and digital artifacts designed and developed in these pursuits. Van Nort's work is a synthesis of his background in mathematics, media arts, music composition, and performance. Van Nort has recently joined the School of Arts, Media, Performance and Design at York University in Toronto, continuing his work in digitally mediated performance. He often performs solo as well as with a wide array of artists spanning musical styles and artistic media. Regular collaborators include Pauline Oliveros and Al Margolis, and he also works as a member of the Composers Inside Electronics. His music appears on several labels (e.g., Pogus, Deep Listening, Attenuation Circuit, and Zeromoon), and his writings on sound/performance/electroacoustics have been published by a number of outlets (e.g., *Organised Sound*,

Leonardo Music Journal, and *Journal of New Music Research*). See www.dvntsea.com.

Ollie Bown is a researcher, programmer, and electronic music maker. He creates and performs music as one half of the duo Icarus, and he performs regularly as a laptop improviser in electronic and electroacoustic ensembles. He has worked with musicians such as Tom Arthurs and Lothar Ohlmeier of the Not Applicable Artists, Brigid Burke, Adem Ilhan, Peter Hollo, and Adrian Lim-Klumpes. Bown has designed interactive sound for installation projects by Squidsoup and Robococo, at venues such as the Powerhouse Museum in Sydney, the Oslo Lux, the Vivid Festival, Sydney, and the Kinetica Art Fair, London. In his research role he was recently local co-chair of the 2013 International Conference on Computational Creativity and is on the organizing committee of the Musical Metacreation Workshop and events series.

Nick Collins is Reader in Composition at Durham University. His research interests include live computer music, musical artificial intelligence, and computational musicology, and he is a frequent international performer as composer-programmer-pianist, from algoraves to electronic chamber music. He co-edited *The Cambridge Companion to Electronic Music* (Cambridge University Press, 2007) and *The SuperCollider Book* (MIT Press, 2011), wrote the *Introduction to Computer Music* (Wiley 2009), and co-wrote *Electronic Music* (Cambridge University Press Introductions series, 2013). Sometimes, he writes in the third person about himself, but he is trying to give it up.

Shlomo Dubnov is a Professor in Music and Computer Science at the University of California, San Diego

(UCSD). His main research is on applying statistical and machine learning techniques to the modeling of music, stories, and entertainment media. His work on computational modeling of style and computer audition has led to development of several computer music programs for improvisation and machine understanding of music. Dubnov studied composition and computer science in Jerusalem and served as a researcher at IRCAM in Paris. He currently directs the Center for Research in Entertainment and Learning (CREL) at UCSD's Qualcomm Institute (Calit2) and serves as a lead editor in ACM Computers in Entertainment.

Greg Surges makes electronic music, software, and hardware. His work has been released on the various labels, and his research and music have been presented at multiple festivals and conferences. He is currently a PhD student at the University of California, San Diego. Previously, he earned a MM in Music Composition and a BFA in Music Composition and Technology at the University of Wisconsin, Milwaukee.

Michael Young is a composer and researcher currently based at Goldsmiths, University of London, and will soon take up the post of Pro-Vice Chancellor (Teaching and Learning) at De Montfort University. He is co-founder of the EPSRC-funded "Live Algorithms for Music" network 2004, which investigates autonomous systems for live music creation. He studied at the Universities of Oxford and Durham. The ".prosthesis" series has been developing since 2007 and includes versions for clarinet, trio, flute, oboe, and piano. Chris Redgate's latest CD release (*Electrifying Oboe*, Metier Records) includes two versions of "oboe.prosthesis." For more info and audio, visit www.michaelyoung.info.

Matthew Yee-King is a lecturer in creative computing at Goldsmiths College as well as a computer music composer, performer, and researcher. His work covers a range of styles, from the use of agent-based live improvisers to regular electronic music. Recent activities include chairing the workshops at the 2012 Supercollider Symposium, including a live algorithm hackathon, and extensive involvement in the Arts Council-funded Music of the Mind project alongside composer Finn Peters. He has been involved in significant public engagement activities, presenting his arts/science crossover projects at Science Festivals around the UK, as well as on national television and radio. He has performed live internationally and nationally as well as recording many sessions for BBC Radio. In the past his solo music has been released on electronic music imprints such as Warp Record James' Rephlex Records. Past collaborators include Jamie Lidell, Tom Jenkinson (Squarepusher), Finn Peters, and Max de Wardener.

Supplementary Audio/Video Examples for Articles from CMJ 38:4

1. An Intuitive Synthesizer of Continuous Interaction Sounds: Rubbing, Scratching, and Rolling—Simon Conan, Etienne Thoret, Mitsuko Aramaki, Olivier Derrien, Charles Gondre, Richard Kronland-Martinnet, and Sølvi Ystad

In this video, an intuitive synthesizer for rubbing, scratching, and rolling interaction sounds is presented. This real-time synthesizer allows the user

to independently control the different types of interaction and to morph between them, and to control the properties of the object, such as shape and material and to morph between the material categories. In the first part of the video, the intuitive control of the properties of an impacted, resonant object is presented. In the second section, the intuitive control of the interaction part is demonstrated, by controlling the synthesizer with a graphical tablet.

2. Cellular Automata Histogram Mapping Synthesis—Jaime Serquera and Eduardo Reck Miranda

See the article's appendix for description of the provided examples.

3. Sound Synthesis of a Gaussian Quantum Particle in an Infinite Square—Rodrigo F. Cadiz and Javier Ramos

Audio Example 1

First 90 seconds of the spectrogram of the full revival time. The spectrum retakes its initial form towards the end of the revival time, as predicted by Equation 29, and exhibits a mirror revival at half the revival time, as predicted by Equation 31. (Please refer to Figures 7 and 8.)

Audio Example 2

Spectrogram of a single bounce. The slopes of the frequency bands change according to the direction of the wavepacket. When a bounce occurs, approximately at time $t = 7$, a change in slope happens. (Please refer to Figure 9.)

Audio Example 3

Spectrogram for a linear increase in α from 1.7 to 400. The initial frequency band gets narrower around the value associated with p_0 , in this case approximately 3200 Hz. (Please refer to Figure 10.)

Audio Example 4

Spectrogram for a linear increase in the mass from 2 to 2.06. The phase bands get further apart in frequency as the wave packet's group velocity diminishes. (Please refer to Figure 11.)

Audio Example 5

Spectrogram for a linear increase in the initial momentum from -0.2 to 0.43 . The frequency band around p moves along with it, from a center frequency of 70 Hz in the case $p = -0.2$ to 3,500 Hz when $p = 0.43$. (Please refer to Figure 12.)

Audio Example 6

Spectrogram for a linear increase in the length of the well in steps of 600, 700, and 800, at times $t = 0$, $t = 2$, and $t = 4$. The frequency band gets narrower and moves towards the lower frequencies. As changing the length of the well implies a full recalculation of the quantum particle's dynamics, audible clicks appear in the sound signal when the length is changed in real time. (Please refer to Figure 13.)

Audio Example 7

Spectrum for linear increase of N from 0 to 60. The cutoff frequency depends directly on N . Because N is an integer in this implementation, clicks

are produced when this parameter is changed continuously. (Please refer to Figure 14.)

Audio Example 8

Spectrum for change in the mass from 0 to 1 (at time $t = 2$) and back to 0

(at time $t = 13$). The ordering of the frequencies is affected when the mass is varied around small values. The behavior of the momentum distribution is chaotic when the mass is near zero, and it is very organized and similar to a sawtooth signal when the mass is near one. (Please refer to Figure 15.)

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Please see the article's appendix for description of the provided examples.