

# Newsletter

Winter 2015/16

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Digital Innovation Beacon

# First year students engineer a national design prize

Three University of Sunderland engineering students have landed themselves a podium position at a national design competition. Having already been named as the top young engineers in the North East regional heat of the IMechE (Institution of Mechanical Engineers) Design Challenge - Naji El-Ali, Vasile Ghidu and Alexandros El-Magkout (pictured) have now picked up Third Prize in the National Final of the competition, held at the organisation's headquarters in London in October 2015.

The Design Challenge brief, open to first year undergraduates from 20 UK universities, was to design and create a small device to carry an increasing load up a 2.5m vertical pipe and return in the quickest time, all within a tight budget of £20, and working to strict specifications.

As part of both competitions teams were required to give presentations and field questions from a panel of professional engineers. Posters were also displayed and once strict inspection was successfully completed the teams could enter into the competition.



The aim is to give students practical experience to complement their theoretical knowledge and give them an edge in the jobs market.

Alexandros El Magkout said he and his fellow teammates were thrilled with the win, adding: "The competition certainly challenged us; the first problem we faced was to keep the cost of the device under £20. One other difficulty was deciding the final design of the device and there was also the added pressure to make sure we finished the presentation, poster and the device itself on time.

"However, this competition showed us how to work as a team, which is really important in our industry. It also gave us

the opportunity to make the most of the physics and mathematics theory and apply this to a real-life working environment as well as learning how to work under pressure."

Vasile Ghidu said: "This amazing challenge helped me improve my teamwork skills as well helped me understand and apply what we've learned throughout the first year. Designing and creating a new device gives you an unforgettable feeling of pride and happiness because of what you have created as a future engineer."

Naji El-Ali added: "It was a pleasure to participate in such a competitive environment that gave me good background in how to deal with difficulties, deadlines and team working. I would recommend all the students to enrol in such activities because it will help you later in the near future, besides having a Life Changing Experience!"

Dave Knpton, Principal Lecturer and Engineering Team Leader, said: "The Sunderland students were a mix from Mechanical and Automotive Engineering and showed great determination and perseverance to balance the performance of their device while at the same time meeting the project constraints.

"Many lessons were learnt throughout the development work. One of the most valuable parts of the competition was seeing the camaraderie between students of competing teams to share ideas, tools and even spare parts!"

He added: "The Design Challenge provides an opportunity for students to work on a real project with simulated customer requirements and very real deadlines. Much of the theory and practical skills learnt during their studies was drawn upon to complete the task."

This was also the first time that the competition had been held in the North East. Cash prizes totalling £1,200, funded by the IMechE, were given out at the event in March for best poster, best presentation and winner of the race event.

## Great seal of approval for AMAP

AMAP (The Institute for Automotive and Manufacturing Advanced Practice) recently turned its advanced engineering equipment and skills to help Northumberland Archives create a replica of its 'Great Seal of the Realm'; a rare artefact that can't be displayed publicly because of its delicate nature.

When Northumberland Archives decided they wanted an exact replica of the Great Seal of Queen Elizabeth II and its attached parchment to go on public display, they asked Durham County Record Office for expert conservation assistance.

Durham's Archive Conservator concluded that the seal was potentially made of 'cella mold', an early plastic made of cellulose acetate. This plastic can become unstable in contact with certain chemicals which can trigger its auto degradation and unstoppable deterioration.



As traditional casting methods involve the application of various chemicals onto and near a seal, another method of replication had to be found. That's when Durham County Record Office turned to the advanced manufacturing experts at AMAP, which is part of the University of Sunderland, after hearing of their reverse engineering and rapid prototyping capabilities.

The Great Seal of the Realm is the chief seal of the Crown, used to show the monarch's approval of important State documents, in this case the document relates to the district of Castle Morpeth being given the status of a borough in 1974.

AMAP managing director Roger O'Brien said: "We're really proud of the outcome of this project, which used engineering techniques to solve a non-engineering challenge.

"The project appears simple, but in reality shows the power of modern advanced manufacturing processes when applied in unexpected ways. It was a great experience for the AMAP team; we were able to apply our state-of-the-art 3D scanning, reverse engineering and 3D rapid prototyping technology to replicate these historical artefacts for Durham County Record Office.

"The historic wax royal seal was scanned using the latest Faro v6 Scan Arm, then reverse engineered through Geomagic and Solidworks to create a finely detailed 3D model, which was then printed on a high precision 3D printer. Finally the conservator spray-painted the replica to colour match the original and attached braided ribbon."

County Archivist, Liz Bregazzi, commented: "We got in touch with AMAP at the University of Sunderland, who kindly agreed to work with us to produce a replica seal. The project has been an interesting and exciting one for all involved. Now the final task of colouring red the printed seal and producing a replica braid is complete I'm delighted to be able to receive it and for this very accurate replica – of what is an important artefact - to be accessible to the public to see and even handle."

Roger concluded: "We're very pleased with the impressive results and it's great to see the replica on display to the public. We were able to produce a highly precise and robust replica that can be displayed and handled, as well as being unaffected by pollution, so can be enjoyed by people for many years to come."

# Positive PR is needed to show there's nothing to fear from human-friendly AI

It's a question even the BBC has been asking: "How safe can artificial intelligence be?"

The broadcaster devoted large chunks of airtime recently on the subject of intelligent machines, with its science editor David Shukman declaring: "If Hollywood movies are your only guide to artificial intelligence, we face a terrifying future in which machines become so clever that they dominate or even destroy us."

So it is hardly surprising that the public is fearful when it comes to the subject.

Make no mistake about it: AI is getting an undeserved bad press. Its presentation and depiction in movies and on television is almost exclusively negative, dark and sinister. From the release of *2001: A Space Odyssey* in 1968, to the *Terminator* in 1984, *The Matrix* in 1999, and the recent TV hit *Humans* the message has been the same: super-intelligent machines pose a massive threat to us all.

At the heart of all these depictions is the unfounded belief that the human race is on the brink of being destroyed by its own creation of super-robots, capable of mimicking the human brain.

In fact, AI is not simply the creation of intelligent robots, but a term that describes a group of techniques and approaches in engineering and technology. And some of those techniques are already working quietly in the background, making our everyday lives better and easier, even though we may not realise it.

## Accentuate the positive

Making people fully aware of the benefits they already receive from AI is the kind of positive publicity that is needed. Those of us working in the field need to show the public how and why our research and work is so important. Informed debate can allay many of the unfounded fears that exist.

It should also be pointed out that we are many years away from having the technology to create anything that could rival the complexity of the human brain. It remains the most complicated and complex structure in the known universe. With it we process vast amounts of information and deal with multiple, complex problems simultaneously.

We have the ability to learn new things and retain old memories; we can solve problems, generate ideas and create amazing art, music and artefacts.

That's all very difficult to replicate with artificial systems. Currently, the creation of super-intelligent, self-thinking, human-like robots, remains possible only in sci-fi films. Science reality is that AI is working for us in a myriad of ways, with not a robot in sight. Embedded and invisible, phones, digital cameras and even washing machines already use some of the techniques that fall under the general description of AI.

Our smartphones are smart, in part, because of embedded AI in their software systems. The technology used to connect your mobile to the best available network when you are out and about is based partly on how ants in the natural world forage for food.

Ants set up a circuit of permanent pathways - much like the network of mobile phones towers - from which they search locally. They also create complex communication networks using trails of pheromones that can be detected by other ants.

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# Unnecessary fears

In fact a lot of new developments in AI are attempts to replicate systems from the natural world, where millions of years of evolution have resulted in systems that work well for particular problems or situations.

Human society is also developing all the time and we are now seeing the development of smart cities, intelligent transport networks and massive connectivity.

Again these smart or intelligent systems use different aspects of AI to help solve specific problems, usually with AI embedded in systems that are invisible to most of us. AI is helping doctors, engineers, scientists, bankers, and even weather forecasters to do their jobs better, and to create healthier, more prosperous societies. That's the story that isn't being told or portrayed in the media.

The key thing is that AI is aiding, not taking over from, humans. Be it AI in your digital camera or in your washing machine or microwave, it only works when you want it to. You switch it on or off - you are the master.

This takes us to the heart of another important issue, which needs to be carefully considered as we see AI techniques and approaches develop. It centres on a difficult but important ethical question that the television drama Humans helped highlight recently.

Most of the negative representations of AI revolve around computer systems, or robots that become conscious, meaning self-aware and acting independently of human control. There is a real question as to what conscious even means, but it asks us some very tricky questions when we look to the future.

For example, if I have created some intelligent software that learns and develops, and develops consciousness, but it only exists on my computers, if I switch off the machine have I killed it? And do I have the right to do so? Can conscious AI systems suffer?

These may seem to be just abstract, philosophical questions at the moment. However, as AI continues to develop over the decades they are questions that will become more relevant. It is only right that we start that debate now.

*Professor John MacIntyre, Dean of the Faculty of Applied Sciences  
and pro vice Chancellor of the University of Sunderland*

## In profile: PhD research student

**Collins Onyema**, PhD student, Department of Computing, Engineering and Technology, supervised by Dr Chris Bowerman and Stephen Swales

Collins studied for his BSc. in Electrical/Electronics Engineering at the University of Benin and completed his MSc. in Telecommunications Engineering at the University of Sunderland in 2015.



The motivation and idea for Collins' research topic was picked up from his experience while working with telecommunications firm Syscomptech which made him discover the lapse in Network security as regards intrusion traffic detection.

A honeypot is a computer system network that is designed to detect and analyse malicious traffic and intruders. A honeypot baits intruders and makes them think they have access to the real network while all of their actions in the honeypot are being analysed and studied to learn the weaknesses of the real network and improve security of the network based on the learnt details. Honeypot systems are generally of two phases which are to detect/separate intruders and malicious traffic from legitimate users and genuine traffic, then analysing the traffic to either find out what the intruder is after, or the source address of the intruder.

This research will be focusing on the malicious traffic detection aspect of the honeypot with a view to developing a new algorithm which will enable high intrusion detection accuracy with low false alarm rate in honeypot technologies which has been found to be a major problem to date.

## *North East University's £29K government grant to train army of cyber security experts*

With cyber security a top priority for UK Government and the challenge of keeping data safe from theft never far from the headlines, the issue of how to train the next generation of cyber security experts is being addressed by UK Universities. According to Government research (June 2015), the average cost of the most severe online security breaches for big business now starts at £1.46 million – up from £600,000 in 2014.

To improve cyber security teaching and learning the Higher Education Academy (HEA) has been working with the Department for Culture, Media and Sports (DCMS) to advise on the distribution of Development Fund grants of up to £80,000 to innovative proposals from higher education providers.

The University of Sunderland is one of the eight UK universities to be awarded a grant, receiving £29,000 for Problem Based Learning (PBL) in cyber security.

Professor Alastair Irons, Professor of Computer Science and HEA Development Fund Project lead for the University of Sunderland said: "We are delighted to be awarded the grant which will allow us to develop our innovative and radically different approach to teaching cyber security through problem based learning.

"We won for a number of reasons - our past experience in developing and evaluating PBL for cyber security teaching and learning, our desire to be innovative and our approach to including students in the learning process.

"The project will take the form of the development of a range of PBL teaching resources, student led workshops, staff development events and a PBL conference on cyber security. We will be working closely with government agencies, businesses and industry in addressing the cyber security skills gap. The legacy will be a set of resources, better cyber security learning experience for students and more highly skilled graduates who will be able to address the cyber security challenges in society."



The Problem Based Learning in cyber security project is a consortium of four universities led by the University of Sunderland; the other participating universities are Warwick, Christchurch at Canterbury and Gloucester.

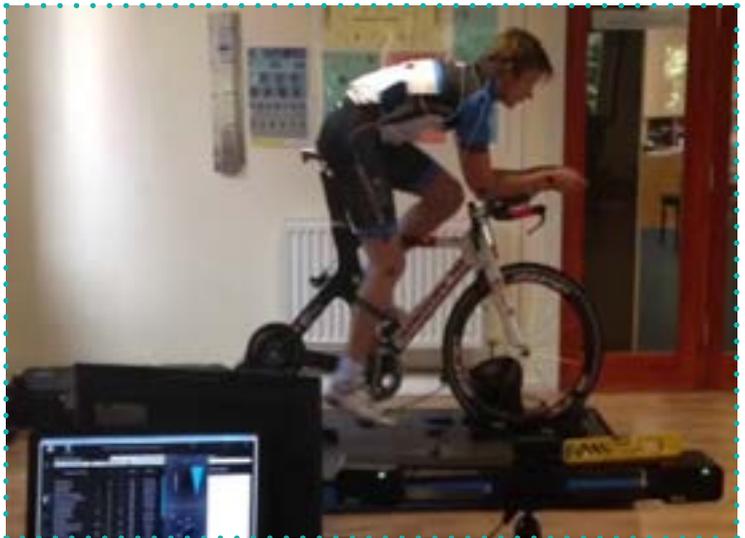
Professor Alastair Irons has research interests in the field of digital forensics, cybercrime and cybersecurity. He also focuses on student assessment and feedback, and has published books on feedback, learning, and teaching issues in computing. Alastair is currently Chair of the BCS Academic Accreditation Committee, serves on the BCS Academy Board and is Chair of the BCS Cybercrime Forensics Special Interest Group. Alastair is currently on the boards of DYNAMO and the North East Fraud Forum and is on the advisory board for Digital Leaders North East. Since 2013 Alastair has been a visiting scholar at the University of Cape Town in South Africa.

## A software solution for the analysis of asymmetry in cyclists using optical motion capture technology

A Digital Innovation Beacon-funded research project is underway to investigate the use of motion capture technology for the analysis of asymmetry in cyclists.

Faculty of Applied Sciences staff Liz Gandy and Sheila Garfield from Computing, Engineering and Technology; Ken McGarry from Pharmacy, Health and Well-being; and Bob Hogg from Sport and Exercise Sciences are working on this project with external collaborators from two physiotherapy clinics: John Dennis and Phil Smith from Physiohäus, Newcastle; and Tim Pigott from HP3, Manchester.

The aim of the project is to develop a software solution to extend the functionality of the Retül Vantage 3D Motion Capture System™ bike fit system, which reports an individual cyclist's cycling position, to carry out statistical analysis on data gathered for multiple cyclists. The software will be used to evaluate the effectiveness of the technology for investigation of asymmetry in a large sample of cyclists.



Cycling is the fourth most common adult sporting and recreational activity in Britain, with 43% of the UK population having access to a bike (CTC Survey, 2011). The health benefits of cycling are widely reported and include reducing the risk of coronary heart disease, stroke, cancer, obesity and type 2 diabetes, in addition to helping keep the musculoskeletal system healthy and promoting mental wellbeing. Despite the health benefits, cycling comes with risk factors of its own, with the cycling position placing the upper body in an unnatural position, increasing the risk of pain and injury. Any asymmetries present may be an aggravating factor, exacerbated by fatigue with extended cycling duration. Despite a lack of scientific studies on lower back pain in cyclists, there is evidence that cycling position and bike setup are an important consideration but few cyclists, other than those in the elite sporting category, maintain an optimal position on the bike.

A range of techniques are employed for the assessment of bike fit and cycling position and, in recent years, systems have been developed which utilise both 2D and 3D optical motion capture technology. The Retül Vantage 3D Motion Capture System™ is an example of such technology. The cyclist is mounted on a stationary bike fixed to a turbo trainer and optical joint markers are attached to specific joint positions on the participant's body. As they cycle, motion data is recorded via a receiver which utilises technology similar to that of the Microsoft Kinect™.

Data for this project is being collected by the external collaborators during bike fit assessments carried out at the two physiotherapy clinics and retrospective permission has been obtained to include additional datasets captured prior to the start of the project. To-date, this has provided a sample of 58 cyclists.

Software has been developed to automate the extraction of biomechanical and joint angle data from the PDF reports generated by the Retül™ system and analyse it for the presence of asymmetry in 32 separate measures of joint angle, limb alignment, limb movement and anthropometrics. In addition to statistical analysis of correlations between asymmetry in the measurements for individual cyclists, comparison between multiple datasets has been incorporated. This enables the extent of asymmetry present across the sample of cyclists to be studied and to determine whether there is a bias towards a particular direction.

Preliminary results for the sample of 58 cyclists have revealed the presence of asymmetry in all 32 measures, with a third of the measures showing a bias towards one side of the body or the other. For 7 measures, a significant reduction in asymmetry is shown after adjustments to the fit of the bike.

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A larger sample size and additional analysis is necessary to determine whether these observations are representative of the cycling population so data collection is planned to continue into 2016.

The intended outcome of the project is for the results to be written up as a journal article to be submitted for publication. A Digital Innovation Beacon Seminar is also planned for 28th June 2016, when more details on the technology and further discussion of the results will be presented.

## *Out and About, presenting Digital Innovation Beacon research to the local community*

In October 2015, Liz Gandy, Senior Lecturer in the Department of Computing, Engineering and Technology and Stuart Dixon, Sciences Manager, were invited by Hartlepool Rotary Club to present their research on the use of 3D motion capture technology for the investigation of dynamic postural changes in horse riders. The Rotary Club members were from a variety of backgrounds so the challenge was to provide a session which would appeal to an audience with a wide range of technical and computing knowledge.

Following an informal chat over dinner, two studies were presented as examples of research carried out using inertial motion capture technology with horse riders to analyse hip rotation asymmetry and postural changes between different gaits. Liz and Stuart also gave a live demonstration of the Xsens™ motion capture suit, a 3D human kinematic, camera-less measurement system, with integrated small inertial motion sensors placed on the limbs. The system captures every twist and turn of the body, with data displayed as a 3D avatar on screen. Examples of its use include sports biomechanics, medical research and applications within the video game and film industries. A brave volunteer from the Rotary Club modelled the suit, much to the amusement of her companions.

Liz said "it was a lively and enjoyable evening as the audience were very engaged and enthusiastic. It was great to share our research within the University as part of the Beacon Research Seminar Series earlier in the year but it was very rewarding to have the opportunity to go out into the local community and speak to an entirely new audience."

Liz is currently undertaking a part-time PhD which she aims to complete in 2018. The project, entitled "Visualising inertial motion sensor data: the design and evaluation of a horse rider assessment interface", is funded by the Digital Innovation Beacon. She is a research active member of the Department of Computing, Engineering and Technology and is also working on a project to investigate asymmetry in cyclists which received funding from the Digital Innovation Beacon earlier in 2015. Liz hopes to achieve sufficient publications from her research to be returned in the 2020 Research Excellence Framework submission and that the work will result in the availability of software that will be of practical benefit to coaches, physiotherapists and athletes within sporting contexts.

*Pictured right: a brave volunteer gets suited up; bottom right - Stuart Dixon and Liz Gandy demo the tech.*





# Engineering experts meet to debate globally-unified approach to education

More than 200 engineering academics and industry experts from across the globe, including Dr David Baglee, Senior Lecturer in the Department of Computing, Engineering and Technology (pictured), descended on Geelong and the Surf Coast in December 2015 when Deakin University hosted the discipline's largest annual education conference.

The Australasian Association for Engineering Education 2015 conference (AAEE2015), focused on a globally unified approach to the future of engineering education, based on design and project-focused learning. The venue was well-placed to host the event, now in its 26th year, with the recent opening of the Centre for Design and Engineering Training (CADET), a world-leading facility that is home to a new approach to teaching.



Supported by funding from the Digital Innovation Beacon, David attended the conference as a keynote speaker to showcase how the University of Sunderland's Institute for Automotive Manufacturing and Advanced Practice (AMAP) is supporting local companies through solutions based on knowledge exchange between industry and academia.

The theme for the AAEE2015 conference was "Blended Design and Project Based Learning: a future for engineering education". The purpose of the conference was to invite the AAEE community to enter into a dialogue about the future of engineering education within design/project-based and blended learning.

Speaking about the event, David said "The AAEE 2015 conference allowed me to present the great work we do in engineering to academics and industry experts in Australasia. In addition I met with senior staff working for Australasian Association for Engineering Education and Engineers Australia, both working to promote engineering academic and industry education programmes. I was asked to join the Engineers for Australia and will present a key note talk at their next technical event in London 2016."

In addition, David was asked to join the editorial board of a new international journal and spoke to several universities including Deakin, Charles Darwin, Curtin and Melbourne about writing papers and potential opportunities for collaborative projects. The papers under development with Deakin and Curtin are based upon research projects supported by the University's Digital Innovation Beacon.

Professor Littlefair, Head of School of Engineering, Deakin University, said the conference was a key opportunity for academics and industry leaders in engineering to come together to debate the best ways to rise to the opportunities provided by current challenges facing the sector.

**Pictured: Deakin University's Centre for Advanced Design in Engineering Training (CADET)**



# Inaugural TNE research conference showcases benefits of collaboration

As featured in the Beacon's Summer 2015 newsletter, the inaugural collaborative research conference entitled 'Creating Futures Through Research: Meeting Challenges, Embracing Opportunities and Delivering Impact' was hosted by The INtel Institute of Higher Education and chaired by Emeritus Professor Helen Edwards on 6th and 7th Nov 2015 in Nairobi, Kenya. Dr Susan Jones, Principal Lecturer & Team Leader, Department of Computing, Engineering and Technology also attended the conference in her capacity as Centre Leader of INtel College.

Helen and Susan's attendance at the conference was made possible by funding from the Digital Innovation Research Beacon. Speaking of his support for the event, Professor Tony Alabaster, Chair of the Digital Innovation Beacon and Associate Dean, Applied Sciences, said: "A key goal of the Digital Innovation Beacon is to stimulate high quality research and innovation and I am delighted that our reach is extending off campus to such a highly valued collaborative partner."

The INtel Institute of Higher Education, first established in 1990, is a privately run university close to the centre of Nairobi, Kenya. Specialising in courses in business and computing, INtel has been a longstanding collaborative partner with the University of Sunderland since 2000, delivering undergraduate and postgraduate programmes in computing and business to students in Nairobi as part of its TNE provision.



Emeritus Professor Helen Edwards

The key goal of the conference was to extend and enhance the current collaborative TNE partnership with INtel, Nairobi by increasing research collaboration and by supporting INtel in its strategic long term goal to develop a culture of research and innovation in line with the Kenyan 2030 Vision for Higher Education. The conference provided an opportunity to build research capacity off campus for the Department of Computing, Engineering and Technology by establishing new research relationships, initiating new collaborative research activity which links the University of Sunderland, INtel College and other public universities in Nairobi. The conference also provided a platform from which to extend and develop research links as part of the broader TNE provision in the Faculty of Applied Sciences, a wholly untapped field for research endeavour.

The conference featured presentations from 12 speakers, including Emmanuel Awuor, Acting Deputy Vice Chancellor, Academic, Research and Extension, of the Management University of Africa, as well as lecturers and students from different institutions in Kenya. Dr Elisha Opiyo, Senior Lecturer, University of Nairobi, School of Computing and Informatics and part time lecturer at INtel, attended the event and said: "I enjoyed the presentations and expanded my networking. It provided a rich forum for learning and it was useful to me as I met at least two other lecturers and one Deputy Vice Chancellor from other Kenyan Universities. I would not have met these people without this forum. I am looking forward to similar events in the future. My students were delighted to take part and still talk about the opportunity they had to share their ideas through the presentations that they made and the opportunities they had for networking. A few of them who were at INtel for the first time expressed surprise at the large size of the College."

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INtel College underwent major renovation in 2015 as part of its strategic focus to become a research active provider of high quality higher education in Nairobi and the conference was the first significant event to take place in the College's newly built conference facility. The facility now features an additional four teaching rooms, conference space and a roof-top learning and recreation space.

The conference was a huge success, attended by more than sixty senior academics and business leaders in Nairobi, including the Chief Executive of the Commission for Higher Education. Chris Marshall, Associate Dean, (International Development), University of Sunderland said: "The recent successful research conference hosted by INtel College marks a major landmark in the development of the INtel College and University of Sunderland transnational partnership in Nairobi, Kenya. The conference coincided with the opening of the major new management development and research centre at INtel College. The centre is designed to offer leading edge higher education and executive development from its new third floor development suite showcasing the highest quality in conferencing facilities allowing corporate and university higher education programmes to come together in a seamless way. INtel Principal Anita Aggarwal's vision to take higher education and executive programmes to the next level fits exactly with the University strategy to combine the development of the next generation of business leaders and entrepreneurs in Nairobi. The new campus reflecting a fusion of UK education values and Africa business enterprise, marks a major new opportunity for the Nairobi business community. This will be the start of a number of high level business events already in the planning for 2016 extending the collaboration between the University and INtel. I wish it all the success it deserves."



By fostering collaborative research activity, it is hoped that events such as the conference will impact directly upon the student experience by enriching collaborative relationships, initiating and consolidating new research networks with an overseas partner in the context of TNE provision, strengthening relationships, creating opportunities for further research collaboration and serving as an example to encourage similar relationships with other existing TNE partners.

## DI Beacon Research Seminar Series 15/16

As part of the Beacon Research Seminar Series, we have already had presentations from **Jonny Edwards, CEO of Thoughtful Technology, Professor Alastair Irons, Dr Susan Jones and Anita Aggarwal, Principal of INtel College, Tom Kirkham, Researcher at the Science & Technology Facilities Council** and **Dr David Baglee**.

Continuing throughout the year, we have seminars coming up from **Dr Kathy Clawson** (9 February), **Dr Tracy Hall of Brunel University** (1 March), **Professor Carsten Maple of University of Warwick**, and **Dr Sharon McDonald** (12 April) and **Liz Gandy** (28 June 2016).

We also have guest speakers from other institutions including **Harjinder Lallie, University of Warwick, Professor Paul Watson, Cloud Innovation Centre at Newcastle University, Professor David Wainwright of Northumbria University** and **Dr Peter Geczy, National Institute of Advanced Industrial Science and Technology and Visiting Professor at UoS**. Details regarding the seminars will be circulated closer to the time but please visit: <http://www.sunderland.ac.uk/research/areasofresearch/digitalinnovationbeacon/seminarsandevents/> to see the full list of upcoming seminars.

The seminars are free and all staff and students are welcome to attend.

# P u b l i c a t i o n s

## Articles

[Baglee, D.](#), Jantunen, E., & Bravo, I. (2016). A Review of the Essential Elements Linked with the Adoption of Condition-Based Maintenance (in press). International Journal of Process Management and Benchmarking.

[Baglee, D.](#), Knowles, M., Kinnunen, S., & Galar, D. (2016). A Proposed Maintenance Strategy for a Wind Turbine Gearbox Using Condition Monitoring Techniques (in press). International Journal of Process Management and Benchmarking.

[Humphries, L.](#) (2016). Let's play together: The design and evaluation of a collaborative, pro-social game for preschool children (In Press). International Journal of Continuing Engineering Education and Lifelong Learning.

Yla-Kujala, A., Marttonen, S., Karri, T., Sinkkonen, T., & [Baglee, D.](#) (2016). Inter-organizational asset management: Linking an operational and a strategic view (in press). International Journal of Process Management and Benchmarking.

## Books, book chapters and sections

[Humphries, L.](#) (2015). Evaluating the Use of a Prosocial Digital Game to Identify and Compare Preschool Children's Social and Emotional Skills. In S. Tettegah (Ed.), Emotions, Technology and Digital Games: Elsevier.

[Humphries, L.](#) (2015). The role of interactive technology in prosocial mobile games for young children. In P. Kommers, P. Isaias, & T. Issa (Eds.), Perspectives on Social Media: A Yearbook (pp. 165-173): Routledge.

## Conference watch: papers, posters and proceedings

Campos, J., Jantunen, E., [Baglee, D.](#), Gilabert, E., Fumagalli, L., & Emmanouilidis, C. (2015). The Use of Mobile Technologies and Their Economic Benefits in Maintenance. Paper presented at the 10th World Congress on Engineering Asset Management – WCEAM 2015, Tampere, Finland.

[Devlin, S.](#), & [Unthank, G.](#) (2015). Will embedded eportfolio-based supervision lead to greater student engagement in a capstone project? Paper presented at the Mahara Hui UK, Southampton Solent University, UK.

[Irons, A. D.](#), & [Peacock, D.](#) (2015). Impact of Gender in Computer Security. Paper presented at the 11th Annual Teaching Computer Forensics Conference, University of Sunderland.

[Irons, A.](#), & [Peacock, D.](#) (2015). The Impact of Gender in Computer Security. Paper presented at the The Cybercrime Forensics Education and Training (CFET) Canterbury, Christ Church University.

Kinnunen, S., Marttonen-Arola, S., Yla-Kujala, A., Karri, T., Ahonen, T., Valkokari, P., & [Baglee, D.](#) (2015). Decision Making Situations Define Data Requirements in Fleet Asset Management. Paper presented at the 10th World Congress on Engineering Asset Management – WCEAM 2015, Tampere, Finland.