



# RCUK Digital Economy Impact Review Research Project Survey



## Project details

Project Title	Ubiquitous Computing for the Digital Economy		
PI/Main Contact:	Professor Steve Benford	Lead Institution:	The University of Nottingham
Other project members & institutions involved	Dr Sarah Sharples (Training Programme Manager), Emma Juggins (DTC Administration Manager), 67 additional supervisors drawn from 13 schools/divisions across the University		
Research Council & Grant Reference	EPSRC EP/G037574/1	Funding mechanism	CDT

### Overview of project objectives (200 words max.):

Ultimately, the Horizon CDT will equip a community of over one hundred doctoral students with the interdisciplinary skills required to lead the application of ubiquitous computing across the digital economy. Our key objectives are to:

- Establish a community of researchers who support one another, build on their mutual connections as they move into industry and academia, and ultimately provide the next generation of research and business leaders
- Work closely with industry through internships, early practice-led projects, and involvement in PhD research
- Deliver a novel training programme that develops students' interdisciplinary skills alongside transferable skills in research, innovation and societal impact.
- Deliver over one hundred PhDs reporting internationally leading Digital Economy research, along with personal portfolios that document students' wider skills and experience
- Build a community of supervisors to spread best practice throughout Nottingham and ensure sustainability
- Extend the international impact of Digital Economy research, including establishing an International Doctoral Innovation Centre in China that will train 50 PhD students based in China in addition to the 75 who will be primarily based at our Nottingham Campus.

## Impact highlights

### Top five impact highlights arising from the project

For our highlights, we have chosen four of the many examples of how individual students have made an economic or social impact by engaging with external partners, either through internships, practice-led projects, or their core PhD research. These examples have been selected to highlight the wide range of contexts within which our students are working. Our fifth example is quite different, highlighting the impact that we are having on shaping academic capacity and innovation internationally through the establishment of our new International Doctoral Innovation Centre in China.

**Rob Mitchelmore** and **Mark Dimond** worked with a telecoms consultant from CommsPlaya to develop a prototype app to gather information about minor car accidents. The app was based on the concept of taking photographs of the crash and used geolocation and ANPR to link to secondary datasets of traffic and weather information. The resulting app won first prize in the UK leg of the European Satellite Navigation Competition 2011 rewarding them with £5,000 cash and £5,000 of business incubation support and office space, free UK patent advice, three years membership to the Royal Institute of Navigation and introductions to industry partners and funding opportunities. Their win will help support the development of their prototype into a fully marketable product. The CDT enabled this by: 1) bringing together Mark and Rob from the Geospatial and CS disciplines, and encouraging them to collaborate on activities related to, but not directly within, their PhDs; 2) the internship scheme encouraging them to take a commercial perspective and providing links to external collaborators who supported them in bringing the app to development; 3) the taught element introduced them to the geospatial tools they needed to develop the app;

**Mark Iliffe** completed his internship with the World Bank. During August - November 2011, as part of the Open Development Technology Alliance – A project run by Global ICT, TWICT/SDN, World Bank – he was involved in leading the survey and mapping of the informal development of Tandale, Dar Es Salaam, Tanzania. The survey process included students from regional universities and citizens from Tandale itself. This geospatial data can now be utilised by the local government, aiding decision making in the deliverance of public services. This project also engaged the Tanzanian Commission of Science and Technology in building capacity in geospatial data collection and

general GIS skills. This, in turn, has stimulated discussions on how data collected using a 'crowdsourced' methodology can be used as a component of Tanzania's Spatial Data Infrastructure, with themes of trust and quality at the foreground. His work is also relevant to other countries in the region (Uganda, Kenya, Zambia and Burundi) as part of the Living Labs and Southern Africa Innovation Support Programme. The internship was in two parts, firstly on mission in Tanzania and Kenya during August/September 2011 followed up with time in late 2011/2012 in the United States of America at the bank's headquarters in Washington DC.

**Rachel Jacobs** is focusing on the ways in which artists can add value to public engagement with the science of climate change. Her research involves collaborating with the UK Met Office alongside various artistic partners to create and study a series of artistic installations that stimulate and frame such debate. She won funding from the Arts Council of England for a project called 'A Conversation Between Trees' to visualise and compare data from sensors deployed in forests in the UK and in the Atlantic Forest, Brazil. This included working with cultural partners and schools in Brazil as well as the UK (Yorkshire Sculpture Park, Fermynwoods Contemporary Arts, and The Centre for Contemporary Art and the Natural World), while also undertaking a field trip to the Atlantic Forest region. Academically, she is collaborating with Professor Gabriella Giannachi from Drama Studies at the University of Exeter which has led to initial papers at the Fine and Performing Arts 1st Annual International Conference and a chapter in the book *Art, Technology & Environment*. She deployed her work for nine weeks in Nottingham's Rufford Abbey Park and at the Centre for Contemporary Art and the Natural World in Haldon Forest in Devon, where it was experienced by 5000 visitors (250 of whom also took part in research workshops).

**Mike Golembewski** undertook an internship in Boston (US) working for ShapeMix LLC, a software start-up developing sound mixing applications for multitouch devices including the Apple iPad. His role involved negotiating the transition from academic research to commercial product development, including designing and developing a series of user-interface prototypes for multichannel audio mixers, as well as code development of a sample-based iOS multichannel audio engine supporting realtime effects manipulation and playback. The results have directly informed the shipping version of the ShapeMix iPad app, which is currently available on the iTunes store and has been favourably reviewed by *Wired* and *Billboard* magazine, amongst others. The CEO of ShapeMix LLC; Colin Owens has commended Mike's work as follows:

*"Without the exploratory research that Mike conducted, there would have been no way with which to evaluate the direction taken by the final commercial product. I think of what he did as a series of proofs of concept, similar to concept cars in the auto industry. His prototypes afforded us an avenue for much needed evaluation of what our software might be able to do, before we committed to a full product development process."*

**International Doctoral Innovation Centre (IDIC)** – the Chinese Ministry of Science and Technology (MOST), Ningbo Municipal Government, and the University have recently announced a joint £17M International Doctoral Training Centre at the University's Ningbo campus in China. This will train 100 new PhD students, 50 in the area of Digital Economy, as a direct international extension of the Horizon CDT. These students will spend their first year with us at the Nottingham campus before embarking on their PhD based in China, but with additional supervision from and visits to Nottingham. Through internships, practice-led projects and PhD research, the students will work with Chinese companies as well as with international companies seeking to engage with the growing Chinese market for digital services. The University is appointing a new Chair to drive forward the Digital Economy thread of the IDIC, and has already appointed Dr Xu Sun to a lectureship at Ningbo to provide additional training and support in this area.

### Key Collaborators (Academic and non academic)

The Horizon CDT addresses several sectors of the Digital Economy, most notably the creative industries, transportation and energy. We engage industry through three key mechanisms: internships, practice-led projects, and involvement in a student's core PhD research.

- Each student is required to undertake at least one internship during their study, typically at an industry partner or a research organisation. Our internship programme has been inspired by the many successful programmes that we have seen operating between major US companies and US universities. In contrast, we believe that this valuable experience for both industry partner and student has been generally lacking in the UK PhD experience. Industrial internships to date include Experian, Microsoft Research Labs, Network Rail (\*2), Ordnance Survey (\*3), World Bank, Pervasive Media Studios, Serco Experience Labs, ShapeMix, Superflux, Telefonica, Nokia, Calvium, fishinabottle.com, Irish Data Protection Commissioner, China Mobile, CommsPlaya Ltd, and Active Ingredient. Internships may also extend to academic partners and so far have involved University College London, Brunel University, and Duke University in the US.
- Each first year student must complete a three-month practice-led project and these often involve industry collaboration. Industry partners that have engaged in PLPs to date include: China Mobile, Nottingham City

Council Museums and Galleries, Monica Healthcare Ltd, BioCity, Nottingham Assistive Technology Programme, OEM partnership, Ordnance Survey, ARM Cambridge, and Marks and Spencer.

To date, the following partners have become directly involved in PhD research: HAT (including History of Advertising Trust, IPA and Advertising community), Proboscis, MET Office UK, the DREAM centre in Denmark, EME (Estudio Movel Experimental) in Brazil, and the Yorkshire Sculpture Park.

To briefly highlight just one example of the impact of such collaborations, the Ordnance Survey has hosted several interns. Glen Hart, research manager of the OS, commented

*“One of the attractions has been the broad range of backgrounds and interests of the CDT students. OS research typically attracts students with a geography background. The Horizon CDT has helped overcome this bias: our cohort 1 student, Emily Webber, had a psychology background and was of immediate use to the Vernacular Geography team; second cohort students Min Zhang and Mercedes Torres have CS backgrounds which we were able to apply to problems related to Linked Data and Image Processing, and Mercedes’ internship project formed the kernel of her PhD work. The CDTs have influenced the direction of our own research: Emily’s work directly led to further research and formed the basis of a follow-on project; the work done by Mercedes, and the approach she took has opened up the potential to classify land areas by means of terrestrial photography and to process air photography taken earlier in the year.”*

Beyond direct industry engagement, our students have taken part in public workshops, performances and exhibitions to ensure impact on the wider research community, practitioners and the public. Examples include:

- Exploding Places urban game performance, Woolwich, July 2010
- Tracing Mobility panel at Nottingham Contemporary, June 2010
- Dark Forest exhibition and panel presentation, Mobilefest, Sao Paulo, November 2009
- Schools workshops at the Gaunabara Bay Institute and at Fineshade Woods
- Contributions to the Open Street Map project and also the Map Kibera slum mapping project in Kenya
- Our students organising three workshops at the first national Digital Economy Summer school
- All three cohorts working together to produce an interactive activity as part of the University of Nottingham Mayfest, an event dedicated to highlighting our research to the local community

### **Have there been any specific problems/challenges in pursuing impact in your topic area?**

We have needed to be flexible in how we engage partners from different sectors of the Digital Economy. In particular, the creative industries are typified by complex and dynamic networks of partners, many of whom are small creative companies. SMEs in the creative sector may struggle to commit upfront to long-term engagements with CDT students and in turn, a given student may need to engage with several small creative enterprises over the course of their PhD. As a result, we have developed a strategy that encourages varied and flexible forms of industry engagement. The internship model appeals to organisations of different sizes and areas, but the provision of financial support for students whilst completing internships can be difficult for smaller creative industry, charitable and government organisations. Therefore we have in some cases used core CDT funding to support students with additional travel and subsistence expenses to enable them to complete internships. This has been a highly valuable activity but obviously demands resource from the CDT. In a few cases, issues of commercial confidentiality have limited the extent to which students can transfer data or knowledge that they have obtained whilst completing their internships to their overall PhD research, but in most cases this has not been a problem.

### **To what extent do you think the Digital Economy Theme funding has helped you in achieving impact?**

Digital Economy Theme funding has been essential to establishing a critical mass of students who form a coherent community and also supporting ‘added value’ impact activities that extend beyond the traditional PhD, such as:

- The Horizon CDT first proposed the idea of a National Summer School for all Digital Economy PhD students and hosted the first Summer School at the East Midlands Conference Centre over two days in July 2010. The first national Summer School attracted 80 CDT students and academics from across the UK, including from the High Wire (Lancaster), Centre for Doctoral Training in Healthcare Innovation (Oxford), Media Arts Technology Programme (Queen Mary, University of London), and Web Science Doctoral Training Centre (Southampton). Participants experienced workshops and networking activities as well as lectures and talks from journalist Aleks Krotoski, artist Matt Adams, and academics Yvonne Rogers and Tom Rodden. Three of our students organised workshops during the Summer School (Jimmy Chim: How do you apply Social Trust to Crowdsourcing applications?; Gilad Rosner: Who owns your Data?; and Mark Selby: Life Stories). Building on this success, the second Summer School was hosted by the High Wire CDT at Lancaster in 2011.

- We have taken part in a series of national meetings among the Digital Economy CDTs that have been organised by EPSRC in order to discuss experiences and exchange best practice.
- We have visited other CDTs in order to give talks and explore opportunities for collaboration. Professor Benford has visited and given seminars at Queen Mary and Oxford, Dr Sharples has visited and given a seminar at Lancaster.
- We have collaborated with HighWire to initiate the DE CDT festival in 2012 where we hope to crowdsource activities from the students themselves to enable them to share knowledge and ideas.

We support our students attending the doctoral colloquia associated with major conferences, or taking part in structured student volunteer organisations at these conferences which gives them valuable conference experience. For example, 10 students (8 from cohort 2009 and 2 from cohort 2010) attended the ACM's CHI conference as student volunteers in 2010 and 2011, 2 students attended the 'Wherecamp' (Geodata un-conference), 1 student attended the International Ergonomics Association conference in Brazil, 2012.

The critical mass of the CDT has also provided good visibility and branding for the students that has helped them to independently pursue internships and collaborators in their research. The resource provided to support administration of the CDT and funding for PhD activities has enabled economies of scale in equipment purchase (e.g. specialist video recording and editing equipment), sharing of data collection opportunities between students and has encouraged collaboration between students. The administrative support for the CDT was complimented by our external review in 2010 as being outstanding and is much valued by staff, students and collaborators. The CDT has also provided a multi-disciplinary framework to broaden the cohort of supervisors to different disciplines across the university. For example, the CDT supervision team now includes colleagues from Linguistics, Policy, Psychology, Management Science, Built Environment and Sociology in addition to the original core teams of Computer Science, Human Factors, Innovation and Entrepreneurship, Science and Society and Geospatial Science.

## Impacts reported against DE Impact Framework

### Capability

**Academia – size and shape:** The University has created two new lectureships specifically to support the CDT. An initial lectureship was taken up by Dr Dave Kirk who joined us from Microsoft to coordinate our industry partnerships and develop and deliver CDT modules. Dr Kirk has now been promoted to Senior Lecturer in Experience Centred Design at the Culture Lab School of Computing Science at Newcastle University and continues to collaborate with the CDT as an external supervisor. His replacement, Dr. Max Wilson from Swansea University, brings new expertise in search technologies.

The wider Horizon centre has appointed six transitional fellows (three in Computer Science, one in Engineering, one in Psychology and one in the Business School). These are senior fellowships that are guaranteed to transform into permanent lectureships with the intention of ensuring the future sustainability of our activity in this area. These six fellows are now playing a central role in supervising CDT students.

Three academic promotions can be attributed to the CDT: Dr Sarah Sharples, our Training Manager, has been promoted to Reader in 2010 and Professor in 2012 and Dr Borianna Koleva who has also been extensively involved in CDT recruitment, organisation, lecturing and supervision was promoted to Associate Professor in 2011. Dr. Andrew Yip, a new member of the CDT management board from Sociology has been promoted to Professor in 2012.

Our original pool of 30 supervisors has already expanded to over 60 and fostered many new collaborations. Part of this is due to recent appointments, but the opportunity for collaborative supervision has encouraged new partnerships. For example, Professor Darren Robinson, a new Professor from the Department of Architecture and Built Environment, is supervising two cohort 3 students in collaboration with colleagues from Computer Science and Human Factors. Supervision involves a variety of roles including mentoring, tutoring, leading events and attending the writing retreat, in addition to the traditional role of guiding PhD research. All supervisors participate in a full day training programme that addresses the challenges of interdisciplinary supervision, while supervision teams combine experienced and early career supervisors.

**International capability** – an exciting recent development is the expansion of our CDT into China. The Chinese Ministry of Science and Technology (MOST), Ningbo Municipal Government and the University have announced the establishment of a new £17M International Doctoral Innovation Centre (IDIC) based at our Ningbo campus to train one hundred PhD students over the coming years. The IDIC is based on an internationalisation of the CDT model, and directly extends the international reach and impact of two CDTs at Nottingham, our Horizon CDT in Digital Economy (that will train 50 of these new students), and our sibling CDT in carbon capture technologies. We are currently recruiting our first cohort of students for entry in September 2012. The IDIC students will spend their first year at

Nottingham engaging in our initial training programme, before embarking on a PhD that spans the two campuses. A core ambition for the IDIC is to engage with Chinese industry or international companies who are looking to enter the Chinese market. The University has already appointed Dr Xu Sun, who has previously worked with the CDT at Nottingham, to a lectureship at Ningbo, and is currently recruiting a new chair in Digital Technologies to drive forward our activity in this area. There is also growing interest in exploring how we can also 'export' our CDT to Malaysia through our campus at Kuala Lumpur.

**Institutional Investment** – The CDT has benefitted from high quality dedicated shared space provided by the University. The University investment in transitional fellows has enabled a widening of the supervision pool as well as provision of the dedicated group project run by the transitional fellow team. The University has supported the CDT with additional studentship funds to enable recruitment of a higher number of excellent international and EU students alongside the initial RCUK funded cohort of 10 students per year, with 49 students funded so far in total

**Portfolio** – the presence of the CDT at Nottingham has directly underpinned major successful research proposals:

- McAuley, D., Horizon: Digital Economy Hub, RCUK (EP/GO65802/1), £12,509,687
- Mulligan, C., BURD, (EPSRC EP/J000604/1), £1,263,925
- Benford, S., Dream Fellowship, EPSRC (EP/J005215/1), £198,490
- Benford, S., Towards Pervasive Media (EP/H024867/1), £201,376
- Rodden, T., Orchid, EPSRC Programme Grant with Southampton and Oxford (EP/I011587/1), £5,492,969
- Sharples, S., SerenA: Chance Encounters in the Space of Ideas (Sandpit project with five other universities – PI M. Woods (Dundee)) (EP/H042741/1), £1,538,295
- Sharples, S. Jackson, M. & Burnett, G. Usability of Geographic Information, KTP/TSB/Ordnance Survey £126,424

**Innovation in PhD training** – our programme provides students with a wide training experience intended to equip them for a career in the Digital Economy. Key innovations here include:

- The internship and Practice-led Project schemes as noted previously
- Our students experience a variety of teaching delivery types, including 'short-fat' modules, standard week-by-week modules, group projects, individual projects, integrator events with supervisors from across the University, PhD Q&A sessions where academics reflect on their own PhDs, and an annual writing retreat.
- All PhDs are supervised by multidisciplinary teams, with a stipulated requirement that supervisors must be taken from two distinct disciplines.
- Our core programme draws on modules from at least five disciplines (computer science, human factors, geospatial science, business and sociology).
- We have developed new modules specifically for the CDT including an interdisciplinary group project; a dedicated professional and research skills training module (now also taken by other CDTs across the University), the Digital Economy Young Entrepreneur Scheme, specialist modules in 'Technology and Society' and 'Innovation and Technology Transfer', and specialist research methods seminars (including participatory design, audience research, ethnography and design research methods).
- A supervisor training scheme, led by colleagues in the University Institute for Entrepreneurship and Innovation, using a problem-based approach to enable supervisors to understand and address the challenges of supervising multidisciplinary projects in an integrated PhD programme.

**Innovation in organisational culture and practices** – The CDT has had a wider impact on the University of Nottingham – Sarah Sharples has since 2011 taken on the role of Associate Dean of the Graduate School for Engineering, influencing research policy across the institution. The framework for training in Research and Professional Skills in the Horizon CDT was used as the basis for a new PGR training framework that supports the EPSRC statement of expectation for PGR training provision. The University has adopted a strategy of encouraging all CDT activities to co-ordinate, supporting these activities with a dedicated individual (Steven Hardy, now Head of Research Outcomes) and the Horizon CDT has supported successful bids for the ESRC CDT and BBSRC DTP.

## Economy

The true economic impact of our CDT will emerge in the longer term as students complete industry relevant PhDs and ultimately embark on careers within the Digital Economy. That said, there is already evidence of likely impact from the internships and other industry engagements that have happened so far. Our impact highlights described earlier provided examples of engagement with industry, cultural and third-sector partners:

- Rob Mitchelmore and Mark Dimond winning a £10K prize to enable them to develop a prototype application into a product
- Mark Iliffe working with the World Bank to coordinate mapping activities in Tanzania

- Rachel Jacobs collaborating with the Met Office and multiple cultural partners to deliver an artwork that engages the public with climate change data
- Mike Golembewski helping ShapeMix develop an innovative mobile audio mixing product

Other examples of impactful collaborations include:

- Gilad Rosner began an internship with Experian in July 2010. Throughout the summer, working in their ID & Fraud division, he researched emerging trends and technologies in federated identity, user-centric identity management and credentialing. In the course of this research, he was exposed to all of Experian's operations and products, as well as key personnel up to Charlotte Hogg, the Managing Director for the UK. The internship was so successful that at the conclusion of the summer, Experian asked Gilad to retain a part-time commitment to Experian and he continues to provide strategy and thought leadership.
- Claudia Krehl completed her internship with Network Rail, applying 'multiple resources' theories of workload to the analysis of signalling technologies. This theory is now informing her PhD research into the use of mobile technologies to support atypical multimodal journeys. Whilst collecting PhD data, she has also worked in collaboration with the TSB funded project 'Stress Free' (co-ordinated by Samsung), with her work directly influencing the content of the app that is now being prepared for launch with a focus on supporting travel to Olympics venues.
- Yousif Ahmed spent his internship working for the Tin Bath Theatre Company and Pervasive Media Studios. He led a participatory design process over a three-month period that developed and showcased a novel live captioning system to support audience members with hearing difficulties who are attending theatrical performances. The system was trialled in a public performance. Yousif was interviewed on the BBC 2 programme See Hear and Tin Bath is currently exploring the potential to commercialise the approach.
- Two of our students, Mike Golembewski and Mark Selby, have collaborated on a new method to support the design of interactive systems called Ideation Decks. This involves the creation and use of bespoke project-specific physical cards to enable designers to constrain and structure the design space for a project. The approach has since been taken up by other CDT students. It has also been reported in a paper at the ACM's prestigious Designing Interactive Systems conference.

Several of the students also have their own companies and consultancy practices that are being directly informed by their personal development whilst working with the CDT.

**Attracting R&D investment** – Investment to the CDT has primarily been in the form of support for internships – 16 students have completed paid internships so far representing £62,160 total additional investment. Over seventy internships will have been completed by the end of this first phase of the CDT (five cohorts of students). One student is co-funded by industry (EADS innovation works) and we are working to expand the portfolio of jointly funded PhDs.

**Academic innovation** – As part of their training programme CDT students complete activities that prepare them for applying their knowledge in business. These include: training on intellectual property and the dedicated week long module on innovation and technology transfer; direct experience of working with industry through internships and collaboration with industry contacts; interdisciplinary team work and perspective-taking throughout their PhDs, preparing them for multi-disciplinary team approaches to technology development, innovation and implementation in industry; public and societal impact awareness through dedicated sessions on ethics and training in communication skills; and vision by being regularly exposed to leading thinkers from Nottingham and elsewhere, encouraging them to see their own PhD work in the context of broader agenda.

## Knowledge

**Publications** – the four-year nature of the Horizon CDT, along with the high standard of incoming students, means that the opportunity to develop publications during the lifetime of the PhD is increased. This both enables students to demonstrate academic excellence at the end of their PhD as well as ensuring that knowledge from the CDT is disseminated widely before the student completes their PhD. A full publication list is at

<http://www.horizon.ac.uk/DTC/About-the-DTC/publications>. Selected highlights include:

1. **Golembewski M, Selby M**, Ideation Decks: A Card-Based Design Ideation Tool, DIS '10 Proceedings of the 8<sup>th</sup> ACM Conference on Designing Interactive Systems, Aarhus, Denmark, August 16<sup>th</sup> – 21<sup>st</sup>, 2010.
2. **Jacobs R, Watkins M**, 'Reflections from The Dark Forest and Paralelo', Paralelo – Unfolding Narratives: book chapter in Art, Technology & Environment, 2009.
3. **Elliston, B.** and FitzGerald, E. (2012) Encouraging museum visitor engagement using spontaneous talk-in-interaction audio guides. Long paper accepted to the 4th International Conference on Computer Supported Education (CSEDU 2012), 16-18 April, Porto, Portugal.

4. **Rosner, Gilad**, "Tokens of Trust: Social Interest and Electronic Identification", *Paper presented at World e-ID, Sophia-Antipolis, France, 21-23 Sept. 2011*
5. **Krehl, C. & Sharples, S.** (2012), Exploring the Requirements of Multimodal Interaction for Mobile Devices in an End-to-End Journey Context, *Work*, Vol. 41, p. 1132 – 1139. IEA Congress 2012 in Brazil.
6. **S. Meek**, J. Goulding & G Priestnall (2012) The influence of Digital Surface Model choice on visibility-based Mobile Geospatial Applications. Paper accepted into GISRUUK Conference 2012, Lancaster University.
7. **Torres, M** (2011) Picture The Past From the Present; Conference: ACM ICIMCS 2011 Chengdu, China
8. **Iliffe, M** When Government 2.0 Doesn't Exist: Mapping Services In The Developing World, Association of Geographic Information, Geo Communications Conference, Nottingham, 2011
9. **Hupfeld, A**, Rodden T Laying the Table for HCI: Uncovering Ecologies of Domestic Food Consumption. Proceedings of the 2012 conference on Human Factors in Computing Systems (CHI 2012) CHI Conference on Human Factors in computing systems Austin, Texas 5 - 10 May 2012
10. **Ahmed A.Y.**, Benford, S., Crabtree, A. Digging in the Crates: An Ethnographic Study of DJs' Work. In Proceedings of the 2012 conference on Human Factors in Computing Systems (CHI 2012) CHI Conference on Human Factors in computing systems Austin, Texas 5 - 10 May 2012

**Web and social media** – Students are encouraged to disseminate their work through both traditional mechanisms such as conferences and academic publications as well as through social media and other networking activities. All students maintain web pages within the CDT website and many use Twitter and blogs. Horizon has been given a distinctive visual brand which is used on its website, signage for the physical space, reports, presentations, student posters and also on a series of brochures and marketing materials. As part of this, each student produces a personal bookmark that describes their background and interests. The CDT maintains the following website:

<http://www.horizon.ac.uk/DTC>

**Keynotes, invited talks and tours** – members of the management team have been highly active in promoting the CDT through keynotes and invited talks. As Director, Professor Benford has given multiple keynote presentations highlighting the outputs and nature of the Horizon CDT. His invited keynote at 'The Doctoral Thesis in the Digital and Multimodal Age', a national event organised by the Institute of Education and held at the British Library on 18<sup>th</sup> May 2010, directly and explicitly focused on the changing nature of PhD research being brought about by initiatives such as CDTs (<http://newdoctorates.blogspot.com/2010/02/doctoral-thesis-in-digital-and.html>). His other recent keynotes have presented the technical work of the centre to various research communities:

- Invited keynote at Digital Resources for the Humanities and Arts (DRHA 2009), 7-9 September, 2009, Belfast
- Invited keynote at Mensch Und Computer, September 2010, the German national conference on human-computer interaction, Duisberg, September 2010
- Invited keynote at the CAL 2011 conference, April 13<sup>th</sup> – 15<sup>th</sup> 2011, Manchester, [http://www.cal-conference.elsevier.com/bio\\_benford.asp](http://www.cal-conference.elsevier.com/bio_benford.asp)
- Invited keynote The 2011 International Conference on Collaboration Technologies and Systems (CTS 2011), May 23-27, 2011, Philadelphia, USA

He also toured the West Coast of the USA in November 2011 visiting Microsoft, Google, Yahoo, Disney, PARC, Facebook, Stanford and The University of Washington, giving talks presenting the CDT, and exploring opportunities for internships and exchanges. He will visit Japan and South Korea for a similar programme of visits later this year.

As Training Programme Manager, Dr Sharples (Professor from August 2012) has given a keynote at the IEHF conference in 2010 drawing on the work of the CDT and has presented invited seminars at UCLIC, UCL, Lancaster HighWire CDT, Kraft Foods and De Montfort University. She has also met with a number of companies to discuss CDT work including Highways Agency, Network Rail, Ordnance Survey, China Mobile and EADS.

As Director of the Horizon Digital Economy Research Institute, Professor McAuley has promoted the CDT in his keynotes and talks at events such as: Institute of Practitioners of Advertising / RCUK workshop; Cosener's House annual UK Networking Conference; Location Based Services 2009 conference; Institute of Management Summer School Cambridge; COMSNET 2011 keynote (India); and PerCom 2011 Keynote (USA). He has also visited and briefed key companies and government departments including: EADS, Transport Research Laboratories; Ericsson; China Mobile; and the World Bank.

Dr Glover, previously Centre Manager gave a talk on the issues surrounding Cross-disciplinary Doctoral Training Centre proposals as part of a seminar session at the Annual Conference of the Association of Research Managers and Administrators in June 2011.

## Society

**Cultural enrichment** – several CDT students are addressing the broad theme of cultural enrichment. Yousif Ahmed has published studies on how communities of musicians, including DJs and also traditional Irish musicians, are using digital technologies to support communities of practice and is developing new technologies to support them. Mike Golembewski has completed a series of studies on how visual artists working in traditional media use digital technologies and is now creating new tools to support their practice. Mark Selby has exhibited projects addressing memory and locative media at Nottingham Contemporary and at the Trampoline Festival in Berlin. Rachel Jacobs has developed and toured the artwork 'A Conversation Between Trees' to engage the public with climate data as described earlier.

**Environmental sustainability** – a number of the projects that have emerged from the CDT have environmental sustainability as a theme. One of our students, Jianhua Shao, is collaborating with China Mobile Research Institute in Beijing, China, to examine management of user data, with a focus on smart energy data in particular (in partnership with the C-Aware project). Two of our cohort 3 students, Martin Kruusimägi and Jacob Chapman, are planning to examine the design of autonomous energy systems in their PhD research. One of our year 1 group projects identified a concept to support waste food management in the home using bar code technologies. Rachel Jacobs' work is investigating the representation of environmental change data, and John Harvey is looking at how digital technologies can affect the way that individuals view consumer commodities in a social context.

**Influencing policy** – two current PhDs (Gilad Rosner and Ewa Luger) specifically focus on Policy. Gilad is examining the regulation of 'digital identity' and has discussed his work with senior government officials in the US and UK, as well as policy-makers, senior management at critical vendors, lawyers and technologists. Ewa is also examining policy and will be running an external policy seminar to a lobbying organisation, linking the open data movement to the public information drive. The CDT has been involved in the Horizon Open Data Masterclasses. Ewa Luger developed a presentation for these masterclasses to contextualise the value of Open Data for practitioners, and as a result received a direct communication from the Transparency Team at the Cabinet Office to invite her to submit a response to the Open Data consultation, 'Making Open Data Real'. Ewa's response can be found at <http://www.niace.org.uk/policy-paper-making-open-data-real-niace-response-to-a-public-consultation>

**Innovation in Public Services** - much of the work emerging from the CDT has the potential to influence public services. Chris Carter's PhD is examining the use of social media in organisations, understanding attitudes to identity in a work context. Much of the work within the transport and navigation stream is also relevant: examples include work to influence design of apps at major events (Antony Cousin); understanding multimodality demands in mobile use whilst 'on the move'; research into the influence of pedestrian navigation systems on the development of spatial maps (Emily Webber) and influences on sharing of location (Abdur Rahman).

**Improving social welfare** – Mark Iliffe's collaboration with the World Bank has supported local communities in Tanzania in mapping local data and conditions and his core PhD research is focused on the use of mobile technologies and social media as part of emergency and disaster management and relief.

**Media representation** – in addition to the established brand identity there have been a number of media reports that have referenced CDT work, as well as publications in trade journals.

- Rachel Jacobs' work has appeared in the Guardian, Birmingham post and the BBC as well as an article on the front page of Wired UK Online in July 2011 <http://www.wired.co.uk/news/archive/2011-07/21/hello-tree-brazil-uk-trees>
- Mark Iliffe's internship work was a front page news story on the World Bank's website <http://go.worldbank.org/VE0N0YOAK0>
- Rob Jones wrote a feature article for iN Magazine to discuss whether video games are damaging to children: Jones, R. **Gaming: Good or Bad?** iN Magazine, Issue 66, August 2010 and also gives radio interviews on BBC Radio Nottingham as a technology correspondent and is heavily involved in the GameCity festival.
- Gilad Rosner gave a BBC News television interview on 27<sup>th</sup> April 2011 about the Sony Playstation hacking of players' personal information.
- Yousif Ahmed was interviewed on the BBC 2 programme See Hear on 29<sup>th</sup> September 2010 about the results of his internship.