Design Innovation Research Centre – Autumn Newsletter 2013

Building Information Modelling (BIM) is rapidly being implemented by leading UK construction companies, with extensive industry work on processes and techniques. Every day sees new guidance for firms on using BIM execution plans; standards (BS1192, Uniclass etc); models at different Levels of Detail (LOD); and library models with manufacturers information and on preparing data for their clients (using COBie).

What role can research play in such a rapidly changing context? A systematically collected evidence base is vital to inform industry decision-making in building and infrastructure sectors, and to support the long-term success of the UK construction sector. Our research is on a) immersive visualization of large data-sets; b) designers changing professional practices; c) delivery of megaprojects such as Crossrail; and d) the value of asset information to clients. Our team works closely with industry partners and international colleagues to develop this evidence base through high-quality scientific and engineering research on digital design and delivery.

This newsletter highlights our work with Infrastructure UK Client Group on collaborative project teams; a top 25 paper on digital design and safety; growing capacity as new staff join the School; summer placement projects on visualization workflows, model checking and COBie; and experiments with new routes to disseminate research findings through the website, blog, linked-in group and twitter.

University of Reading's growing capacity in Digital Practices research

The Centre welcome Dr Dragana Nikolic and Prof Mervyn Richards, who have recently joined the School of Construction Management and Engineering, as members of the Digital Practices theme. Dr Dragana Nikolic has joined as a Lecturer in Digital Architecture, and Prof Mervyn Richards as a visiting Professor. Both will act as associate members of the Centre, be involved in teaching BIM within the School during the autumn and joined us for our summer picnic in August.

Completed research

Top 25 paper – Digital design and building safety

Our article on "Construction safety and digital design: A review" is recognized by ScienceDirect as one of the Top 25 papers published in *Automation in Construction* in 2012. Professor Whyte presented findings on "Digital Design and Safety" at a Costain/CIC event on BIM and Health and Safety on 10 September 2013, based on the IOSH 'Building Safely by Design' project carried out at the Design Innovation Research Centre.

BIM and Facilities Management

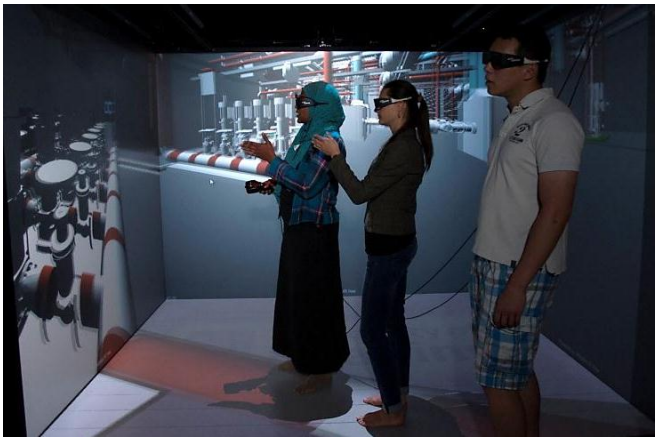
Scholars within a number of research-intensive universities are collaborating with their university estates and facilities departments to understand the new practices of using Building Information Modelling (BIM), and related technologies such as laser scanning and Geographic Information Systems (GIS) in Facilities Management (FM) on university campuses. Following a related research project on BIM and FM, the Design Innovation Research Centre hosted an online seminar on this topic. Academics from Penn State, Washington State, Northumbria University and the University of Reading attended this seminar to share best practice and discuss future collaboration, as well as the practical opportunities and research challenges.

New research areas

Work on 'Collaborative Project Teams' with IUK Client Group

Over the summer the team input into workshop with Infrastructure UK (IUK) Client Group that brought leading researchers from 5 universities to discuss the governance, working practice and behavioural challenges of developing collaborative teams. In September and October the team is working with a leading client to explore information and digital technologies and their role in collaborative project teams. Dr Sunila Lobo, Dr Richard Davies and Prof Jennifer Whyte will feedback the findings of their work to senior managers in UK Clients in a workshop hosted at the University of Reading in November.

Visualisation facility software redesign



The CAVE facility over the last 3 months has been converted to run under Windows to enable simpler accessibility for users, with new software installed to utilise existing hardware more effectively. We have been working with software vendors including Autodesk to use their tools directly in the facility. At present the system employed to run the CAVE under Windows is the Unity3D game engine, with MiddleVR acting as middleware for the head-tracking system and screens. This new system allows for rapid deployment and modification to simulations in full 3D, with frame rates up to 160Hz, allowing for future collaborations with industry to be simplified and reduce the time taken by a researcher to visualise the CAD/BIM data. The system is currently undergoing load testing and user training.

The initial work that supports this project has been published as DIRC working paper 6 by Ben Dalton one of our summer placement students and Dr Maxwell Parfitt, specifically on the workflows to manipulate CAD/BIM models for use in the visualisation facilities. Ben's work will enable future iterations of model data to be transferred into the CAVE facility in a day compared to the old system which took around 3 weeks.

Whitechapel visit

Over the summer we have been working with Whitechapel station to help visualise the current infrastructure plans, as part of the Crossrail development, using our fully immersive visualisation facility, the CAVE (Computer Automatic Virtual Environment). An initial meeting was held in July with our strategic partner Vinci, part of the joint venture BBMV that is delivering the station, along with their industry partners Morgan Sindall Professional Services. This initial meeting, which proposed targets for the visualization system, was followed up in early September by a second visit to see the model visualisation in the CAVE, where it was displayed using the Unity graphics engine. Our discussions have shaped the direction of our ongoing visualization research, to refine the usability, accuracy and requirements of immersive visualization.

Energy Centre Development

The University has started work on a new Energy Centre which will help reduce carbon dioxide emissions by almost 10%, whilst providing both heat and power for the campus. We have been working with Estates and Facilities management on campus to help them visualise the development of the new Energy Centre using the CAVE facility. We have received and processed CAD models from the designers with two successful demos to university facilities staff. The visualisation allowed the project management team to explore the Energy Centre to scale, leading to realisations about positioning of additional structures required for access and maintenance.

Other team updates

Forthcoming events

On Friday 1 November, we will be holding a workshop on BIM. Among the speakers will be Rafael Sacks, Associate Professor of Construction Management at Technion University, Israel, John Messner from Penn State, Mervyn Richards, a new visiting professor at the University of Reading, Dragana Nikolic, lecturer in digital architecture at the University of Reading . The workshop participants will also take a tour to CAVE. Also some PhDs nearing completion will be presenting their work at the event. The details of the event including how to register your interest in attending will be published on our website.

Undergraduate research

The Centre hosted undergraduate research placements through the summer, these include:

- **Immersive visualization of Building Information Models** – This work was aimed at creating workflows, to enable conversion of many common file formats used by 3D CAD and BIM software vendors, so that many different models could be visualised in the CAVE (Collaborative Automatic Virtual Environment) efficiently. Ben Dalton worked for 6 weeks, funded under the UROP (Undergraduate Research Opportunities Program) scheme. This work helped develop standard processes to bring the CAVE facility into frequent use.
- **Visualizing digital models** – Andy Sears worked at the EPSRC vacation bursary project on model checkers and student perspective on learning about BIM. At the end of his studentship, Andy ran practical hands-on

sessions on Solibri for the University staff and students to disseminate what he had learnt at the Design Innovation Research Centre.

Changes to website, blog and Linked-in site

We have been doing some work on making our website even more engaging with our stakeholders. You will notice our new Blogs feed on our homepage (http://www.reading.ac.uk/designinnovation/), which will take you to our News Blog that we aim at updating regularly with the developments in our research. We welcome any comments and feedback on our news articles on the Blog. You may also send a request to join our linkedin group 'Design Innovation Research', which has become a platform for interaction with friends of our Research Centre.

Recent publications and presentations

Journal publications

Larsen, G. D. and Whyte, J. (2013) Safe construction through design: perspectives from the site team, *Construction Management and Economics*, Vol 31, (6): 675-690.

Jaradat, S., Whyte, J. and Luck, R (2013) Professionalism in digitally-mediated project work, *Building Research Information* , Vol 41(1): 51-59.

Conference presentations

Comi, Alice; Eppler, Martin; Herrmann, Andreas; Schlager, Tobias (2013). Cognitive Biases in New Technology Appropriation: An experiment on the impact of judgmental and presentational priming. *Proceedings of ICIS* 2013, Milan.

Stasis, A., Whyte, J., Dentten,R. (2013) A critical examination of change control processes, *2nd International Through-life Engineering Services Conference*, November 5-6, Cranfield, UK.

Lindkvist, C., Stasis, A. and Whyte, J. (2013) Configuration management in complex engineering projects, *2nd International Through-life Engineering Services Conference*, November 5-6, Cranfield, UK.

Guo, G., Larsen, G.D. and Whyte, J. (2013) Digital interaction patterns on construction projects: A study of dynamic approval processes, *CIB W78*, October 9-12, Beijing, China.

Lobo, S. (2013) Learning across Megaprojects: Medieval Cathedrals to the Shard, *EBHA 2013*, August 22-24, Uppsala, Sweden.

Whyte, J. and Lobo, S. (2013) Digital innovation in the management of engineering projects, *Academy Of Management 2013*, August 9-13, Lake Buena Vista (Orlando), Florida.

Comi, A., Lurati, F. and Zamparini, A. (2013) Green Alliances: How Does Ecophilosophy Shape the Strategies of Environmental Organizations? *Academy of Management 2013*, 9-13 August, Lake Buena Vista (Orlando), Florida.

Book chapter

Comi A., Jaradat S., Whyte J. (forthcoming). Constructing Shared Vision in Design Practice: Material Mediation in Professional Work between Architects and Engineers. in: S. Ammon and I. Hinterwaldner (Eds). Imagery in the Age of Modelling: Operative Artifacts in the Design Process in Architecture and Engineering. Fink Verlag.

Please contact the Centre at designinnovation@reading.ac.uk or individual authors for further details or to request copies of these papers.

For more information about our work please visit our website at www.reading.ac.uk/designinnovation