iNTELLIGENT DATA-DRIVEN DESIGN FUTURES

INTERNATIONAL SYMPOSIUM

Organised by

Resilient Urban Ecosystem (RUE) Network

at Liverpool London Campus

on May 11th, 2016

Report

INTRODUCTION

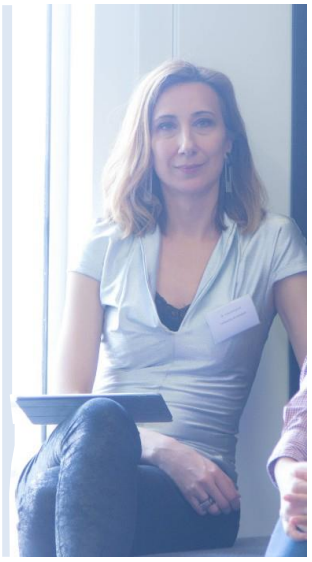
As data-driven approaches are introducing and establishing a new set of economic, social and cultural values, we have started to question some of our age old assumptions, conceptions and practices about our built habitat. One of the most profound implications is the transformation of the AEC (Architecture, Engineering and Construction) industry from a document based to an information based business. Both the impact and scale of this transformation will become more dramatic with the increase in global data traffic two thirds of which is predicted to move on to cloud computing systems by 2016 (Cisco Global Cloud Index, 2011-2016). This implies the introduction of even more complex and diverse interactions (e.g. through internet of things) between buildings, infrastructures and humans. Such developments have already made significant impact in other industries and are likely to be a step change in how we build and operate in the near future.

"Data" is not new to our industry, however what is new is the amount of data that is currently available to us and our improved capacity to share, capture, measure, compile, process and translate data into meaningful and actionable information. Although the potentials are vast, Architectural/Engineering practice and Construction sector are slow to adopt the data-driven approaches.

The IDDF (Intelligent Data-Driven Design Futures) symposium brought together some of the world-leading thinkers, practitioners and innovators from the Built Environment and Urban Informatics research and practice to explore what "data-integrated" future might hold for our sector. The presentations and discussions challenged our "business as usual" mode of thinking and highlighted diverse insights and perspectives for more agile and adaptive solutions for the future, and in discovering sustainable modes of imagining, creating and working intelligently. With this document we aim to summarize the presentations and discussions, and highlight some of the diverse insights and perspectives we captured from this day-long symposium.

ABOUT RUE NETWORK

The symposium has been organized by the RUE (Resilient Urban Ecosystems) Network, as the first of a series of events/symposiums we aim to organize in the near future. RUE Network has been initiated by the University of Liverpool IDEA Research group and ARUP to explore emerging models of innovation through intelligent adoption and use of data and computation in built environment sector. We aim to build new connections and establish a wider network of leading scientists, industrial experts and consultants to cross-fertilise knowledge; raise awareness and share best practice examples of intelligent data-driven innovations in Built Environment.



Dr. Tuba Kocaturk
IDEA research group,
University of Liverpool

Martin Simpson
Associate director at ARUP,
Structural engineer,
Visiting professor at the University of Salford

Prof. Richard Koeck
CAVA, The University of Liverpool

Dr. TUBA KOCATURK: *"... Our definition of "Ecosystem" resonates with Mitchell's (2006)[1] prediction of our cities transforming into artificial ecosystems of interconnected, interdependent and intelligent digital organisms where he defined this new condition of built environment as "programmable" and emphasized that the design of its software becomes as crucial – socially, economically, and culturally – as that of it hardware. Mitchell's analogy gives crucial hints for some of the ideas we pose and explore within the RUE network, such as: a) how can design and operation of buildings contribute to the economic, social and environmental sustainability? and b) what is the scale and level of intervention this contribution could be achieved and sustained? We organized the IDDF symposium*

[1] *Mitchell, W. J. (2006) "Smart City 2020", in Metropolis. Online resource. Available: http://www.metropolismag.com/April-2006/Smart-City-2020*

as an initial attempt explore the transformational power of embedding computation, big-data, artificial intelligence, and real-time connectivity into the conception and realization of buildings for a sustainable built habitat. Through various best practice examples, future oriented scenarios, and open discussion, we have highlighted a radical departure from the earlier practices and understanding of "technology" through adoption of "data", "information" and "intelligence", which not only empowers diverse actors and stakeholders (including end-users) but also challenges the established notions of ownership and agency in the process of deployment of technology in our everyday practice"

MARTIN SIMPSON *"...The idea behind the development of RUE network came from a series of presentations I was giving a couple of years ago and which highlighted the serious environmental problems including population and growth. With this current trend, it's been speculated with 80% certainty, that population will be between 9.6 to 12 billion by the year 2100 and it's going to have a huge impact on the way we build, create and live in cities. We are going to have high density future alongside accidental urban sprawl or if we take it to the extreme we might end up with something similar to that of an American dream with those infamous images of huge sprawling cities with considerable repercussions including resource depletion and decrease in biodiversity. There is a series of issues connected to this which really affect us all. But the problem is that these questions are too big and it's impossible for one person, one company, one institution to resolve them together so together with Tuba, we came up with the idea of creating the (RUE) network revolving around these ideas using current trends, information, statistics and data. Another influence was a key speech given by Ove Arup on "Total Architecture" which refers to consideration of all relevant decisions and integrating all ideas into the design concept as a whole. We can only achieve this if the right people makes the right decisions at the right time and the key to that is information/data. The core idea of this network is to bring together academics, industry and relevant bodies together who are passionate about exploring "data" and "information technologies" to solve bigger problems that our built environment is a part of".*

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INTERNATIONAL SYMPOSIUM

Report

11th of May, 2016

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Workshop organised by:
Resilient Urban Ecosystem (RUE) Network

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OUTLINE

1

What is the transformational potential of data to create a future-resilient built habitat?

EXECUTIVE SUMMARY

Although the potentials are vast, our sector is slow to adopt the data-driven approaches. In order to progress as a sector, we need to raise our capacity to "intelligently" share, capture, measure, process and translate data and convert it into meaningful and actionable information. Technology and digital media/tools, however, cannot be considered as the only force that is currently re-shaping architectural industry. Through the use of diverse media and technologies, new networks, collaboration styles, and work practices have also emerged and in turn have facilitated the development of new methods to deal with the emerging knowledge and complexity affecting the ways in which the technology is applied and used.

With this symposium, we aimed to raise questions and to provoke a debate about "intelligent use of data" and the potentials that "data-driven innovation" holds in the AEC sector. Through presentations and discussions, the symposium aimed to explore the transformational potential of embedding big-data, computation, artificial intelligence, and real-time connectivity into the conception and realization of buildings for a sustainable built habitat.

The presentations from key professionals challenged the "business as usual" mode of thinking and proposed diverse insights and perspectives for more agile and adaptive solutions for the future, and in discovering new modes of imagining, creating and operating for a future-resilient built environment. **The symposium consisted out of three sessions where key experts presented, provocated and discussed:**

SESSION 1: DATA & THE BUILT ENVIRONMENT

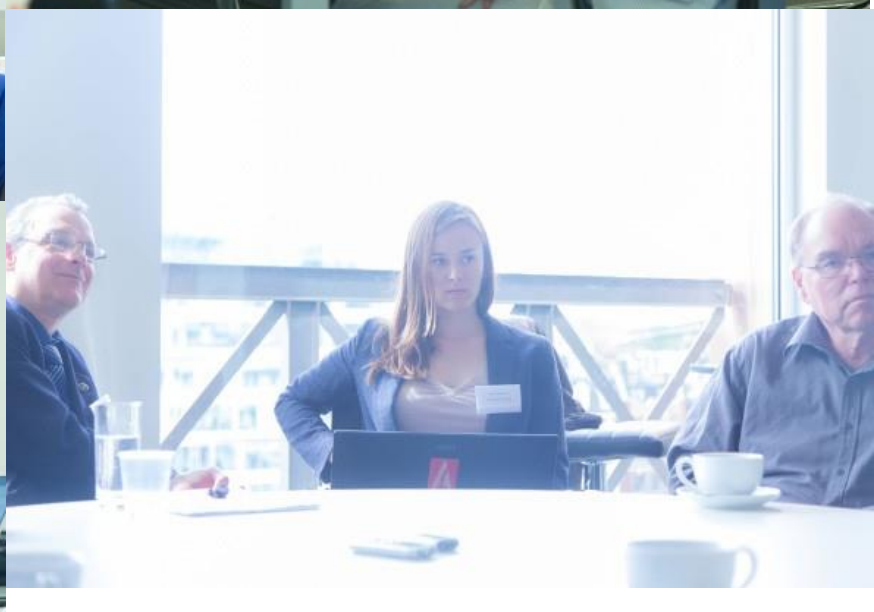
What does "data" signify for the Built Environment and what potentials does it hold to transform the way we think, imagine, innovate and operate as Built Environment professionals. What are the current challenges that should be addresssed?

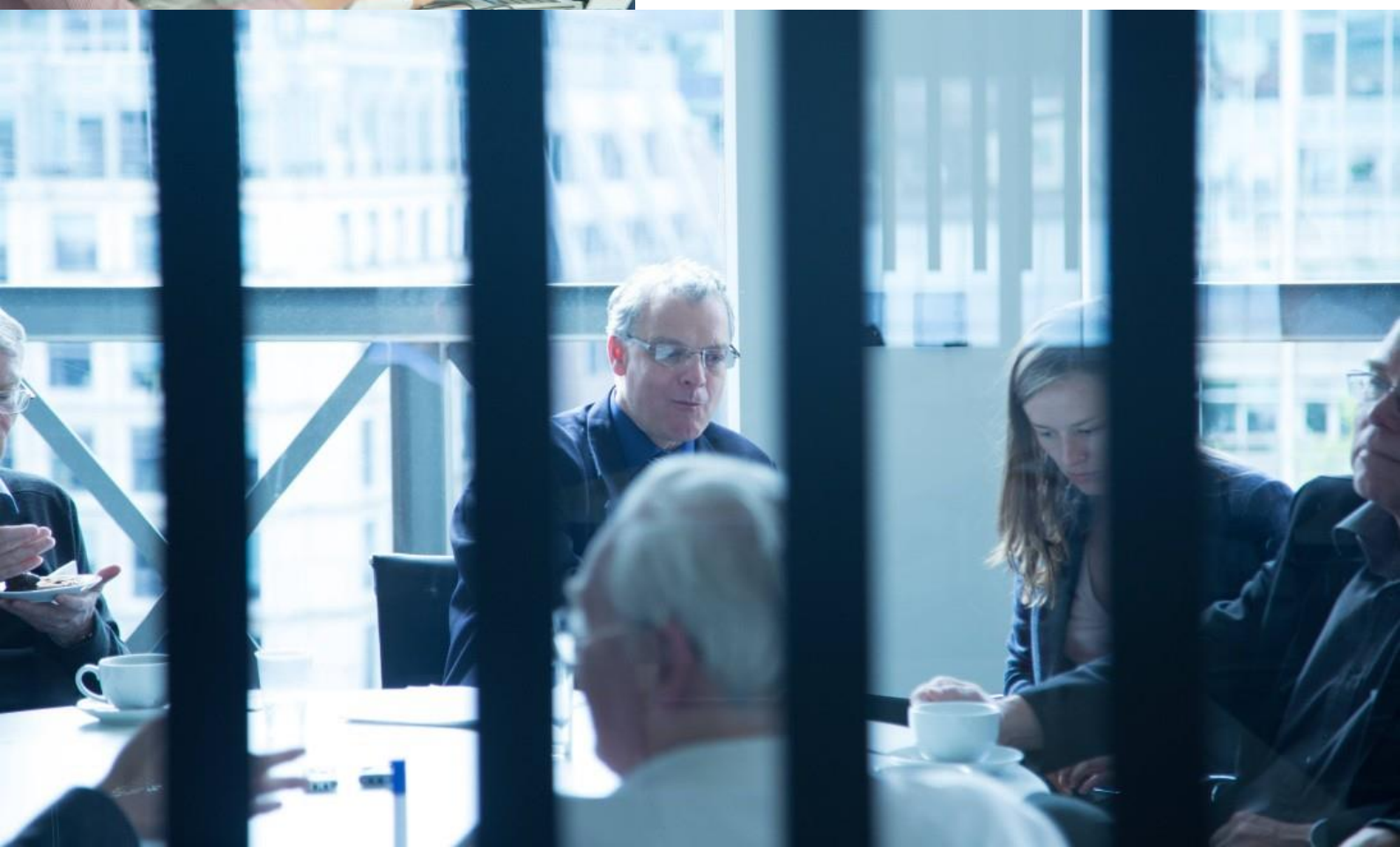
SESSION 2: INTELLIGENT USE OF DATA

How can we use the potential of data intelligently? What are our sector needs to adapt to data-driven practices? How can intelligent data-driven approaches increase our ability to deal with industry challenges at local and global scales? What can we learn from best practices and from other sectors?

SESSION 3: FUTURE SCENARIOS

What potential does real-time data, connectivity and predictive intelligence hold for our future cities and buildings? How is the built environment practice likely to transform? How do we adapt our practice(s) and thinking to a digital future?





THEME 1

data & built environment

- What does "data" signify for the Built Environment?
- What potentials does it hold to transform the way we think, imagine, innovate and operate as Built Environment professionals?
- What are the current challenges that should be addressed?

SPEAKERS:

Damien McCloud (ARUP, UK)
"The digital built environment. Next in line for data driven change"

Kimon Onuma (Onuma systems, USA)
"Building Informed Environment"

Leif Granholm (Trimble, Finland)
"What does data mean in built environment?"

THEME 1

speakers

ARUP Global Skills Network lead for GIS, Spatial Services lead in the IT & Comms group.

Damien McCloud (ARUP, UK)

"The digital built environment. Next in line for data driven change"

In Arup the digital agenda started last year and lots of our client has started to understand the value of data both in consulting and creating products that are driven by data. Data is great but how we deal with data and make it useable are very interesting questions in an industry that does not manage change that well. We would also need to question where data comes from? Do we know who captured it? And how consistent, accurate and complete is it?

I'd like to present a few case studies from ARUP for this symposium. The first one is a "city resilience index" we created for cities to assess how resilient they are. We developed a platform by which people can answer questions to individual issues like crime, safety, affordable housing, food and environment. Such an approach provides a completely new approach to a city and changes our thought process because we focus directly on the user experience. From this perspective, making sense of data is actually bringing/putting data together holistically and seeing the value of it within a specific context. In the second project, called Crown Estates, we developed a tool to allow stakeholders to look at data (based on models) to understand where to take sand from offshore and pump up into the coast to create a new environment. The tool facilitated a collective and informed decision making process. For the third project, Arup was involved in creating a five-year regeneration project for Croydon and we needed a platform to make this happen successfully. So we used to open source platform to contact and collect answers from the local authorities, the planners the stakeholders and the end users. The key thing is that technology is great but we still need the expertise of the planners, engineers and architects to tell us what needs to be done and we can only run such projects successfully if we do not lose sight of the collaborative and holistic approach.

The key thing is that technology is great but we still need the expertise of the planners, engineers and architects to tell us what needs to be done and we can only run such projects successfully if we do not lose sight of the collaborative and holistic approach.

THEME 1

speakers

Architect, FAIA, software developer, founder of Onuma Systems, informed built environment

Kimon Onuma (Onuma systems, USA)

"Building Informed Environments"

Mobile devices started gaining popularity and now we use these devices together with GPS to navigate though data and find information in real time. However, this navigation system and data is not coming from a single model, but from multiple sources easy to use and implement for developers where you can keep on adding new functionality based on the business needs. For example Uber has overtaken taxis in 2015, uses GPS, maps and technologies created by others to identify "need" and "availability" to create a whole new business. This is only one example of a huge disruption that has happened around us. In this rapidly expanding world of smart cities and internet of things (IoTs) where all is connected but there is one gaping hole. The Building Industry has been overtaken by the technologies around us. Amazing results are being achieved by Building Information Modelling, yet a level 2 BIM is still a file focused format. Exchanges from one application are imported to the next and it's also very much project focused.

The larger system of smart cities, internet of things, real time data and the technologies are already out there to make change happen, and we don't have to wait. But we need order, we need to be methodical, structured, and go step by step as we build up the capabilities of the building industry. Navigating a stacked canyons of books, or data, or a set of buildings requires technologies to get to the data in real time, through web-service, dynamically and in a non-linear way. BIM Level 3 data will not only come from BIM or IFCs. Smart cities are already moving ahead and they are not in BIM. In our BIM centric view we assume that everything should map to us but we must look at it in a different way. New patterns and uses will emerge on the fly and machines can find those patterns. Our value in the Building industry is that as experts we can understand the complexity and build the connections, navigate through this complexity and create solutions. It's now time for disruption in Building Industry to occur. We need to align Building Smart standards with technologies around us.

Making data cloud and web-service enabled and accessible (to its end users), and transferable to all apps is the key.

All other applications and vendors could then tap into the exact same data service to be able to translate data to their own format. The Onuma systems on the website uses such data coming from other services which are lined in different tools then you can go online without logging in and it's also linked to other BIM applications. This level three BIM implementation in the cloud is a huge step and it's an approach that can be expanded for any building type. The result is an ecosystem of data, system and functionality that can be expanded over time and ready to be used.

THEME 1

speakers

BIM ambassador, programmer, consultant in construction and IT

Leif Granholm (Trimble, Finland)

What does data mean in built environment?

BIM has begun to change from production to consumption of information. The consumption of data by software is going to be the next huge change within the Built Environment Industry. Information modelling is made from an information structure and making its semantic means we have an agreed meaning for this data which becomes information used in creating technology. But we have different types of objects by which we describe buildings for different purposes. Semantic data then becomes information which can be used in creating new technologies, which I believe will inform an interesting future of digitalisation and standardisation.

In open BIM is it very important that we use standards to exchange data because you might need to transfer information from different tools and different software for different purposes. Licensed standards prevent new actors and players to come into the field but open standard do not but they rather drive innovation. This is how information in one project connects to the next so it's very important how we convey this information.

There are new paradigm shifts in information processing such as making data/ information cloud-based, and transforming human readable data to machine readable data. All this is happening in all sectors of the society so the semantic web based is becoming more software driven. Also there is a shift from human to digital-data-driven society; which requires us to be digitally present but still put the "human" factor first.

We have to be digitally present and put the "human" factor first..

THEME 2

intelligent use of data

- How can we use the potential of data intelligently?
- What does our sector need to adapt to data-driven practices?
- How can intelligent data-driven approaches increase our ability to deal with industry challenges at local and global scales?
- What can we learn from best practices and from other sectors?

SPEAKERS:

Michael Batty (CASA/UCL, UK)
"Big Data, Real-Time Streaming and the Intelligent Transport Planning"

Martin Simpson (ARUP, UK)
"A case study of information management from a client perspective?"

THEME 2

speakers

Bartlett Professor of Planning, Chair of the Centre for Advanced Spatial Analysis (CASA)

Michael Batty (CASA/UCL, UK)

"Big Data, Real-Time Streaming and the IntelligentTransport Planning"

We have been working on advanced civic design for a long time since 1967 and what we have been doing has always been with big data. Disruptions is key to what we are learning with regards to this data and there have been a great deal of changes in the dynamics of a city in particular where the city is a living organism and what constitute its hub is continually changing.

We have always drawn data from the city and articulated our theories and ideas about it so there have always been a group of people thinking about and abstracting from it. When the main frame computer came into existence in 1940's people began to develop models and develop data pertaining to the cities. Computers has always been used for a long time now but the big change is that the same computers have been embedded into the built environment which caused the current information revolution. Today, the way we access the smart city is through technologies that let us generate and use data and its useful equivalent – information (data) is key. We get access to information (data) through mobile and fixed devices like phones, smart cards, through fixed sensors which record transactions and so on. Most big data is real time data which is "big data". Big data is a product of sensing and it's big because of the temporary element and its continual streaming in regards to the management of the real time system.

Information (data) is key…The data we collect today usually complement rather than substitute for data which we collected and used in the past…

However, there is a big shift which is the introduction of time into our thinking – in the past most urban planning for future cities was timeless –think of garden cities, new towns, master plans. This is all part of an increasing complexity; more time scales, more opportunities, more diversity.

We are building a model for the UK at the moment alongside Future Cities Catapult. This model helps people across England and Wales to be able to log on this model and test scenarios, for example, job creation and its impact on a specific area. So if you have a lot of people, for example 2 million people using this data, it generates more data exponentially which is exactly on of the interesting features of big data revolution; not just capturing data but using the data to generate even more big data. Another example involving real time streaming is our London dashboard where you can log on (www.citydashboard.org) and connect to live video coverage of some streets within London. And lastly the oyster card project involves the impact of commuting on the system during special events like the summer Olympics of 2012.

THEME 2

speakers

Structural Engineer, Associate director at ARUP, Visiting professor at the University of Salford

Martin Simpson (ARUP, UK)

"A case study of information management from a client perspective" (Thames Tideway and Crossrail)

Cross rail project looks at how to translate and converge a set of data for the benefit of the client. This was achieved through the development/use of an information management platform to bring together Computer Aided Design (CAD) data (model), data from BIM enabled tools, Project Information Management and GIS. This has been achieved by creating both virtual and physical assets; integrating data for design, construction and operation life-cycles; modelling a 3D model of the environment envisioned to be built, by managing all types of data collaboratively and creating a "single source of truth", which is a simplified term for integrated systems and databases.

This has led to the development of a new BIM strategy comprising of: technology development (through partnership with Bentley), development of a vision for the management, cross-linking and migration of all different data sets (and assets), and adoption of 4D analysis to mitigate interface risks. A simple web-interface allowed access to all data sets created for the project. The types of tools and systems that were integrated were: spatial and non-spatial databases (geotechnical database, land ownership, risk, mapping data, assets, etc.); 2D and 3D CAD for design and drawing production; desktop GIS for analysis, visualisation, data management; web-GIS for data sharing and dissemination; Office applications for reporting, calculations, communication; specialist software, i.e. for settlement analysis; document management system for document storage and management; engineering content management system for drawing and model storage and management.

Crossrail was able to achieve huge cost savings through this single source of truth.

At Farrington station, the 4D analysis model (3D model linked to the delivery programme) cost £120k to develop but reportedly saved over £8million from risk contingency due to interfacing complexity.

THEME 3

future scenarios

- What potential does real-time data, connectivity and predictiveintelligence hold for our future cities andbuildings?
- How is the built environment practice likely to transform?
- How do we adapt our practice(s) and thinking to a digital future?

SPEAKERS:

David Philp (AECOM, BIM 2050 Task Group, UK)
"Applying of New Digital Construction Technologies to Building and Infrastructure Projects"

Rob Snyder (Tangerine, USA)
"Piercing the data bubble"

Lars Hesselgren (PLP Architects, UK)
"Urban transport: why cars aren't like trains?"

THEME 3

speakers

Head of BIM Implementation at the UK Cabinet Office , Chair of BIM Delivery group for Scotland

David Philp (AECOM, BIM 2050 Task Group)

"Applying of New Digital Construction Technologies to Building and Infrastructure Projects"

What data means for the AEC is that it help making well formal decisions. This creates more productivity and improves the way we process data. The cumbersome part is all about optimisation of data by looking at future scenarios in order to generate potential outcomes. There is a rapid shift in the built environment moving into the 4.0 model in order to work in both physical and digital aspects. 4.0 models in the AEC sector looks at how the built environment becomes sensor rich and how cyber security system meets and connects with the internet of things (IoTs) or with the complete visualisation. Data is becoming more service oriented, through the internet of services, and more open in order to inform key decision making.

We have started to see advanced manufacturing where buildings are built off site with advanced logistics in the world of construction. This has influenced new commercial transactions in our digital economy so things have been pushed together to change methods in construction.

...perhaps the biggest challenge is not technology or data around us but how e-building changes our environment, and its integration into the smart city agenda.

We are creating lots of data with software using keyboards, and touch screens but how do we address this change in our sector from an academic point of view? How do we identify the skill gap and up-skill the industry? And how do we think about the industry and organisational changes? How do we think about optimisation and performance instead of thinking of careers alone? We therefore need to embrace a future with the 4.0 model, understand how to integrate the structured, semi-structured and unstructured data into our systems, and develop mechanisms to manage data volume coming from numerous data sources.

THEME 3

speakers

Researcher, software developer, founder of Tangerine

Rob Snyder (Tangerine, USA)

"Piercing the data bubble"

When environmental data is evaluated, what matters most is detected, other data is ignored, and understanding is formed through some kind of tangible articulation, decisions are made, and actions are taken.

Thinking is the interplay between — all the data in the built environment — and, the purposeful act of narrowing it down to something we can grasp.

Techniques used to understand environments are absolutely essential. Such techniques are evolving. Part of the evolution is to communicate with complex environments by contributing to human understanding, and also to machine parsing of complex environments by cognitive systems like IBM Watson. We can extend Watson into spatial data/media types in unique and meaningful ways. Thus we can help to extend Watson's capabilities for human-machine dialog, discovery Q&A helping us find meaningful insights when questions don't have predefined answers.

At Tangerine, our work can extend Watson capabilities into highly complex spatial and visual data environments and there is a link between the need for human being to develop sense making techniques through narrowing, focusing, articulating and creating an entirety of the built environment.

Architect,
Director of Research, Senior Associate Partner at PLP

Lars Hesselgren (PLP Architects, UK)

"Urban transport: why cars aren't like trains?"

London will always have traffic problems and our ideas are what matters. This idea has to be driven by intelligent data obtained from our urban environment. We need to look at cars like a transport pod just like trains. We are in the process of developing a new underground transportation solution (CarTube) for London which operates with autonomous electric cars. The key benefit of digital information is that we can ride cars apart in platoons by separating them. And this ability of spacing can improve efficiency in transportation. Based on data simulation, a CarTube solution could take 4 people in a car with an average speed of 80km/h and 40000 passengers can be transported in the same tube each hour. And there is plenty of space underneath London to accommodate this concept as soon as we drop down 10 to 20 meters below ground level.

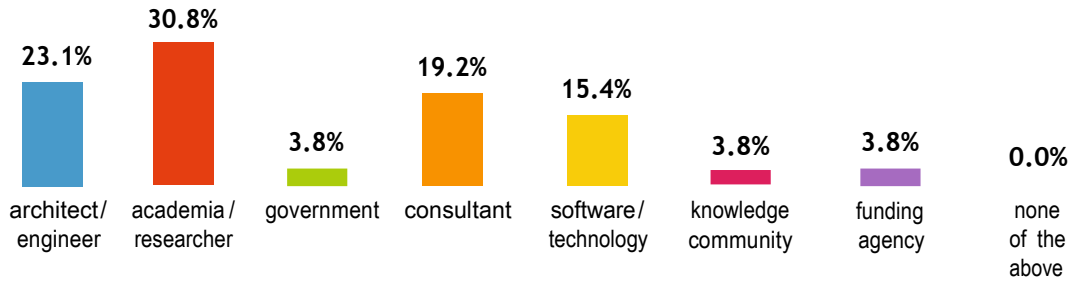
To travel from the end of the M4 to our office in Central London will take about 12MINS with the CarTube whereas at the moment it takes about 58mins or longer. Most journey times could take 5mins with this solution because you won't have to change the line or stand by the side of the tube. It will be integrated with the motorway system and we already have an existing infrastructure across the country and the remaining infrastructure can easily be built/achieved with today's technology.

It will be integrated with the motorway system and we already have an existing infrastructure across the country that can be easily built with today's technology.

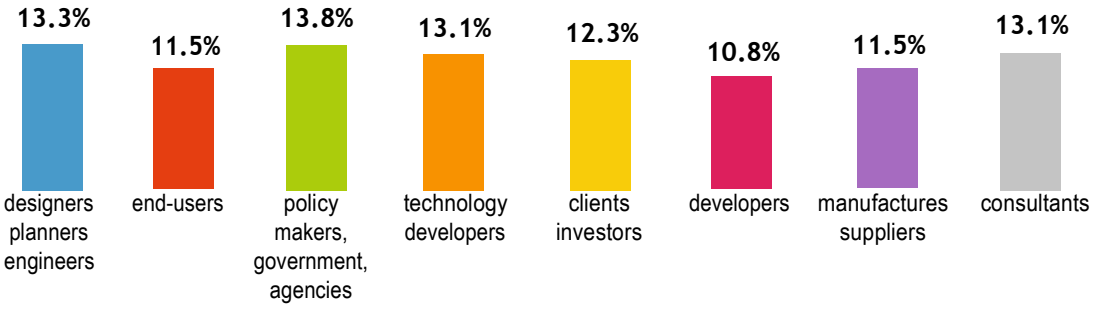
SURVEY RESULTS

Participants of the symposium were asked to participate in a survey pertaining to the questions of data; i.e, value obstacles, potentials, stakeholder needs, useful forms of representations, ease of access. The complete set of questions we posed and responses we have obtained are summarised below.

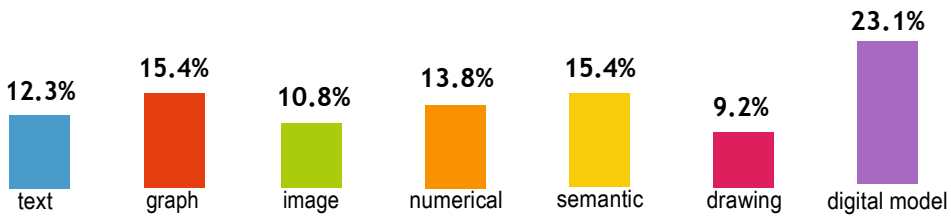
Which of the below best represents you (and your company/ instituion)?



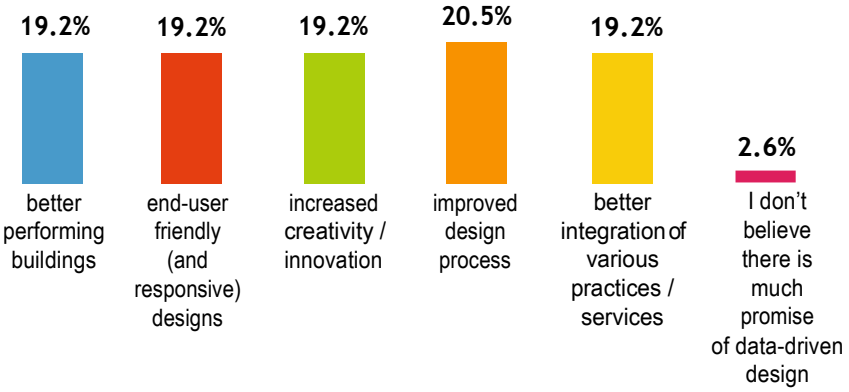
Who needs data in the built environment?



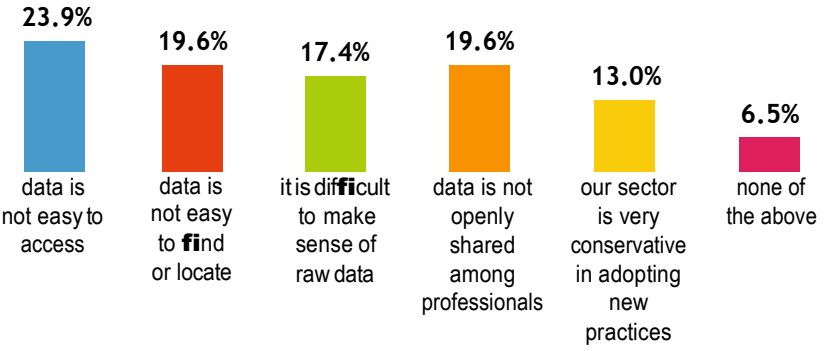
In which formats is data most usable for you?



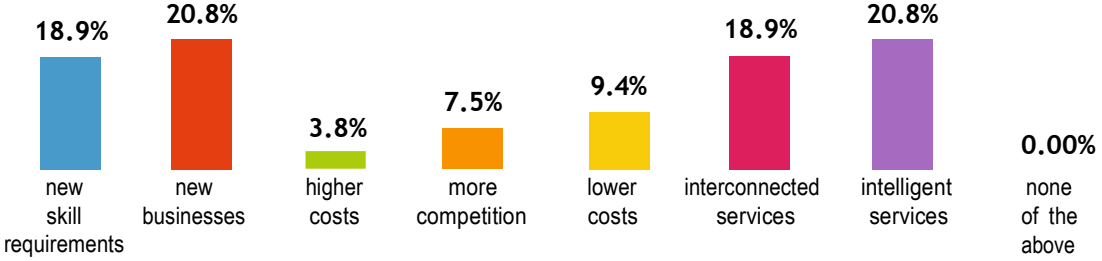
What do you think is the “added-value” of data-driven approaches?



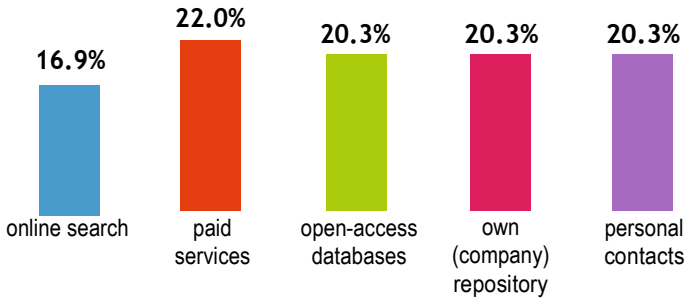
In your opinion, what are the biggest obstacles impeding data-driven approaches in architecture, construction and engineering?



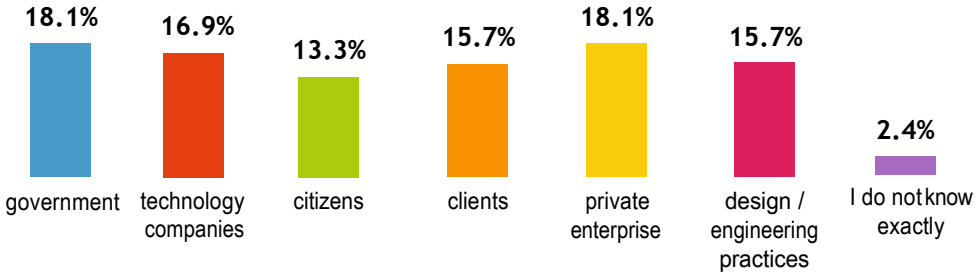
Please, select the three most crucial “potential” impacts of data-driven practices for architecture, construction and engineering sector



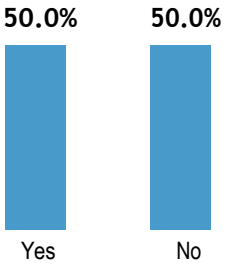
How do practitioners currently access data in our (architecture, construction and engineering) sector?



Who owns the data in our sector?



Would you (or your company) be willing to share your own data (generated by you or your company) for free?



BREAK OUT GROUP 1

future scenarios

Participants: *Winnie Rogers, Arto Kiviniemi, Leif Granholm, Lars Hesselgren, Gary Cook, Ricardo Codinhoto, Sebastian Macmillan, John Baird, Gulnaz Aksenova.*

Participants of the break out group 1 have explored how cities and built environment might transform in the future, 15 to 20 years from now; proposed possible future scenarios and explored how looking at the past and present can influence possible future development. Below text is an excerpt highlighting some of the key points captured during the conversations.

Cities are growing attracting more capital, driving better productivity and generating more inequality between poor and rich. Migrations are increasing with more intense interactions in artificial indoor spaces. Cities attract more capital and intellectual workforce. Cities were juxtaposed against countryside whether they will become more productive and economically sustainable. Considering multiple viewpoints, there will be more cultural and economical differences between rich and poor, life in cities and countryside. How values are different and will they be different for different levels?

Would it be possible to achieve an equality of sharing data while having inequality of economical situations?

It is obvious that pervasive computing and internet of things will be more embedded in to the built environment to create building awareness. It will be able to learn about human behaviours in use of buildings. Artificial intelligence is increasing; technologies are getting more intelligent. Intelligence is about learning. Robots can provide adaptable systems that support data-driven communities to make sense out of data converting it into knowledge and then into automated processes. Volume of choices will increase everywhere. Data will be generated by masses, information will be distributed and will not be controlled by any party or might be controlled by individuals. We have to understand how to transform data into information and into knowledge. Are there any particular actions that could be taken now?

Flexibility of physical spaces can generate new business opportunities. Spaces will be smaller and now they are wasted. We shall be using existing stock where sharing of spaces can make buildings more flexible with more opportunities for work.

If we have opportunities to use existing buildings in a more intelligent way, why should we build new ones?

However, if we heavily rely on data, we will still not be prepared for the disasters which are out of our control. Moreover, we have to take in consideration paradoxes that more we know, more we have to do and to know. Predictions usually fail, for example, there was a huge trend going in relation to Artificial Intelligence in 70s and we were still not able to realise visions that have been put thirty years ago. Can we really think that in 15 years' buildings will become robots? We would rather have to think about joint future, if one person sinks, then everyone sinks.

We would rather have to think about our joint future, if one person sinks, then everyone sinks.






future scenarios. break out group 1

BREAK OUT GROUP 2

future scenarios

Participants: *Michael Batty, Richard Koeck, Tuba Kocaturk, Fei Chen, Martin Simpson, Damien McCloud, Rob Snyder, Job Momoh*

Participants of the break out group 2 have explored how cities and built environment might transform in the future, 15 to 20 years from now; proposed possible future scenarios and explored how looking at the past and present can influence possible future development. Below text is an excerpt highlighting some of the key points captured during the conversations.

Everybody is moving to automation and maybe in the future we will design a city based on algorithms. A future possibility might be the ability to assign tasks to algorithms to do the design. But how do you put aesthetics into a design if you hand it to an algorithm? How far will you introduce and monitor human interaction into a design process led by algorithms? When the algorithm is left to do the design you will need people looking at things differently.

In the future we would hope that methods, algorithms and information underpin the design process in order have a system in which we tap in data that's clean, intractable, usable and can be easily exchangeable

Maybe our disciplines will still remain and the decisions would be made still by professionals not by machines. The understanding of a machine is very limited, for example, we are able to input values in a way that IBM Watson can't do. We will get to a point where we would be designing based on values and certain criteria. How do we evaluate these things, for example environmental factors over economic factors and what are the prominent values?

It seems like we will see dramatic improvement in software development in the next 50 years. Currently, many software developer are just stuck in the idea that modelling is everything and we should throw drawings into the bin because it's counterproductive.

Software is supposed to be helping you understand the information.

We have to develop new forms of techniques in this spatial environment so that we can understand what happened in the past and how it informs present and future models. Bringing this data together is a prerequisite but you have to provide the tools that would make people able to articulate/understand the data.

If you have the user in the heart of the design when it's been produced then the result would answer most of the questions. Every software company says they are user centric but look at what they are producing today.

Another problem with design software is that they don't document the procedure to the solution but rather the solution is documented therefore it's not possible to backtrack and understand the decision. How you achieved the solution is what really matters rather than the actual solution.

With globalisation the market will be very competitive and we will need to have the capacity to use data very intelligently to provide services based on global needs. Given this complexity, most disciplines would have to collaborate with each other e.g. collaboration between science, engineering and social science. Back in the 60s, there was no interest in this topic but now physicist, computer scientist, sociologist and other disciplines are all going into this field. Also most research groups have similar research themes but different focus so e.g. Transport group at UCL, and economist at UCL are looking into urban science and econometrics which has created a lot of fluidity into the urban science research. Another example is the various journals out there are now publishing into the built environment area. So there is no reason why other disciplines should not interact with each other looking at the same area of focus.

The likes of Brunel, during the industrial revolution, were not just engineers or innovators. They were also looking at ways of creating new businesses and economic values out of their inventions. Will big data answer the big economical question, for example? Can an increased and intelligent use of data have societal/economical and geographical effects?

We need to develop data ethics, how we value data, privacy, openly shared data and democratize data which might lead into a new profession which aims to build this relationship. There would be a need for commoditization of personal data and people would set up new roles in managing people data like internet history, mobile phone data, advertisement space, etc.

The standard idea is that technologies will solve every problem. It is not a smart way to think. Political issues and social problems need both political and social interventions that data cannot solve on its own.





future scenarios. break out group 2

FINAL REMARKS

The challenges that lie ahead for a data/information driven future are highly complex and multi-dimensional and will require innovation at many levels across many disciplines including AEC professionals, technology developers and policy makers. The potential that real-time data, connectivity and computational intelligence offer will undoubtedly alter the traditional relationship between humans and their environments. We need to develop a deeper multidisciplinary understanding of the problems and opportunities for our sector to discover how information can be linked to performance and values, and what this can imply for the society, the environment, the economy and how our sector operates.

Until recently, the main emphasis in AEC has been on "environment" and "energy" concerns including minimizing waste, responding to existing needs and making the most efficient use of our existing resources.

However, there is a growing tendency, in recent years, that associates future resilience and sustainable development with innovation through propositions that promote new behaviours, new life styles, new ways of playing, working, consuming and producing in and for the future.

This opens up a whole new set of discussions regarding the role "built environment professionals" can and will play for the development of a sustainable future, not only to serve "environmental sustainability", but also with a highlighted emphasis on economic and social sustainability. In this expanded scenario, "data" and "intelligence" are seen to be the key drivers towards that goal. The questions we posed and explored throughout the symposium are not simple but point towards the two crucial and transforming dimensions of a data-driven future for our sector. One is the technological and the other one is the political dimension. While technology will act as a catalyst to build the necessary mechanism and infrastructure to achieve data-driven innovation at product/process and operational levels; the political dimension will have a profound effect on shaping the means, actors and scales of "human" interventions and thereby can help enhance, or stabilize, or diminish possible, probable or desirable scenarios proposed for a data/information driven future. The discussions laid the foundation for a data-driven model of a future digital ecosystem as a distributed, adaptive and socio-technical system. We have explored alternative scenarios whereby the conceptual development, design, construction and operation of buildings could be intricately linked to past or instantaneous data in a continuous loop where buildings themselves could become as active data generators and as such contribute to the continuity of a sustainable and integrated digital ecosystem for the built environment.

final discussion

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If you would like to take part in future RUE Network activites, hear about upcoming events, or join this network, please send your intents, ideas and propositions to Dr. Tuba Kocaturk (kocaturk@liverpool.ac.uk)