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Editorial

Foreword

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The financial crisis is certainly of current significant concern, but our economy is not the only example of how the interconnected systems that we have created dictate, or shape events that can affect us all. Historically, nations, expanded their influence for reasons that included financial gain. While nations still play a role (and I am not just talking about my own country), multinational businesses now also have a global influence. Recently, the internet and the worldwide web have enabled financial systems and other services to be globally connected. But all this global connectivity has taken place without a science of global systems that would help us understand the possible outcomes of these connections. Technology is seen both the culprit and a possible solution to some of our current and future problems. Furthermore, we now see that there are many who are happy to share information, with communities and groups pooling expertise and data for common causes. And yet, in contrast to biology, where ethical committees are set up to try and provide moral guidance, many of us seem oblivious to the underlying consequences of the complex techno-systems that we are creating. Therefore, the biggest challenges that our society now faces, require people, science and technology to come together.

My own early research was, until recently, mainly about isolated problem solving, from ship capsize to fires in rooms, and I am mindful that each crisis leads to human tragedies. But there is an upside to this type of backward looking research. It improves our understanding of how systems behave. With a newfound knowledge of dynamical behaviour we can seek innovations, and hence begin to look forward. For example, bridge engineers can conceive new designs, which are not merely extensions of existing concepts. To tackle our major socio-economic problems what we really need to do is to bring together data, from many sources, and models at a large scale that will allow us to consider events and crisis at a societal level. This will also allow us to respond much better to unforeseen crises, such as earthquakes and other natural disasters, by developing improved strategies for crisis management, enabling us to better coordinate relief efforts.

Many of the major issues today are caused by the fact that world population has grown and that actions can now have a global influence. Climate change is the clearest example but social unrest, crime, cyber-crime, pollution are other examples where we now need to take in a broader picture of the problems. Therefore, to help policy-makers arrive at evidence-based decisions, we need models to capture the dynamics of interactions. There is a need to model the present to protect the future.

Financial markets now operate on a global scale with much of the trading carried out automatically by computer systems. We have recently seen social network sites not only take off but rather fly supersonically around the globe based on internet use, the fact that we have socially adapted to this form of communication and the mobile

Fig. 1. Steve Bishop, Professor of Maths at the University College London and Coordinator of the Pilot Phase of the FuturICT project.

capacity. Having seen the financial crisis unfold, we should seek new technologies for both informational exchange and communication that are both useful and ethical. But, do we need regulation, or self-regulation?

If we want to increase our social well-being while reducing energy consumption and emissions, then we need to be able to innovate. It often appears that innovations come about serendipitously, but what is actually needed is a methodology to encourage innovation. All this comes at a time when data is becoming available. Oodles of data, in fact. Energy data, research data now placed on-line, sensor data from telephone use, travel, and much, much more. This comes from a range of devices – the internet of things where almost everything is able to transmit and receive information, which arrives in real time, from fixed data sources – like that released by governments, or indeed that contributed by others through "twitter" and the like. What we need is to be able to turn this data into information, and then into knowledge so that wisdom can be created. All this sounds achievable, since there is now a flood of data, but it is still not trivial for some people (such as charities) to select specific data. This is where academics or small businesses should step in, by creating platforms for data to be formulated in a simple, readable way. Ultimately there is a question whether data, methods and platforms should be available to all as a public good? If all data is open how can businesses create their own niche market?

In 2009 the European Commission set in motion a plan to support ambitious, science driven initiatives that require a federated effort across Europe to provide a basis broad for technological innovation as well as novel benefits for society. The idea was to support a 10-year programme of research from 2013 with an ambition to reach funding levels of up to one billion euros, although this funding will have to come from a variety of sources. I was part of the initial group gathered by FuturICT's initiator and scientific coordinator, Dirk Helbing, responding to both the challenges we face and the call from the EC. The FuturICT project is the result of this multi-partner collaboration. It brings together different disciplines to fashion tools for understanding – at the global scale – the complex behaviour of our social and economic systems, plus the role that information and communication technologies can play to improve our society. The planned work is truly transformational: it will lead to significant changes in the way that we interact with the systems that govern our lives and perhaps even with each other via new forms of social networks. We are not pushing against closed doors. Technology is becoming more socially adaptive, researchers in the social sciences are becoming more computational while academics studying so-called complexity science are solving more and more complicated problems which involve both technology and social behaviour. Acting as Coordinator of the Pilot Phase of the FuturICT project, I feel lucky to have been involved in this exciting work from the start. I get the same feeling now that I had back in the early 80's when chaos theory was bringing together people from many disciplines to understand the paradigm shift away from

determinism that its discovery gave us. The work we are doing with FuturICT is just as exciting, if not more so, mainly because the potential gain to society is huge. We have developed a comprehensive research roadmap that has energised the community and built tremendous international commitment to move towards our vision. Carrying out interdisciplinary work is not easy in any environment, but when this is spread across the humanities and the sciences it is much harder. But it is interesting. We have "big data", we have a "big society", in the sense that there are now a lot us who are globally connected. What we therefore need is big science.

The papers within this issue highlight just some of the problems that lie ahead and indicate possible solutions. They highlight the need for further research pointing out what could be gained if the scale of their activities could be increased significantly.

I hope that it gives you a hint at the excitement that I feel embarking on a research journey that will improve our understanding of social systems, inspire new technologies and help provide 'what if' scenarios that policy-makers vitally need to explore and manage our complex, connected world.

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