Towards Global Scale Socially Interactive Pervasive Systems

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The Background

The authors lead the FuturICT consortium (http://www.futurict.ethz.ch) within the EU Future and Emerging Technologies (FET) "Flagship" call for proposals (http://cordis.europa.eu/fp7/ict/programme/fet/flagship/). The envisioned project aims to leverage data from the global network of heterogeneous pervasive data sources to facilitate the construction of planetary scale, real time models of our social system (the Living Earth Platform). Insight from such models will both feed back into development of our pervasive planetary computing infrastructure, allowing it to become socially informed, self organised and responsive, whilst also pushing forward the development of new methods and tools for intelligent, informed human decision making.

The Authors

Paul Lukowicz (who would represent the consortium the workshop) is a leading researcher environment aware pervasive computing and is in charge of the CS part of the project. He has a long history of leading interdisciplinary projects and is currently coordinating the SOCIONICAL (www.socionical.eu) FET Project on modelling large scale pervasive computing based socio-technical systems. Paul Lukowicz is Associate Editor in Chief of the IEEE Pervasive Computing Magazine, member of the editorial board of the Hindawi Advances in Human Computer Interaction Journal, has been a member of the PC Committees of all key conferences in the area of Pervasive Computing. His group is active in pervasive computing related European research including current participation in 7 ongoing projects.

Dirk Helbing (ETH Zurich) is the consortium overall scientific coordinator. Helbing was elected as a member of the German Academy of Sciences 'Leopoldina' and the European Academy of Sociology. He is cofounder and chair of the Physics of Socio-Economic Systems Division of the German Physical Society, and founder of the Competence Centre 'Coping with Crises in Complex Socio-Economic Systems'. His research ranges from fundamental science to practical applications. He has advised the International Risk Governance Council, and edited a book on Managing Complexity. He scientifically guided the reorganisation of the Muslim pilgrimage to Mecca in 2007, accompanying the construction of the New Jamarat Bridge. He has published highly influential papers in various journals including Nature, Science and PNAS and participated in abroad range of European research projects.

Steven Bishop (Maths, UCL), who is the overall manager of the consortium is a mathematician of international renown and has expertise in dynamical systems, complexity science and experience of crossing into the policy and decision-making domains. His experience ranges from 20 years as Manager of the UCL Centre for Nonlinear Dynamics to recent successful coordination of the EC project 'Global System Dynamics and Policies' (GSD).

The Vision

We take a global view of large scale pervasive computing seeing it as (i) a complex, dynamic, globe-spanning system, (ii) composed of billions of entities interacting over multiple spatial and temporal scales, (iii) interweaved with society in a multitude of ways across different functional and structural layers. A core question to be addressed by our vision is how to manage the relationship between the complex, globe-spanning pervasive computing infrastructure and

human society into one that leads to usefull applications and more stable, trustworthy, reliable, and inclusive technology. The core aspects of the vision ar:

1. Leverage the current global computing infrastructure into a pervasive, socially aware "nervous system of the society" that will provide real-time information about relevant events, social processes and structures, with a strong focus on preserving privacy. It will collect and analyse a multitude of heterogeneous, dynamic data sources ranging from crowd sourced sensor information through digital media, social networks and blogs, to public infrastructure. Examples of the derived information are shifts in collective opinions and social attitudes, changes in consumer behaviour, emergence of tensions in communities, demographics, migration, mobility patterns, or health trends.
2. Develop a novel, data driven computational social science that builds on the real-time information provided by the above "nervous system" to enable the comprehensive, real-time description of the techno-socio-economic dynamics on various temporal and spatial scales up a global scale. This will lead to the construction of the Living Earth Platform: a sophisticated planetary scale simulation and visualization system together with an interactive social science platform facilitating a broad range of novel participatory applications for individuals, communities, organizations and policymakers.
3. Develop a novel complex systems models, theories and tools for the analysis of complex, dynamic interactions between society and socially adaptive pervasive computing infrastructure. It will also lead to novel methods enhancing trust, stability and reliability in self-organised pervasive computing infrastructures by leveraging socially inspired mechanism for cooperation, coordination and reputation propagation.
4. Make the global computing system socially interactive by allowing it to adapt to social needs, react to unforeseen events and in general to increase systemic resilience of the society. The system will be able to shuffle resources (e.g., information sources, bandwidth, distributed computing resources) to enable better monitoring and management of an emerging crisis situation to promote and support interaction in and between communities; offer 'persuasive computing' based approaches to facilitating behaviour change; and provide emergency "slow down and ask human" mechanisms, preventing the system from accelerating crises and systemic failures. The adaptation will be directed by high level, human-formulated goals and implemented by bottom-up, self-organised processes leveraging the systems' social awareness and ability to comprehend complex social phenomena
5. To engage users in the system, give people the possibility of creating intelligent, proactive "digital proxies", combining all their devices, services, and data. The proxies will act as virtual guardians of their interests and as an adaptive, human centric interface to the global information system. Based on user-specified personal preferences, a proxy will follow in virtual space the behaviours, attitudes, and social interactions of the corresponding user in reality, providing data and services to causes and people that the user cares about or can be expected to directly benefit from. It will give back real-time, appropriately presented access to aggregate social models, predictions and interaction patterns related to them, based on privacy-respecting, value-oriented model for sharing data and services, the '**new deal on data**'.