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Editorial

Transdisciplinary approaches to urban computing

1. Introduction

Welcome to this special issue on transdisciplinary approaches to urban computing. Let us begin by discussing the two titular terms, transdisciplinarity and urban computing, and the reasons these two topics are so closely entwined. Transdisciplinarity as a term is, of course, built from the Latin word trāns, meaning "on the other side of," and discipline, referring to scientific disciplines. In this sense, the term can be understood to refer to *going beyond* disciplines, crossing disciplinary boundaries, and examining topics in a holistic fashion through several overlapping lenses – epistemologically, theoretically, and methodologically. The term differs from the related concepts of *multidisciplinarity*, where a topic is studied by several disciplines that are in service of a "home" discipline, and *interdisciplinarity*, where methods from one discipline are transferred to another.

In compiling this special issue, we called for a multi-themed discussion on urban computing, asking authors from several interrelated fields of study to discuss a more transdisciplinary approach to the field. The starting point that we hoped authors would launch their investigations from, is that urban computing systems are always necessarily an amalgamation of three interrelated components – people, place, and technology (Foth et al., 2011; Kukka et al., 2014a,b). It is clear that with a field as complex and heterogeneous as urban computing, computer scientists cannot expect to stand alone and create systems that can ignore the complex and messy sociocultural context in which these technologies operate. It is only through a deeper understanding of the existing social, cultural, and political contexts that we can hope to design interventions, create prototypes, and build deployments that respect and enhance the experience of a technologically mediated urban lifestyle (Bull, 2013).

2. On understanding urban spaces and places

The impact of computational culture on cities, buildings, and spaces drives with it innumerable kinds of change (Fuller and Ekman, 2013); urban computing technologies embedded into our everyday lived environments have the potential to alter the meanings of physical space, and affect the activities performed in those spaces. The common characteristic of these spaces is that they are public and shared – spaces that people in general have access to, as opposed to private or semi-public spaces such as office buildings or university campuses. However, specific urban spaces found within cities – outdoor markets, walking streets, shopping malls – are viewed as representative of other such locations, in other cities, anywhere in the world. As shown in the articles in this special issue, these spaces are neither interchangeable nor are they without specific cultural meaning – and we should always aim at understanding the very local and culturally specific characteristics of the location in which a specific urban computing system is deployed (Williams et al., 2009). In other words, we must understand and address the design practices of urban technologies (Suopajärvi et al., 2012) situated in the built environment, in order to navigate the complex rules and roles that different spaces impose on both the people in those spaces, and the technologies we add to them (Kukka et al., 2014b).

Anne Galloway noted that with the advent of urban computing research, the discursive construction of ubiquitous computing as "everywhere" has shifted through a relocation of these technologies "somewhere," and has thus also stressed active engagement with new technologies to create more meaningful relations with the people, places, and objects that surround us (Galloway, 2012). Urban computing views places as settings for sociocultural protocols, conventions, and values, as well as means for shaping our shared conception of community and individual concepts of identity (Kostakos et al., 2006; Paulos and Jenkins, 2005). The articles in this special issue corroborate our view that understanding the existing human activities, cultural practices, and the holistic nature of a given place should be the starting point for any urban computing research and deployment project.

For anthropologists and for other social researchers, place is a complex thing created by people's interactions with each other and their environment. It comes into existence when the flow of goods, information and people meet and separate again and when history and memory are confronted with the present. Place is also always affected by certain power structures that limit and create possibilities, and it is within this framework that people give meanings to spaces, making them places. Motta et al. (2013) note that place-building activities people employ in their everyday life are highly varied, and are as much about appropriation as they are about the negotiation and control of space when interacting with other people. Further, place-building practices through situated technologies also involve an element of performance, which people enact when interacting with technologies in public spaces. These performances can be understood to add to the sociological and cultural milieu in which the performance acquires its meaning and cultural significance. Hence, place building includes an intricate interplay between the space and the interaction with and between people and technology, and extends it with cultural dimensions, making it a useful addition to the tools that can be applied when considering the deployment of a technology in a given public setting. The transformation of space through the introduction of novel computing artifacts must then be seen in this context; the technologies transform the 'cultural work' being done in space, but also become sites of cultural production themselves. It is this cultural understanding that then provides a frame for encountering space as a meaningful and coherent place, and relating it to human activities (Dourish and Bell, 2007).

3. On understanding the users and non-users of urban computing technologies

In order for urban computing to move forward as a field and for researchers to begin carrying out such transdisciplinary investigations,

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it is crucial that we first understand *who* it is we are designing for, but also *who are we leaving out*; that is, to understand both *users* and *non-users* (Baumer et al., 2014; Satchell and Dourish, 2009; Selwyn, 2003) of urban computing systems. Often, urban computing researchers have a tendency to focus on "young urban professionals" as the desired or imagined user of urban computing systems (Dourish and Mainwaring, 2012; Dourish et al., 2007; Williams and Dourish, 2006). Marsden et al. have previously pointed out that these "averages" are of limited use for design (Marsden et al., 2008), and Oudshoorn and Pinch (Oudshoorn and Pinch, 2008) have remarked that the "*very act of identifying specific individuals or groups as users may facilitate or constrain the actual role groups of users are allowed to play in shaping the development and use of technologies*". Similarly, Wyatt (2008) urges us to distinguish between '*real users*' in the '*real world*' and the images of those users and their relationships held by designers, engineers, and other sorts of system builders. Penny (2012) notes that the actual term '*human factors*' speaks volumes about the '*engineering mindset*' in computer sciences where the qualities of human embodiment and experience are reduced to mere peripheral '*implementation details*,' and Bannon (1991) points out that the very idea of '*the user*' re-configures a multifaceted human being as an adjunct to a piece of hardware or software.

Hence, in order to understand technologically mediated urban life not only from the point-of-view of the more technologically minded individuals but as a whole, it is important to also take what Susan Leigh Star has called 'non-standard users of information technologies' (Star, 1990) – a term used to highlight the differences in power relations among the multiple actors involved in the development and usage of technology – into consideration. Satchell and Dourish (2009) identify six forms of non-use: *lagging adoption*, *active resistance*, *disenchantment*, *disenfranchisement*, *displacement*, and *disinterest*. Similarly, Wyatt et al. (2002) identifies four categories of such non-users: *resisters* (people who have never used a certain technology because they do not want to), *rejectors* (people who do not use a given technology anymore because of lack of interest or due to cost, or because they have alternatives), *the excluded* (people who have never used a technology because they cannot for a variety of reasons), and *the expelled* (people who have stopped using the technology involuntarily because of cost or the loss of access).

In our own work, we have started to expand this debate by critically looking at the established focus on '*use*-ability' and considering new and broader design goals and aspirations towards '*citizen*-ability' (Foth et al., 2013).

4. On understanding urban technologies

Finally, we must of course also understand the technology, because without it, we would not have "smart" cities. The transdisciplinary perspective of this special issue prominently acknowledged that the future of cities is characterized not only by technological innovation. Rather, it is also shaped by new technological user practices that are fueled by trends towards mobile, personal devices; broadband connectivity; open data; urban interfaces; and, cloud computing. These technology trends are progressing at a rapid pace, and have led global technology vendors to package and sell the 'Smart City' as a centralized service delivery platform predicted to optimize and enhance the key performance indicators of cities, as well as generate a profitable market. The top-down deployment of these large and proprietary technology platforms have helped sectors such as energy, transport, and healthcare to increase efficiencies. However, an increasing number of scholars and commentators warn of another 'IT bubble' emerging (Townsend, 2013; de Waal, 2012). Along with some city leaders, they argue that the top-down approach does not fit the governance dynamics and values of a liberal democracy when applied across sectors. A transdisciplinary understanding is required, of the socio-cultural nuances of how people work, live, play across different environments, and how they employ social media and mobile devices to interact with, engage in, and constitute public realms.

Genuinely putting people, that is, a socio-culturally nuanced understanding of urban citizens, at the centre of the urban computing agenda sounds simple, even trivial, but it is not. Similarly to how Bannon (1991) at the time called for a profound shift in attention "from human factors to human actors," more and more commentators these days have started to critique the commercial and top-down-only vision of the smart city and consider alternative approaches that focus on the "smart citizens" (Hemment and Townsend, 2014).

We are far from witnessing another Biedermeier period, with post-election violence in Kenya in 2008, the Occupy movements in New York, Hong Kong and elsewhere, the Arab Spring, Stuttgart 21, Fukushima, the Taksim Gezi Park in Istanbul, and the Vinegar Movement in Brazil in 2013. These examples of civic action shape the dynamics of governments, and in turn, call for new processes to be incorporated into governance structures. Participatory and transdisciplinary inquiries into these new processes across the triad of people, place and technology is a significant and timely investment to foster productive, sustainable, and livable urban environments. With this special issue, we want to reframe the current debates in academia and priorities in industry and government to allow citizens and civic actors to take their rightful centerpiece place in urban computing research and innovation. This calls for new participatory and transdisciplinary approaches for co-inquiry and co-design. It is an evolving process with an explicit agenda to facilitate change – change that requires new governance infrastructures and practices for civic and community engagement.

5. Summaries of accepted papers

This special issue brings together five papers that exemplify the diversity of transdisciplinary approaches to urban computing.

The first paper, "**Public Visualization Displays of Citizen Data: Design, Impact and Implications**" by Nina Valkanova, Sergi Jorda, and Andrew Vande Moere, is representative of a particular community of practice within urban computing, that is, media architecture. With the Media Architecture Biennale and the Pervasive Displays Symposium, this community is developing and growing as designers, architects, and planners are coming together to realize the practice and promise that the combination of digital media and architecture can provide to enhance the experience of the built environment. The paper by Valkanova, Jorda and Vande Moere reports on a citizen-driven, public data visualization providing further proof that pretty lights and colorful façades in media architecture are increasingly making way for situated installations and interventions fostering community engagement.

The article "**Public Design of Digital Commons in Urban Places: A Case Study**" by Maurizio Teli, Silvia Bordin, María Menéndez Blanco, Giusi Orabona, and Antonella De Angeli, illustrates the difficulty and arguably impossibility of trying to contain urban computing to just technical aspects. A transdisciplinary approach embracing urban/spatial and social/cultural study domains is imperative in order to not only bridge and connect the digital and the physical layers of cities, but also for designers to start questioning broader concerns, such as governance, public space, and digital commons.

Flora Salim and Usman Haque co-authored the paper, "**Urban Computing in the Wild: A Survey on Large Scale Participation and Citizen Engagement with Ubiquitous Computing, Cyber Physical Systems, and Internet of Things**", which offers a survey on existing approaches in engaging participations and devising interactions with a range of existing urban computing technologies: smartphones, public displays, cyber physical systems, and Internet of Things. The authors propose a taxonomy for categorizing and characterizing urban computing technologies and approaches with regards to the level of participation they stimulate, the participation scale they support, the manipulation and effects mode they enable, and the interaction mode and scale they enable. The paper concludes by discussing strategies for structuring and engendering participations and interactions with empirical evidence gathered from small to large scale urban computing projects in the wild.

Paul Edward Gault and Judith Masthoff propose "**DiCER: A Distributed Consumer Experience Research Method for Use in Public Spaces**." This paper takes a more business-oriented approach,

and presents research into new ways in which organizations can gather field-based consumer insight particularly in public spaces. The authors present a method called DiCER for using large groups of ordinary people to make fieldwork observations in a transdisciplinary setting with ethnographers and designers, with the goal of harnessing the potential of an organization's staff for a shared goal of generating useful fieldwork material.

Last but not least, Christian Nold raises some pertinent epistemological and theoretical questions in his paper "**Micro/Macro Prototyping**." He argues that there often appears to be a disconnect between the top-down notion of the smart city and the more recent bottom-up notion of the smart citizens. This conundrum may be reminiscent of past events that are perhaps useful to revisit. In the early 1960s, prominent urban planner Robert Moses proposed the Lower Manhattan Expressway, which was met with sharp criticism by Jane Jacobs. Similarly to today's debate, there was Moses' bird's eye view perspective and Jacobs' pedestrian perspective. Both have merits for different reasons and purposes, and Nold discusses what he calls a gap in 'scale of audience' and 'scale of normative ambition' in urban computing, which he tackles with aid from actor-network theory, critical and participatory design.

We hope that this special issue broadens your horizon and enriches your thinking moving forward as much as it did for us. We would appreciate your feedback and comments, and look forward to continuing this discussion.

Best,

Hannu Kukka, Marcus Foth, Anind K. Dey

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