

Beyond the ‘Smart’ City: Reflecting Human Values in the Urban Environment

Louise Mullagh*, Lynne Blair*, Nick Dunn†,

*School of Computing and Communication

Lancaster University,

Email: l.mullagh@lancaster.ac.uk, l.blair@lancaster.ac.uk

†Imagination Lancaster

Lancaster University,

Email: nick.dunn@lancaster.ac.uk

Abstract—The paper presents a work in progress that will develop a tool for mapping and reflection upon human values within the context of the ‘smart’ city. As the rise in ‘smart’ city initiatives and implementation of technologies within the urban environment become more evident, citizens face irrevocable changes to their environment and their lives within the city. Such a reliance upon technological strategies to fix cities’ ills and a drive for constant innovation within the ‘smart’ city is largely being driven by technology companies and city leaders. Citizens must live with the consequences of such strategies which have the potential to change their environments in momentous ways. In order to develop new technologies within the urban environment Living Labs are becoming increasingly prevalent, enabling designers of technologies to engage with multiple stakeholders, including citizens, in the design and implementation of new products. We present a work in progress that develops a tool for the mapping of and reflection upon, human values in order to avoid unnecessary technologies being imposed upon citizens. Furthermore, we seek to engage those currently driving the ‘smart’ city agenda in envisioning an alternative future where consideration of citizen’s values and the effectiveness of the city takes priority over technology implementation for the sake of efficiencies. We present the need for this new tool as it goes further than existing methods in its potential for enabling citizens to develop clear understanding of the values present in the ‘smart’ city environment.

Keywords—urban areas; social factors; appropriate technology

I. INTRODUCTION

The contemporary city is a progressively complex entity, with issues such as increasing populations, sustainability and the need for greater efficiency becoming the focus for city leaders and technology companies. As examples of ‘smart’ cities increase and the implementation of urban, mobile and ubiquitous computing within this environment become more apparent, the landscape of the city is becoming redefined in a seemingly irreversible race toward autonomous operation of the urban sphere [1].

Physical environments impact upon human psychology and behaviour [2], yet there is little evidence to demonstrate the human aspects of what makes a city are considered when leaders or technology companies begin to consider transformations to make a city smart [3]. Currently there seems to be a focus on the ‘smart’ rather than the ‘city’, with a bias toward technological solutions [4]. Although cities are making some advances in dealing with major issues such as increases in population, decreases in funding and pressure on existing services, this is not done in a holistic and integrated manner. This results in the neglect of human factors [3][5] and too much reliance upon technology to fix existing and future ills [6].

There is little consensus as to what exactly defines this

emerging paradigm between ‘smart’ cities across the globe, many differing approaches to their development currently exist [4][5][7]. “A city can be called a ‘smart’ city when investments in the human and social capital and traditional ICT based infrastructure fuel a sustainable economic growth and a high quality of life, with wise management of natural resources” [8].

This definition can be contrasted with the following statement, taken from a white paper on “Smart Cities and the Internet of Everything” [9].

“Smart cities are a future reality for municipalities around the world. These cities will use the power of ubiquitous communication networks, highly distributed wireless sensor technology, and intelligent management systems to solve current and future challenges and create exciting new services” [9].

The first definition places ‘human and social capital’ before ‘ICT based infrastructure’, whereas the second definition talks exclusively of technological based solutions. It is this conflict, between the significance of human and technological drivers within ‘smart’ cities, that forms the basis of this paper.

Within the context of the ‘smart’ city, Living Labs [10] have sought to involve ‘users’ in the development of technologies, with a broad aim of demonstrating a “user-centric open innovation approach for fostering everyday life innovation in users’ real life context” [10]. As with ‘smart’ cities, there is no consensual definition of a Living Lab, but they are increasing in numbers globally, engaging in user-centric research relating to technology but not exclusively within the ‘smart’ city context.

The paper is structured as follows; the introduction (section I) presents the context of the ‘smart’ city and Living Labs, section II presents a discussion of Living Labs and their role in shaping ‘smart’ cities, using the particular example of the UrBan Interactions (UBI) programme in Oulu, Finland. This is followed by the introduction of human values and technology, a justification for their consideration within this discussion, and an example of values based HCI approaches in section III. In section IV we present a discussion of technology in the urban environment and in section V we introduce the Value Reflection Map, a tool through which values can be evaluated within Living Labs in relation to ‘smart’ cities. This forms the basis for the next stages of the research development. Section VI concludes the paper with proposals for future work.

II. THE RISE OF THE LIVING LAB IN THE SMART CITY.

Living Labs are increasingly considered to be effective sites through which to engage citizens in the development of technologies deployed within cities [11]. As sites of innovation,

they began development in the 1990s as a method to test new technologies in a home-like environment at MIT Medialab. More recently they have developed a more user-centric, open innovation approach across many technological fields. They can be found in cities across the globe with differing scopes and different funding models, sharing no unified methodology or framework. Although no unified framework or definition is available, they tend to share the ethos of user-centred approaches [10] with the broad aim of enabling citizen based innovation for the development of new technologies.

New networks such as the European Network of Living Labs (ENoLL) [12] aim to develop a more coherent and connected approach, using the following definition; “A Living Lab is a real-life test and experimentation environment where users and producers co-create innovations. Living Labs have been characterised by the European Commission as Public-Private-People Partnerships (PPPP) for user-driven open innovation.” ENoLL consider Living Labs to adopt four main activities; co-creation, exploration, experimentation and evaluation. [12]

Oulu, a member of the ENoLL network and situated in northern Finland, offers an example of a partnership operating across public and private organisations. It seeks to integrate technology into all aspects of city life and to place itself as a leading archetype of the ‘smart’ city and living lab movements. The city has the largest regional research and design spending per capita in Finland and fifth largest in Europe, providing 14000 jobs in the ICT sector. In the late 1990s Oulu was ranked as the world’s third “silicon valley” in Wired Magazine and the area has the youngest population average in Finland and Europe [13].

Ubideployments are currently deployed outdoors and indoors in Oulu city centre, in order to experiment and test technologies and applications ‘in the wild’. Displays are implemented, deployed and evaluated in a ‘real world setting atop an open urban computing testbed’ [14][15]. This approach marks a response to criticisms that technologies designed and tested in labs do not account for ‘real world’ environments or applications [16]. The UrBan Interactions (Ubi) programme is joint sponsored by the City of Oulu and Nokia, with a budget of €6 million.

The hypothesis for the deployment of Ubideployments states “by deploying new technology and services in the urban space we make it a ‘better’ place for people” [17]. Without a description as to what ‘better’ is, the hypothesis suggests a place is enhanced by the deployment of technology, in this case the Ubideployments. In literature relating to the project there appears to be little consideration of the environment in which the displays are being deployed, or evidence that citizens are engaged prior to the design process. This also suggests that deploying a piece of technology enhances a space, without surveying the environment or indeed the need or desire for having such a display within the public arena. Through the mapping of human values within the urban environment, our research aims to establish the appropriateness of a technological fix to perceived problems within the ‘smart’ city. Such an approach fundamentally questions the current methods of user-participation methodologies and highlights the need for value elicitation and reflection tools.

III. HUMAN VALUES AND TECHNOLOGY

It is widely accepted that human values become manifest in the design and use of new technologies [18], and as such are a

vital component of our research. Human values have long been recognised as important in disciplines such as anthropology, sociology and psychology [19]. Values in psychology are conceptions of desirable ways of behaving or desirable end states, characterised as relatively stable, transcending specific situations [18][19]. Empirical evidence demonstrates that all values are held by all people, across cultures all of the time, but their importance is ranked differently within each individual. [19]. Within more technology-based disciplines, communities such as CSCW and Participatory Design have also long embraced overarching human values such as cooperation, participation and democracy in their design methods [20]–[22].

An important and co-dependent relationship exists between human values and design as a result of their fundamental shaping of the human condition and people’s attitudes towards technology [18]. Values are also a fundamental component of the design process, as has been recognised in the field of Human Computer Interaction (HCI). In this particular case, we take the ‘smart’, technologically mediated city as the context. Citizen’s experiences will be affected by the design and implementation of such technologies to their everyday environment, therefore it is essential to take into account their values and ensure they are not negatively affected.

A design tradition which has placed values at the heart of its practice is Participatory Design (PD) [22], in that it considers stake-holder participation in the design of technology as fundamental. The inclusion of values within the core design criteria of PD echoes a similar approach within Value Sensitive Design (VSD), a theory aiming to offer a principled and comprehensive framework for accounting for a set of (universally held) human values of ethical import throughout the design process [23]. The field of HCI has acknowledged the need to respond to human values, echoed by Sellen et al [24], who believe that greater finesse will be required in order to determine and understand values in the context of large systems and sets of systems that users operate within. They state “Much effort also needs to be expended on determining what is desirable within a place, an institution, or a society” [24].

IV. TECHNOLOGY AND THE URBAN ENVIRONMENT

Within the field of HCI methods do exist to work with values during the design phase of the development of new technologies, however there is a lack of tools allowing users role to actively define their own contextualised values within the design process [18]. Values are not explicit and easy to discuss, leading to interpretation issues between users and designers. The lack of existing tools is acknowledged by Kujala and Väänänen-Vainio-Mattila [18], who call for further research and the development of a toolkit which will enable this to occur more effectively. However, the toolkit has not been developed, leaving a space for the development of a Value Reflection Mapping tool (VRM). The tool will enable greater understanding and development of user’s values in two ways. Firstly, the VRM will enable citizens or organisations to map values for new technology designs and the urban space into which they might be placed. Secondly, it encourages questioning of the suitability of new technologies and whether they are needed, rather than jumping immediately to a technological solution.

Introducing technology into the urban environment, as can

be seen with the ‘smart’ city paradigm, changes the nature of place. As a result the city is transformed into a digitally augmented physical space, and therefore can be considered as ‘hybrid’. In this respect, we can understand the intention to augment a physical space with technology as a means of attempting to improve that particular space, as can be seen in the example of Oulu’s Ubidisplays and their aim of making the space ‘better’.

At present there are too few theoretical and methodological approaches which examine the effects of technologies upon physical spaces and subsequently the human relationship to them [25][26]. A need for new ways of understanding physical spaces with respect to their digital augmentation is required. This is a view held by Ciolfi, [26], particularly in terms of how their “features support and affect our physical presence and further experiences with the environment...in order to shape the way in which a system will be embedded in the space itself.”

Deployment of technology within the city might be the solution to some important issues affecting citizens, but without considering the value environment in which such issues exist and active engagement with all citizens, it is not possible to determine if it is necessarily the most appropriate answer. By beginning with human values and mapping layers of values within the urban environment, suitability emerges and will enable a ‘bottom up’, human approach. Human values are certainly present within technologies and urban environments but often remain hidden to both citizens and those developing new technologies within the urban environment.

V. THE VALUE REFLECTION MAP

A prototype tool, the Value Reflection Map (VRM), was developed as part of a short research project with one city based stakeholder in Lancaster, UK, in order to assess the viability of such an approach. As an independent retailer and café owner, the stakeholder has engaged in projects seeking to introduce a variety of digital interactions within his business spaces [27]. The starting point was to question the approach taken by Oulu in order to evaluate the environment into which a new technology might be placed. Central to this study was the question of how human values can be made manifest within a physical space and objects within that space.

We began by questioning whether design processes considered the spaces where interactions were being placed, furthermore whether human values were taken into account in such a process. Through eliciting contextualised values of the stakeholder, we sought to investigate how consideration of values might enable designers to question whether introducing new technologies into a space was appropriate and if so, how values might be designed into such technologies.

The method employed to develop the VRM consisted of three stages, with the output being a paper based map of colour coded values elicited from the physical environment and objects contained within. Schwartz’s value model [28] was taken as a starting point, where the stakeholder answered questions from the European Social Survey (ESS) [29]. This survey was chosen due to it being based upon empirically established questions, which seek to elicit values of individuals across different cultures. Other models could have been employed, but for the purpose of the initial short research project it was useful to use an example with existing surveys and against which answers could be modelled.

We built upon the ESS in the next stage through conducting a contextualising interview with the aim of elaborating on the information gained from the values survey. In order to discover values held by the stakeholder which were made explicit within the physical space the interview was coded and specific values identified. The third step, artefactual analysis, was conducted in order to interpret how the stakeholders values were embedded and communicated within the environment. Using an image of The Hall, we systematically identified the stakeholder’s values for each object within the space, colour coding each value. Areas of particular value density were identified that helped the stakeholder visually aware of where his values were manifest within the space.

As a short and initial research project, we produced a paper artefact that mapped one particular space with the values of one person. One very encouraging aspect of this technique, as identified from the initial test with the stakeholder, is the ease in their understanding of the Value Reflection Map. Through employing a visual map the stakeholder was able to clearly identify value clusters within the space where he was considered the introduction of digital interactions.

Insights from the initial research included feedback that the stakeholder is immediately able to identify with the physical space and objects. We also discovered use of imagery rather than text led to a clear and unambiguous reflection of values. A further reflection was that a paper based artefact widens potential access to citizens who do not engage with technology, either through choice or circumstance. By developing the VRM further it will enable the values of multiple people within multiple spaces to be considered and reflected. Further development of this tool will require the creation of a new methodology, as it is vital to engage citizens and investigate their experiences within the built environment.

The term ‘mapping’ is embedded within the practice of cartography, but is often used when information is being visualised. We employ this term in order to enable citizens and organisations to use the map as a way-finding and sense making tool in order to elicit their own values and those of the designers of technologies. Human values are not always easy to discuss, even though we all hold them, we do not necessarily make connections between what we value and the expression of those values. We believe a primarily visual tool will facilitate more effective elicitation of values within the environment.

Existing methods and tools have created some interesting and challenging approaches to mapping emotions or charting citizen unrest within urban environments. PanoRemo [30] enables designers to map user’s emotions onto a variety of panoramic images, employing emotional design and market research techniques in order to evaluate how people feel about a particular environment. The Centre for Urban Pedagogy (CUP) [31] work with stakeholders in cities, most often disadvantaged or marginalised groups. They develop information brochures that are of particular use to that community, employing analogue techniques and community led design. A variety of different techniques for making visible issues that are hidden are included in The Atlas of Radical Cartography. The most notable example featured is iSee [32], an online initiative where citizens log and map surveillance such as CCTV throughout the city, meaning they can then plot their routes through the ‘path of least surveillance’. The VRM does build upon the principles of making information visible and

community led design, but the point of departure is that it is not a digital tool, nor will it be employed for market research as Panoremo. It also differs from the work carried out by CUP, in that the aim of the VRM is for citizens to discover information and values for themselves, rather than relying upon organisations to do so.

VI. CONCLUSION AND FUTURE WORK

The aim of this initial investigation was to identify the potential effectiveness a visual approach to representation and reflection of values might have and if the VRM was a valid starting point for further work. Through questioning current approaches taken by cities such as Oulu, we intend to develop a longer term research project. Based upon the position we have taken regarding the current focus upon the 'smart' within cities, we believe the VRM tool will be effective if employed within contexts such as Living Labs. Furthermore it will enable the visualisation of citizen's contextual values before the design of any technology occurs.

Distinct opportunities exist in cities as technological environments, such as improvements in health care, education and sustainability [33], however these need to be realised in balance with the potentially negative consequences produced by the introduction of such technologies as big data, ubiquitous and mobile computing. At present the balance within the 'smart' city paradigm favours efficiencies rather than effectiveness, which does not always provide the optimal environment for citizens.

Key to the next stage of research is the engagement of Living Labs involved in the development of new technologies within the 'smart' city. In order to develop the Value Reflection Map further, we intend to use such sites as case studies, to enable us to begin developing the new methodology through engaging with real world practices within the city.

A crucial strength of the Value Reflection Map will lie in the visual representation of values, enabling designers and citizens to clearly identify important values. Visual representation of values within spaces will ensure connection of citizens, space, objects and values, leading to more informed decisions regarding implementation of technology in the city. It is through the deployment and use of this tool that we intend to ensure focus on citizens within the city is valued more highly than focus on the 'smart'.

REFERENCES

- [1] A. Townsend, *Smart Cities*, ser. Big data, civic hackers, and the quest for a new utopia. London: W.W Norton and Company, Inc, Mar. 2013.
- [2] R. Gifford, *Environmental Psychology: Principles and Practice*. Colville,WA: Optimal Books, Mar. 2002.
- [3] J. Kim and A. L. Steenkamp, "Analysis of Smart City Models and the Four-Foci Taxonomy for Smart City Design," *The Visibility of Research*, 2013, p. 637.
- [4] G. Galdon-Clavell, "(Not so) smart cities?: The drivers, impact and risks of surveillance-enabled smart environments," *Science and Public Policy*, vol. 40, no. 6, Dec 2013, pp. 717–723.
- [5] R. G. Hollands, "Will the real smart city please stand up?" *City*, vol. 12, no. 3, Dec. 2008, pp. 303–320.
- [6] A. Greenfield, *Against the smart city: The City is here for you to use*, 1st ed. New York: Do Projects, 2013.
- [7] H. Schaffers and et al, "Integrating Living Labs with Future Internet experimental platforms for co-creating services within Smart Cities," *Audio*, Transactions of the IRE Professional Group on, May 2011, pp. 1–11.
- [8] A. Caragliu, C. Del Bo, and P. Nijkamp, "Smart Cities in Europe," *Journal of Urban Technology*, vol. 18, no. 2, Apr. 2011, pp. 65–82.
- [9] R. Yesner Clarke, "Smart Cities and the Internet of Everything: The Foundation for Delivering Next-Generation Citizen Services," Alexandria,VA, Tech. Rep., Oct. 2013.
- [10] T. Tang and M. Hämäläinen, "Living lab methods and tools for fostering everyday life innovation," 2012, pp. 1–8.
- [11] "FIREBALL white paper on Smart Cities as Innovation Ecosystems sustained by the Future Internet."
- [12] <http://www.openlivinglabs.eu> - (accessed February 2014).
- [13] N. Simič, "Smart City as an Innovation Engine: Case Oulu," Jan. 2013, pp. 1–7.
- [14] V. Kostakos and T. Ojala, "Public Displays Invade Urban Spaces," *Ieee Pervasive Computing*, vol. 12, no. 1, 2013, pp. 8–13.
- [15] T. Ojala and V. Kostakos, "UBI challenge: research coopetition on real-world urban computing," 2011, pp. 205–208.
- [16] T. Ojala and et al, "Multipurpose Interactive Public Displays in the Wild: Three Years Later," *Computer*, vol. 45, no. 5, May 2012, pp. 42–49.
- [17] PanOULU Network and UBI Programme Presentation. [Online]. Available: <http://www.slideshare.net/femmerm/timo-ojala-oulu-university-helsinki-panoulu-network-and-urban-interactions-program-unique-publicprivate-partnership-and-living-lab-in-oulu-finland> (accessed February 2014)
- [18] S. Kujala and K. Väänänen-Vainio-Mattila, "Value of information systems and products: Understanding the users' perspective and values," *Journal of Information Technology Theory and Application (JITTA)*, vol. 9, no. 4, 2009, pp. 23–39.
- [19] A.-S. Cheng and K. R. Fleischmann, "Developing a metainventory of human values," *Proceedings of the American Society for Information Science and Technology*, vol. 47, no. 1, 2010, pp. 1–10.
- [20] J. Grudin and S. Poltrock, "Computer supported cooperative work," in *The Encyclopedia of Human-Computer Interaction*, M. Soegaard and R. Dam, Eds. Oxford: Interaction Design Foundation, Sep. 2013.
- [21] J. Halloran, E. Hornecker, M. Stringer, E. Harris, and G. Fitzpatrick, "The value of values: Resourcing co-design of ubiquitous computing," *CoDesign*, vol. 5, no. 4, Dec. 2009, pp. 245–273.
- [22] O. S. Iversen, K. Halskov, and T. W. Leong, "Rekindling values in participatory design," 2010, pp. 91–100.
- [23] B. Friedman, "Value-sensitive design," *Interactions*, vol. 3, no. 6, 1996, pp. 16–23.
- [24] A. Sellen, Y. Rogers, R. Harper, and T. Rodden, "Reflecting human values in the digital age," *Communications of the ACM*, vol. 52, no. 3, Mar. 2009, p. 58.
- [25] L. Cioffi and L. J. Bannon, "Designing hybrid places: merging interaction design, ubiquitous technologies and geographies of the museum space," *CoDesign*, vol. 3, no. 3, Sep. 2007, pp. 159–180.
- [26] L. Cioffi, "Supporting affective experiences of place through interaction design," *CoDesign*, vol. 3, no. sup1, Jan. 2007, pp. 183–198.
- [27] E. Edwards, L. Mullagh, G. Dean, and G. Blair, "Collective spaces and collected action: towards reconnecting food, consumers and nature," in *UbiComp '13 Adjunct: Proceedings of the 2013 ACM conference on Pervasive and ubiquitous computing adjunct publication*. ACM Request Permissions, 2013, p. 563.
- [28] S. H. Schwartz, "Are there universal aspects in the structure and contents of human values?" *Journal of social issues*, vol. 50, no. 4, 1994, pp. 19–45.
- [29] R. O'Shea, C. Bryson, and R. Jowell, "European Social Survey," London, Tech. Rep., Oct. 2006.
- [30] PanorEmo. [Online]. Available: <http://www.panoremo.com/> (accessed February 2014)
- [31] Centre for Urban Pedagogy. [Online]. Available: <http://welcometocup.org/> (accessed February 2014)
- [32] Insitute for Applied Autonomy. [Online]. Available: <http://www.appliedautonomy.com/isee.html> (accessed February 2014)
- [33] C. G. Susanne Dirks and M. Keeling, "Smarter cities for smarter growth," Jan. 2014, pp. 1–24.