How to Design for Diversity in Smart Cities?

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ABSTRACT

This contribution presents how a value-sensitive participatory design approach was used with the aim to design meaningful applications for inhabitants in a city. In two bachelor courses, design students were challenged to account for a diversity of human values in urban interaction design by following a participatory approach to engage inhabitants in specific urban areas. These two case studies are described and their results are discussed to improve the approach of value-sensitive participatory design in urban interaction design.

Categories and Subject Descriptors
K.4.1 Public Policy Issues

General Terms
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1. INTRODUCTION

Advancements in information technology offer ample opportunities for cities to improve performance, reduce resource consumption, and enhance the wellbeing of their inhabitants. In these so-called smart cities, technology contributes, for instance, to a more efficient organization of transport, more effective distribution of water, or higher-quality health care [4]. Furthermore, smart cities allow for more active engagement with citizens and faster response to changes.

An important challenge in the design of smart cities is that they are inhabited by people with very diverse cultural backgrounds and socio-economic statuses, leading to a diversity of distinct values, preferences and priorities. Yet, many technological innovations in a city are meant to serve all its inhabitants. The challenge, thus, is to design solutions that are meaningful for all people affected by the technology at stake.

Only then will innovations be fully accepted and make true impact.

Within our research group we try to explore links between the topics of smart cities and cultural diversity. To account for diversity of values in the design of smart cities, we believe that citizens should be actively involved in the process of designing new solutions. In particular, we advocate an approach of participatory design in which multiple stakeholders collaboratively explore new applications of technology for urban practices. This enables participants to come to understand each other's values and develop working prototypes that express their shared visions of the desired future.

In this paper, we will first elaborate upon how design can account for the diversity of values of people in the city, and describe our proposed approach of participatory design for meaningful smart cities. We then will describe two case studies in the city of Rotterdam in which we applied our approach and conclude with a discussion of the results.

2. CREATING MEANINGFUL SMART CITIES BY DESIGNING FOR DIVERSITY OF VALUES

Smart cities are often described in terms of their technical and functional features. In this view, the Internet of Things (IoT) seems to be an appropriate approach to make existing city systems and processes leaner and meaner. However, though IoT-systems might serve utilitarian needs such as lower energy usage, efficient waste management, or water management, they do not necessarily make the city meaningful to live in and might not tap into the full potential of smart cities. Uckelman et al. propose to excite and enable businesses and people to contribute to the IoT in such a way that end-users experience a personal benefit [17]. They see interaction possibilities of users that benefit the society as one of the key goals to achieve in IoT architectures. The utilitarian aspect of IoT-applications for smart cities is just one aspect of designing for meaning, as we mentioned in earlier work [18]. Utilitarian (instrumental) aspects are integrated with aesthetic and symbolic aspects of design [11, 13]. Designers should be aware of all of these aspects. Focus on the symbolic aspect in technology design is crucial for understanding how to design 'meaningful' user experiences in smart cities.

IoT-applications in smart cities do not exist out of single artefacts, but instead, as (often invisible) fabrics of networks and data flows interwoven in people's living environment. Since designing this pervasive technology is designing a 'new context' for people to live in, it would be helpful for designers to learn from the studies of embodied interaction in space and place [5, 6,

12]. In what they call the third paradigm of HCI, Harrison et al. argue that the question of how context gives meaning to the design of technological systems should be replaced by the question of how design of technology should accommodate the context [10]. In their framework, interaction is treated as a form of embodied meaning-making and they mention participatory design, value-sensitive design, user experience design, ethnomethodology, embodied interaction, interaction analysis, and critical design as methods to approach this design challenge [10]. In value-sensitive design (VSD) Friedman et al. argue that computer systems are biased by the values of their designers and engineers and enforce their worldview on the users of their designs [8, 9].

A design gets its meaning through the interaction people have with it. We define 'meaningful' as 'aligned with one's values'. When designers consciously and deliberately put their values in their design, the design might stimulate specific behaviour at the user's side as intended by the designer. It can be questioned whether this is experienced as meaningful by the user since that behaviour might be forced by the design rather than following from people's values. We thus argue that human values should be accounted for in order to create meaningful design.

Human values envision one's personal preferred world to live in and give purpose and meaning to life [15, 16]. They are a type of concerns that determines our attitude and intentions for acting under influence of imposed subjective norms [7]. According to Schwarz, people's values form an ordered system of value priorities that characterize them as individuals. The experience of meaning is multi-layered: private, idiosyncratic meaning relate to public or common (shared) meanings [2]. The position one has in society determines to a certain extent the specific set of one's values. Values are not only an impression of one's position, but are also embodied expressions of one's standpoint [3].

We emphasise individuality because we want to allow every individual to have an optimal meaningful experience. The more people can bring in their own personal concerns and interests into a 'design', the more chance that design will be of meaning to people. In society people need to negotiate importance and prevalence of their values [16]. For envisioning and creating an 'ideal smart city', people need to debate their opposing views with one another. Interactive technologies could mediate this exchange of views and values. From this perspective, meaningful technology design could be the initiation and facilitation of a state or situation in which people themselves negotiate, create and contribute to their ideal world together. From this we conclude that to address the symbolic, mediating features in smart city development, urban interaction design should account for the diversity of human values to guide the design of meaningful experiences in networked cities. Participatory design could be used as method to account for people's values in future smart cities. Since participants bring their values into the designing process in which they partake, explicit elicitation of their values is not necessary, in contrast to value sensitive design in which designers design for rather than with participants.

Designers are thus challenged to facilitate the process of creating systems and artefacts that citizens can use in envisioning and realising their ideal world. In the next section, we describe two case studies in which we followed this approach.

3. CASE STUDIES: I-LAB AND SMART POPUP LAB

In one of our research programs, Meaningful Design in the Networked City, students participate in the design of meaningful interactive technology applications for urban interactions in the city of Rotterdam. In the minor courses 'I-Lab' and 'Smart Popup Lab', for 4th-year bachelor students of the Rotterdam University of Applied Sciences, we informed students with the guiding principle that human values are the source for the experience of meaning when interacting with products, services, and environments. We told them that it would be their task as designers to be aware of the impact of their own values on their designs, and to facilitate ways to take the values of the stakeholders of their designs on-board by inviting them to partake in the designing process.

In the I-lab 'Co-Creation in the Public Domain', that ran from September 2011 till February 2012, inhabitants of the (central part) of Rotterdam South were encouraged to share their values and opinions and take these as input to design solutions. The aim was to enhance their participation in, and sense of ownership of, the (public space in) their neighbourhood.

The aim of the Smart Popup Lab, which ran from September 2014 till February 2015, was to empower social interactions and initiatives of people in the neighbourhood of Rotterdam West by creating a hybrid environment. Students were encouraged to design from a participatory approach, involving citizens in concept development and prototyping of technological applications to enrich their environment.

The urban context of the area around Zuidplein shopping mall in Rotterdam South and the neighbourhood in which the Smart Pop-up in Rotterdam West was located are very similar. Both parts of Rotterdam were (mostly) built in the first decades of the 20th century to supply cheap and efficient housing for those that found employment in the fast growing harbour or related industries. Many of these workers and their families were new to the city. Today the inhabitants of the two areas have very diverse cultural backgrounds and are in majority of Non-Dutch descent and have strongly varying values and belief systems. The average level of schooling, employment and income in these neighbourhoods is low, as are the election turnouts and the trust placed in public authorities.

With regards to the I-lab, we will now focus on one of the interventions devised by the 'Zuidplein group'. The main goal of this student group was to come up with innovative and co-creative solutions to improve the sense of belonging experienced by visitors of a large shopping mall, 'Winkelcentrum Zuidplein'. The students' initial research strategy was to conduct interviews to probe the values of the visitors, but they quickly acknowledged that by using this method the visitors became 'interviewees' rather than participants. Therefore the students decided to use large posters imitating the Facebook interface. They wrote comments on the so-called 'wall' and invited input from visitors. The students also provided 'like' stickers and felt-tip pens for visitors to express their opinions. It turned out that the Facebook wall was recognized by visitors from different age groups and diverse cultural backgrounds. By using the Facebook wall, the students created a cross-cultural and recognizable environment for research. The wall enabled certain types of mostly online performed actions, such as commenting and using the 'like' button, to be performed in a real physical space, which resulted in public interaction and co-creation. Therefore the method as used

by the students can be described as a web-oriented approach to co-creation in the public domain [14].

Figure 1. Creative session with participants for the neighbourhood during Smart Popup Lab

One of the resulting designs of the Smart Popup Lab was the 'Participation Kit'. The aim of the kit was to empower citizens by giving them the tools to collect data about their neighbourhood by themselves with the use of sensors, so they would have more insight in these data and could use them when negotiating or discussing with the local government about issues they experience. The students reached out to a local organised group of inhabitants in the neighbourhood to organise a creative session. In that session, students introduced sensors as a means for local collection of data on temperature, humidity, sound, and light. The idea of students was that people could use these data to obtain a better insight in the environmental conditions in the area. The inhabitants conceptualised possible applications of sensors around their homes and they were interested in the aggregated data of the area. However, they showed fear to share data from their personal sensor kit for reasons of privacy and safety.

4. CONCLUSIONS AND DISCUSSION

The aim of both minor courses was to train students in designing from a value-sensitive participatory for empowering inhabitants in the design process of smart cities. In order to measure the level of participation by the inhabitants of the neighbourhoods achieved by the interventions of the students, we turn to Sherry R. Arnstein's Ladder of Citizen Participation [1]. This tool focuses on the redistribution of power and distinguishes eight rungs, with 'manipulation' as the lowest and 'citizen control' as highest [1]. The web-oriented approach to co-creation in the public domain as conducted by the I-lab students can be regarded as a depoliticized form of consultation with the aim of bringing people together and allowing them to express their opinions and values [14]. The aim of the students in the Smart Popup Lab was more ambitious. By sharing decision making within their design process, they hoped to establish a partnership with the inhabitants of the neighbourhood. In this they partly succeeded: a few people in the neighbourhood pro-actively engaged with the design students.

The students mapped their values using Schwarz's model (as can be done on yourmorals.org/schwartz_process.php). However, they still displayed the tendency to see themselves and, moreover, the research and design methods they employed as relatively objective compared to the values of the people they worked with in the city, who they often viewed as the more subjective 'others'.

Another conclusion we draw is that students have difficulties to define design goals based on insights and participation of inhabitants. Although the students did use obtained insights in the interests and preferences of the inhabitants to inform their design process, from our assessment of the resulting designs we have to conclude that most of the concepts and prototypes of the student design teams were still more designer-led rather than user-led and do not properly address the diversity of people living in the neighbourhood.

We consider the following measurements to improve this method of value-sensitive participatory design. We intent to increase the understanding of students of both their own subjective standpoints as of the relativity of the 'truth' of the methods and technologies they employ, as they are outcomes of historically specific practices. Next to that, we will seek for interventions to urge students to engage in the neighbourhood even more, to have them work collaborate more intensely with the inhabitants in order to ensure that the diversity in values is more accounted for in the designs.

In September we start a new minor, 'Urban Interaction Design' in with we will aim for these improvements. The focus of the minor will be the urban fabric, which we will approach as both an outcome and a 'battlefield' of spatial power struggles, thus exploring Lefebvre's notion that space is heterogeneous and actively constructed rather than natural or transparent (Lefebvre, 1974). We hope to sharpen our ideas what this would imply for the role of designers through the workshop.

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