

Prototyping a Smart City

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ABSTRACT

In this paper, we argue that by approaching the so-called Smart City as a design challenge, and an interaction design perspective, it is possible to both uncover existing challenges in the interplay between people, technology and society, as well as prototype possible futures. We present a case in which we exposed data about the online communication between the citizens and the municipality on a highly visible media facade, while at the same time prototyped a tool that enabled citizens to report ‘bugs’ within the city.

Author Keywords

urban interaction design, media architecture, design research

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

In the coming years, cities are confronted with a dual challenge. The increased urbanization puts pressure on the city infrastructure and service delivery and complicates environmental, economic and social sustainable growth (Cohen 2006), while digital and pervasive technologies increasingly challenge notions of space, place and how we experience the city (Williams et al. 2009; Greenfield & Shepard 2007). City leaders, policy-makers and practitioners have recently turned to the so-called Smart City concept, as a possible solution to the challenges from urbanization, while the implications regarding the utilization of ICT and sensors in city management are largely left unaddressed.

The concept of a Smart city is far from unproblematic (Hollands 2008). It is often presented as technological fix, a “Wundermaschine” as Rouche et al. (2012) puts it, with a heavy emphasis on creating an efficient city, where the city is a platform for commercial innovation and the citizens are staged as consumers or data providers for service innovation and efficient management (see e.g. Arup 2011). A large part of the existing definitions depart from infrastructure and ICT as a primary mover, while the role of leadership,

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social infrastructure and specificities of the city are neglected (see Nam & Pardo 2011 and Chourabi et al. 2012 for a compilation of smart city definitions). Hollands (2008) points to the self-congratulatory nature of the smart city label and asks rhetorically “*what city does not want to be smart or intelligent?*” (Hollands 2008, p. 304).

At the same time, the smart city represents a movement towards integrating IT systems and data across departments, sectors and work areas in the city, based on needs and challenges instead of being driven by what is technically possible (i.e. technology push). Moreover, the attention from city leaders, and acknowledging that there is a need for a coherent strategy of coordinating across the city, means that there is a momentum within cities that opens up for a broader approach towards ICT and smart city solutions within the city. The point is that despite being pluralistic and contested, the smart city term is also an opportunity to reconsider the role of technology, people and the city from a more citizen-centered and holistic perspective. However, while the smart city is gaining momentum and cities are starting to work with the concept, there is still missing a framework for approaching and operationalizing the smart city from such a citizen-centered perspective.

While interaction design traditionally works with interfaces, products and services as the final outcome of an (iterative) design process, the subject matter of interaction design is increasingly investigating the *wicked* (Rittel & Webber 1973) and *messy* (Schön 1983) nature of addressing (societal) challenges and working within a complex landscape of technologies and stakeholders.

Following the continued expansion of application areas for and the diverse ways of interacting with information technology (IT) (Bødker 2006), interaction design has theoretically and methodologically matured to include the context of use (Dourish 2004), the experiences and felt life (Wright & McCarthy 2010) of users, and within the Scandinavian strand of participatory design, questioning the underlying rationale for developing and introducing technology in a given setting (Bansler 1989; Iversen et al. 2012). Moreover, while technical and futuristic paradigms, such as urban and ubiquitous computing, dominate the visions for the proximate future, interaction design challenges these visions, and at the same time proposes alternative avenues for research and practice (see Bell and Dourish 2007).

Our point is that while the smart city represents an inherent conflict between the ‘efficient and optimal city’ and the

messy and emergent city as a backdrop for urban life (Gehl 2010), interaction design already has a ‘language’ for describing and exploring the discrepancy between the ‘optimal and efficient solution’ and the messy socio-technic interplay between technology, people and society.

We argue that by approaching the smart city as a design challenge and introducing perspectives from interaction design, it is possible to ‘prototype’ the smart city in a local context. The design processes and the prototypes are defined frames wherein interaction designers and stakeholders from different sectors can explore the multiple visions of a smart city in a local context. In the following we scaffold an approach from an interaction design perspective and present a case developed within the frame of a smart city initiative.

THE ROLE OF RESEARCH AND PROTOTYPES

Fallman (2005) presents two distinctive views on knowledge and how it is put to use in design. In *research-oriented design*, the knowledge built up through the process is aimed at the final outcome. Choices and considerations regarding who to involve, what materials to use and how to approach the task – ultimately the initial ‘setting’ of the problem (Schön 1983) – are particular to and manifested in the resulting artifact. In *design-oriented research*, the design process, the interim prototypes and the final outcome are a means to understand how the interplay between people, context and technologies changes when a new artifact or prototype is introduced. As Fallman points out, in practice the two views on knowledge and their respective implications can be regarded as a continuum where the researcher moves between the two outer positions throughout the process. In relation to the smart city, the continuum presented by Fallman resembles what we see as the ‘meta’ challenge in local smart city initiatives. Namely, trying to comprehend what the concept means in a local context and understand the implications and possibilities of ICT technology, while at the same time starting to design and implement ‘smart’ services and solutions. As a consequence of this meta challenge, it is necessary to approach the operationalisation of a smart city, from a research perspective, as both research-oriented design and design-oriented research.

Here we regard the concept of prototypes as a key notion, with focus on two ways of using prototypes as vehicles for understanding the design space. Lim et al. (2008) point to prototypes as filters: “*Prototypes are filters that traverse a design space and are manifestations of design ideas that concretize and externalize conceptual ideas.*” (p.4). Whether it is the designer’s interpretation of a client’s requirements or crude prototypes co-produced with users, a given prototype filters the interesting aspects in the design process from the vantage point of the designer, client and/or participants. This means that prototypes exhibit aspects individual interpretations and mutual negotiated interpretation of the challenge and solution. Similarly, Mogensen (1992) have proposed *prototypes* as a way of “[...] provoking discrepancies in the concrete, everyday practice to call forth what is usually taken for granted” (p. 22). By using prototypes as a way to provoke and challenge the existing practice, it enables us to build a more coherent picture of the many implications – technical and social – in the development of specific design proposals and solutions. The point is not to underplay the importance of the final outcome, but to highlight the ability to understand broader aspects of the existing situation and the desires of the involved stakeholders towards developing a ‘smarter’ city, through the development of prototypes and by approaching the underlying design process as design-oriented research. In the following we will attempt to illustrate this with a specific case.

DESIGN CASE: CITY BUG REPORT

The following case was a project developed in relation to the Media Architecture Biennale 2012¹ in Aarhus, Denmark (Brynskov et al. 2012). The project was collaboration between Aarhus University and the Media Architecture Institute, while the local smart city initiative, Smart Aarhus², acted as the anchoring point and thematic frame among the participating stakeholders. As researchers from the Center for Participatory IT (PIT)³ and the Center for Advanced Visualization and Interaction (CAVI)⁴, we were interested in developing a novel interface and explore the potential new roles for citizens and administration within a smart city. As such, our design intent with City Bug Report was twofold. First, we wanted to explore the readiness of the municipality to provide data, deal with increased transparency and expose the communication between the citizens and the municipality within the urban space. Second, we wanted to investigate potential new tools for citizen services and how they could act as a platform for a more open discussion around current issues within the city and how these issues should be prioritized.

The project had two specific components, a media façade for the city hall (Fig. 1) and a web service where citizens could report specific issues on the city, either via a browser or a smartphone application (Fig. 2). The media façade showed a time lapsed animation of previous online interactions between the citizens and the municipality, drawn from the official ‘mail list’, a public record of incoming and outgoing mail. If citizens have an official complaint or request for information, they can write the municipality and they are obliged to respond within a given period (now 24 hours). The list is per law open, but in practice it is difficult to access for normal citizens. This data was displayed on the tower as red and blue dots. Each request was identified by an ID reference, and each thread of correspondence was

¹ www.mab12.org

² www.smartaarhus.eu

³ www.pit.au.dk

⁴ www.cavi.au.dk

given a color depending on whether it came from the citizen (question: red) or from the administration (answer: blue). When a question was posted, a red spot spawned on the facade at the lower ribbon, and when the question was answered it turned blue. When a transaction occurred, the specific dot would jump up a ribbon and grow in size. If/when the case was closed, the dot disappeared. The core idea was to avoid too many unanswered questions, represented by red dots, and—more importantly—to avoid any drifting red dots at the uppermost ribbon, indicating a question that remained unanswered.



Figure 1: CBR: Media façade at city hall tower.

The reporting tool adopted the notion of a bug from software development. The service enabled citizens to report city 'bugs', i.e. things that citizens thought was a problematic issue within the city. However, it was not just for trivial matters, such as missing pavement, errors on the municipal website or broken utilities, well known from services such as FixMyStreet.com; also complicated and much more political matters were welcomed. In fact, anything could be reported, which essentially turned the City Bug Report into a single interface to the entire city administration.

When a bug or case was reported, it was added to a list for others to share and discuss on social media, explicitly providing a link directly to the case for the submitter or others to share. Moreover, the list was envisioned to be a shared information space between the citizens and the responsible departments within city administration.



Figure 2: CBR report service

The two elements was not directly linked on the technical level and the bug reports was not displayed on the façade, partly due to the difference in the dataset and partly due to the potentially low content level for long periods of the short installation time. Instead we utilized the high visibility of the media façade as a way of promoting the reporting service, with a poster in the existing information pylon right beneath the city hall tower, placed outside the primary citizen service (Fig. 3).



Figure 3: CBR promotion poster

FINDINGS AND PERSPECTIVES

When seeing the case as a prototype of future smart city components, and as a way of addressing municipal data as shared data within the city and in the urban space, the case provided a number of insights.

While citizens did not link the visualizations on the tower with the underlying data, the high visibility of the project created awareness within the municipality on the seriousness of the data and the potential exposure on how the municipality handled communication with the citizens. As the participant from the citizen service noted in a subsequent interview: "Could this project stand a front cover in the

local newspaper or tabloid?”. Furthermore, in the interview the respondent described how participating in the project prompted reflection on the role of citizen service within the urban space, and engagement with communities with a similar combination of information pylons and digital platforms. Moreover, following the project, the department has participated in workshops on big data and data visualizations, as a direct result of their involvement and work with municipal data. More importantly, the bug reporting service has inspired citizen service to start developing their own ‘public hearing portal’ within their own department, providing a “track and trace” service for cases on a general basis, and mandating that all requests are reacted upon within 24 hours.

As such, the case both acted as a critical probe or prototype exposing how the municipality dealt with the increased exposure and transparency within the smart city, as well as inspired the citizen service to see new perspectives in how to approach citizens and use technology to initiate a dialog. Through our involvement in the local smart city initiative, we are able to draw on the insights from the specific case at a more strategic level on policy and future prototypes. City Bug Report made us even more aware of the organizational and political sensitivity around transparency and open data. While this is a recurring issue, it is often necessary to address it on a social and organizational level, opposed to only providing technical expertise and solutions. It is always a challenge to balance between challenging the existing conceptions and practice and providing examples that inspire stakeholders to participate and providing access to the public data.

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