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Municipal WiFi and interactive displays: Appropriation of new technologies in public urban spaces

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ABSTRACT

This study focuses on the appropriation process of two public computing infrastructures in the City of Oulu, Finland, a municipal WiFi network and large interactive displays. We analyze the adoption of these technologies in public urban places with a conceptual technology appropriation model involving three layers of factors contributing to the adoption or rejection of a technology. Quantitative data shows that while the use of the WiFi network has grown steadily, the use of the displays has been declining. Qualitative data obtained with ethnographic methods reveals that the adoption of the displays is hampered by their questionable utility and people's apprehension about interacting with the displays in a public social setting. Finally, we identify issues that designers should take into account when deploying these technologies in urban spaces in the future.

1. Introduction

Oulu is a city of about 191.000 people in northern Finland, just 200 km south of the Arctic Circle. Downtown Oulu has been transformed into a civic laboratory [1], where different types of computing infrastructure have been deployed and adapted to provide novel applications and services to people. The civic laboratory dubbed Open UBI Oulu is a joint initiative of local academia (the University of Oulu) and municipal government (the City of Oulu), each motivated by their respective complementary objectives to enhance people's everyday lives and interaction between the city and its residents. In this article we explore the appropriation of two public infrastructures: the *panOULU WLAN* (Fig. 1(a–b)), a municipal WiFi network providing open, free and unrestricted wireless Internet access; and the *UBI-hotspots* (Fig. 1(c)), a network of large interactive displays providing a wide range of information services. Although the "official" given name of the displays is "UBI-hotspots", in this article, for clarity, we refer to them as "displays" from now on, to avoid confusion with the term hotspot often used in the WiFi context.

Appropriation refers to an approach in social science technology studies that strives to explain the adoption of new technologies as a part of everyday life. The two infrastructures, the panOULU WLAN and the displays, were selected for this study, because they are relatively rare as municipal infrastructures, have been publicly available for several years, and are used by a significant number of people. Further, the contrasting characteristics of the two technologies under examination provide an intriguing starting premise for the study. For example, while the panOULU WLAN is practically invisible and its usage is not tied to a certain fixed device or to a certain place, the displays are very visible, situated and their usage can be compared to public performance. We base our exploration on two complementary datasets. First, our quantitative data comprises a two-year usage log of the infrastructures and a questionnaire study of local university and high school students on their perception and usage of the infrastructures.

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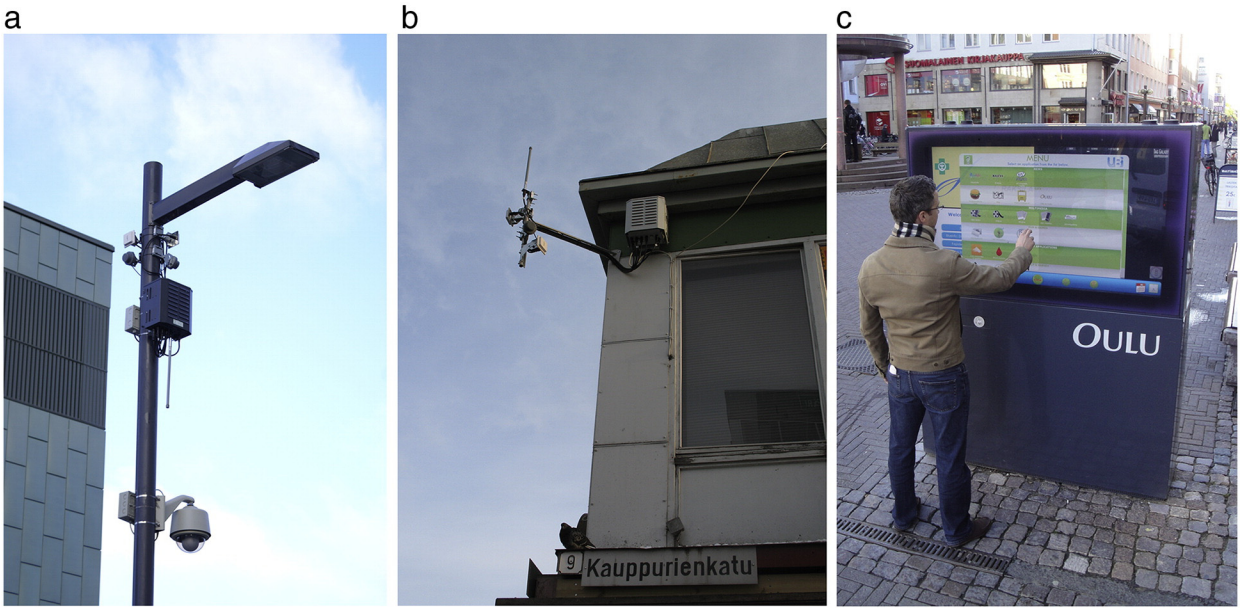

Fig. 1. (a–b) panOULU WLAN access points; (c) Outdoor UBI-display.

Second, using ethnographic methods we have collected qualitative data which enable us to explain and understand why people have (not) used the infrastructures in particular ways. While the quantitative data provides an overview of long-term usage trends, complementing it with ethnographic material offers a deeper insight into the data and raises an opportunity to perform "thick description" [2] of people's narrations of their urban practices related to technology. For this purpose we develop a technology appropriation model derived from an existing appropriation model. We take especially into account people's behavior in urban public spaces; through this analysis we scrutinize why the trends in the quantitative usage of these two infrastructures differ so remarkably. Lastly, based on these findings, we identify issues that designers should address when deploying new technologies in urban spaces in the future.

2. Ubiquitous computing and smart cities

The civic laboratory dubbed Open UBI Oulu is driven by two related paradigms, ubiquitous computing and smart cities. The "ubiquitous computing" (ubicomp from now on, [3]) paradigm has been driven by a vision of an omnipresent technology-rich space providing intuitive, unobtrusive and distraction-free interaction. In this kind of urban surroundings computers are regarded as secondary "invisible" artifacts, embedded into the physical environment and operating in the background. The set of physical objects in which computing resources are embedded are understood as the primary artifacts, the "interface". The study of ubicomp in urban spaces is referred to as "urban computing" which is an emerging multidisciplinary field considering public places such as cities and parks as sites for computing, including interaction between humans and such environments [4].

Despite the substantial investment by government and industry in ubicomp research during the past 20 years, few lasting contributions to the urban digital fabric have emerged. This lack of coherent progress has triggered critical discussions on how ubicomp research is being conducted. Most ubicomp research is still conducted in labs, due to the high cost and efforts involved in setting up (and maintaining) similar real world installations for real people. Even though ubicomp system studies dubbed as "in the wild" are increasing, they are still predominantly short-term and small-scale, thus failing to establish the critical mass of real users needed for the rigorous evaluation of a system as (un)successful [9]. Further, these studies are hampered by theoretical and methodological gaps. First, there is no fundamental theory for designing and building ubicomp systems as integral elements of urban landscape [10]. Second, the unsuccessful porting of existing interaction theories developed in labs into real world suggests that there is no solid theoretical basis that would unambiguously explain "wild practices" [11]. Third, we do not have rigorous metrics for evaluating ubicomp systems in real-world settings. To address these gaps, we need a much wider access to large-scale, city-wide ubicomp installations, in order to significantly advance our understanding of the design, practices, and evaluation of smart city applications.

In the latter half of the 2000's the ubicomp paradigm became prominent as a technology-driven realization of the "*smart city*" concept, most notably in the U-Korea initiative [5]. Cities are increasingly looking at ICT to reduce costs, to become more efficient, and to deliver the quality of life citizens expect while balancing budgets. Accelerated by the digitalization and miniaturization of electronics and the explosion of communication networks, new ICT technologies have pervaded the society in many ways. The convergence of smaller, cheaper and faster computers and ubiquitous communication technologies have made it easier to control systems and to empower people to make cities smarter. However, empowering people cannot be taken for granted but people's role in the design process needs to be carefully discussed and explored. People play a pivotal role in cities becoming "smarter". This raises several important questions that need to be carefully considered when designing

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