



From cyberpunk to calm urban computing: Exploring the role of technology in the future cityscape



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ABSTRACT

In this paper we will present studies aimed at uncovering the attitudes, needs, and expectations people have towards novel types of urban computing technologies deployed in a city. First, we conducted a storytelling competition to elicit future visions of how people imagined the role of technology. Second, we conducted a rapid ethnographic study using a mock-up prototype device in various public locations to gain a deeper understanding of how people would appropriate a specific technology, namely interactive public displays. Lastly, we collected ethnographic material through a diary study and interviews where people recorded their use of existing technology, and through these experiences, imagine how future technologies might affect their lives. We found that these methods proved useful in engaging a city's community to imagine the city's future. Consequently, we were able to explore the current use of technologies in the city and project their possible future use. Contrary to previous speculation in academic and cyberpunk literature, we conclude that digital technologies will not necessarily induce an abandonment of physical urban spaces. Rather, we project an increased sophistication in the sociable uses of urban spaces and technologies, where people blend their online and offline worlds into a single lived reality.

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1. Introduction

In much of science fiction literature, and especially in the cyberpunk genre, epitomized in the works of the authors featured in Sterling's "Mirrorshades: The Cyberpunk Anthology" [58], future cities are often depicted as dangerous, alienating, media-saturated mega-cities dominated by large corporations where our lives (and minds) are more integrated with technology than ever before. In addition to cybernetic limbs, characters in this genre are often augmented with cranial implants that enable direct brain-computer interaction and

offer access to virtual worlds, which are often depicted as semi-physical places where the protagonist, through an avatar, ventures to find information or to gain access to places that are inaccessible in the physical world. These virtual worlds are dangerous places, where computer firewalls and viruses are also represented by beings that can harm the character, and often the result of injury in these worlds also means death in the physical world — a prime example of such a world can be found in the Matrix films [42], where sentient machines have enslaved all of humanity and keep them under control by feeding a virtual representation of the world as it was before the revolution directly to their brain. Of course, a small group of resistance fighters have managed to escape from the illusion and can traverse between the real world and the virtual one. This dichotomy between the physical and the virtual worlds is very common in much of the cyberpunk literature — people are either in the physical world, or in the virtual, but these two are seen as

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separate, detached from each other. These science fiction narratives are also widely used by researchers as materials to study human-technology relations through its various themes, e.g. globalization, embodiment, feminism, and urbanism [64].

Whereas the image of a city in cyberpunk novels and movies is without exception very bleak, a growing body of literature in the domain of *ubiquitous* and especially *urban computing* paints a completely different picture. Starting with the writings of Mark Weiser [63], the father of ubiquitous computing, these visions of future always depict technology as benevolent, friendly, useable, and always there when needed, never failing, never disturbing. Ubiquitous computing (from the Latin word *ubique* meaning “everywhere”) is the name given to the third major era of computing, following the mainframe era and the personal computer era.

In a world of ubiquitous computing, technology is built into the physical environment. Computers are everywhere, invisible, watching our every move in order to know exactly when to step out and provide whichever service is required. Mark Weiser called this calm technology [63], to highlight the fact that computers blend into the background when not needed, and only ask for our attention when appropriate. In this sense ubiquitous computing is the exact opposite of the vision put forth in science fiction literature – instead of making humans live inside the computer in a virtual world, the vision of ubiquitous computing is to make the computer live in our world. As William Gibson, the author of well-known cyberpunk novels such as *Neuromancer* [18] and *Mona Lisa Overdrive* [19], explains in an interview with the *Rolling Stone* magazine:

“Totally ubiquitous computing. One of the things our grandchildren will find quaintest about us is that we distinguish the digital from the real, the virtual from the real. In the future, that will become literally impossible. The distinction between cyberspace and that, which isn’t cyberspace is going to be unimaginable. When I wrote Neuromancer in 1984, cyberspace already existed for some people, but they didn’t spend all their time there. So cyberspace was there, and we were here. Now cyberspace is here for a lot of us, and there has become any state of relative non-connectivity. There is where they don’t have Wi-Fi...”

In a world of super-ubiquitous computing, you’re not gonna know when you’re on or when you’re off. You’re always going to be on, in some sort of blended reality state. You only think about it when something goes wrong, and it goes off. And then it’s a drag” [36]

There is no doubt that technology is increasingly pervading our shared urban spaces, and the rate at which new digital services are made available is continuously increasing. Accelerated by the digitalization and miniaturization of electronics and the explosion of communication networks, new technologies have pervaded the society in many ways. There are already over 5 billion mobile subscribers in the world and over two billion people use the Internet [6,25,48]. Over 30 billion RFID tags have been embedded in our world and a billion transistors per human, each costing one ten-millionth of a cent [6,48]. Over one billion Bluetooth chips are shipped every year and a new WiFi access point is

deployed every four seconds [6,48]. 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.

In this paper we will discuss the concept of urban computing and its various facets from the point of view of creative prototyping. In our case, the prototype in question is a large-scale technology deployment built into the existing urban fabric of the city of Oulu, in northern Finland. This deployment of various technologies constitutes a large, geographically distributed and completely public civic laboratory for studying ubiquitous computing technologies “in the wild”, and is technologically the largest such research deployment in the world. Here, our main focus will be on discussing shared urban technologies, i.e. technological artifacts deployed as an integral part of the public urban fabric, and thus useable by the whole community. Specifically, we will look at the early stages of planning and design process of the technology deployment, and at the various studies conducted to understand the needs, attitudes, and even fears people have towards new urban technology.

The contribution of this paper is threefold: first, we will offer a theoretical look into cities as settings for new technology, and identify challenges and opportunities that arise from the introduction of a new digital layer into the existing physical urban environment. Next, we will introduce work done in designing the “Ubiquitous Oulu” (Fig. 1), a prototype of a future smart city augmented with new technology and services, and discuss the steps we took to harness the imagination of the community in the design process. Using storytelling and rapid ethnography we first identify ways in which citizens envisioned that such technology would change their lives once installed across a city center. By transitioning through a complete design process including elicitation using storytelling, interviews and focus groups, and drawing from a rich theoretical background from the fields of urban design, architecture, anthropology, and computer science, we will then attempt to forecast how such urban technologies might induce societal change in the following decades.

The rest of this article is structured as follows. In Section 2 we will present an extensive theoretical literature review and attempt to place our own research in this context using concepts of *spatialization*, *temporalization*, and *embodiment*. In Section 3 we will then move on to describe the studies we conducted to elicit feedback on the planned technology injection from people. These studies include storytelling, rapid ethnography using a mock-up prototype, and technology diaries and interviews meant to uncover so-called *stories of everyday life* on how people use existing technology, and how they see technology in the future. In Section 4 we will then discuss the findings of our studies, and reflect on those using the concepts introduced in the theoretical framework. Through this reflection we will attempt to project on the role of public urban computing technologies in the upcoming decades. Section 5 concludes the paper.

2. Urban computing artifacts: design challenges and opportunities

In order to take a look forward and speculate on how urban computing artifacts might affect society in the future, we first take a look back and reflect on activities in urban



Fig. 1. Conceptual illustration of a 'smart city'.

contexts on a conceptual level. This is necessary in order to address the varied and multifaceted underpinnings of what it means for technology to function in such an environment. First, we will briefly introduce urban computing as a field of research. Then, we will provide a theoretical look into past research on cities and attempt to place our work within this rather broad context using the concepts of spatialization, temporalization, and embodiment.

2.1. Urban computing

Urban computing, defined as “the integration of computing, sensing, and actuation technologies into everyday urban settings and lifestyles” [55], is an emerging research field, which considers the use of pervasive computing technologies in spaces not traditionally associated with computing needs – urban environments. These urban places are often seen as “third places” – the spaces between home and work [53], where many vitally important social activities happen. Space and place are key concepts in urban computing [21,62]; however, as these terms are often used interchangeably in everyday circumstances, we must take care to specify what we mean by them. Borrowing from architectural and urban design sources, Harrison and Dourish [21] have expressed the difference between the terms in the following manner: “*Space* refers to the structural and geometrical qualities of a physical environment, while *place* includes dimensions of lived experience, interaction and use of space.” Urban computing, then, views spaces as settings for social protocols, conventions, and values, as well as means for shaping our own individual concept of identity, community, and self [31,55].

However, there is no fundamental theory, knowledge base, principled methods nor tools for designing and building computing systems as integral elements of the urban landscape [31]. While urban computing is focused on understanding

technological effects on the urban landscape, it is important to reflect on urban life itself [54]. As urban computing is a field situated at the intersection of a multitude of different disciplines, the themes and research topics can easily seem fragmented and divided. This is partly due to the inherent nature of urbanity and densely populated urban areas, which in effect mirror all the complexities and varied aspects of human life, and brings with it the barely controlled chaos that is the construct we identify as a city. It is this omnipresence of places and people that excludes urban computing from the family of purely technological subjects, and requires researchers to focus on themes that are technology-driven but not technology-focused.

2.2. On cities, technologies, and people

Public and shared urban places outside of the home and the workplace – sometimes referred to as 3rd places [53] – are places which enable people to engage in crucial social activities. Understanding the often competing needs, requirements, hopes and even fears people have towards new technology in such places is a crucial component in designing urban computing systems that are bound to alter and disrupt the everyday flows and functions that occur in these places. Furthermore, shared urban places arguably encompass the whole spectrum of human characteristics, and it is important yet very challenging for designers to navigate the maze of competing needs, attitudes, skills and expectations of people from very different demographics, and to propose designs that would serve the needs of the many instead of being exclusive to a certain niche subgroup of the population such as young, technologically savvy students [60].

The seat of urban computing, after all, is the city in all its forms, the locus of great many activities where people come together. If we are to create new forms of urban experiences and services through urban computing, it is crucial to develop

ways to understand the role of the built environment in urban life. To understand different kinds of outdoor activities, we refer to architect Jan Gehl's [16] categorization, according to which there are three main types of outdoor activities. *Necessary activities* include those actions, which we must accomplish, such as commuting and shopping. These activities occur no matter how unfavorable the surrounding environment. *Optional activities*, like sitting, playing or eating outside, however, require a certain level of enjoyment of the environment. These pursuits only occur if we wish to participate in them, and the time and place allow us to do so. Finally, *resultant or social activities* often occur during these necessary and optional activities. These include chance meetings with friends on the street, children playing outside, and simply seeing and hearing other people. These activities occur spontaneously, Gehl [16] argues, as a "direct consequence of people moving about and being in the same spaces", for example, while we are running errands or just spending time in a park. This is, of course, a greatly simplified categorization of urban life, but it does create a more serious urgency to explore the role of urban computing in the city. How can we create situations that not only serve us well, but enable us to willingly enjoy our urban spaces more? Furthermore, it advises us that any deployment of urban computing systems that aims to succeed needs to consider these modes of urban activity.

We could say, then, that cities "deal in physicality and proximity. They are like machines for facilitating physical meetings" [7]. As this is the essence of cities, what the urban computing community must also address is the perceived threat that information technologies impose on urban life. For example, Mitchell [46] has argued that urban computing technologies will bring about a wholesale change of urban life and the built urban form. What does it mean that we do not have to use and traverse public spaces to pursue necessary activities (to use Gehl's categorization), or that we do not even have to live in cities to be connected to the rest of humanity? This contradicts, as Castells [4] has pointed out, with the fact that the world is urbanizing at an ever-increasing rate [13]. Similarly, even Mitchell argues that the "twentieth century still needs agoras – maybe more than ever" [46].

The question, then, is how can urban computing support and create situations for a larger variety of urban activities? As our social lives increasingly move towards the digital – today, we learn more about what our friends are doing through social networking services such as Facebook than through face-to-face conversations – can urban technology be used to facilitate real-world social encounters? Can public displays, for instance, be viewed as modern day meeting points where people come together to collaborate, share content, and discuss everyday happenings either physically or virtually?

Related to the blending of physical and virtual worlds through new technology, we must understand how temporal rhythms and the variation of seasons, weekdays, and even the time of the day affect the use of urban computing artifacts. Kevin Lynch has argued that time and space "are the great framework within which we order our experience. We live in time-places" [38]. Furthermore, he goes on to state that we experience time in the city in two ways: through *rhythmic repetition* and through *progressive or irreversible change*. Thus the city is not the same in night as it is in day, and neither is it

the same in the summer as it is in the winter, nor does it remain the same throughout the years. The inhabited environment is under relentless change through an endless iteration of daily rhythms and yearly cycles [47,49,50]. These rhythms depend crucially on the kinds of spaces and places Oldenburg and Gehl describe: the urban environment should foster "casual encounters and should facilitate solitary as well as informal social activities" [30]. Moreover, progressive change must also be managed; metal rusts, technologies become obsolete, places might become abandoned or their very nature might change. To these, Carmona et al. [3] have added a third aspect, namely *continuity and stability*, which takes into consideration those aspects that do not change over a period of time, either by their nature or by our will. Consequently, we arrive at a temporal framework, which factors in rhythmic change, progressive change, and continuity or stability. If pervasive technologies are truly here to stay, any successful application of urban computing must take these aspects into consideration. Environments should be designed "to reflect and enhance the changing day and season add to the richness of the urban experience" [3]. These rhythms, however, have been disrupted by the introduction of the so-called '24-hour society' [32], due to which our patterns of use and activity have changed drastically, reducing the likelihood of impromptu coincidences in time and space. Fortunately, digital technologies are, by their very nature, much more adaptable than the traditional urban places; and through this virtue, they harbor a potential to support these complex ongoing cycles. In other words, digital technologies that operate in the digital counterpart of the physical world are much less susceptible to the real-world factors that affect how people function in the city – weather conditions, for instance, can limit or encourage social behavior in outdoor public spaces. People are far less likely to stop and socialize when it's pouring with rain, and conversely far more likely to do so in fair summer weather. Interaction through digital technologies is not affected by such real-world conditions, however, and thus people will have a choice to move between the digital, the physical, and the blended worlds according to which ever fits their current conditions best.

Urban spaces are also quintessentially physical spaces where people move around, interact with technology, structure cognition and experience the world through their bodies and senses in a particular social and physical context. This is process, which is fundamental to the human experience, is referred to as *embodiment*, a concept whose major proponent in Western philosophy was Merleau-Ponty [44]. In ubiquitous computing and interaction design, Dourish [11] has built upon theories of embodiment, introducing the concept of *embodied interaction* to the field. It has been pointed out that powerful designs intimately incorporate artifacts into bodily practice, to the point where people perceive artifacts as an extension of themselves; they act through it rather than on it [29].

Further, as urban computing systems reside in the public domain (i.e. are not personal devices but rather owned by somebody else), it is challenging to make people understand that they are allowed to physically interact with the devices. This is because typically you are not supposed to touch surveillance cameras, advertisement displays, or any number of other technical devices in public spaces. Thus, we need to consider also the power dynamics and hierarchies that define people's behavior in public urban spaces [20]. Sociocultural,

sometimes very local, rules determine how we are supposed to behave in relation to public installations but also in relation to other people; what kind of actions we are allowed to take; who is welcomed in public places and who is not; this is something David Harvey called ‘the right to the city’. He writes: “...but new rights can also be defined: like the right to the city which is not merely a right of access to what the property speculators and state planners define, but an active right to make the city different, to shape it more in accord with our heart’s desire, and to re-make ourselves thereby in a different image” [22]. New technologies can – and will – alter the existing hierarchies and rules, and therefore their possible effects, both good and bad, should be considered carefully. If access to the city and urban life is partially gained only through the digital, we must be ever cautious of the many ways this might cause the already existing and identified *digital divide* [51] widen between the inhabitants of the city. The term, first popularized by the National Telecommunications and Information Administration, describes the gap between those who benefit from and have access to new technologies, and those who do not [56].

2.3. Designing for the city: Challenges, possibilities, and threats

The research community is still in the process of transitioning from the traditional software engineering for workplace environments to the messy and iterative processes used in urban computing design. Designing urban computing systems and services is technologically challenging. These systems often span multiple devices and platforms, and interaction may begin on one device and, as better-suited resources become available in the environment, may continue on a completely different device. An example of such multi-device interaction is browsing digital photographs on a mobile device, and when passing by an interactive public display, continuing browsing on a larger display surface [26]. Numerous projects have looked at building toolkits to aid developers in designing multi-device off-the-desktop systems (see for example [8,9,35,26,37,40]), but these toolkits are by default aimed at technologists, i.e. programmers, and therefore are not suitable tools in eliciting early-stage requirements from non-technologists [12].

In general, the cultural and social aspects of urban computing remain insufficiently explored and represented in the design process [14]. While technical innovation has been considered as a cultural practice and explored within social studies of science and technology (see e.g. [34,59]), the problem of relating these theories to technology and everyday life persists [14]. Mackenzie [39] introduced the term ‘transduction’ to describe a way of thinking about technologies processually, i.e. as events rather than objects, and to refocus investigations towards non-representational understandings of technological practice – in other words, to understand technology not just as a tool but rather as an integral part of everyday processes and activities. Applied to urban computing, this concept allows us to “shift our focus from computers as networked objects or artifacts, to computing as diverse procedures or performances in which socio-technical assemblages take shape”, and thus “identify precise moments and locations in which we may possibly intervene and alter the course of events” [14]. The concept of directly intervening in the everyday flow of urban life was already an integral part of the Urban Probes methodology used by Paulos and Jenkins

[55]. They draw an analogy to archeologists excavating and altering a dig site to gain a better view of the space, and insightfully remark that in order for researchers to understand urban spaces, they must directly intervene to alter/disrupt the usage, actions, or flow within the urban focus of attention.

However, the potential for urban computing systems to alter and disrupt everyday life in shared public spaces is something that needs to be considered carefully when designing such deployments. As outlined above, the complex social, cultural, political and technological underpinnings of such potentially invasive technologies may in fact turn against their intended purpose, and rather than enhancing the experience of the city cause a backlash from the community they were supposed to serve. To take an example, let us consider an application that lets people post photographs from their mobile devices to a large public display with the purpose of pointing out problem spots in the neighborhood. What if, instead of pictures of uncovered manholes and missing traffic signs someone posted, say, invasive pictures of their neighbors? The technology, intended to help make the neighborhood a better place, would have done potentially irrevocable damage and thus had turned against its original intended purpose. Similarly, we must be sensitive to the existence of the digital divide and carefully consider what demographics our designed technologies serve and, even more importantly, which ones they do not, as discussed next.

3. Creative techniques for designing the public spaces of tomorrow

Our research is based on the premise that instead of running “artificial” studies in laboratories or other controlled environments built to merely convey the idea of a public setting, we actually develop a unique civic laboratory at the very heart of our city to study the multifaceted field of urban computing. Technologically, our installation is today the largest of its kind, aimed at studying urban computing in an authentic city environment. The most visible part of our installation is a network of large interactive public displays (Fig. 2) [33,52], made available to the whole community on a 24/7 basis. The displays support several modalities of use, including direct input through a touchscreen interface, and distributed user interfaces between personal mobile devices carried by the users, and the displays. The displays also provide multiple applications and services, and enable collaborative use for several co-located users using a single shared display, or several users using dislocated displays.

An important point to note is that our work focuses on interactive, as opposed to one-way broadcast displays. While public displays have been utilized in one-way broadcasting of advertisement for decades, recent technological advances have enabled interactivity on these displays. However, the majority of experiments with interactive public displays focus on a single application running on a single display, which is not meant to be a permanent addition to the space it is deployed in – in other words, a display is deployed in a space for the duration of the experiment, and is then used by either a pre-selected group of people or made available to the general public, usually under researcher supervision. After the study is over, the display is removed. Therefore, given the ephemeral nature of such deployments, and the fact that the display in question is single-purpose in nature, i.e. only running a single application



Fig. 2. Interactive public display in Oulu.

or service, it is very hard to identify longitudinal effects of the technology, how it becomes appropriated, and what impact it has on the society once the novelty effect wears off.

Prior to actually deploying technology into downtown Oulu, we first conducted a series of studies to understand how the planned technology deployment would best serve the community. These studies will be the focal point of this article. First, a storytelling competition was launched to engage the local community in the design of new urban technologies. Despite the high media visibility around the upcoming deployments and valuable prizes to winners, the storytelling competition gathered a relatively small amount of entries. However, these stories provided us multiple design ideas and helped us to understand how citizens perceive technologically augmented cityscapes.

In order to involve the local community and gain a more in-depth understanding of how people perceive the addition of new technology into their everyday surroundings, we carried out a “rapid ethnography” study where we made the concept of interactive public displays more concrete through a lo-fi prototype device designed to conjure the idea of an interactive public display. By using the mock-up as a demonstration device, we interviewed people to learn what type of content and services they felt would be valuable and useful through this infrastructure.

A third set of data consists of technology diaries and semi-structured theme interviews collected from the young adult citizens of Oulu (ages 20–30). The technology diary study combines traditional ethnography and methods from

design studies, and is partially based on cultural probes methodology [15,43]. Cultural or design probes are usually based on self-documentation and aim at uncovering people's personal perspectives and experiences. The participants first kept a diary for a couple of weeks; it was supposed to map their everyday practices and encounters with information technology. After finishing the diary, participants were invited to take part in a group or couple interview where they could share their thoughts about the themes of the diary.

We discuss these studies next.

3.1. Storytelling

Storytelling is considered a valuable method of Participatory Design, since stories are both tools for remembering and contain clues to future making [1]. In order to engage the local community, we launched a storytelling competition with the theme ‘Oulu in 2020’. The competition was advertised in an extensive newspaper article detailing the upcoming plans for building Oulu of the future. The competition was promoted with handsome prizes, including a laptop for the best story selected by a jury of researchers and industrial experts, and a smartphone raffled amongst all participants. To help guide the storytelling process, we also wrote and illustrated a set of our own ‘Oulu in 2020’ stories (Fig. 3) and posted these on the project website.

The Oulu in 2020 stories written by us consisted of 30 short snapshots into the imaginary lives of 15 personas of different demographics ranging from young children to elderly retired people. The stories were set in varying environments including home, school, café, restaurant, downtown, etc., and depicted everyday situations where new technology helped the characters in different ways.

Our stories naturally introduced technologies that we were planning to include in the upcoming deployment: interactive public displays, sensor networks, short-range wireless communication through RFID and Bluetooth, and personal mobile devices. Adhering to the vision of ubiquitous computing, our stories were all very *optimistic* – technology was there when needed, never failing, and never used for malicious purposes. Of course, as the stories were meant to create a positive vibe for the upcoming developments in Oulu, we did not want to paint a bleak picture of a future where technology would work against its users and affect urban life negatively, but rather encourage positive discourse around the topic. Further, as we wanted to engage the whole community and not just those who had an interest in new technology, our stories featured scenarios that were easily understandable and approachable even with superficial understanding of technology.

“Valtteri and Julia are in high school. They decide to have coffee after school. Walking on a pedestrian street towards their favorite café, they notice an aquarium, which is actually wall-mounted display, but the animated fish are so realistic that most passers-by mistake them for actual living fish.

As Valtteri and Julia approach the aquarium the fish become more active, and as they stop in front of the display the fish scatter in all directions, revealing a localized bulletin board. Valtteri takes out his personal mobile device and starts waving it in the air. He thinks that gesture control is just



Fig. 3. "Oulu in 2020" story illustration.

perfect for these kinds of situations – controlling a wall-mounted display, for instance. With a few gestures he pulls out the specials for nearby cafés, and together they pick one that has two cappuccinos for the price of one". (Excerpt translated from Finnish by authors).

Despite the high media visibility around the upcoming deployments and valuable prizes to winners, our storytelling competition gathered only 8 entries. The stories featured scenarios ranging from the ordinary (controlling home appliances through smart phones) to the extraordinary (holographic guide dog). Popular settings for the stories were public and shared indoor locations such as cafés, pubs, and bars, where technology was used to perform various functions including ordering beverages, paying the bill, using place-based messaging services, etc. From the stories we were able to identify issues related to the three themes presented previously, namely *spatialization*, *temporalization*, and *embodiment*.

Spatialization was discussed in several stories where the characters moved about in urban space, navigating unfamiliar paths with the help of technology. Unfamiliar cities were seen as confusing places where the help of technology was sought out in several narratives.

"An hour later the man attempted to walk in a straight line in the hotel lobby. 'Where the hell am I?', Mustonen cursed to himself. 'Just take it easy, don't worry you bastard', he muttered while his headache continued to grow worse. Suddenly a small dog materialized beneath the chandelier. It stared at Mustonen, looking somehow amused, and appeared to be asking him to follow. 'Damn, too much Jack Daniels', Mustonen growled. The greasy receptionist waved his hand. 'Go ahead, the Writer will show you the way'. Mustonen stared at the young man. Lunatic. The dog barked and started dancing towards the large revolving doors of the hotel. 'What the hell, let's go', Mustonen said and followed the dog." (Excerpt translated from Finnish by authors).

Temporalization also featured in several narratives, mainly in the form of characters needing to know when given activities were available, or when certain locations such as shops were open. In the stories technology was seen as close to all-knowing, able to provide information on any topic upon request.

"The young couple make their way towards a nearby restaurant in the hopes of dinner, but at the door are told that the restaurant is full of fans celebrating the success of a local figure skating team, and the overall atmosphere seems too rowdy for a romantic candlelit dinner anyways. Timi-Kullervo checks his smart device, and finds the reservation status of all nearby restaurants. He makes a reservation to an idyllic bistro that's only a block away. At the restaurant door their reservation is easily found by touching Timi-Kullervo's device to that of the doorman, and the couple is shown to their table." (Excerpt translated from Finnish by authors).

Due to the nature of the stories and their settings, embodiment was found in every story – characters interacted with their environment through their bodies, by physically manipulating digital interfaces or simply by moving about in an augmented space. A common denominator was that bodily interacting with public technology was seen as very natural and effortless, and the characters were intuitively aware of where these interfaces were located. Further, the characters were not worried about things related to privacy, but were rather eager to share even their most personal information with the imaginary systems.

"I finished my coffee and began planning my schedule for the rest of the afternoon. My wardrobe was in dire need of updating, and the shops were open for a few more hours. I knew of a public display a few blocks away, where I could have my strategic measurements up to my shoe size digitally taken. After this the computer would search all nearby stores for clothes that would fit me – I could browse the selection on the screen, and after that march on into the store to purchase the items I had picked out." (Excerpt translated from Finnish by authors).

The winning story was titled "By golly, where am I?" (translated from Finnish). The humorous story depicts events during a one-day period, revolving around an apparently demented elder female character, who navigates various everyday situations with the help of her intelligent wrist computer (story translated from Finnish):

"Sit here for a moment, while I go to the restroom. How about you read the train company's magazine?" Mirjami Jyrä-Suonio, a nurse from Jyväskylä if I remember correctly told someone, possibly me. Her eyes darted to my left wrist, to the screen of a gadget with an animated smiling face. "Seems you have enough battery, 'spose you'll be fine without me for a bit", she said and left me by myself at a small table with the paint flaking off. "Hi Sanelma, we are at the Oulu railway station", the smooth masculine face on my wrist gadget said, appearing to be looking around. "How on earth can this thing speak", I said half to myself. "These modern times are just full of wonder". I looked at the device, then at my hand, which looked dry and wrinkled. "Could use some lotion, to be sure..." The face lit up. "Would you like some lotion?" "Yes please", I said, stroking the freckled back of my hand with the other, equally dry hand. "By golly, where am I?" I looked around. In a shop.

A rotund woman dressed in a red shirt and an indecent black leather corset handed me a small black plastic bag. “Here’s your lotion. That’ll be 15 euros.” The woman extended her arm, and the device, which looked like a wristwatch beeped almost simultaneously with my own.

“The Erotic Shop at Asemakatu just charged your account for 15 euros”, my wrist device stated.

“The Erotic Shop at Asemakatu? By golly, where have I gotten to now? I have got to get out from here, my oh my”. I limped to the door, but didn’t have to courage to go out. “I can’t leave, there’s too many people! They’ll see where I’m coming from!” I exclaimed to myself. The lady behind the counter tittered.

“There is one passer-by outside. Not very close”, my wrist gadget stated and started showing a map of the nearby streets with a green and a red dot.

“Well, that’s a relief, but where am I going to?”

“The next bus to the Raatti Island leaves in seven minutes. Showing route now.” The map changed to showing a route in red, and a compass.

“By golly, where am I? In a car?” The gadget, secured to my wrist with wide leather straps, blinked to life. “Hi Sanelma, you are on a bus headed towards the Raatti island. We are almost there. I will signal the bus to stop”. The apparatus vibrated shortly, and the stop-sign towards the front of the bus lit up. The bus slowed down, eventually coming to a full stop.

I stepped carefully over the curb and onto hot asphalt. I was followed by several young men and women, some of who were very loud. One was carrying a can of beer – in public, oh dear! The bus doors shut with a whoosh, and the car left. I remained at the stop, looking at the peculiarly dressed youngsters.

“Public Transportation Services of Oulu just charged your account for 1 euro and 23 cents. Distance travelled was approximately 0.9 kilometers”, my gadget stated in its usual monotonous drawl. The screen flickered from showing a face to map and compass. “Your destination is less than 100 meters away”.

The hands of a young, bald man groped my body “By golly, young man, keep your hands to yourself!” I screamed, again wondering where I was. My memory was playing tricks.

“Might I check your bag?” The same rude young man asked and took the plastic bag from my hand, as if I’d given my consent. “Okay, thank you very much”, he said returning the bag to me. “Grandma’s got a wild night planned I see, ha ha. Anyways, we’ll charge you automatically based on your location, feel free to roam the festival area”.

“What are you laughing at young man? My poor old skin is dry”, I replied, suddenly remembering what was in the bag. The man exploded with laughter, doubling up on himself with mirth. How very, very rude. I looked around. A huge crowd of people, mostly youngsters, colorful tents and music. A pervading scent of food. “Where am I?”

“You are at the Qstock festival. The program is as follows...”

“Oh, there you are!” A distantly familiar voice interrupted my wrist apparatus. Mirjami. “I only went around the corner and you were gone. Thank goodness for that device.” Mirjami looked at her own wrist apparatus. “How would demented people get by without it?”

This story was selected as the winner because it depicted scenarios and technologies that were imaginative yet plausible, and while the story was centered around an elderly woman, it also featured personas from various demographic groups as

supporting characters. In other stories the users of technology were mostly depicted as young citizens spending time in restaurants, bars and cafes. The winning story was constructed around temporal and spatial rhythms that divided the story into smaller sections creating transitions from one situation and space to another but creating also dark forgotten temporal spots due to the dementia of the main character. The urban rhythms of the story were constituted together with other pedestrians, as well as with cars and buses. Space and technology were experienced through bodily practices when the talking wristband both gave the user the information she was asking for, and gave orders about her movements as an independent actor. Her moving in the city space shifted between Gehl’s [16] necessary activities, like shopping for body lotion, and resultant/social activities, like spontaneous visit to the rock festival, though this was not dependent on the user herself. Like other stories, the winning narrative happened during a period of one day, and thus the temporal rhythms were not connected to seasonal or even weekday changes. In addition, all stories were situated in the near future, and new ubiquitous technology was appropriated in the situations that already were part of people’s everyday practices [10].

Overall, the stories painted a picture of a society very much adhering to the vision of *calm computing*. Technology was there when needed, would stay in the periphery of attention until requested, and could provide answers to all questions. However, the competitive nature of the storytelling task most likely influenced the way people envisioned future technology. People likely wrote positive stories because they felt that this was what the competition organizers wanted to read, and thus attempted to improve their chances of winning. While this very optimistic view was of course an encouraging sign that people were willing to welcome new technology into their everyday lives, the low number of stories led us to design another study that would allow us to better engage with a larger group of people in the actual shared urban spaces we were planning to bring new technology into.

3.2. Rapid ethnography with situated mock-up devices

Rapid ethnography [45], sometimes also referred to as “quick-and-dirty ethnography” [23], is a field study method where researchers, instead of spending at best months in the field documenting a certain phenomenon as in traditional ethnography, do short focused studies to rapidly gain an understanding of the target setting. Especially in the field of HCI (Human–Computer Interaction), with quick-paced product development cycles and deadlines, it simply is not possible to spend months or even weeks in the field gathering data, and a similar amount of time understanding the field data. The benefits of examining field situated user activity, however, remains crucial [45]. The well established benefits of doing field studies combined with the aforementioned problems with the storytelling competition led us to devise another study where we would make the concept of interactive public displays more concrete through a lo-fi prototype device designed to conjure the idea of such a public display. The apparatus in question was built by rigging a large whiteboard on a wheeled stand (Fig. 4), and researchers took the mock-up to various public locations around downtown Oulu. The locations were selected as candidates for the upcoming deployments, and we also wanted

to prompt people to give their opinion on how such public displays would fit in these locations. In a sense this mock-up study can be seen as an appropriation of the generative technique introduced by Sanders [57], where users are given a toolkit with simple components and are then asked to make artifacts such as collages or mock-ups to describe their past or ideal experience for the domain under consideration [2]. In this technique, the main interest is the story that the person tells while s/he is describing the artifact. Similarly, we were interested in the stories of everyday life that people described when drawing their service suggestions and ideas on the whiteboard.

The study ran for a period of 2 days (~8 h per day), during which 74 interviews were conducted. Interview subjects included both individuals and groups from a wide range of demographics. Researchers first explained the concept of interactive public displays to the interviewees using the mock-up as a demonstration device, and then asked the participants to describe how they would want to use such technology by sketching concrete application ideas on the whiteboard. Most interviews were videotaped for later reference (some participants did not agree to be videotaped), and researchers also collected extensive field notes and photographs.

Overall, participants reacted positively to this type of municipal service. They specifically named non-commercial content that would benefit their everyday lives as more desirable than commercial or sponsored content. Participants also felt that reliability and consistency was more important than application sophistication and the “wow-factor” — people wanted services that *work for them, are reliable, and easy to use*. Possibly due to the ease-of-use factor, people also predominantly named touchscreen technology and services as more desirable than distributed interfaces using device ensembles such as mobile phones as private input devices to public displays. Several participants also brought up another recent (commercial) technology deployment made into the shared public spaces of Oulu, namely displays at bus stops showing timetables and arrival times of buses. As the displays had suffered from severe technical problems, interviewees often remarked that they do not “need more black screens” in the city.

The mock-up display proved successful in capturing the curiosity and imagination of passers-by, and the familiar nature

of the whiteboard, combined with the “life-sized drawing” technique clearly enticed people to approach the researchers and give present their ideas. However, a caveat that should always accompany low-tech prototyping should be that the given measurements, materials, look and feel of the prototype necessarily affect and possibly limit the participants’ imaginations. Nevertheless, the participants proposed a wide variety of application ideas, most of which were very practical and down-to-earth such as event information, news items, local services, public transportation, etc. Also, as a hot topic around the time was the planned construction of a large underground parking facility beneath the downtown area, several respondents suggested that the displays could be used to provide information on free parking spaces. Overall, the ideas of the participants were tightly connected to the public urban space where the mock-up study took place, and were connected to all three types of outdoor activities categorized by Gehl [16]. Participants felt that new ubicomp technology could assist them in their *necessary* activities by providing for instance information on opening hours of stores, bus timetables, and available parking spaces; in their *optional* activities with real-time information on local events, like concerts, movies and plays, as well as on restaurant menus; and in *resultant/social* activities with leisure applications such as games. Participants seemed split in their opinion about using the displays for social entertainment activities, with some being strongly in favor of them and others claiming that the displays should be used for “serious” purposes only. Temporally, the ideas were tied to both momentary activities, like parking spaces and queues in nearby restaurants; more long-term information on, for example, municipal decision making; and relatively permanent information such as maps of the city center. The mock-up study was conducted in autumn before snow season, and consequently, seasonal changes were not apparent in the imagined future of new ubiquitous city space. There were also participants who claimed that the whole idea of deploying public displays into the city was ludicrous, and that the money required for such an installation would be better used for other purposes such as elderly care. These participants were a small minority, though, as only two people expressed this opinion.

Further, the importance of spatialization became very apparent. As the mock-up device was taken to several different locations during the 2-day period, we were able to observe the effect of location on the willingness of people to interact with us, and the mock-up. For instance, in the main square of downtown Oulu people were in a very leisurely mood, happy to stop to chat and interact with the device. Interviews in this location lasted markedly longer than those in other locations. Conversely, when we moved the mock-up just one block away from the square, to a busy intersection where four pedestrian streets meet, people did not even glance at us or the mock-up, but rather passed by in a hurry and even went as far as to change their route in order not to pass by the mock-up too close. Even though the two locations are geographically very close to each other, the nature of the spaces is completely different. In the square people come to meet, spend time, and just look at other people — in other words, perform *social* activities to again use Gehl’s classification. In the intersection, however, people were passing through in a hurry, coming out of one shop and going into the next, or looking for a restaurant to have dinner in — performing *necessary* activities,



Fig. 4. Participant interacting with the mock-up device.

which do not leave room for other distracting actions such as stopping to talk with random people.

The stories people told while explaining their ideas were of particular interest. These stories mirrored the complexities of everyday urban life, with rushed schedules, competing tasks, the need to coordinate activities with several other people, and the never-ending need for everyday information items to help mentally and bodily navigate the urban messiness. People also had a very omnipotent view of technology, assuming that whatever they needed could be built, though their ideas were simultaneously entwined with their everyday practices of that moment. We encouraged these wild ideas rather than attempted to suppress them, as we felt it was interesting to see how, in a perfect world, people would utilize such urban technology.

3.3. *Technology diaries and interviews*

To continue probing the idea of stories of everyday life introduced in the previous section, we began systematically collecting a large amount of ethnographic material consisting, among others, of technology diaries and semi-structured group interviews with 20 to 30 years old citizens of Oulu. The study involved 48 participants between ages 20 and 30 years. 37 of them were women and eleven men. Participants were recruited mostly through mailing lists of different academies in Oulu. A majority of participants were studying at the University of Oulu or at the Oulu University of Applied Sciences or had already graduated from either. Most were still students; a few were working full-time; two were unemployed; one was on maternity leave and one a stay-at-home mother. Participants came from highly different areas of expertise, from communication to industrial engineering and midwifery. Only sixteen participants were originally from Oulu, while 25 had lived in the city less than five years and four of them even less than a year. This reflects the role of Oulu as the most popular student city in northern Finland, which attracts young people, especially from northern Finland and nearby small townships.

In their diaries and interviews, participants were asked to contemplate broadly their own technology usage in the city. Through this material we hoped to gain a more nuanced understanding of everyday practices connected to information and communication technologies in this particular northern city; the goal of this material was not to function outright as a design tool, but it could also be used to such purposes.

Further, the collected data gives us a more in-depth view into the lives of the citizens. Given Mackenzie's [39] thoughts on understanding technology not just as a tool but rather as an integral part of everyday processes and activities, we need somehow to get a grasp on those everyday processes, and understand how they are connected to spatialization, temporalization, and embodiment. We have adopted an approach called "thick description" [17], which usually refers to an (anthropological) study that does not just explain the behavior but the *context* as well, so that the meaning of the behavior becomes understandable also for an outsider. In other words, we do not only aim to describe the action, but the socially constructed meaning behind it as well.

The collected data complements findings from the rapid ethnography and storytelling. While these provided us with a broad understanding of how people view technology in their everyday life shared urban environments, the view remained

somewhat *fragmentary*. The main weakness with rapid ethnography is that it does not allow us to contextualize the gathered information; the needs presented by citizens remain detached from the larger flows, rhythms and connections of everyday life. Storytelling, on the other hand, was found challenging by the citizens, possibly because it was so future-oriented and detached from the present. As Buskermolen and Ozcelik [2] state, storytelling methods in participatory design produce more useful outcomes if participants are first allowed to contemplate their existing experiences and build links between the past and the future. After this it is easier for them to dream what kind of services or technologies could be useful or desired in the future.

Thus, we found it useful to ask people to tell "stories" about their present, real lives with the devices they already have and then continue with some hypothetical questions. This approach emphasizes the utility value technology can bring into the everyday lives of the people. However, the "too slow" *traditional* ethnography and "superficial" *rapid* ethnography methods are not contradictory. Rather, we are constructing new methods to study urban public technologies that mingle different ways of collecting data and exploit our experiences on different types of studies.

Results from the diary study and follow-up interviews show that for the clear majority of young adults, a mobile phone or a smartphone was the most essential technological tool in public places. First and foremost it was used for finding and getting in touch with important people; we call this practice "social navigation". In addition, the possibility to check any information anywhere was valued; it was obvious that especially smartphones had reduced the participants' need for careful pre-planning, and increased the flexibility of everyday life. On the other hand, some mobile phone users claimed they did not need a smartphone for online information access because they could always call a friend who had access to the internet. The phone itself acted as a mnemonic for many; it also enabled making written notes or photographing things to remember. Many previous studies have shown how mobile or smartphones collapse the restrictions posed by time and place and turn users into cybernetic creatures who are dependent on the digital "layer" offered by easy-to-access social networks and information [5,28,27]. Thus, the mobile phone has been a powerful device in moving urban life towards visions put forth in science fiction.

Further, from this material we can interpret both optimistic views towards new technology, and pessimistic attitudes that resonate with the cyberpunk dystopias discussed in the beginning of this article. These attitudes are apparent throughout the material, but are especially often stated in the answers concerning dreams about the future technology; what participants would wish the future would be like. The storytelling competition did not reveal the anxiety and distress that at least one fourth of the young adults participating in this study expressed. In the diary study and follow-up interviews, some participants repeatedly complained how computer usage is consuming all of their free time; some felt that the demand of constant availability was stressful; technology was also blamed for the feeling of restlessness or being constantly in a hurry. These participants often wished that in the future the role of technology would diminish. In addition, it is worth noting that quite a few of the young adults expressed that they cannot follow the rapid development of the new technologies

anymore. They felt they were not competent users of current technologies, like smartphones. This caused anxiety for some and made them skeptical towards technological innovations.

When discussing about possible threats posed by future technologies, a couple of participants referred directly to bleak future visions of science fiction films like *WALL-E* [61]. In this particular film the earth has been completely covered in waste due to mass consumerism and people are totally dependent on machines. This indicates how media feeds people's imagination and can also color their perceptions about new technologies.

On the other hand, a majority of the participants expressed either neutral or positive attitudes towards new technology. Perhaps not surprisingly, speed and efficiency were recurrent adjectives connected to future technologies. Some of the participants clearly just mirrored the current development rather than expressed radically new views. However, some of the dreams differed greatly from the usual future visions of the world of efficient, fast machines and included rather organic aspects; also the word “natural” was used relatively often to describe the ideal human-technology relation. Many participants also wished that technology would become more ecological. One group of technology dreams was surprisingly similar with the original vision of *ubicom* (see [63]): a hope that technology would settle in the background of daily life, become more invisible and adjust to peoples' routines, and not vice versa.

4. Discussion: Towards blended reality in shared urban spaces

In the discussion part of the article we will focus on issues raised both in the theoretical section, and those uncovered during the various studies. By discussing these issues, we will attempt to take a look forward and speculate on the role of urban computing technologies in the following decades.

4.1. Change in the use of public spaces

It is an already established everyday reality that many activities have been virtualized. The number of local branches of banks and government offices has been reduced to an absolute minimum, and even some educational facilities have moved to a primarily online existence [46]. Reflecting on Gehl's [16] categorization of activities in urban spaces, we can observe a decline in necessary activities. Building upon this, many have hypothesized that the resultant social activities in the form of impromptu encounters are reduced due to virtualization of many necessary activities. This could lead to at least a partial abandonment of urban spaces, causing an impoverishment of urban life. In the stories submitted to the storytelling competition, however, this divide between physical and virtual services was not present; rather, online and the offline were seen as complementary. This was apparent in the case of clothes shopping, in which the superior search functions of online shops were enhanced by the instant physical accessibility of high street shops and their products.

Consequently, an argument can be made for the likelihood that these blended commercial services continue to evolve and become more of a function of everyday life. However, we also argue that public services could be made more attractive and efficient with the use of urban technologies and embodied

interaction. Libraries have already learned to blend physical and electronic books and materials, and powerful databases with their existing networks of buildings and logistics. One might argue, then, that it would be of crucial importance that clinics and hospitals, which are notoriously hard to navigate, and where up-to-date information plays an enormous role in the overall well-being of patients and their loved ones, could be made more friendly, inviting and efficient with the aid of urban technologies.

Additionally, participants in the diary study clearly claimed that technological tools (in this case, a smartphone) improve the possibility of arranging impromptu meetings while out on the town. This was expressed as “social navigation”. Taken a step further, we can assume that when the formerly pressing need to work or run errands in a specific place is reduced, social navigation in urban spaces through technological devices will become much more important [cf. []]. After all, when outside forces do not mandate our presence in a certain place, we are also able to escape some place-specific social norms; in effect, we can use technology to pick and choose, which norms we wish to adhere to. Consequently, it is prudent to argue that we wish to engage in more elaborate social activities when given the opportunity to do so. This runs counter to the bleak, anti-social visions so often present in cyberpunk literature, and also in more academic visions, such as Mitchell's idea of a “city of bits” [46].

The prevailing view that arises from our analyses is that activities in public spaces are not necessarily diminished, but rather likely to take new form. Extrapolating, we foresee further sophistication in the use of public spaces for an innumerable array of social uses, such as activism, socializing and artistic purposes, i.e. for optional and resultant/social activities. A good example of this would be the flash-mobs fad, wherein a group of people organizes a real-world performance, often with activist overtones, through online means. It is reasonable to suggest a further development of similar social uses of a blended reality also in the future.

4.2. The perceived threat of information technologies on urban life

Looking back to the bleak dystopian depictions of future found in cyberpunk literature, we must also consider the flipside of urban technology. While in most of our studies participants adopted a highly optimistic view of new technology, the material collected in the diary study also revealed contradicting attitudes. Many participants were rather skeptical towards current technologies and expressed distress; they felt the role of technology has grown too broad, and that they cannot follow the fast cycle of development anymore. The willingness and capabilities of adopting new technology differed greatly even among this rather homogenous (age, level of education) group. Further, given that even young people felt they were getting left behind in technological advances, we can only speculate how far from the “technological focal point” more marginalized groups such as elderly people are drifting.

Additionally, the voluntary opting-out of some younger people could lead to a widening digital divide among people within a generation. If the city and the access to urban life becomes primarily a matter of being within a blended reality what, then, will become of the right to city from the point of view of 21st century Luddites? The urban computing community must make sure that access to urban life is not barred from those who lack personal technological devices. Our studies show a

need for more public forms of computing; public in the sense of physical and socioeconomic accessibility as well as a locus for sociable activities. Continuing in this vein, the lo-tech mock-ups of urban screens served as a prototype of such a public technology. Similarly, the constant availability in time demanded by personal devices and the subsequent distress and anxiety reported by our interviewees during the diary study could be diminished by urban technologies that are time-agnostic and work primarily in space, rather than vice versa.

With public services, however, the issue of control remains ever presents. Who controls the technology, and the space in which the technology operates (cf. [41])? In cyberpunk visions public spaces are often controlled by mega-corporations, who use technology to further their sinister and selfish agendas. Public screens blare brainwashing messages to the unwilling masses, and urban spaces are continuously monitored by multitudes of security cameras and sensor networks that report the movement of civilians in excruciating detail, depriving people of any kind of privacy. This Big Brother view on technology is scary, and if not addressed, can lead to people rejecting the technology and even avoiding spaces they know are augmented. In a sense we are in a fortunate position to make such a technology injection into shared urban space, as universities and research institutes are seen as 'less evil' than large corporations or even governmental agencies. On the other hand, universities often lack funding and resources to truly build a large-scale deployment, whereas corporations have no lack thereof. However, in the future, the issue of control and ownership will take an even larger role in dictating the power dynamics and hierarchies in shared spaces, as it is highly likely that future large-scale urban technology deployments will be privately owned rather than communal – that is, owned and controlled by corporations instead of communities [24].

Following the privatization of urban technology, this technology would be geared for commercial gain – either through advertising, as is the case with modern day one-way public screens that are solely used for this purpose, or through direct consumer marketing of goods, services, or other consumables. In a worst-case scenario public urban technology would no longer be accessible to everyone, but rather only to those with the financial means access it. This development would again only serve to widen the digital divide. Additionally this would further catalyze the process in which public outdoor and indoor places are becoming ever more subsumed into private ownership. In the very city that our living laboratory is located, bus stops and the area they occupy are controlled by an international advertising company; furthermore, the very pedestrian area is owned by a collective of businessmen.

4.3. Effect of temporal rhythms on the use of urban computing artifacts

Our participants' stories were closely linked with their everyday lives in their city, using them as a backdrop from which they drew their inspiration. Similarly, they based their stories on their personal history in that location. This shows the importance of the past in imagining the future, the progressive and irreversible changes [38] that add to the

historical and cultural richness of the city, layer upon layer, and the personal histories of those who inhabit it.

As discussed before, shared urban spaces are highly susceptible to temporal variations and natural rhythms of days, weeks, months, and seasons of the year. Cities both operate in time, where some parts change permanently and some stay constant for longer periods of time, and also force time onto others – deliveries must be made before rush hour, people must commute to and from work at certain times, and the in-between time is then dedicated to leisure activities. Similarly, urban computing systems must respect and respond to these rhythms, progressions and constancies.

Due to the increasing digitization of services, people are no longer tied to the operating hours of commercial or municipal service points such as stores or banks, but are rather able to conduct their business regardless of place or time. Similarly, urban computing technologies that are tied to certain physical contexts will have to both support activities that are sensitive to the temporal dimension by, for example, providing up-to-date information on local events, traffic, opening hours, or scheduled meetings with friends and colleagues, but also support time-agnostic activities that occur in that specific context, such as place-based asynchronous messaging, navigating the physical space, or even entertaining oneself to 'kill time'.

Further, on a more concrete level, the variation of seasons greatly affects the activities people do in shared urban spaces, and thus also their usage of public technology. Especially in countries with much variation in the conditions around the year, such as the arctic climate found in northern Finland, the turning of seasons must be taken into consideration when designing urban technology. Such harsh conditions do not invite people to linger in outdoor settings, and thus optional and social activities in places that are teeming with activity during the warmer months is greatly diminished. However, the need to perform necessary everyday tasks and actions, socialize, and obtain everyday information pertains despite the changing seasons. In the future, technology should have the capability to adjust according to varying conditions, and proffer different ways of interacting based on these factors – to take a simple example, a public display might offer a sophisticated touchscreen interface and foster shared use during the warmer months, and switch to fast-to-use gesture control when weather conditions do not permit the user to linger.

5. Conclusion

Fictional storytelling, rapid ethnography with situated mock-up devices, and technology diaries and interviews proved to be useful methods in engaging a city's community for the purposes of imagining the city's future. Each method was found to offer different, complementary views. The storytelling method enabled us to gain a good understanding of the role that technologies play in the lives of the inhabitants of a northerly city. However, as storytelling is highly future-oriented and in our case deals with a topic people have little frame of reference with – novel urban technology – we did not reach a very wide audience through this study.

Rapid ethnography through the mock-up study deepened our knowledge by allowing us to have meaningful conversations with people about how they perceived new technology,

and how they felt about including such technology in public spaces. However, as the encounters on streets were very fast and fleeting in nature, we could not really contextualize the information properly, or probe the participants' feelings very deeply. Furthermore, a study of this nature necessarily harbors some restrictions on the participants' imaginations due to the given material properties of the mock-up; and the carnivalistic, highly social nature of the event does not enable the participants to envision the future scenario where they necessarily meet the designed technological artifact after implementation all by themselves, sans researchers and the honey-pot effect. However, it can be very desirable from the designers' point of view to engage the community in such a positive way, establishing a respectful, dynamic relationship between the community and the implementers of new technology.

To counter these issues, we conducted a diary study to better contextualize how people utilize technology they currently have, and through these diaries then probe how they would see technology in the future. This last study was highly valuable in that it also uncovered negative thoughts and feelings related to technology use, something that did not become apparent in the previous studies. Thus, each method offered a different viewpoint into the shared topic of urban technology. Data gathered from each study was different, but put together these studies nicely complement each other and provide a rather holistic view on the topic.

Resulting from the use of these methods, we were able to explore the current use of technologies in the city and project their possible future use. The perceived threat posed by digital technologies towards the use and sociability of urban places is not a necessary evil; rather, based on our participants' stories, which highlight their hopes and dreams, we conclude that the way people use and imagine using technology does not warrant the extreme dystopian views presented in many cyberpunk stories. Rather, we are convinced that people will continue to develop ever more sophisticated ways to interact with each other in urban spaces, and that we must explore the possible uses of public technologies in this, bearing in mind the various divides that exist among different users of technology. For instance, the use of mobile phones in what our participants called "social navigation" was interesting, and extrapolating from that we conclude that social activities are among the most important aspects of urban life that need to be supported through the introduction of new technology and services.

By harnessing the imagination of the inhabitants of the city, we can begin to remold our deeply held ideas about urban life and project them into possible, desirable futures. Our ethnographic material pointed towards an undercurrent of negative feelings towards existing technology, and this is something that needs careful consideration in building future systems. We, as designers, must be careful not to widen the digital divide by further excluding certain demographic/social groups from the technology-oriented society of tomorrow. However, a majority of people participating in our studies had positive views towards future technology; ethnographic material also revealed an interesting set of visions where organic images derived from nature blended with technology.

Finally, we can state that contrary to previous speculation in academic and cyberpunk literature, digital technologies will not necessarily induce an abandonment of physical urban

spaces. Rather, we project an increased sophistication in the sociable uses of urban spaces and technologies, where people blend their online and offline worlds into a single lived reality.

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