Place-Specific Computing: *A Place-centric Perspective for Digital Designs*

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An increased interest in the notion of place has evolved in interaction design based on the proliferation of wireless infrastructures, developments in digital media, and a 'spatial turn' in computing. In this article, *place-specific computing* is suggested as a genre of interaction design that addresses the shaping of interactions among people, place-specific resources and global socio-technical networks, mediated by digital technology, and influenced by the structuring conditions of place. The theoretical grounding for place-specific computing is located in the meeting between conceptions of place in human geography and recent research in interaction design focusing on embodied interaction. Central themes in this grounding revolve around place and its relation to embodiment and practice, as well as the social, cultural and material aspects conditioning the enactment of place. Selected examples of place-specific computing are presented from a series of pilot studies, conducted in close collaboration with design students in Malmö, Berlin, Cape Town and Rome, that generated 36 design concepts in the genre. Reflecting on these examples, issues in the design of place-specific computing are discussed, as well as questions for further research concerning how digitally mediated interactions can be understood as elements of practiced place.

Keywords **–** Embodied Interaction, Interaction Design, Human Geography, Mobile Computing, Place-Specific Computing.

Relevance to Design Practice **–** The intention of formulating Place-Specific Computing as a genre of interaction design is to allow practicing designers to better conceptualize the relations between digital systems and place. Also, by discussing examples, central issues of the genre are highlighted for further exploration in research as well as in design practice.

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Introduction

In design disciplines such as architecture and urban planning, the social, cultural and material aspects of human environments have always been inherent design concerns, but in interaction design this has not always been the case. Interaction design is design with digital materials, shaping interactive digital systems, services and products with a particular focus on users and use experience. Over the last decade in the field there have been several developments motivating an increased attention to how the use of mobile information and communication technologies (ICT) relate to context in terms of *place* – with regard to social and cultural as well as material aspects. Arguably, we have reached a point at which it makes sense to design interactive digital systems and services for specific places. The changes leading up to this point emanate from technological developments as well as developments in the use of ICT, and to some extent from how the concepts of *context, place* and *space* have been interpreted in the field of interaction design.

Context of use as a matter of concern for interaction designers has moved from the periphery to the foreground of attention over the last two decades. In the 1970s, when human-computer interaction (HCI) emerged as an area of study, computers were mainly used to support desktop office work. Consequently, software developers focused on the work task supported and in general disregarded context. During the 1990s, computing developed from serving individual needs to supporting cooperative work, giving rise to the field of Computer Supported Collaborative Work (CSCW). Social analyses of interaction became increasingly important, and interaction between people and systems became understood as a feature of a broader social setting (Dourish, 2001a). Also, an emerging influence from ethnomethodology pointed towards a more fundamental role for context in interaction. In her influential book *Plans and Situated Action*, Lucy Suchman (1987) argues for an understanding of social conduct as emerging from a direct response to the immediate circumstances of interaction–a perspective labelled "situated action." From this perspective, organizational, cultural and temporal context all play a critical role in shaping action, as well as providing a basis for understanding action as intelligible social conduct. The work of Suchman and others has contributed substantially to a deeper understanding of context as a basis for creating meaning in interaction, but has not to the same extent accounted for context in the wider sense needed for mobile computing and its relation to the concept of place.

The concepts of space and place have been subject to debate in the field of CSCW. Early CSCW systems were designed to connect people who were working together from remote physical

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locations through video and audio channels, forming "media spaces" (Bly, Harrison, & Irwin, 1993). The systems often relied on spatial metaphors that mimicked the spatial organization of the real world, drawing on aspects such as relational orientation, proximity, presence, etc. In a frequently cited article, Harrison and Dourish (1996) critically explore the use of space as a basis for design. According to them, the way we manage collaborative activity is not rooted in space at all, but in a mutual cultural understanding of behavior and action. Place is space with invested understandings of behavioral appropriateness and cultural expectations: "space is the opportunity; place is the understood reality" (Harrison & Dourish, 1996, p. 67). This conceptualization of space and place has become subject to criticism by several researchers. For example, Brown and Perry (2002) object to the sharp distinction between the physical world and meaning that is suggested by Harrison and Dourish, as well as to viewing meaning as a permanent attachment to physical objects, as this view disregards how meaning is created in a flow of activity. Finally, Brown and Perry (2002) object to the description of on-line environments as "virtual places," as this confuses matters by ignoring the primacy of the physical world we dwell in.

The notion of virtual space or place has become problematic also in relation to understanding Internet use. "The Internet is a place" – this was the war cry coming out of the concluding plenary session of the 1994 Doors of Perception conference entitled *@home*. As the Internet took off in the mid-nineties, the opportunities for connecting people and for community building, strengthened by early promises of immersive virtual reality, introduced spatial metaphors that dominated the language around the use of the Internet and the striving for a "virtual placeness." In popular understanding, the Internet was a *place* we could inhabit, and the vocabulary used to describe it often referred to motion and space. We *visited* sites, we met in *chatrooms*, etc., not to mention *surfing* being used as a label for an activity most often carried out with minimal motion in an office chair tied to a keyboard, mouse and screen. These descriptions of "virtual place," whether as chatrooms or avatar worlds, all rely on digital representations with varying degrees of immersion, in kind as well as degree. Later, the usefulness of some Internet applications as well as the appropriateness of using a space analogy was questioned. In his book *On the Internet*, Hubert Dreyfus argues against the claimed benefits of Internet use, with tele-presence and distance education among the examples (Dreyfus, 2001). The architect Malcolm McCullough (2004) goes further, dismissing the notion of the Internet as a place for immersive inhabitance altogether and seeing it as a "societally enacted myth."

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In parallel with the developments above, the field of ubiquitous computing based on Mark Weiser's (1991) vision from the early 1990s, also addressed issues relating to *place,* albeit from a more technological viewpoint based on a geometrical notion of space. For example, early research in the field developed technical solutions for tracking the position of devices in space (Want, Hopper, Falcão, & Gibbons, 1992; Want et al., 1995). The idea of ubiquitous computing was that low-cost technology embedded in the environment, in combination with mobile devices, would make access to computing resources available everywhere. In essence, the world would become the interface. This vision underlined the need to understand context on a more detailed level, and in particular how technology could blend into the user's surroundings. In the related field of context-aware computing, a wider range of contextual data has been explored as input to make systems respond to changes in the environment that go beyond location and time (Abowd & Mynatt, 2000), e.g., who is present at the point of interaction, what they are doing and why. However, accurate detection of context data beyond location and time has proven to be difficult, according to Abowd and Mynatt. As Jones and Marsden (2006) point out, the problem is that such systems still fail to demonstrate *social* context awareness.

In summary, early conceptions of place in interaction design in general have not accounted for the richness of social, cultural and material aspects of context to the same extent as have design disciplines such as architecture or urban planning. However, over the last few years there have been changes in the landscape of interaction design that warrant a renewed concern for how we relate interactive technology to *place*. These changes are mainly driven by developments in mobile and ubiquitous computing, regarding technology as well as use. From the perspective of technology and infrastructure, recent developments are promoting the feasibility of realizing the ubiquitous computing vision at an increasing pace in urban settings. The strong proliferation of wireless infrastructures and networks provides increased connectivity. This is coupled with increased computing power in a growing range of mobile devices. In parallel, the use of information and communication technology is changing, in particular for mobile devices. Today there are many commercially available location-based services (LBS) aiding the user in finding objects or people in proximity, or navigating to a target, based on the user's current geographical position. Mobile phones and other mobile devices are also increasingly used for media consumption and production. Digital media are converging, and new forms for media-production, -distribution and -consumption are continually evolving. The computing power of today's mobile devices is dissolving borders between production and consumption, creating a role for mobile users as "pro-sumers" that engage in new global arenas for public opinion. YouTube, Google Earth and Wikipedia are all significant examples of the emergence of multiple arenas for public opinion in which pro-sumers contribute from globally dispersed sites. But even if new media channels are transnational, the larger part of our everyday life concerns the local. Recent research in human geography shows that we do develop a personal sense of place that connects the local and the global even if we are part of a global network (Cresswell, 2004). From an individual

user perspective, a renewed interest in phenomenology has furthered our understanding of how meaning is created through constant presence and participation in the immediate world around us (see e.g., Dourish, 2001b). In addition, it has been suggested from an architectural perspective that the spatial structures of urban environments embody cultural patterns of interaction that form the basis for socially intelligible conduct (McCullough, 2004), though it is important to note that the immaterial spaces formed by digital infrastructures embody their own cultures and conditions, evident for example in the various ways of free-riding on wireless networks (Sipior & Ward, 2007). In conclusion, as noted by Ciolfi and Bannon (2003), the recent increased interest in the notion of place in interaction design resonates with the shift from the desktop computer to the Ubicomp vision, in which users interact with the environments of everyday life, as well as with the shift from traditional HCI towards interaction design, with its focus on the overall user experience.

The focus of this article is to discuss a *place-centric perspective* for the design of digital systems and services, in which functionality, as well as information content, emanate from the place of use. The article starts by presenting examples of location-aware systems as the stream in current research that most closely relates to place from a broadened view of use context. Next, Place-Specific Computing (PSC) is introduced as a suggested genre of interaction design that aims to capture the potential of a place-centric perspective for the design of digital systems and services. Examples of Place-Specific Computing are then presented from a series of conceptual design studies in an ongoing research project. This is followed by a discussion of the theoretical grounding for the genre, located in the meeting between conceptions of place in human geography and recent research in interaction design, in particular relating to embodiment and practice. Finally, the design implications of adopting a place-centric perspective for mobile and ubiquitous computing are discussed.

Location Awareness and Place

One stream of current research that, implicitly or explicitly, refers to place from a broadened view of use context is *location-aware systems*. In the current research on location-aware systems, focus is in general not on deeper probings of context using ethnographic studies or other methods to inform design functionality. Rather, the focus is on information content and the different mechanisms for matching information delivery to user needs. One of the earliest examples of a location-aware system is CyberGuide (Abowd et al., 1997), a mobile context-aware tour guide, which uses location and the history of past locations to provide contextual information to tourists. Prototypes of the system were tested with visitors to a research center at Georgia Tech, but the intended use was for tourist locations in general. Campus News (Maron & Read, 2007) and CampusWiki (Schuler, Laws, Bajaj, Grandhi, & Jones, 2007) are two examples of systems explicitly designed for the university campus as a typological place. Campus News is a Bluetooth-based network for distributing personalized information to students, and CampusWiki, a location-aware Wiki providing local information to students. Also, Brown et al. (2005) developed a location-aware system for George Square, an open city square in the center of Glasgow. It uses a small, portable tablet PC that allows mobile visitors to explore the city while sharing locations and activities with distant others, for instance through photos taken on location. In these examples, design functionality is generic rather than based on studies of social or cultural aspects of everyday practice at tourist sites, university campuses or city squares, respectively. An example in which user activities in a specific context do provide grounding for design is the Magitti Mobile Leisure Guide (Belotti et al., 2008). This context-aware mobile recommender system was designed for dwellers rather than visitors, and is based on field studies of leisure-time practices in Tokyo, albeit with the broader target group of "young urbanites interested in all kinds of leisure activities, emphasizing spontaneity rather than sightseeing" (Bellotti et al., 2008, p. 1157).

Rather than tapping into the social and cultural practices of particular places to inform design and provide contextual grounding, most location-aware systems restrict focus to different mechanisms and strategies for making the information provided place-specific. Whether enabling users to supply information content, rate content from a service provider, or set up a personal profile to filter information, the strategies these systems provide all offer increasing quality and grounding of place–specific information. The Magitti system (Bellotti et al., 2008) is an example of a system that allows users to have little control over content, since a key feature of the system is to optimize the information provided through context awareness. User interests and future activities are inferred from models learned over time based on individual and aggregate user behavior, thus not requiring the user to explicitly enter a profile or preferences. However, the user exerts influence by rating content. Campus News (Maron & Read, 2007) achieves personalization through allowing users to edit a profile for their phone, indicating interests and disinterests by selecting key words. In CampusWiki (Schuler et al., 2007), content is supplied by the service provider, but users rate the content as well as generate rating labels, thereby introducing a mechanism for social filtering of place-specific information. In the Cyberguide project, despite the technological limitations, Abowd et al. (1997) envisioned systems with dynamic location-based information and user-generated content. These ideas were later realized, for example in the Geonotes system by Persson, Espinoza, and Cacciatore (2001) that allowed users to annotate locations with "virtual notes." Current examples also enable communities to develop around place-specific content. Stewart et al. (2008) have presented Talking Points, an urban orientation system that enhances walking journeys with contextual information about points of interest along a route. The information content is community-generated, rendering users as active contributors rather than passive information consumers. Bilandzic, Foth, and De Luca (2008) take this notion one step further with CityFlocks, a mobile application providing local information to visitors in public urban settings. The application builds on indirect social navigation, through local residents rating restaurants, etc. But, in addition, direct social navigation is also provided, with which the user can get advice from local people via phone or SMS. However, user tests showed that most people

prefer indirect social navigation, and that contacting a stranger for advice feels uncomfortable.

As an attempt to organize the design space of location-aware *community* systems, a framework has been proposed by Jones, Grandhi, Whittaker, Chivakula, and Terveen (2004). They have studied the relationship between places and people's information needs, and argue for *place* as a first-class object in location-aware systems, based on work mainly in environmental psychology. In a qualitative study, they examined the relationship between place and information needs, and the relationship between place-types and informal social communication, specifically information used to locate others and information providing one's own location. Their main focus was to find reliable links among places, activities and information needs in order to improve contextual awareness in a system. The framework proposed for organizing the design space of location-aware *community* systems is in the form of a 2 x 2 matrix. One dimension differentiates between people-centered techniques, which use location to support interpersonal awareness and communication, and place-centered techniques, which use location to provide place-specific information to aid navigation or decision-making. The other dimension differentiates between synchronous location awareness, based on current location data, and asynchronous location awareness, using historical accounts of location. It is important to note that the conception of place suggested here is *user-centric*, focusing on the relations between place and everyday activities from a user perspective – e.g., an office, home, coffee shop, museum, school, etc. – thus, referring to typological rather than specific places.

To conclude, by restricting the scope of design to information content and efficient matching of broad user needs, current research on location-aware systems typically assumes a design perspective that is *user-centric* rather than *place-centric*. Even considering that systems that deliver information based on location combined with other contextual information have become quite sophisticated, as is true of the Magitti system (Belotti et al., 2008), arguably, the increased connectivity, mobility and computing power of today's mobile IT users warrant a deeper exploration of place as a wider understanding of use contexts. Ethnographic approaches have successfully been applied in developing designs for work settings as well as for the home. As the use of digital systems and services in public space is increasing, current approaches need to be adapted and new approaches developed for public use contexts, informed by other fields, such as human geography, that have developed substantial understanding of the concepts of space and place. The user-centric perspective and lack of contextual grounding in functions and services offered by current location-aware systems motivate the exploration of a *place-centric* perspective for the design of digital systems and services. From this perspective, the scope of design is not restricted to the delivery of place-specific information content, but includes explicitly grounding the design of system functionality in the social and cultural practices of a particular place. As wireless communication infrastructure is increasingly becoming an inherent part of the urban environment, it does not seem far-fetched to envision a subset of the digital information services using this infrastructure as emanating from the particular social and cultural practices of a specific urban setting rather than from the generic needs of mobile users. In the following section, attention will be directed to the potential of digital systems and services designed from a place-centric perspective, based on qualitative studies that use specific places as a grounding for design, and *place-specific computing* will be introduced as a label for such a class of digital designs.

Place-specific Computing as a Genre of Interaction Design

Today's broad use of interactive digital systems, services and products poses a challenge for those in the interaction design field when the qualities of digital designs are discussed, in research as well as in design practice. Uses range from work tools, to interactive digital media and gaming, to digital installation art. Clearly, assessing the use experience of a digital design differs greatly if it is a work tool or if it is an interactive game. As an attempt to provide a better basis for discussing the qualities of digital designs across use domains, Löwgren and Stolterman (1998, 2004) have introduced the notion of *genre* to interaction design, which may be understood as a class of digital systems or products that share certain properties deemed as important from a design perspective. Specifically, for each genre, some qualities of use are more pertinent than others and should therefore be addressed by the designer. They discuss examples from a number of genres, for example: design tools, virtual environments, interactive visualizations, and computer adventure games. Arguably, the tensions between earlier conceptions of place in interaction design arose at least partly because of attempts to apply the concept of place across several genres. Trying to develop a unified conceptualization and understanding of place across a wide range of forms for computing is bound to cause more confusion than help. Place-Specific Computing (PSC) is here suggested as a separate genre of interaction design, in which place is conceptualized from a starting point that combines perspectives from human geography and recent research in interaction design. Obviously, this does not exclude other conceptions of place in the field. The notion of genre is applied to establish a class of digital systems based on the particular perspective of place outlined here; no doubt other genres can be identified that use different conceptions of place.

As a genre of interaction design, place-specific computing may be described as computing in which the designed functionality of systems and services, as well as information provided by these systems and services, are inherently grounded in and emanating from the social and cultural practices of a particular place, and account for the structuring conditions of place – social and cultural as well as material. Systems and services are thereby designed to cater to the people that, temporarily or regularly, visit or dwell in a particular place. This place-centric perspective for digital designs does not make users and their needs less important for design, but merely suggests that the range of users is determined by the place we design for, rather than being defined as a target group disconnected from place. Consequently, services, users and needs also change over time as a place develops. In essence,

place-specific computing is the shaping of interactions between people and place-specific resources, mediated by digital systems and services, and connected to global socio-technical networks.

In a research project titled *REcult,* I have, together with colleagues, studied the potential of *recultivating* urban contexts through place-specific computing. The overall goal of the project is to explore how digital systems and services can be understood as elements in practiced place, through design-oriented research. In our research, the focus has been on public and shared use of digital systems and services more than on private and individual use, and on hedonistic use more than on work-oriented use. Most important, the research undertakes a shift from an *anytime-anywhere* perspective to a *here-and-now* perspective of mobile and ubiquitous computing. Places organize around flows of people, information and material, engaged in a variety of activities and practices. The flow of people includes residents as well as temporary or regular visitors. Rather than focusing on the personal technologies of a single user, we have emphasized the meeting between place-specific resources offered through shared technology on the one hand, and personal devices and individual preferences on the other. In contrast to context-aware computing, we have sought to support the context-awareness of people rather than machines, providing cues for potential interaction rather than explicit directions for action. Furthermore, we have focused on hedonistic use, i.e., leisure activities and casual interactions between people and their surroundings, rather than on work-oriented use. The perspective of practice applied is more open-ended than in other streams of interaction design, e.g., "social computing" (Dourish, 2001b), in which work practice is studied with methods from ethnography as a basis for design. Finally, a central point in the research has been the shift in perspective from anytime-anywhere to here-and-now. However, *here* does not imply an isolated view of a place as disconnected from other places. Rather, it acknowledges that places are connected to larger socio-technical networks and to the mediated presence of other people and activities, bringing forward the qualitative differences between places and how place-specific resources can be turned into design opportunities. Also, *now* does not imply an ahistorical perspective of interaction. Rather, we are interested in the potential qualities of people engaging in long-term relationships with place-specific resources, and in digital content developing over long periods of time. By focusing on the here-and-now, we have sought to introduce a complementary perspective for interaction design, one that reaches beyond the geometric and user-centric notion of place in location-aware systems, and is driven by the local social, cultural and material resources and conditions of place rather than the generic needs of broader user groups.

Although human geography so far has had limited influence on developing an understanding of *place* in interaction design research, there are studies that explicitly refer to *place* as it is understood in human geography. As an example from current interaction design research, Ciolfi (2004) has successfully applied a perspective of place drawn from the phenomenological vein in human geography to the design of augmentations of physical environments in the form of interactive museum installations. Drawing heavily on Yi-Fu Tuan, one of the main proponents of a phenomenological approach in geography, she has applied his notion of place to the design and evaluation of an interactive exhibition at a museum. The four dimensions of place suggested by Tuan (1977): physical, personal, social and cultural, have been used to structure field studies as well as the interpretation and evaluation of data. According to Ciolfi, this conceptualization of place and its application has been particularly effective in highlighting the importance of the physical dimension of the experience of place, and its dynamic interconnections with the other three dimensions of place suggested by Tuan.

Björgvinsson (2007) is another example of current research in interaction design that refers to conceptions of place adopted from human geography. He has explored how self-produced rich media can facilitate the sharing of meaning in healthcare, in one study within a community of practice at an intensive care unit, and in another study between healthcare professionals and patients at a hand surgery clinic. Björgvinsson criticizes the notion of place as a homogenous and harmonious experience and resists a distinction between space and place. He prefers to use the term space since it allows for seeing activities and practices as spread across time and space rather than as located in the immediate local activity. In particular, he criticizes ethnomethodological perspectives for locating meaning-making completely in the social. For example, Dourish (2001b) as well as Ciolfi (2004) define space as the physical and mechanical elements of the world that are devoid of meaning. Björgvinsson resists this view of physical artifacts and environmental elements as discrete and separate, and claims that a physical environment without meaning is inconceivable. The qualities of artifacts and representations are relationally defined and receive their meaning in relation to practice, according to Björgvinsson. Drawing distinctions between space and place, artifacts and practice, is viewed as deeply problematic since it diverts attention from how the physical environment and formal tools are intertwined in particular practices. The bottom line here is that the construction of meaning is neither located in the technology nor in the social, but in the interaction between humans and non-human elements, or what he terms socio-material assemblages. This is a position against social constructionism on the one hand and technological determinism on the other, and places Björgvinsson's argument in line with human geographers like Malpas who claim that place is primary to the construction of meaning (Cresswell, 2004, pp. 31-32). Another important element in his position is the relation between activities, space and time. In Björgvinsson's conceptualization of space and place, a central concept is practice, but with reservations about the ethnomethodological perspectives of work practice studies. He criticizes the emphasis on immediate action in the analytical perspectives of phenomenology, disregarding how immediate activity or place of action is influenced by other actors not present. In addition, ethnomethodological perspectives tend to approach practice as ahistorical by marginalizing history and memory, according to Björgvinsson. Drawing on Actor-Network-Theory (ANT), he urges us as designers to acknowledge that meaning, coupling and contextualization happen across a network of relations stretched across time as well as space.

Clearly, there are several candidates to consider as potential theoretical perspectives of place for place-specific computing, with ANT being one. See for example Ciolfi (2004) for a summary of how the concept of place has been understood in environmental psychology. In the REcult project, however, we have viewed the meeting between conceptions of place in human geography and recent research in ubiquitous computing, specifically on embodiment and practice, as a particularly fruitful starting point that is outlined in the following section.

Place-specific Computing and Human Geography

The theoretical grounding for place-specific computing outlined here is mainly located in the meeting between human geography and recent research in interaction design, taking as its starting point the conception of *place* found in contemporary human geography. Place has always been a central concept to human geographers, but it is only in recent decades that the concept has been thoroughly scrutinized. Today in human geography, place is regarded as a way of understanding the world that puts focus on the "rich and complicated interplay between people and the environment" (Cresswell, 2004, p.11). Thus, current human geography resists the rationalization implicit in a spatial objective perspective of the world, thereby also rejecting the geometrical notion of space and place found in early ubiquitous computing, and to some extent in current research on location-aware systems.

In human geography, a range of perspectives of place developed, with roots in phenomenology, starting in the 1970s. A renewed interest in phenomenology has also spawned the notion of embodied interaction in interaction design, emphasizing the qualities of our participation in our immediate surroundings (Dourish, 2001b). Arguably, an interest in embodiment shared by these two strands of research forms a fruitful starting point for interaction design in furthering our understanding of relations between place and interactive digital systems and services. Dourish argues that systems designed around context awareness and systems supporting social computing are both part of the same program of context-based exploration. The common foundation for these explorations is the notion of *embodiment*, as it has been developed in phenomenological philosophy. Dourish suggests a conceptual framework for "embodied interaction" that provides a new perspective on context-based computing. Embodiment is about establishing meaning. It may be true that we can capitalize on natural social or physical skills in designing more natural interaction, but according to Dourish, the underlying purpose of embodied interaction is to let us engage with technology in ways that allow the development of meaning of use as it is incorporated in practice. He suggests that for ubiquitous computing this means "focusing on 'place' rather than 'space,' since it is a notion of 'place' that is socially meaningful" (Dourish, 2001a, p.12). Another observation is that meaning arises in the course of action. This is to say that meaning is not inherent in the technology, and therefore not determined by the designer. Rather, meaning emerges through the encounter with technology, making it open for various appropriations and adaptations as it is incorporated into a community of practice. Dourish does not explicitly develop the relationship between context, interaction and place any further, but the notion of embodiment provides a potential starting point for such an investigation. From a similar perspective, human geographers have engaged with place by studying our daily practices, movements and habits on a fine-grained level. Inspired by the phenomenology of Merleau-Ponty, David Seamon regards bodily mobility as the key component to understanding place (Cresswell, 2004, pp. 33-34). Repeated movements such as walking to the mailbox or reaching for a pair of scissors in a drawer are established as time-space routines. Seamon uses a dance metaphor, describing these habitual movements as "body ballet." From the collective effort of many time-space routines performed within a certain location, a "place-ballet" emerges that, according to Seamon, provides a strong sense of place. Someone who does not know the expected moves in this ballet quickly appears as "out-of-place." In his studies, Seamon attempts to transcend the specific example and provide a general account of place as embodied. Even if place is not a central concept for Dourish, Seamon's thoughts allude to the claim by Dourish that context is continually produced and negotiated through our everyday actions.

An important question for the argument presented here is to what extent underlying permanent structures, whether material or social, influence our behavior – an issue largely neglected by Seamon, according to Cresswell (2004), as well as by Dourish (2001b). Geographers such as Allan Pred and Nigel Thrift have, informed by structuration theory, studied the tension between constraining overarching structures and our free will (Cresswell, 2004). Material structures as well as laws, rules and social expectations provide constraints on our actions. According to these geographers, actions are neither determined by structures around us, nor completely a product of free will. Rather, they are a process of constant negotiation between structures and agency. In this sense, places are never finished entities, but constantly in process, or being performed (Cresswell, 2004). Dourish (2001b) uses the term appropriation to describe how practice and technology evolve together. Arguably, practices around the use of place-specific computing should therefore not be regarded as finalized. Rather, place-specific computing should be viewed as subject to constant re-appropriation embedded in the continuous process of re-constructing place.

In human geography, material structures are regarded as embodying structuring conditions that emanate from the practices performed around them. As an example, Cresswell (2004) refers to universities and their long history of established meaning as centers of knowledge and learning. He quotes Hebdige on how authority is established in the material structures of university buildings carrying "implicit ideological assumptions which are literally structured into the architecture itself" (pp. 12-13). In the interaction design field, the architect Malcolm McCullough (2004) has presented a related argument in his book *Digital Ground*, with the intention of developing "a theory of place" for interaction design. McCullough suggests that the spatial structures of the city embody the cultural patterns of interaction that form the basis for our socially intelligible conduct, implying that new technology must be culturally grounded in *place.* We should acknowledge

our embodied predispositions as social beings, according to McCullough. These predispositions are grounded and developed in persistent cultural structures in which we develop our skills not only through interaction with the world around us but also through interaction with others. McCullough further argues that this interconnection of place and culture should be the basis for place-oriented interaction design bringing context and intention back into focus. Taking the argument towards a level of practiced design, McCullough suggests that the social conduct grounded in our embodied predispositions is continually reproduced and that we can identify context patterns, or what he labels "situated types." Using situated types as a starting point, interaction design should aim for shaping service ecologies that respond to the needs of local communities. McCullough presents thirty types of interactions that are described and organized in four categories: at home, at work, on the town, and on the road. Examples of situated interactions include: collaborating, dealing (at work); sheltering, recharging (at home); belonging, shopping (on the town); and hoteling and adventuring (on the road).

Similar to Seamon above (Cresswell, 2004, pp. 33-34), McCullough aims to transcend the particular and provide a general account of our behavior as emanating from cultural patterns embodied in our urban surroundings. However, his description of our predispositions as embodied in persistent cultural structures implies a view of structuring conditions for place as rather static, leaving the construction of place less open to the influence of social processes. More important, the notion of situated types is problematic. It seems difficult to account for the categorized interactions across a variety of cultures, and an important question is to what extent the typology can inform a specific design situation. Consequently, the notion of situated types implies a designer stance starting from general accounts of *place,* disregarding qualitative differences between places, rather than grounding design in the particular social and material conditions of a specific place.

If we choose the position of understanding place as an embodied relationship with the world, we find theoretical grounding in interaction design as well as human geography, based largely on a shared foundation in phenomenology. But in understanding how material and social structures influence our embodied behavior and create contextual conditions for use of place-specific computing, we need to find a position between the end-points of environmental determinism and radical social constructionism. Furthermore, for this position to be able to constructively contribute to informing design practice, we also need ways of constructing an account of the place-specific that avoids being caught in generalizations and vague typologies, and at the same time enables transcending the specific design situation to support the development of place-specific computing as a genre of interaction design. I argue that the concept of practice can help us to this end. Practice as a concept has been used in interaction design, particularly in relation to ethnographic design approaches and studies of work practice, as well as in human geography (Dourish, 2001b). A source particularly relevant for understanding practice in relation to space and place is Michel de Certeau's (1984) *The Practice of Everyday Life*, in which language is used as a guiding metaphor to describe our practices around place. The terms space and place, however, are considered to have almost opposite meanings compared with the way they are used by human geographers. Place to de Certeau is a stable entity. It is a set of elements coexisting beside one another in distinct locations, forming an instantaneous configuration of positions, implying an indication of stability. Space is composed of intersections of mobile elements, according to de Certeau. It occurs as the effect produced by the operations, in vectors of direction and time, that constitute practice in a place. In short, to de Certeau space is a practiced place. Place is pre-structured and we follow its rules of grammar, i.e., we cannot walk through walls and we do not walk down the middle of a street. But our possibilities of operating within these structures are still as infinite as the expressive power of language. This notion of practice is different from how *work practice* is understood in CSCW or in ethnographically inspired approaches to interaction design. Work practice is structured through an intersubjective, collective understanding of what is competent and appropriate behavior in a particular work setting, and structuring conditions emanate as much from the work situation as from established craftsmanship. The rule-following is here constitutive of the practice itself. In contrast, de Certeau points towards a more open-ended understanding of practice, in which a multitude of behaviors, sometimes challenging rules or resisting the structuring conditions of place, are reflections of the endless variety of aspirations and motivations of urban citizens. Thus, concrete structures become skateboard ramps and muddy paths emerge as shortcuts across public lawns.

Arguably, this understanding of practice resonates well with the increased unpredictability in the use of mobile IT products. Recent research in mobile technology use has underlined the social shaping of technologies (Taylor & Harper, 2003), with the unexpected ubiquitous use of SMS being a frequently used example. In fact, the development of i-mode applications in Japan has been driven more by use culture than by designers (Rheingold, 2001). An understanding that starts from the emergent social and cultural practices in particular places stands in contrast to the perspective reflected in many of the examples of location-aware systems referred to earlier, as well as the framework by Jones et al. (2004) presented above. If we embrace an open-ended perspective on place practice, as suggested by de Certeau (1984), place-specific computing becomes an addition to the repertoire of operations in the continuous construction of place – a potential extension of the *language* of practicing place, grammar as well as vocabulary. Consequently, as designers we should be aware that the use cultures around place-specific computing may be as open-ended as the practices around city streets and town squares, implying a potential shift in our role as designers. To conclude, two important issues for place-specific computing thus become: (1) to develop an understanding of practice as developed under the specific structuring conditions of (a particular) place; and (2) to understand what roles applications of place-specific computing can play as part of such practices, and consequently as part of a larger social process of place construction. In the following section, these issues are explored through the discussion of three design examples from the REcult research project.

Design Examples of Place-specific Computing from the REcult Project

It is important to note that the notion of place-specific computing can neither be stable nor normative. Genres of interaction design, as suggested by Löwgren and Stolterman (1998, 2004), are constantly being developed through design practice as well as research. In our future work, the notion of place-specific computing will no doubt be elaborated, criticized and re-constructed through design-oriented research and reflective practice. Here, some first steps in this direction are presented through the analysis of selected examples from pilot studies undertaken as part of the REcult project, which involves conceptual design work in the genre of place-specific computing. We have deliberately chosen to conduct conceptual design studies with design students from universities in the cities studied. By setting up the pilot studies as projects within university design programs, we could avoid the requirements for generic design solutions that are most often imposed on research projects. Instead, engaging design students allowed us to tap into their knowledge of local city culture and to focus on the particulars of the selected places, thus maintaining ecological validity through a better grounding of the design work in social and cultural practices. A series of six pilot studies exploring place-specific computing have been completed in Sweden, Germany, South Africa and Italy. In each pilot study, a conceptual design project has been carried out in different zones of the city, in cooperation with students studying interaction design or product design at local universities. In total, 16 studies of city zones were carried out in Berlin, Cape Town, Malmö and Rome, resulting in 36 detailed design concepts. For a full description of the pilot studies, see Messeter and Johansson (2008). Also, see the project website: http://www.do-fi.com/REcult/ for a full description of concepts and sites. In the following sections, three selected examples from the pilot studies are presented.

Tune-In Music (TIM): Supporting Club-hopping through Live Music Feeds

TIM, Tune-In Music, is a small handheld device that lets users listen in to ongoing or future performances at the music clubs in Observatory, Cape Town, South Africa. TIM was developed by product design students Ben Bell, Albert Coertse, Ewaldi Grové and Harriet Kasper at the Cape Peninsula University of Technology as part of a five-week design project in the third year of the 3D design program at this institution in 2006. Observatory, and specifically Lower Main Road, is described by the students as an eclectic, bohemian neighborhood with a broad mix of residents and visitors. It is laidback but vibrant. It is artsy and eccentric, but encompasses a close-knit community. There is a high concentration of music clubs around Lower Main Road that makes it a popular place for young people to hang out, listen to live music and socialize.

Figure 1. The Tune-In Music device.

The Tune-In Music service uses a local wireless LAN to provide live feeds from ongoing performances, or announcements for upcoming events, at local music clubs. The device is simple to operate and only has two controls, a dial for selecting the music club you want to tune in to, and a volume control. When you select a music club, a live feed is streamed to the device and the street address of the club is shown on a small display. If there is no ongoing musical performance at the moment, samples from upcoming bands are streamed together with spoken announcements. This means that you can tune in to any music club at any time, thus providing a support for club-hopping at nighttime as well as for planning an upcoming night out during the daytime. As the device uses relatively cheap technology, it is assumed that it can be handed out for free to regular club visitors in order to create a broad user community in a short time.

Disarming: Technology Rituals in Church

Disarming is a concept developed by Marika Bredler, Edda K. Sigurjonsdottir, Azadeh Mohammadi, and Nixi Kennedy, master's students in interaction design at the School of Arts & Communication, Malmö University, in 2006. Given an

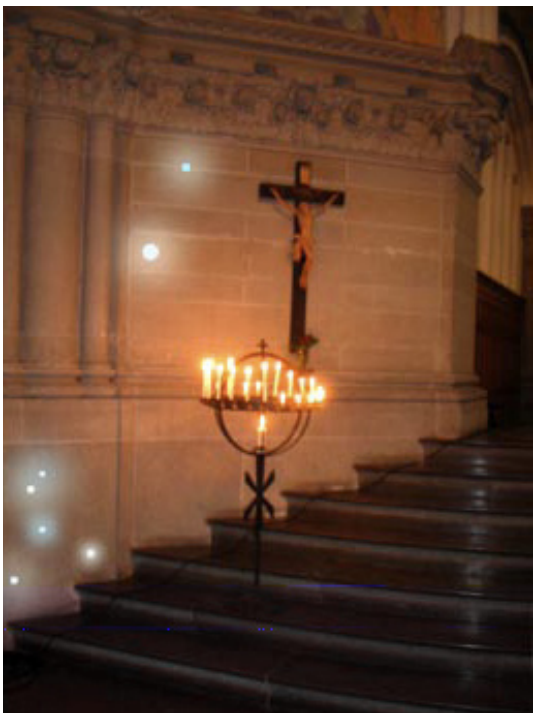

Figure 2. As part of the Disarming concept, lights on the walls indicate donations made by visitors.

assignment to design a place-specific experience, one group set out to explore the St. Johannes Church in the city center of Malmö. A field study was carried out that included visits to the church and its surroundings, observations of visitors and their rituals, interviews with employees of the church, and a survey of the church's history. It was found that upon entering the church, the visitor first passes through the armory room. In old and more violent times, weapons were left behind in this room, the visitor thus putting faith in the protective powers of religion and also becoming part of a larger entity. Focusing on this in-between space, the concept developed for the assignment aims at creating a modern version of the disarming ritual, and in the process enhancing the personal experience of the visitor. This way, the concept specifically addresses the border between the outside world and the inside of the church, on a physical as well as a social level, and the transformation that one goes through upon entering the church.

In the armory room, visitors are invited to disarm by exchanging their mobile phones for an interactive cross to be used while inside the church. The cross is made from a 15 mm plexiglass tube, 2 mm thick, and contains four LED lights powered by a silver oxide battery, and it allows the visitor to give a donation to charity by holding the cross next to designated spots inside the church. This donation act will also leave a light behind as part of a light installation in each designated spot. Light was chosen as a key element because of its strong connection with religion. Upon leaving the church, the visitor reclaims her "armor" and returns the cross. A message is left on the phone via Bluetooth, thanking the visitor for the donation and referring her to a website where all of the lights activated by donations can be viewed in a mirrored installation.

Kalk.com: Offering Local Services and Connecting People in Kalk Bay

Kalk.com was developed by product design students Theo Booyens, George Hugo and Hamish Chilton at the Cape Peninsula University of Technology as part of a four-week design project in the third year of the 3D design program at this institution in 2007. Kalk Bay is a small fishermen's village located on the east coast of the Cape Peninsula south of Cape Town. It has a mixed population, ranging from hippies to retired fishermen. There are numerous antique shops and junk shops along the main road interspersed with cafés and restaurants. Lately there has been increased interest by commercial investors to turn parts of the village into an upscale seaside residential area.

Kalk.com is an information network accessible to people in Kalk Bay, residents as well as tourists. It connects residents in the village and allows them to offer local services to each other as well as to tourists. A number of information terminals are placed in positions where people frequently pass by, e.g., at the train station and at the quay in the harbor. The concept involves two interconnected goals. First, it provides a new communication layer in Kalk Bay. Since the information terminals are public, the information network is accessible also to residents without computers or an Internet connection, a category that includes

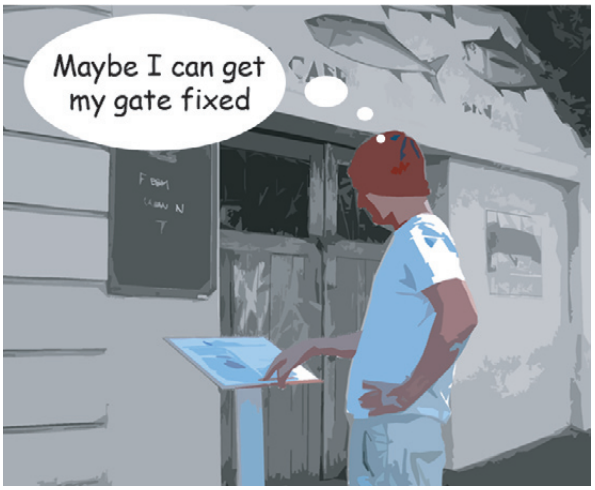

Figure 3. Information terminal for the Kalk.com network.

most fishermen in the village. It allows the fishermen to post their skills in construction and repair work to local residents. In addition, they might offer tourists the opportunity to go on reel fishing trips in their boats. The underlying purpose is to create new opportunities for fishermen to supplement their income, in the first case, when they are prevented from fishing by weather or water conditions, and in both cases, when their fishing quota has been expended. Finally, in response to the concern of many local residents that commercial forces may turn Kalk Bay into a "yacht club," Kalk.com serves as a communication channel for engaging people in activities to preserve the genuine cultural identity of the area as a fishermen's village.

Reflections on Examples of PSC – Themes and Directions

The selected design concepts from our pilot studies presented above are used as a sounding board for reflecting on emerging themes and issues in place-specific computing and on possible implications for design. Further research in which examples of place-specific computing are developed, implemented and evaluated over time is needed in order to provide firmer ground for place-specific computing as a suggested genre of interaction design, but here some tentative issues are presented that should be viewed as potential directions for further design and research in the area.

Granularity of Location – Scale and Identity

One of the most obvious observations from these examples is that place-specific computing can operate on many different scales. The limited range of electromagnetic waves in a Wi-Fi network can be turned into a resource for seamful design of place-specific computing, a notion Chalmers (2005) has used in the design of games for urban settings. However, scale is not determined by the designer but by the social and material conditions of a place. The above suggested construction of place-specific computing states that place-specific services are developed from local resources, but how local is local? The philosophically oriented

geographer Yi-Fu Tuan (1977) has defined place through a comparison with space that suggests a wide range of scales for place. Place is about stopping, becoming involved and developing emotional attachment, whereas space is about openness, freedom and movement. Thus, space may be regarded as a realm without meaning that structures and organizes places and thus gives them subjective meaning, much like time structures everyday life through events and thus provides meaning. Consequently, place is something that exists on many scales, according to Tuan – from the corner of a room to the whole of the earth. However, such an unbounded definition of place becomes problematic in the case of place-specific computing.

The different scales found in the selected examples provide some idea of how far we can stretch the scope of *local* and still conceive of something as place-specific. Being confined to use inside a church, the "Disarming" service has a clear and obvious locality, with the walls of the building as a highly present material border. However, it should be noted that the armory room, where the disarming act is performed, is in fact a place within a place (the church). Outside the armory room, the use of the cross is intermingled with other rituals and practices within the church. In addition, making donations by using the cross obviously has consequences outside the church's walls, underlining the fact that place-specific computing is always potentially connected to ever expanding socio-technical networks. The locality of TIM has a different character, as it serves an area of a size we would refer to as a neighborhood or a quarter. As pointed out by Cresswell (2004), naming is an important part of the social construction of a place and its identity. To younger Capetonians, "Obz Lower Main" does not merely connote the location of Lower Main Road in the Observatory district in the eastern part of inner Cape Town. It demarcates a strip about three blocks in length along the lower main road where there are eight live music clubs and a number of drinking holes, bustling with activity at night and attracting a younger, slightly bohemian and artsy crowd. Alongside the music, there are also poetry readings and other cultural activities. To the crowd hanging out in Obz, this is a most definite place with a clear boundary and a distinct cultural identity. The place-specific character of the TIM concept is very closely connected to the scale of place. It is the close proximity of the music clubs that affords the kind of spontaneous club-hopping that takes place and provides the social and cultural grounding for TIM as a place-specific service. The cultural identity of Obs Lower Main is therefore captured and reflected in the use of TIM for tuning in to and hopping between clubs at night, or in the daytime for finding out what's on on the upcoming night. TIM becomes meaningful to Obz visitors through being part of the ongoing social construction of the identity of Obz Lower Main as a place.

Places maintain their identity through shared perceptions of their specific culture as part of their on-going social construction. The scale of place, and the scope of place-specific computing concepts, is therefore strongly rooted in identity. Consequently, designing place-specific computing requires an understanding of identity. In our pilot studies, we have relied on conventional field study methods, such as observations and interviews. The use of sonic moodboards, on which collages of images are combined with recorded sound from a place, has been one example in our search for new ways to convey identity of place. Another example of new methods for portraying place is Ciolfi's (2004) participant walk-throughs, in which a place is presented to the researcher by a person who knows the area. For place-specific computing, there is a strong need to continue developing new approaches for understanding the social and material conditions of specific places.

Designing in Place

The stance we take as designers towards place-specific computing is very much dependent on how we conceptualize place. One possible position is to conceptualize place from the perspective of radical human geography. The critical human geographer David Harvey claims that place is in essence a social construction (Cresswell, 2004, p. 29). In line with a progressive political agenda, places can be done and redone by people in power or through subversive means. This essentially makes place the object of design. There are many examples of radical gentrification in modern cities, and in our pilot studies, perhaps Cape Town provides the most extreme cases of politically enforced place-making, e.g., the forced removals in District Six in the late 1960s. It is not difficult to envision PSC as part of the political power struggles around the social construction of place. Kalk.com has implicit interventionist elements that could be viewed as part of a larger political agenda. However, I do not view radical reconstructions of place as the main endeavor of PSC. The notion of PSC is not about creating entirely new places, but rather about having digitally mediated interactions integrated into the social and cultural practices of a place. Thus, PSC has the potential of changing social practices in a local context.

Other geographers resist the reduction of place to something being constructed by either social, cultural or natural forces. Cresswell (2004) refers to geographers like Robert Sack who, like philosophers of place Edward Casey and J. E. Malpas, argue for a much more fundamental role of place in life. They see society as inconceivable without place. According to Sack, the social has no privilege in discussions of place. Rather, bringing together the worlds of the social, cultural and natural produces the fundament for place, and these worlds are in part produced by place. In the same vein, the philosopher J. E. Malpas claims: "It is within the structure of place that the very possibility of the social arises" (Cresswell, 2004, pp. 35-36). In this view, place is a necessary construction. Unlike social constructionists, who claim that the meaning as well as the material structure of places are constructed by humans, Malpas and Sack argue that place is primary to the construction of meaning and society. We cannot construct anything without first being in place. According to Cresswell (2004), place is "the experiential fact of our existence" (p. 32).

I regard this position as more valuable than radical human geography in considering the conditions for designing place-specific computing. The object of design for place-specific computing is not place in itself. Neither are the functions, services, artifacts or infrastructures the object of design. Whether we adopt a perspective from radical human geography or a perspective from philosophers like Casey and Malpas, the digital artifacts are

not the gravity center of the design process but rather it is the interactions and mediations these artifacts provide that create this center of gravity. Starting from human geography, place becomes the basis for the social practices we as designers can intervene in. Kalk.com is intended to mediate meetings between people in Kalk Bay, creating new opportunities for fishermen to supplement their income, as well as connecting and engaging people in activities aimed at preserving the genuine cultural identity of Kalk Bay as a fishermen's village. Disarming is an exploration of how place-specific computing can transform old customs into new practices in a setting heavily constrained by established rituals. In contrast, TIM has a less intervening character, as it mirrors a culture already in place by supporting club-hopping in Observatory.

Arguably, the main concern for place-specific computing is to enhance places through digital media and technology that are grounded in the specific socio-material circumstances offered by a place. The purpose of introducing place-specific computing is to explore mediations of place that open the way for new meaningful opportunities in the meeting between people, technology and place. These interventions in turn will potentially change social practices and interactions among people – in effect, changing place. Consequently, place-specific computing is not a once-off process of delivering new opportunities for interaction. Or, in other words, PSC is not about designing for place. Arguably, place-specific computing becomes part of the continuous construction and re-construction of place, supporting established social practices but also adding to the potential to shift meanings and interactions so that places can develop in new directions. In short, PSC is about designing *in* place.

Transgression and Dynamics

In conceiving place-specific computing from a design perspective, the results from our pilot studies indicate a potential range between, on the one hand a more conformist view of designing, in which PSC as an intervention is embodied within the existing culture of place and serves to enhance its practices, and on the other hand a more radical and transgressive view of designing, in which interventions are aligned with the existing culture but aim to introduce change based on an external agenda. On this scale, TIM is a conformist concept that reflects a sensitivity in design to the culture of club-hopping in Obz, and enhances this culture by letting people stay connected with the whole music scene of Obz. In contrast, Kalk.com is an example of PSC in which design, starting from a problem-framing that is grounded in the culture of place, suggests a transgressive intervention with the goal of changing things for the 'better.' Kalk.com starts from a shared concern voiced by people in the village regarding external stakeholders aimed at turning Kalk Bay into a fashionable seaside resort, and with the objective of counteracting these forces by strengthening the community around the local fishing culture. By the same token, Disarming starts from the generally perceived potential of mobile phones to cause disturbance in peaceful places, and introduces a modern version of an old practice in a designated place, the disarming in the armory room. Again, this is a transgressive intervention aimed at improving a perceived problematic condition. However, the ritual and practice that is embodied in the armory room as a place is long forgotten, and it can be argued that this grounding of a design concept in a place has more to do with design rhetorics than sensitivity to local practices. Nevertheless, today's armory room is in general an empty space that lost its function centuries ago – in essence, a non-place. Using it for a place-specific design also simply brings attention to the persistence of our material surroundings, and perhaps also to the fact that the strongly inscribed rituals and practices of a place can make some material structures less subject to change than others. This stands in contrast to the malleability of digital materials. The resources for our pilot studies have been limited, and a long-term engagement with the people and practices of the places studied may have led to designs radically different from those presented. However, they suggest that the transgressive potential of place-specific computing is a complex interplay between the social and material conditions of place.

As described above, place-making is an ongoing dynamic process, and if we regard place-specific computing as part of this process, a design approach not only should be grounded in deep field studies of place and its social, cultural and material conditions, but must also account for the dynamics of place that continually change these conditions. On one level, place has a dynamic lying in its own everyday life through its flow of people and activities. More important, if we recognize place as something in continuous social reconstruction, it follows that social and material conditions may change, with new needs and possibilities emerging. Consequently, we cannot regard place-specific computing as a finished design, but rather as something constantly open for reconfiguration and reappropriation. This underlines the potential in place-specific computing for building long-term relationships among people, places and place-specific information resources.

Conclusion

Developments of use through the increased connectivity, mobility and computing power of today's mobile IT users warrant a renewed concern for how we relate interactive technology to context of use, and more specifically, to the concept of *place*. In this article, Place-Specific Computing (PSC) is suggested as a *genre* of interaction design that categorizes a class of digital designs whose functions, as well as the information these functions provide, are inherently grounded in and emanating from the social and cultural practices of a particular place, accounting for the structuring conditions of this place – social and cultural as well as material. In essence, PSC addresses the shaping of interactions between people and place-specific resources, mediated by digital systems and services, and connected to global socio-technical networks. PSC is introduced with the intention of clarifying the relationship between interactive digital systems and services and the concept of place for interaction design, informed by research in human geography. However, digitally mediated interactions as an element in the enactment of place have received little attention in place research. Therefore, as urban geography is becoming increasingly digitally networked, the hope is that place-specific computing may be an informative concept also for research on place, possibly providing links from place research towards interaction design.

In current interaction design research, location-aware systems are the stream that most closely relates to place from a broadened view of use context. However, rather than tapping into the social and cultural practices of particular places in order to inform the *functionality* of a design, most location-aware systems restrict the focus to different mechanisms and strategies for efficient matching of place-specific *information* to broad user needs. In contrast to this *user-centric* perspective of current location-aware systems, PSC implies a *place-centric perspective* for the design of digital systems and services, in which place is foregrounded in the design as a primary concept for understanding the contextual conditions that shape digitally mediated interactions between people and place-specific resources. Importantly, a place-centric perspective for digital designs does not make users and their needs less important to design, nor does it contradict a user-centered perspective in design. It merely suggests that the range of users is determined by the place for the design, rather than being defined as a target group disconnected from place. It should be regarded as a complementary perspective for interaction design, reaching beyond the user-centric and geometric notion of place in location-aware systems, and allowing design to be driven by local social, cultural and material conditions of place rather than generic needs of broader user groups.

The theoretical grounding for PSC is located in the meeting between conceptions of place in human geography and recent research in interaction design. Central themes in this grounding revolve around place and its relation to embodiment, practice, and mobility, as well as the social, cultural and material conditions for the enactment of place. From this starting point, two central issues have been identified for place-specific computing: (1) to develop an *understanding of practiced place* as developed under the specific structuring conditions of (a particular) place; and (2) to understand *what roles applications of place-specific computing can play as part of such practices*, and consequently as part of a larger social process of place construction. Results from a series of six pilot studies, which involved conceptual designs of place-specific computing across sixteen urban settings, have substantiated the potential of PSC as a concept, and in this article three selected design examples from these studies have been discussed in relation to the above issues, evoking tentative directions for informing PSC design. First, regarding the *understanding of practiced place*, the identity of a place is maintained through shared perceptions of the specific culture that is part of the on-going social construction of place. Thus, successful design of place-specific computing requires approaches for understanding place identity. Furthermore, the digital artifacts are not the gravity center of the design process but rather it is the interactions and mediations that these artifacts provide that create this center of gravity. Starting from human geography, place becomes the basis for the social practices that designers can intervene in. Thus, place-specific computing becomes part of the continuous construction and re-construction of place, supporting established social practices but also adding potential to the shifting of meanings and interactions and to the development of places in new directions. Consequently, PSC is not about designing *for* place, but rather designing *in* place. Secondly, regarding the potential *role* of place-specific computing in practiced place, if we regard place-specific computing as part of an ongoing dynamic process, a design approach should not only be grounded in the social, cultural and material conditions of place construction, but should also account for the dynamics of place that continually change these conditions, resulting in new needs and possibilities emerging. As an intervention in the construction of place, PSC may induce change in the practice of place. However, this relationship is reciprocal, and the inherent dynamics of practiced place also change the conditions for PSC. Consequently, PSC is never a finished design, but rather one that is constantly open for reconfiguration and reappropriation. This underlines the potential in place-specific computing for building long-term relationships among people, places and place-specific information resources.

To conclude, in conceptualizing place-specific computing as a genre of interaction design, it is important to recognize that the concept is neither stable nor normative. Rather, it raises an array of questions that need to be further researched concerning how digitally mediated interactions can be understood as elements of practiced place. Arguably, research should explore transgressive design that can open new possibilities in the meeting ground of people, technology and place-specific resources. It should also further explore new design approaches in which place is foregrounded, evoking a deeper understanding of the social, cultural and material structuring conditions for place-specific computing.

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