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SPECIAL ISSUE ON DESIGN-USE RELATIONSHIPS IN SOSIOTECHNICAL CHANGE

Sampsa Hyysalo, Mikael Johnson, and Eva Heiskanen, Guest Editors

Pertti Saariluoma, Editor in Chief

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Contents

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From the Editor in Chief

OPEN ACCESS PUBLISHING AS A BRIDGE ACROSS THE DIGITAL DIVIDE

Pertti Saariluoma
Cognitive Science, Department of Computer Science and Information Systems
University of Jyväskylä, Finland

In today's world of snappy catchphrases, the complexity of a phenomenon is often hidden behind the simplicity of the terminology. Take, for instance, the concept of the digital divide. In short, the term means that there is a gap between those people who have effective access to digital technologies (and all the benefits that brings) and those who do not (Organization for Economic Cooperation and Development [OECD], 2001; Selhofer & Hüsing, 2002). While the definition seems simple enough, in fact, there are numerous reasons for the technology gap among people in the world. Typical reasons for the digital divide include material access (i.e., no access to a computer, lack of access to specific software programs or related technologies), usability or usage access (i.e., lack of qualified instruction or environmental issues that limit access, such as an erratic electrical power supply or an underdeveloped Internet infrastructure), or mental access (i.e., a lack of digital experience resulting from disinterest or computer anxiety; Van Dijk & Hacker, 2003). Because the digital divide is such a complex phenomenon, it needs a complex approach to bridging this gap. A multilayered approach to address this multifaceted problem has been proposed by both individuals and organizations (Arunachalam, 2003; Oyebode, 2002; Papin-Ramcharan & Dawe, 2006).

The digital divide creates implications for human development. Throughout the millennia, humans have used varying types of technology to support their economic and social existence. Often, scientific development has underpinned economic growth. Science is the frontrunner of human development, and one of the significant means of addressing human problems in a diversity of areas, such as health, education, social development, technology, and communication, to name a few. It forms the border between what we know now, what we are learning at this moment, and what could be as a result of current learning. The production of new knowledge is built upon prior knowledge (Arunachalam, 2003). No other human institution provides such systematic, practical, and progressive stepping stones to bridge the past

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to the future. Scientific knowledge forms the foundation for new ideas and applications in industry, and thus for economic life.

All peoples, no matter what the economic nature of their society, need the opportunity to access scientific knowledge. For this simple reason, the free flow of knowledge remains essential for development of all societies. In both developed and developing countries, small- and medium-sized enterprises play an enormous economic role, by generating new ideas, designing new products, and addressing the human needs to benefit their own society, and perhaps others as well. Therefore the digital divide is more than simply an academic discussion, but rather a vital issue to allow all peoples to participate in the contemporary information society and global economy.

One major challenge facing many developing countries is that their researchers have very little access to contemporary scientific literature. The majority of research is published in the hundreds of journals that require a subscription fee. The costs of maintaining an adequate library is often out of reach for universities in developing countries, where governments must prioritize the distribution of limited funding to address multiple, equally demanding social needs within the surrounding society (Fourie & Neale-Shutte, 2006; Oyebode, 2002). Yet, even universities in developed countries face similar budgetary constraints, and thus either do not have the funds to subscribe to new journals or need to reduce the number of journals to which they can subscribe (Arunachalam, 2003; Welch, 2002). Limited access results in a limited scope of knowledge.

In addition, the digital divide does not stop just the flow of know-how from more experienced to less experienced researchers; it keeps knowledgeable researchers in developing countries from contributing to their scientific fields. Because many researchers in developing countries face an unreliable electricity supply, poor Internet connections, as well as a lack adequate computer equipment, appropriate software, and even technological expertise (Arunachalam, 2003; Fourie & Neale-Shutte, 2006; Papin-Ramcharan & Dawe, 2006), the opportunities to get their research into the international arena is severely compromised. In addition, some journals—even some open access journals—charge authors a page fee when their article has been accepted for publication, with these funds serving as the financial income for the journal (Papin-Ramcharan & Dawe, 2006). Because of these constraints, not only are researchers in developing countries less able to access research, but they also are less able to contribute papers, participate fully in collaborative research, or receive peer support or acknowledgment as compared to those in more IT-connected countries. As a result, qualified scientists in developing countries can find themselves outsiders in international scientific discussions (Arunachalam, 2003; Langer, Díaz-Olavarrieta, Berdichevsky, & Villar, 2004). This is to the detriment not only of their own research and to their colleagues and local societies, but to all humankind.

Human Technology: An Interdisciplinary Journal on Humans in ICT Environments has, from its very inception, envisioned open access to knowledge and collaboration among multiple disciplines as its key benefits. Funding from the Agora Center at the University of Jyväskylä, Finland, has allowed, so far, articles from around the world to be considered, peer-reviewed, accepted, and published without the need for author-funded page fees and for the content of all articles to be fully available to individuals in higher education and industry no matter what the economic status of a researcher's country**.** We seek to bring the perspectives of multiple disciplines and multiple cultures into dialogue regarding the interplay between

humans and technology. Knowledge is not neutral, and in fact it is culturally based (Volet, 2004). By allowing a free and open forum for many voices and many perspectives on developments in science and technologies—as well as many manifestations of the human experience—all societies benefit. That is *Human Technology*'s focus in the pursuit of science.

Of course, publishing a journal does take financial resources. Therefore all open access journals remain ever challenged in maintaining the necessary funding flow. But we at *Human Technology* know the vital role we play in serving the scientific community, and so we continue to pursue the means it takes to allow researchers, no matter what their financial circumstances, to submit quality articles and engage their peers in the multidisciplinary discussion about the role of humans in the application of technologies.

We can't fully resolve the complexity of the technical, material, and access the issues of the digital divide faced by researchers in developing countries. But we can—and do—address some of the strain by lifting somewhat the burdens of access to quality research and in providing the opportunity for any knowledgeable researcher to contribute to the international discussion. We can bridge two gaps within the digital divide by making quality research available, and in encouraging an international discussion of the essential human element within technological development. Both of these roles are essential to the economic and human development in a globalized world.

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All correspondence should be addressed to:
Pertti Saariluoma
University of Jyväskylä
Cognitive Science, Department of Computer Science and Information Systems
P.O. Box 35
FIN-40014 University of Jyväskylä, FINLAND
psa@it.jyu.fi

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Guest Editors' Introduction

DESIGN–USE RELATIONSHIPS IN SOCIOTECHNICAL CHANGE

Sampsa Hyysalo
Helsinki Collegium for Advanced Studies
University of Helsinki
Finland

Mikael Johnson
Helsinki Institute for Information Technology
Helsinki University of Technology and University of Helsinki, Finland

Eva Heiskanen
National Consumer Research Centre
Helsinki, Finland

The last decades have witnessed a significant shift in the orientation towards users in management, design, and innovation research. "Science discovers, technology applies, man conforms," the motto of the 1933 Chicago World Fair, was for long the received view on the design–use relationship. The linear model of innovation was the norm in textbooks up until the 1980s. Its legacy is still strong. Tens of thousands of large marketing departments in both corporations and universities churn out technologies and research on technologies. In contrast, only a few hundred programs explore what happens with technology after it is purchased and how those events translate back to production. A further twist in this imbalance is that, by far, the most common social science approach to technology focuses on "technology diffusion." Here, technology is expected to be diffused as is, and the main research methods, such as the diffusion surveys, were until the late 1980s structured so that the practices of using—that is, the local variations and modifications—do not easily come to the fore (Rogers, 1995).

The significance of users in innovation has remained below the radar because of these widely held assumptions. When Eric von Hippel interviewed R&D managers in the 1970s, they were firmly convinced that their products originated in their internal research labs. It was a great surprise to all, for example, that a closer scrutiny revealed that 80% of inventions in medical instruments were in fact initiated by users (von Hippel, 1988).

Today many companies and policy makers argue for a drastic transformation in innovation and design–use relations. Open innovation (Chesbrough, 2003), living labs (Living Labs Europe, n.d.), user innovation communities (von Hippel, 2005), open-source

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software, and the proliferation of various user-centered design methods (Beyer & Holtzblatt, 1998; Kuniavsky, 2003) are said to have revolutionized the way innovation takes place.

Two things capture our attention here. First is the "re-invention of novelty" in the recent enthusiasm for users in innovation. The Italian scooter Vespa, VW Beetle, and "Ripple Bonnet" Citroën 2CV clubs were marketed ages ago, and recognized for creating much of the value of these vehicles. Mountain bikes; most modern equipment in surfing, windsurfing, and sailing; environmentally friendly home fixtures, and so on were invented by users, not manufacturers. Tinkering with technology and hacking code are by no means new practices (Ratto, 2003). Influential emancipatory initiatives include the 1950s sociotechnical design approach at the Tavistock Institute in London and the participatory design movement since 1970s. And there always were companies that were quick to get the drift or were founded by user-inventors themselves.

The second noteworthy facet is the relation between the research and events "out there," in the real world. The previously mentioned user innovation studies by von Hippel were an offshoot of a 1970s debate over whether the science push or the market pull was more important in creating inventions (Freeman, 1979; Pavitt, 1984; von Hippel, 1988, 2005). Another strand of management studies showed that some users make or demand a significant number of modifications. Together, such demands or applications create a great proportion of the eventual economic and practical usefulness of a product, even when they involve only routine engineering (Gardiner & Rothwell, 1985; Leonard, 1995; Rosenberg, 1982; von Hippel, 2005). Such findings were certainly key in laying out the terrain for attempts to tap the innovativeness of users and they reinforced the idea that technically savvy and demanding users are at the core of achieving such benefits (von Hippel & Tyre, 1995).

Meanwhile, in design and computer sciences, research on computer–human interaction and user-centered design has broken into the mainstream, especially under the title of usability (Dix, Finlay, Abowd, & Beale, 2004; Nielsen, 1993). Characteristically, this research has relied on cognitive psychology, human factors, and ergonomics in explaining how humans behave with interfaces and in drawing implications for design improvements (Dix et al., 2004; Sinkkonen, Kuoppala, Parkkinen, & Vastamäki, 2006). Since the late 1980s, recurring attempts have been made to expand the cognitive paradigm and to overcome its limitations in understanding complex interactions (Carroll, 2003), especially in multiuser groupware applications (Grudin, 1994) in the research field of computer-supported cooperative work. In addition to this "turn to the social," another important development has been a "turn to context" in gathering information on what the users of particular products do by means of observation, interviews, and other kinds of fieldwork (Beyer & Holtzblatt, 1998; Kuniavsky, 2003). Also here, attention to postmarket launch improvements and value creation can be found in the "design for communities" initiatives (Hagel & Armstrong, 1997; Kim, 2000; Preece, 2000), as well as the current Web 2.0 debate (Wikipedia, 2007). The imprint of these lines of research is becoming increasingly visible in how design–use relations are discussed and practiced on company shop floors.

Along these lines of research, social and cultural studies of technology have increasingly been seen as a potential source for insight on technology design and use. While the economic importance of users' contributions to innovation is increasingly clear, it remains rather unclear how these contributions are made (von Hippel & Tyre, 1995). The processes and practices of designers, users, and various third parties thus need to be understood more in depth than has

been possible with traditional quantitative research designs (Miettinen, Hyysalo, Lehenkari, & Hasu, 2003; Pantzar & Shove, 2005; Williams, Slack, & Stewart, 2005).

The findings from these studies show that usage is more than a matter of adopting or rejecting given technologies. It concerns the very shape of technologies, as users tend to subvert, reinvent, and recontextualize designs. This processual approach to consumption can be illustrated by Igor Kopytoff's concept of "the biographies of things" (Kopytoff, 1986, 66-67). He asks us to consider "the biography of a car in Africa… the way it was acquired… the uses in which the car is regularly put, the identity of its most frequent passengers and of those who borrow it, the frequency of borrowing, the garages to which it is taken… and in the end…the final disposition of its remains. All of these details would reveal an entirely different biography from that of a middle-class American, of a Navajo, or French peasant car" (Kopytoff, 1986, p. 67). Such biographical differences have encompassing significance for design, production, and sales as well.

In turn, studies on the actual practices of product developers have shown that they are indeed active—even if not always very successful or skillful—in preparing for the prospective use and in responding to users' actions. Explicit investigations, such as market research or usability tests, have been shown to be merely one of the means in which future use is represented (Akrich, 1995; Hasu, 2001; Hyysalo, 2004; Oudshoorn, Rommes, & Stienstra, 2004; Woolgar, 1991). The relationships between design and use are critical in the creation of the economic and societal impact of new technology. Often various forms of social learning—learning about the appropriate functions, form, uses, values, styles, and so on, of products or concepts—between stakeholders play a key role at this (Williams et al., 2005). However, the prevailing models of innovation and technology policy still foster somewhat more rigid and linear views of what constitutes "designing," "using," or "regulating" within the various venues and times in the life-span of new technology. In contrast to the "received" innovation models, our emerging understanding of actual design practice forces us to reopen the question regarding the actual roles played by product developers, consumers, citizens, activists, and government officials (Sorensen & Williams, 2002).

This special issue of *Human Technology* hopes to foster multidisciplinary discussion that refines our understanding of how technology is shaped in the different phases of its existence. The issue grew out of a track of papers in the international "Innovation Pressure" conference, held in Tampere, Finland, in March 2006. Examples of the questions that we set out for the conferences and this special issue were:

- How is use anticipated and "designed in" during product development?
  From where and how do designers draw their understandings? How realistic (or fluid) are these conceptions? What are the possibilities and limits of user involvement? To what extent does prior design determine the eventual use?
- What is "using" and how does it affect design?
  What happens when people appropriate technologies? How do technologies, people, and organizations shape one another? Is "the critical and active consumer" merely a fashionable slogan?
- How should the models of technological change, innovation, and consumption be refined?
  Is there an overemphasis on design in most current models of innovation and, if so, in which ways? How should we conceptualize social learning between producers,

various users, and regulators to inform the development of better technologies? What methodological questions become salient in studying design–use relationships?

To our satisfaction many of these concerns are indeed addressed by the papers in this special issue. In the first article, Mikael Johnson considers the design–use relationships of the on-line chat and game environment Habbo Hotel. A literature review delineates different approaches toward the user in design: users as social actors, as participants, and as configured users. Through examining one developer's use of a figure of speech, the "average user," Johnson aims to create an understanding about the practices of categorization in design. A qualitative analysis illustrates not only the meaning of the "average user," but also the work that both the developer and the category do. The analysis highlights the developers' role in balancing and governing different users' interests. In comparison with the many other product development contexts in this special issue, the Habbo Hotel developers have the benefit of easy access to users and use practices: They can log in to the hotel and observe the action, or read what the users write on on-line discussion forums.

In the second article, Tanja Kotro presents a particular and interesting form of user involvement in design—one in which the designers employed by the company are also long-term and enthusiastic users of the products. Through their engagement in sports communities, these designers develop "hobbyist knowing," that is, a practice of making sense of the user context through participation in the relevant social and physical environments. Such hobbyist knowing allows designers to translate the values and ideals of user communities into the product development process. Kotro compares hobbyism within the company with other forms of user involvement and concludes that, through the ongoing nature of participation and the types of tacit knowledge developed, hobbyists are able to develop a long-term relation to the intended contexts of use of the product.

Eva Heiskanen and Petteri Repo examine the effectiveness of a set of interventions aimed at enhancing user involvement in small entrepreneurial companies. This article analyzes the capacity of designers and their superiors to make sense of "users" and "use" and to enact changes. They explore these issues within a framework of action rationality, which refers to a biased, action-oriented but effective mode of managerial behavior that is typical to entrepreneurs. They conclude that direct, face-to-face interaction serves a number of purposes for companies in learning about their users. Yet there are limits to user participation that cannot be overcome merely through increased awareness or short-term interventions.

Next, Hannele Hyppönen examines the roles of customers, users, and technology providers in the integration of ICT into healthcare services. The aim of the study is to develop a conceptualization that would allow future practitioners to be more successful in achieving their goals. On the basis of two case studies on eHealth codevelopment cycles, Hyppönen develops a conceptualization that reveals a lack of coordination and balance between different objects of development: the development of the service and that of the technology. The conceptualization directs attention toward the need to analyze and learn from the practices in which the technologies are to be implemented, and to build a balanced network of actors who have adequate knowledge about the technology, the service, and the use of both.

We then move to examine in more depth what constitutes technology usage. Christie and Verran examine the complexities in how DVD technology is viewed and applied by indigenous Australians. Aboriginal Australian peoples' ontologies and epistemologies regarding teaching and learning are grounded in perspectives that every lesson is unique

performance of knowledge, while contemporary Western technologies create a definitive representation of events and knowledge. These contractions of use of the DVD technology continue to be explored as a means for the Aboriginal leaders to pass on essential historical and social information to their peoples, as well as to make clear statements of ownership, history, and communal significance of Aboriginal lands when dealing with representatives of mainstream Australia. Christie and Verran elaborate how the necessary (re)designing-in-use hangs in a delicate balance between assisting to undo some the capacities of the technologies to represent, while retaining just enough for them to remain appropriate in the knowledge practices in question.

Finally, Hyysalo provides a literature review of what technology use is seen to consist of in the light of ethnographies of work and consumption. He then examines how a novel medical alarm and monitoring appliance was appropriated in the work of home-care nurses and in the everyday living of elderly people. Analysis shows that these technically unsavvy users shape technology considerably by various, even if mundane, acts of adapting it materially and by attributing different meanings to it. The paper argues further that the full significance of these modifications and meanings becomes visible only when they are interrelated and mapped with different versions of technology that are enacted in de facto practices of its users.

Even the limited number of in-depth studies on design–use relations presented in this issue highlight the diversity of contexts in which both design and use can occur. Yet the studies, taken together, point out that we indeed should revise our understanding of design and perceive of it more as a situated and relational activity. All of these cases further highlight the differences and significance of the multifaceted contexts within which the relations between designers and users take place. It matters greatly how removed from each other design and use are situationally and culturally and what kinds of intermediaries and mediators there are to bridge these differences.

Many of the articles draw attention to various ways of learning about the usually distinct priorities and rationales of various stakeholder groups as a prerequisite of success. But such learning tends to take place alongside more pressing concerns and priorities, regardless of whether one looks at designers or at users. Actions crucial to the evolvement of desirable technology appear somewhat fragile by their very nature. Thus, more is needed than merely demanding that designers subscribe to more apt values or keep pace with latest knowledge from cognitive science or with cutting edge requirements gathering techniques in their work.

The term user is also rendered problematic. When the perspective is shifted to users-in-context and to the relationality of users, new concepts such as “everyday informatics,” “work and life projects,” and users as “doers” emerge to challenge the passive concept of users as recipients of or merely operating a technology. This perspective questions established categories in usability engineering: The usefulness, utility, and usability of a technology do not appear to be intrinsic properties of the artifacts or measures of fit to their eventual user base. Rather, usability and utility appear as achievements that evolve over time so that parts of them are done by designers, parts by users, and parts by various third parties that maintain, configure and sanction (and reward) the use of the technology (cf. McLaughlin, Rosen, Skinner, & Webster, 1999; Williams et al., 2005).

These observations carry practical implications: Attempts to intervene in the design–use relations by initiating codesign processes require sensitivity to the context and process and are by no means limited to the early stages of development or to formal R&D organizations.

We challenge the readers of this issue to open up their perceptiveness to the diversity of design–use relations that exist, and their imaginations to the diversity of interventional modes and strategies that could serve to enhance the relations between design and use.

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Authors' Note

All correspondence should be addressed to:
Sampsa Hyysalo
Helsinki Collegium for Advanced Studies
PO Box 4
FIN-00014 University of Helsinki, Finland.
sampsa.hyysalo@helsinki.fi
Phone +358 9191 23460
Fax +358 9191 24509

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UNSCRAMBLING THE "AVERAGE USER" OF HABBO HOTEL

Mikael Johnson
Helsinki Institute for Information Technology
Helsinki University of Technology and University of Helsinki
Finland

Abstract: *The "user" is an ambiguous concept in human-computer interaction and information systems. Analyses of users as social actors, participants, or configured users delineate approaches to studying design-use relationships. Here, a developer's reference to a figure of speech, termed the "average user," is contrasted with design guidelines. The aim is to create an understanding about categorization practices in design through a case study about the virtual community, Habbo Hotel. A qualitative analysis highlighted not only the meaning of the "average user," but also the work that both the developer and the category contribute to this meaning. The average user a) represents the unknown, b) influences the boundaries of the target user groups, c) legitimizes the designer to disregard marginal user feedback, and d) keeps the design space open, thus allowing for creativity. The analysis shows how design and use are intertwined and highlights the developers' role in governing different users' interests.*

Keywords: *design-use relationships, user, designer, categorization practices.*

INTRODUCTION

Designers and users are commonly treated as trivial roles in research on design processes, but the question, "Who are the users?" is far from trivial. Take, for instance, the case in this paper, the on-line chat and game environment Habbo Hotel. Should the users be defined as the Internet surfers who visit the hotel at least once a month? This is the designation of users when discussing popular Web site statistics. Considering Habbo's role in the everyday life of some teenagers, one could say that the Habbo users are mostly teenagers who—apart from going to school, practicing their hobbies, and spending time with their families—log on to Habbo for 30 minutes a day. Yet another way of describing the users, found on the Habbo Web site and in their press releases (Sulake 2006a, 2006b), is to say that they are creative habbos[1] who decorate magnificent guest rooms in the on-line hotel and spend time with their

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friends there. From a global perspective, one could perhaps say that the users are privileged children whose parents have an Internet connection at home. Or, considering all the different stakeholders of Habbo, the users could be defined as those whose income does not depend on Habbo's commercial success.

These brief examples show that, depending on who is asking, when and for what purpose, there is a wide range of alternative designations for the users[2]. This diversity of meanings for the term user highlights its elasticity, making it a blessing for some, but a curse for others. In addition, the term also is commonly used interchangeably with *actors*, *participants*, *humans*, *knowledge workers*, *customers*, *interactors*, *citizens*, and so on. It is no wonder that the user-centered design literature warns against designing for the "elastic user," and recommends the use of techniques for personifying the user, such as personas (Cooper & Reimann, 2003).

The ambiguousness of the user has been noted and problematized by a few researchers (Oudshoorn & Pinch 2003; Stewart & Williams, 2005; Westrup, 1997), and there are several different approaches to studying use-related processes of design and innovation in information and communication technologies. In this article, I distinguish between users as social actors (Lamb & Kling, 2003), users as participants (Hales, 1994; Kling & Gerson, 1977), and users as co-constructed and configured (Mackay, Carne, Beynon-Davies, & Tudhope, 2000; Woolgar, 1991). A focus on design-use relationships and an ambition to make sense of a developer's reference to the "average user" guide the comparison of these approaches. The aim of this paper is to provide a means to understand and tackle the dilemma of user categories and their management in practice, in the design and the continued development of virtual world features for complex and heterogeneous communities.

How users are defined and by whom greatly shapes the result of any design process, since undoubtedly the words that we use shape our outlook and affect our behavior. The increased number of people using computers at home and in leisure situations, as well as emerging software for virtual communities, has created a need for both researchers and practitioners to reassess Grudin's question from 1993: "Have our terminology and habits of speech kept up with the changes, or do they perpetuate an outmoded perspective that holds us back?" (p. 112). This became one of the tasks for the Mobile Content Communities research project that started in 2003 (Turpeinen & Kuikkaniemi, 2007). One of the aims of the project was to understand virtual communities (Porter, 2004) by trying out design concepts, models, and prototypes.

This author participated in a case study on Habbo Hotel, which contributed to one of the results of the project: a community model[3] that aims to sensitize designers to ask the right questions about social and cultural issues of computer-mediated communities. During the 3 years of the study, Habbo grew from a popular on-line meeting place for 1 million regular visitors in five countries to more than 7 million visitors in 18 countries. The company developing Habbo, Sulake Corporation, grew from a small organization of about 50 employees to a medium-sized organization with 270 employees (Sulake 2006b).

The fastest way to get insight into the Habbo communities is to read the Habbo-themed Web sites, also called *fansites*, created by active community members. These fan magazines on the Web are broadly known among Habbo visitors and many visit them as often as the hotel itself (Johnson & Toiskallio, 2005). The fansites can be seen as an amateur media world around the Habbo site that informs community members about Habbo news, gossip, opinions, hints, events, competitions, and so on. Because they complement the official Habbo Web site and influence the norms for behavior in Habbo, the fansites play an integral part in the communities.

In interviews I conducted with Habbo developers, I learned that the fansites have become an important source for user feedback. The fansites were a frequent topic during the interviews, and in this paper I reflect on one developer's statement about the community members participating in the fansite discussions. The developer referred to the Habbo Hotel's "average user," which at first seemed like a strange category, especially since human-computer interaction (HCI) literature discourages design for the average user. However, in this paper the developer's reference to the average user is taken seriously.

This concept of average user has been analyzed to understand which subcommunities are given voices through the fansites. Especially interesting is the developers' agency, or their ways of shaping the user groups while they speak. First, this paper begins with a literature overview of different approaches to users. It continues with a brief introduction to the fansites, to contextualize the text extract from the interviews with Habbo developers. After the analysis of one developer's reference to the average user, these findings are related to the other Sulake developers' ways of speaking about the users.

WHO IS THE "USER"?

User is a highly controversial and ambiguous term in computing. Recent user-centered design literature defines the user in two major ways. First, users are defined in terms of their knowledge of computers or of a particular computer program: as novice, intermittent, or expert users (Shneiderman, 1998). Second, a distinction is often made between those who actually operate the computer, the primary users, and the secondary users, who are indirectly affected by the computer system (Courage & Baxter, 2005; Hackos & Redish, 1998). In addition, Courage and Baxter (2005) recommend considering anti-users, who would not buy or use the product. Hackos and Redish (1998) warn against confusing users with buyers, against interacting with surrogate users only, and recommend studying users as members of communities. Table 1 summarizes these viewpoints.

However, outside local design contexts and for research purposes, there is a need to define the user more carefully to achieve a shared understanding. This has been a challenge, since different fields of research discuss users differently. In HCI, *user* traditionally referred to a person sitting in front of a computer in an office, completing tasks by entering information and commands and using the output. In contrast, the information system (IS) user refers to a beneficiary of the computer output, who might be a person (or even an organization) not directly interacting with the computer. To distinguish the person sitting in front of the computer, IS researchers talk about "end users" (Grudin, 1993).

Table 1. Users in a Sample of the User-Centered Design Literature.

Hackos & Redish (1998)	**Shneiderman (1998)**	**Courage & Baxter (2005)**
Primary users Secondary users User communities ¬Users as buyers ¬Surrogate users	Novice or first-time users Knowledgeable intermittent users Expert frequent users	Primary users Secondary users Tertiary users Anti-users

Over time, these differences have changed, since the HCI researchers have followed the user outside the office, into mobile technologies, and the use of computers in leisure contexts. In particular, research on user experience and mobile HCI puts the user in mobile contexts of use (Maguire, 2001; Toiskallio, Tamminen, Korpilahti, Hari, & Nieminen, 2004) with a focus on fun and pleasure (Blythe, Overbeeke, Monk, & Wright, 2003), instead of the traditional effectivity and efficiency focus within work contexts. Also, some researchers report that the term user is understood differently in the USA as opposed to Scandinavia. Carmel, Whitaker, and George (1993) find an unambiguous definition of *user* impossible:

> The North American reader understands "user" to mean any non-IS/nontechnical individual in the organization who is affected by the system—this includes managers. The Scandinavian reader understands "user" to mean any operational worker who is affected by the system—this does not include managers. (p. 40)

Friedman and Cornford (1989, p. 274) report similar differences, stating that Scandinavians seem to be more likely to consider power relations between users and system designers in their definitions, whereas American analyses tend to focus on personality conflicts and differences in cognitive styles. However, these generalizations have exceptions (Kling & Gerson, 1977; Lamb & Kling, 2003; discussed below), so it is not clear to what degree these cultural aspects have shaped or continue to shape research on the user. The globalization of research and the increase of the number of both publications and researchers have probably made the fields more heterogeneous.

Another difficulty in defining the (computer) users is that the computer technology has changed a lot since its invention. From being room-sized and expensive equipment available only to a few, the hardware innovations and mass production of computers have made them smaller, mobile, and more affordable. This shift is noticeable in the change of the meaning of the term user. In the early days of computing, the user referred to those who used computer hardware, in other words, software developers (Friedman & Cornford, 1989; Westrup, 1997).

In sum, *user* is a complex term. So far, one can only say that it is used in the context of computer systems development, and its meanings have changed over time and space (e.g., USA vs. Scandinavia). This encourages a further look into different approaches to users. Without aiming for completeness, I will explore three approaches in which users can be distinguished: as social actors, as participants, and as co-constructed and configured.

Users as Social Actors

The definition of users within the HCI and IS fields has been challenged because of its implicit technocentrism (Kuutti, 2001). Those opposing the use of the term argue that when a person is defined with respect to a technological system, as a computer user for instance, this represses other more relevant identities as well as the multiple and intertwining reasons for use. In contrast to many car owners, who identify themselves as owners, few computer users make a lifestyle (or identity) of being someone who uses computers (Grudin, 1993). More important identities are their professional identities, the relation to their family and special someone(s), hobbies, and so on. Most people who use computer applications utilize multiple

applications, in various roles, and as part of their work or leisure activities, while interacting with a variety of other people in multiple social contexts (Lamb & Kling, 2003).

This critique is noted in some studies on designers' conceptions of the users (Dagwell & Weber, 1983; Isomäki, 2002; Kuutti, 2001; Nurminen, 1988), arguing that these conceptions influence the design more fundamentally than do applying human-centered design methodologies. The fear is that the designers cannot contribute to the humanization of computer systems with socially thin concepts of the users. Lamb & Kling (2003) have responded to the critique of those user concepts that include only individualistic or cognitive dimensions, by reconceptualizing the user as a social actor. Their view of a *social actor* is based on four dimensions: affiliations, environments, interactions, and identities (see Table 2).

Their concept has clear benefits: It is "1) predictive without being deterministic, 2) scalable, based on the multilevel explanatory power of institutional theory, and 3) extensible in multiple ways" (Lamb & Kling, 2003, p. 221). This critique intentionally leads away from the reference to systems development in defining users, which can be fruitful in studies of ICT use.

Research in the field of information systems is influenced by and related to both the "social shaping of technology" approach (MacKenzie & Wajcman, 1985) and the "social construction of technology" program (Bijker, Hughes, & Pinch 1987)[4]. These approaches shared the aim of criticizing technological determinism by coupling technology to designers' conceptions and values. In addition, political, economic, and cultural interests as well as established social categories, like class and gender, were seen as shaping technology (Sørensen, 2002).

However, even in these more nuanced models of the user, the perceived "problem" with current design processes seems to be the designer. Seeing the designers as almighty heroes or demons, either praising or blaming only them, has been criticized as the "design fallacy" by Stewart & Williams (2005). They argue that a design-centered view describes technology as finished when leaving the hands of the designers, which ignores the innovation that takes place in use. If technology is seen as influenced by designers only, this also ignores user involvement in design. These shortcomings are partly resolved if the users are seen as participants in design, as in the next subsection.

Table 2. Social Actor Dimensions (Lamb & Kling, 2003).

Affiliations	organizational and professional relationships that connect an organization member to industry, or national and international networks
Environments	stabilized, regulated, and/or institutionalized practices, associations, and locations that circumscribe organizational action
Interactions	information, resources, and media of exchange that organization members mobilize as they engage with members of affiliated organizations
Identities	avowed presentations of the self and ascribed profiles of organization members as individual and collective entities

Users as Participants

The definitions of users can also be seen as reflecting design philosophies, as has been the case particularly in the computer-supported cooperative work (CSCW) field (Mackay et al., 2000). For instance, Mike Hales (1994, p. 155) discusses different conceptions of users based on

different design styles: users as clients (the "specify and deliver" style), users as actor-constructors (the "enable and empower" style), and users as codesigners (the "reflect and reinterpret" style). These distinct design styles designate the different ways of users participating in the design. The multiplicity of actors in design is highlighted by Kling and Gerson (1977), who distinguish 14 major orientations that people may adopt within the computing world (Table 3). They are arranged by their closeness to the center of the computing world (Kling and Gerson's concept for all those people and groups that collectively produce computers and computer-based services). The first eight orientations are insiders, while people who adopt the last six positions are more in the margins.

From this perspective, the term user is not about identification but participation in the technology production. The user is seen as a very established category referring to a particular way of participating in technology production. It is not a very favorable position, since traditionally the innovation is seen to flow from the developers via the other stakeholders to the users, and not vice versa. The interests of the users traditionally are not served first, because business and technology production are primary, which leaves the user interests in a challenging position. In Hales' (1994) view, where the users' relation to production becomes visible, emancipating the users becomes less a question of finding other labels for this group and more a question of organizing the production differently.

Friedman and Cornford (1989) have studied the history, organization, and implementation of computer systems development. They found a six-fold typology useful to explain the changes of the computing world over time: a) patrons, who initiate the system, b) clients, for whom the system is intended and designed, c) design interactors, who are involved in the systems design process, d) end users, who directly operate the man/machine interface, e) maintenance/enhancement interactors, and f) secondary users (both the system victims and those who benefit indirectly from it).

According to Friedman & Cornford (1989), the user relation became the biggest critical factor constraining development in the early 1980s, after the hardware and software constraints were mitigated in earlier phases. To decrease the distance between programmers and end users, five major strategies emerged to reorganize technology production: a) user involvement, b) end-user computing, c) decentralization, d) prototyping, and e) job rotation (p. 271).

Table 3. A Sample of Research on Users as Participants.

Kling & Gerson (1977)		**Friedman & Cornford (1989)**	**Hales (1994)**
technology stimulators	users	patrons	users as clients (the "specify and deliver" style)
innovators	feeders	clients	users as actor-constructors (the "enable and empower" style)
diffusers	tenders	design interactors	users as co-designers (the "reflect and reinterpret" style)
vendors	sustainers	end users	
service providers	hobbyists	maintenance or enhancement interactors	
educators	consumers	secondary users	
system architects			
application architects			

These and other movements strive to give the users greater influence in the technology production. Some aim to influence the process: involving the users early on, demanding a multidisciplinary development team, or applying iterative design cycles with prototypes and user evaluation in all phases. As Hales (1994) noted, the emphasis put on participation, democracy, and emancipation varies in different approaches. For instance, participatory design (Ehn, 1988; Greenbaum & Kyng, 1991; Schuler & Namioka 1993) gives the users the status of codesigners, whereas many user-centered design techniques (Beyer & Holtzblatt, 1998; International Organizations for Standardization [ISO], 1999; Norman & Draper, 1986) maintain that consulting the users is enough. Others initiatives try to influence the product by making sure that the division of labor between people and machines is appropriate (Mumford, 1983), or making it flexible to support customization (Andersen, 1999; Kay & Goldberg, 1977; Laukkanen, 2005; Mørch, 1997; Nardi, 1993). A third focal point is the methods and techniques to represent the work processes and their relations to the computer system (Bødker, 1998; Checkland & Scholes, 1981; Mumford, 1983; Suchman, 1995), as well as the models of the user and contexts (ISO, 1998, 1999; Maguire, 2001).

However, despite the good intentions and the recognition of the multiplicity of actors involved, these participatory and user-centered design initiatives have been criticized due to lack of impact on system design overall. Stewart and Williams (2005) note many obstacles to the wider applicability and uptake of the initiatives, and strive to broaden the understanding of the design process. They argue against too simplistic models of the design process and point to studies where many aspects of it have been problematized. One important point is to rely not on armchair philosophy regarding the user, but rather to ground the term user empirically in order to understand design practices.

Users as co-constructed and configured

Since the early 1990s, some researchers have shaped an approach that studies the “configuring of the user,” which can be seen as an extension of the broader social shaping research community (Sørensen, 2002) mentioned above. It takes as its starting point that there are no users prior to the conception of a particular computer system. The argument is that qualitative research should not take a category such as the user as given, but instead acknowledge the considerable work that has gone into its constitution (Westrup, 1997). This implies a distinction between the users as imagined by the developers and the users who actually use the system, including an analysis of their interrelations. Woolgar (1991) coined the notion of configuring for the process of “defining the identity of putative users, and setting the constraints upon their likely future actions” (p. 59). His work is an important theoretical move for studying how users are imagined in computer systems development (Mackay et al., 2000). It is one alternative to study the interrelations of the social and the technical in design, especially regarding the construction of “affordances” (Norman, 1988) and “mental models” (Norman & Draper, 1986), both practical and widely used design concepts.

Woolgar’s (1991) work on the configuring of the user in a microcomputer manufacturing company has been both extended and criticized. Among others, Westrup (1997) noted that not only are the users configured, but so are the developers. He used his extended version of Woolgar’s work to examine two approaches to requirements analysis in a novel way. He argued that the categories of users and designer are constituted by the techniques that seek to

represent them, in this case Mumford's (1983) influential ETHICS/QUICKethics methodology and the techniques of the participatory design project UTOPIA (Bødker, Ehn, Kyng, Kammersgaard, & Sundblad, 1987). Westrup (1997) also highlighted difficulties in the very vocabularies of systems development. Many authors (Hyysalo, 2004; Mackay et al., 2000; Williams, Stewart, & Slack, 2005) criticized Woolgar in that he stopped his analysis too soon, not giving room for the process of consumption work by the users.

Woolgar's (1991) approach, together with similar initiatives from Akrich and Latour (Akrich, 1992; Akrich & Latour, 1992; Latour, 1992), are termed material semiotics by Oudshoorn and Pinch (2003), as they outline influential approaches to the co-construction of users and technologies. Another approach has emerged from gender studies, where the focus is on the mutual shaping of gender and technology, as well as an inclusion of more invisible or implicated actors. Consumption and domestication studies de-emphasize the developers and focus on active consumers using products in ways that might not have been imagined by developers. Agre (1995) suggested that developers do not intentionally try to configure users, and Hyysalo (2004) has drawn attention to the imaginaries bound in the professional practices of developers.

Williams et al. (2005) warn against the tendency of the early work (Akrich, 1992, 1995; Bijker et al., 1987; Woolgar, 1991) to demonize designers as omnipotent manipulators of users, which they see as a consequence of studying snapshots of design or use processes. They argue that technologies should be seen and studied as sums of many projects, configurations of previous technical frameworks, and never complete. All actors involved at multiple locations need to be considered, as well as their interrelations, while remembering that information about the users is typically incomplete and uncertain.

To sum up, there is no general answer to the question "Who is the user?": It is up to the researcher to make the relevant aspects of the user explicit, both theoretically and empirically. I have outlined three different approaches to the user, finding that especially the reconceptualization of the user as a social actor is appropriate if the focus is either on design or use alone. When users are seen as participators in computer systems development, the point is that not all stakeholders can participate on an equal basis. When users, designers, technology, organizations, and so on, are seen as co-constructed, the point is that the distribution of agency, power and actors are empirical questions.

METHOD AND DATA

This paper is part of a larger research undertaking where I study the slowly paced dialogue between different developers and users through material software. Because the Habbo software has several design cycles in a year, it has been possible to study a dialogue that starts from the developers' vision of future use. The vision is realized during game development into Habbo features. Next, the users appropriate the hotel features for their own purposes and invent their own ways of using it. Soon after, the developers learn a little about these more or less unexpected use practices through various forms of user feedback. This feedback modifies the designers' original vision about future use and, as new features are developed, the cyclical dialogue continues with the next loop. In this paper, I freeze the moment when a developer talks about user feedback.

One developer’s reference to the “average user” is carefully scrutinized. It is studied as an example of a general dilemma for people engaged in creating products for mass consumption: There is no single “correct” way of categorizing users. Still, all of us act in worlds where we must use categories, and the question is how to manage this dilemma. In this study, the text extract around the “average user” is analyzed with the interview data analysis technique called *membership categorization* (Baker, 2004). The interviews are not treated as simple reports on some state of affairs (representationalism), but talk is considered as social action. This makes it possible to analyze not only the meanings of the categories, but the work the categories do and how they influence development. The categories referred to in the interview talk are treated as empty at first, giving them only the meanings emerging from the particular situation. During the interview the membership categories are elaborated on and refined; the established categories might even be internally conflicting. The point is to understand why conflicting categories are needed to communicate.

In this case study, we (Johnson & Toiskallio, in press) had the opportunity to conduct both quantitative and qualitative research to understand the Finnish Habbo communities. We started with an explorative survey on the visitor profiles (N = 10,000), because no use statistics were available. In 2004 we identified 173 Finnish Habbo fansites, and we analyzed 23 that were written for a large Habbo audience (Johnson & Toiskallio, 2005). The survey findings provided background statistics, whereas the fansites and forum discussions allowed us to distinguish user groups and popular activities. During the spring of 2005, we conducted 10 themed interviews, lasting 2 to 3 hours each, with 10 Habbo developers, or about two thirds of the Habbo game development organization. Six of the interviewed developers (graphical designers, and client and server developers) had been in the organization since the beginnings, 5 years earlier, while four developers had about 1 year of Habbo experience. In addition, we conducted individual, pair, and group interviews, 2 to 3 hours in length, with a total of 12 Habbo community members (users) from different subcommunities. These interviews made further elaboration of membership categories possible.

The interviews were conducted in Finnish, as all developers and the author are fluent speakers of Finnish. All of the interviews were recorded and content logs created. The interviews were transcribed in detail and excerpts translated to English by the author as needed. The different data sources have afforded triangulation (Yin, 1994) of the slowly paced user-developer dialogue. Preliminary results include conference talks on the design reasons behind the retro look of Habbo (Johnson, 2006a), user categorization practices (Johnson, 2006b), and stereotypical images in membership categorization practices (Johnson, 2006c). The approach adopted here is informed by qualitative research (Silverman, 2004) in HCI (Thomas, 1995) and IS (Lee, Liebenau, & DeGross 1997), as well as science and technology studies on the social shaping of information and communication technologies.

CASE HABBO HOTEL

Habbo has its origins in the experiences drawn from two Internet chat rooms, Mobiles Disco and Lumisota. In terms of Internet technologies, Habbo is a graphical chat environment on the Web that can be accessed with a Web browser with the Shockwave plug-in. This chat

environment is designed as a virtual world where people can hang out and make new friends. When checking in to the virtual hotel, one creates one's own cartoon-like Habbo avatar (Figure 1) that can walk, dance, eat, drink, and chat in the cafés (Figure 2), restaurants, swimming pools, and games rooms. Besides experiencing these common rooms in the hotel, one can decorate and furnish a room of one's own. In contrast to many on-line games, there is no entrance fee to the virtual world, which allows the majority of the users to chat for free. Instead, the profit model is based on micropayments in the hotel. Virtual furniture, minigames, and membership in the Habbo club are bought with so-called Habbo credits. These credits can be purchased with prepaid cards, bank transactions, or special text messages that add a specified amount of money to the customer's mobile phone bill.

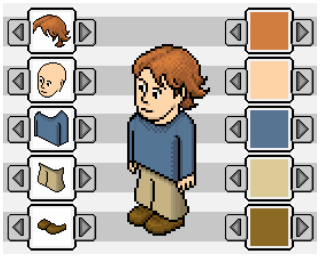

Figure 1. A Habbo avatar. The image © by Sulake Corporation. Used with permission[5].

Figure 2. The welcome lounge in Habbo. The image © by Sulake Corporation. Used with permission[5].

During the early Habbo days, the hotel was developed by a handful of game developers with their core competencies in graphic design, macromedia flash clients, and java server programming. At first they developed a hotel called *Kultakala* (*goldfish* in Finnish) for themselves and their friends but, already within a year of the launch, the site became popular among teenagers. According to our survey in 2004, 75% of the visitors were between 10 and 14 years old. Later, with the internationalization of the hotel, the organization grew and, in every country where the Habbo Hotel operates, a local office was started with a few employees working on the site moderation, community management, customer relations, and marketing. More administration and business people have joined the headquarters in Finland, and the game development division now includes more than a dozen game developers.

Based on developer interviews, it became clear that the original group of Habbo developers had made use of their own retrogaming subculture. Video games from the 1980s are and have been a great source of inspiration (Johnson, 2006a). This is of course easily deducible by looking at the retro appearance of the Habbo lounge in Figure 2, but there is more to it. The benefits of making Habbo retro include positioning Habbo as original compared to other games that strive to be photorealistic. It also avoids pressure to follow fast-changing 3D graphics techniques, which in turn allows for Habbo to stay popular for a longer time. In addition, there are reduced performance requirements for both client computers and network bandwidth. Finally, the retro look encourages a simplistic design making Habbo easy to use.

Learning from the Habbo Fansites

We (Johnson & Toiskallio, 2005) studied 173 Finnish Habbo fansites in 2004. The focus was on what could be learned about the Habbo visitors and their Habbo practices from user research (Hackos & Redish, 1998; Kuniavsky, 2005), focusing on the membership categories visible through the fansites. Since the fansites are accessible without research intervention, the risk of distorting the data by the presence of the researchers is reduced.

The most popular fansites are usually made by a small team of Habbo fans with different expertise and roles. For example, one designs the look and layout of the site, another one writes the stories, and a third has the technical skill to publish the site on the Web. The most active fansites have small updates (such as news and rumors about Habbo) several times per week, but publish reviews and articles once a week or bi-weekly. Some fansites group their articles together and publish them as an issue of a Web magazine. The Web magazines seem to follow a rhythm of one issue per one or two months. The fansite contents were classified and a list of common fansite elements was produced (Table 4).

Based on the fansites, we clustered the hotel residents into eight groups: a) furniture traders and collectors, b) chatters (in public rooms), c) gang-members and VIPs (insider groups not open to everyone), d) supervisors with administration powers, e) cheaters, f) quiz-makers and players, g) the hotel manager (a Sulake employee), and h) celebrities. Similarly, 11 popular activities were identified: trading furniture, casinos, dating, beauty contests, competitions, dice games, team sports, formula tracks, talk shows, clubs & hotels, and orphanages. More important than the exact details of these listings are two observations about Habbo that they convey: the diverse and commonplace qualities of Habbo. First, there is not one particular Habbo activity that attracts all Habbo visitors, but many different ones. Second, the activities

Table 4. Common Habbo Fansite Elements (based on Johnson & Toiskallio, 2005).

Fansite Elements	Description
News and rumors	Fansites are convenient for Habbo visitors who want to reach a large audience, a fast way of spreading information about Habbo happenings (e.g., competitions, pop idols visiting Habbo), new features, news about Sulake Corp.
Participation	The fansite audience is provided ways to comment on the fansite through discussion forums, guest books, polls, etc.
Links	The fansites link to relevant Habbo places: other fansites, and to the hotels in other countries.
Hints, secrets, guidelines	Fansites teach newcomers both basic and advanced tricks with which to impress others. Guidelines on acceptable behavior are frequent.
Reviews and lists	The fansites keep track of the features and possibilities in Habbo: public spaces, different furniture items, pets, etc.
Histories	Two major histories are told on the fansites: the history of Habbo and the history of that particular fansite
Fashion and celebrities	Habbo "journalists" interview Habbo celebrities, avatars who have become famous in Habbo, and report on fashionable clothing and activities.
Graphics	Edited screenshot pictures are an integral part of many fansites, some even provide pixel graphics drawing schools.
Habbo fiction	A few fansites write fictional stories about characters in Habbo.
About	Who comprises the fansites staff, number of visitors, updates, banners, etc.
Real life	Habbo meetings "in real life," stuff not about Habbo that is important to teenagers, as well as blogs, e-cards, etc.

going on in Habbo resemble games with rules and pretend play familiar from schoolyards, playgrounds, youth clubs, and so on.

The Habbo visitors and their practices seem to be strongly influenced by the fansites. They complement Sulake's official Web site by providing more detailed information about the hotel from an experienced visitor's point of view. Hints, secrets, and guidelines, and stories about Habbo fashion influence the boundaries for acceptable behavior in Habbo. The fansites improve the Habbo visitors' awareness of the fan cultures around Habbo, and also reproduce and reinforce social positions (like potential Habbo career paths or legitimized visitor groups).

Membership Categories

The membership categories from the fansites were further developed, based on interviews and artifacts analyses (Johnson, 2006c). In a discussion on the influence of images on membership categorization, Johnson discussed visual and nonvisual categories (Table 5).

Table 5. Predefined and Emergent Visual and Nonvisual Membership Categories based on Johnson, 2006c).

Predefined visual categories	Emergent visual categories	Non-visual categories
avatar appearance: boy / girl *purchasable badges*: Habbo Club, Golden Habbo Club, Halloween smile *special badges*: Habbo staff, NGO workers, youth workers, mental support, VIP guests *earnable badges*: Habbo X (guides), fansite authors, Battle Ball gurus	*clothing styles*: punk, gothic, teenie, wannabe (strictly dressed), personal style (independent of fashion) *professions*: journalist, nurse, TV show host, bartender / waitress, pharmacist, actor, police, doctor, nurse, fireman, postman, veterinarian, etc. *TV show formats*: Idols, the Bachelor(ette), Greed, Do You Want to be a Millionaire, Big Brother, Survivor, America's Next Top Model, "Dating," etc. *categories formed from value judgments on others' appearances*: good looking, bad looking	*visitors from other hotels* (nationality / language region) speaking another language *age*: small children, "my age" (teen), older *gender*: combinations of nickname, avatar, real body (e.g., boy with girl avatar but masculine nickname) *Habbo age*: newbie, regular, guru *relation to room*: room owner, visitor, shared rights *friends made in or outside of Habbo*: Habbo friends, real friends *trading furniture*: little by little, skilled traders, cheaters *time of day* (is associated with distinct visitors): daytime (children with flu at home, mothers), after school (preteens), evening-night (older, best discussions)

To sum up the Habbo experience, the following dimensions can be found to delineate what is important in Habbo:

- one's own avatar: clothing styles, character description
- one's own room and furniture: collecting, trading, decorating
- friends: school, hobbies, new friends, dating, distant friends
- play: beauty contests (popularity), TV shows, games of chance, Habbo-sports, insider clubs, roleplay, playing with the spatiality of the virtual world
- Habbo Career: celebrities, getting rich, popular room, in a game or gang, being a fansite author, being a Habbo guide
- testing boundaries and rules: expressing self, treating others (e.g., cheating, bullying), finding and using glitches in the hotel architecture.

The Role of Fansites in Development

The fansites are not only important to the visitors, but they also play a big role in the game development. The developers visit them regularly to follow what's going on, reading both articles and forum discussions.

> *Otherwise much of it [user feedback] doesn't come all the way to me; that's why I try to look at those ... Habbo fansites, what they discuss there, because if I have to*

> *develop something for Habbo, then I should know what's going on there.* (Game Developer[6]1)

> Game Developer [GD] 2: *We get feedback from the users all the time; it's something that is really important.*
> Author [A]: *In what ways do you get feedback?*
> GD2: *If we publish, for instance, a red chair then, as soon as it's out there, then the users tell us if it's good or not.*
> A: *Where, in Habbo or somewhere else?*
> GD2: *Well, in Habbo and on the users', those, fansites.*

> *Well, those fansites are really important, of course. There things are said quite frankly. Then there are some e-mails directly from the users, though I never reply to them. Sometimes I followed the feedback e-mails and the bug e-mails some many years ago, and then directly from friend-users I get [feedback]. But if I want to know how some new feature is liked, then I go and look at the fansite forums. Of course, they are always a little over-critical.* (Game Developer 6)

The first quote (GD1) shows how the developer feels a responsibility to check out the fansites: it is as if they are part of the job. The second quote (GD2) gives an example of the immediacy of the fansite feedback, while the third quote (GD6) shows a brief comparison of feedback sources in favor of the fansites. Some more active fansite readers among the developers send e-mails to the other developers about interesting articles.

> *Well, actually, to be totally honest, what always gets me to surf there is usually that [one developer], or somebody else who follows them actively, sends a link that "Here is something funny." Then I usually go and look, but I don't remember when I last would have gone looking just myself.* (Game Developer 4)

This quote (GD4) shows how one of the developers lets another developer act as a mediator to the fansites. Some developers, who are eager to get responses on what they have created, visit the fansites regularly, especially after new Habbo releases, when the users discuss the new features.

> *Well, it is probably a bias towards the final stage of the release, when something comes out, one can see if there is something new about it. But yes, every now and then when, when there is a pause or moment that I don't have anything terribly urgent, then I can go and peek at them.* (Game Developer 9)

One developer describes how the fansites can influence the development of new features: *"The fansites are worth gold. From them, one can see what they expect and what they, on the other hand, what they don't expect, and then one can do that too"* (Game Developer 3).

This is worth underscoring. Because the fansites are "out there" without developer intervention, the discussion topics are not limited to specific questions from the developers'

side: They are rather fairly open-ended. The above quote (GD3) shows how this enables the developers to learn about what the fansite writers expect, but also what they do not expect.

Not all developers have equal interests in the fansites, often because of their different work tasks. Server developers are furthest away from the users, whereas client developers and graphic designers are closer to the users. This can be seen as shaping their interests in fansites as well, allowing, of course, for individual differences. One developer described the graphic designers' interest in fansites: *"When a graphic designer designs a new [Habbo] space, s/he[7] is extremely interested in how the users receive it. And because of that s/he surfs on the fansites and discussion forums to find out what's said about it"* (Game Developer 4).

However, another developer stated that the fansites do not provide reliable user knowledge. *"From there [the fansites] one doesn't get real knowledge [about user opinions]. But [by] going into the [guest] rooms, one gets better [knowledge]"* (Game Developer 8).

This developer was concerned that the fansites do not provide representative user feedback. He continues by discussing the user groups visible through the fansite, and coins a category "average user." This is interesting because the average user seems to have an effect on the boundaries of the other target user groups.

THE "AVERAGE USER"

In design guidelines, the category "average user" is mainly used in two ways. On the one hand, it is contrasted with more technically skilled developers, suggesting that developers should remember not to assume too much technical competence among most of the users (Spillers, 2006). On the other hand, in HCI literature a common phrase is, "There's no such thing as an average user" (Budde, 2004, p. 54), which can be seen as a warning against reducing identities, practices, and tastes into too abstract user needs. Abstract user needs that are not grounded in particular settings might harmfully shape a design into something that nobody can identify with (Cooper & Reimann, 2003). However, in my empirical data, yet another aspect of the average user has emerged, which is not about the technical skill of developers or average users, nor about statistical methods to advocate a representative user (Muller, Millen, & Strohecker, 2001). In my analysis, the average user is used in relation to other user groups, not developers. By analyzing the following quote, one can better understand the complexities of categorization practices in design for complex and heterogeneous communities:

> *If one goes to the [guest] rooms ... then one gets feedback from the* average user. *But in the forums, the users have used Habbo Hotel for a longer time and slightly grown out of it [Habbo] and they have moved on to the forums to discuss it. There are the [furniture] collectors, the older ones, and the other HC [Habbo Club] users.... I have the impression that the opinions are not that black and white among* normal users. *In the forums everything is either extremely great or then it really sucks.* (Game Developer 8).

I started the analysis by reading what was stated by the developers about the average user category, and then what this category's relation was to the other mentioned categories. In the

above text fragment, the average user concept is used twice[8], first to state that the average user rarely writes in the fansite forums, and then that they have more nuanced opinions than those expressed in the fansite forums. However, the reason for talking about the average user emerges by reading the whole paragraph. The function of the average user in this text is to contrast them with other mentioned user categories: furniture collectors, older users, and Habbo Club users. So, actually the average user cannot be taken literally, since the developer is not talking strictly about the average user of the whole Habbo population, but about the users who are not opinionated furniture collectors, older, or Habbo Club users. This interpretation is supported by the change to talk about "normal" users.

Based on his experience, this game developer feels there is a large group of users whose opinions do not get voiced in the fansite forums. Still, he feels it is important to include them in the design considerations. The problem is that since they are not so opinionated, they are hard to reach easily, and not much is known about them. Even though the group is probably as heterogeneous as any other user group, it is difficult to distinguish the subgroups. Therefore they are grouped together as the average user.

Why the name "average user"? One interpretation is that it implies large masses of users; as the developers want to please as many users as they can, the "average users" get more emphasis than other more marginal (although well seen and heard) user groups. The designer not only describes the user groups, but also actively constructs and configures the user groups in his speech, while reflecting on the constructed user groups that have influenced his earlier actions. He actively speaks for some users, and devalues other users, who in his perspective can and do speak for themselves.

User Feedback Seen as Reflected and Refracted By Fansites

In this section, the users' voices and the developer from the previous quote will be visualized through three simple sketches. Although the first drawing is problematic, it assists the understanding of the second, as it makes it possible to contrast and compare the two drawings. This comparison brings forth qualities of the average user that elaborates on the previous analysis.

Physics is a source for inspiration to understand social relations: think of attraction and repulsion, for instance. When retheorizing relationality, gender researchers have criticized reflection and refraction as useful optical metaphors, and turned to diffraction and interference as more promising candidates (Barad, 2003). In this article, to illustrate the user–developer dialogue described above, I will follow the same reasoning. Inspired by reflection and refraction, I draw as Figure 3 an image of the user–developer dialogue through the fansites, criticize it, and come up with a more useful visualization. Figure 3 shows how voices (the waves in the image) of different user groups become either reflected or refracted by the fansites. The image succeeds in showing that not all users get their voices heard on the fansites.

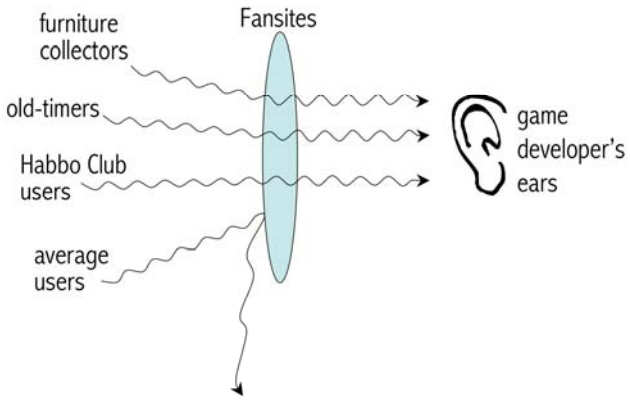

Figure 3. Drawing displaying user feedback that is reflected (average users) and refracted (furniture collectors, old-timers, Habbo Club users). The drawing illustrates that not all users get their voices heard on the fansites, but its lack of dynamics is problematic.

However, the metaphors of reflection and refraction have their limitations. First, the average user gets the same ontological status as the other user groups. This is wrong, because it is not possible to observe an average user: One can only observe particulars, whereas the “average” is an abstraction. Also, this drawing is not dynamic; there is more going on in the text fragment. Both the game developer and the average user are more active, yet their agencies are rather absent in this drawing.

Of course the furniture collectors are a constructed and heterogeneous group, since there are probably many different reasons for collecting furniture. The point is that, except for the average user, the defined groups have a fairly clear “shape.” They can be located in user practices. But the average user is somehow more open, and not so stable or well defined as the other groups. It is as if the term average user becomes a placeholder for the unknown users.

“Configuring” the User Groups

The second visualization is based on the form of a comic strip. I tried to make one drawing of diffraction, but it was difficult to get a single image dynamic enough. As I started drawing several images in a row, the whole changed, and the optical metaphors became deemphasized. However, the qualities associated with diffraction (interaction, interference, reinforcement, difference) are present in Figure 4, which presents a more dynamic illustration of the user–developer dialogue through the fansites.

The first panel shows some of the user groups on the fansites. In the second panel, the developer discusses the user groups that get voiced on the fansites. The next panel shows the developer creating the “average user,” which in the final panel dominates the other user groups. In this comic strip, the active role (agency) of both the game developer and the average user become visible, and the rigidity of Figure 3 is swept away.

Making the average user bold and larger than the other user groups in the fourth panel symbolizes the work the category does. Even though the average user is fairly shapeless and unknown, it seems to direct the design. The developer wants to design for the average users rather than pay much attention to what the opinionated user groups write in the fansite forums. Creating the average user concept is a way of legitimizing this. Using the average user

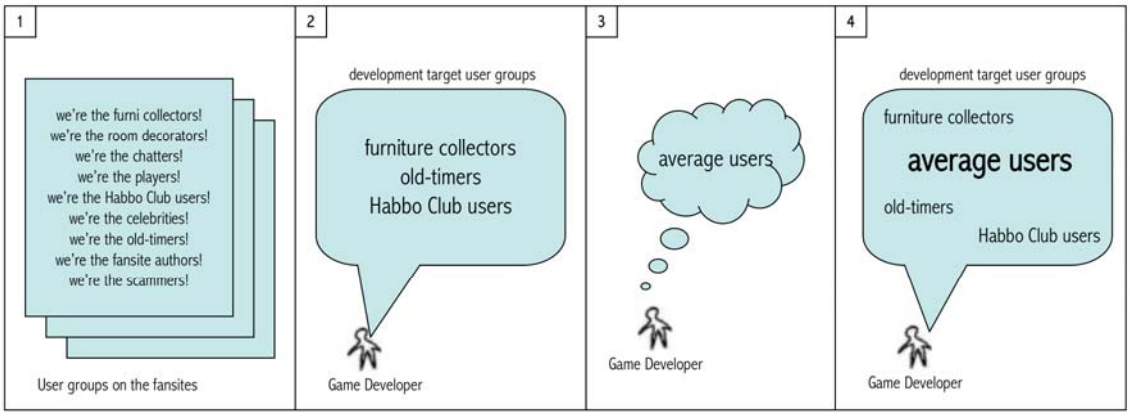

Figure 4. Configuring the users. The first panel shows the user groups on the fansites that the developer is very familiar with. Panels 2-4 show how the developer, in his discussion of the user groups that get voiced on the fansite forums, creates the concept of the "average user," which then dominates the user groups in design talk/practices. The developer interacts with the user groups and reinforces a group in favor of others. The resulting target user group constellation is not a mere displacement of panel 2, but show the difference that matters in the subsequent design considerations.

in connection to the fansite forums (referring to the users not writing there) also leaves room for more representative user feedback from other sources. Yet another reason for leaving the average user shapeless is perhaps to allow and give room for new designs. Had the average user been completely defined, there would not be room for creativity.

To sum up, the category "average user" cannot be taken literally. It gets its meanings in relation to the other categories defined and mentioned. These categories are different, as they are locatable in user practices, while the average user is not. Furthermore, the categories are shaped or configured by the developer, to fit his aims. At the same time, these configured categories shape the developer, as they keep the design space open. This second element, however, is still missing from Figure 4. To change Figure 4 from a rhetorical drawing towards a description of the co-construction of the developers as well, the transformed developer needs to be visually marked as well. Figure 5 is an attempt at visualizing this by fading out bars in front of the developer. The bars represent design obstacles that are mitigated as the designer speaks.

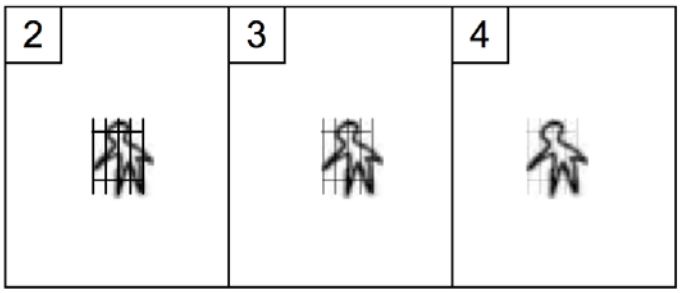

Figure 5. Visualizing the "configured" developer as well. The fading bars in front of the developer represent design obstacles that are mitigated as the designer speaks. The numbering of the panels start 2, as it refers to the first panel where the developer is visible in the panel series of Figure 4.

Now, that the “average user” has been unscrambled, this paper will conclude by zooming out from this particular situation and this particular developer. This analysis is related to the other Sulake developers’ ways of speaking about the users.

HOW FAR DOES THE “AVERAGE USER” REACH?

How far does the agency of the average user reach? Do all designers at Sulake talk about the average user? Does it shape other different representations of the user? When reviewing my interviews with the designers other than GD8, I did not find exactly the same configured actor of “average user”: The others did not talk about the average user as such. However, when considering the different aspects of the average user, I found similar configurations, such as the “typical user” and the “normal user.” One developer discussed the importance of fixing problems for certain users, favoring the normal user over trouble-causing users. *“It is perhaps less important... if they [the troublemakers] get some problems from causing problems to other users. Then it is not necessarily as serious as when the normal user gets problems from using Habbo normally”* (Game Developer 7).

Here, *normal* again designates everybody else, except for the troublemakers. The category “normal users” is not locatable in user practices, while the trouble-causers are. This developer also shapes the categories, giving the normal users a higher priority than the troublemakers. At the same time, these categories shape the developers’ actions, freeing the developer to design for the normal use, instead of the exceptional and generally not desired use.

Another developer discussed a “typical user” when asked whether enough is known or not about the users.

> GD9: *...but, when we think about a new big feature... we should know how large a group, or how large the number is, absolutely, who would use it then. Another thing is that we don’t really know how lasting they [the groups] are, that for how long-term one can design something.... So the user, the typical user, is still a little bit hazy at this time.*
>
> A: *The typical user isn’t visible in the forums or the statistics?*
>
> GD9: *It isn’t visible anywhere. Some kind of an age group exists and the boy-girl distribution is fairly clear, but [these] are limited to terribly high-level things.*

On this occasion, *typical user* became a category for the unknown, but perhaps also a wish for regular use patterns. In contrast to the previous quotes, this typical user did not free the developer to do something else, but stayed as an obstacle for design.

Creativity in the Developer–User Dialogue

While the shapeless average user leaves room for the creativity of the designers, the designers are also careful not to restrict the users in their design. Designing for open-ended use leaves room for creativity among the users. This has been possible due to the kind of product Habbo is: a software product that can be frequently updated without requiring the user to do

anything. The Habbo development process started out with very frequent release cycles. Even though the product was on-line, during the first year it was continuously updated, sometimes several times a week. Gradually the development process became more complex, as the product grew and more people were involved. A developer describes the transformation from on-line prototyping to robust release processes as follows:

> Kultakala *was done very, very quickly, in a fairly, so to speak, feeling-based way, or, organically. It was up; then we started to fix it, or develop it.... Today we talk about totally different numbers of users, amounts of money. We simply can't afford to have [a situation where], in tens of countries around the world, everything would stop.* (Game Developer 1)

This on-line prototyping stage gave the users lots of space to explore the design and take advantages of things not yet considered by the developers. One famous bug that turned into a feature was a way to lift things up in the room and leave them floating. It was possible because the world model was not that well thought through in the early days. Lifting up furniture can seem harmless, but as a piece of furniture is moved out of reach, it becomes a way of destroying furniture. That is a serious threat to the world model and also the business of selling virtual furniture. One developer explained how this user creativity influenced the world model:

> *"You can put things on a table, and tables have a height. But then, we hadn't programmed that kind of a model; so that when you took the table away, the thing [on the table] stayed in the air. From this followed that the users lifted up furniture with the aid of two stackable objects, by rotating them in peculiar ways. Other people's things [were lifted] over that box, so high in that room that [they] moved up over the upper edge of the room, which made them gone in practice; they were destroyed. Then we had to make a limit, so no thing could rise up more than to the height of three or something.* (Game Developer 1)

Some features were developed for a certain use, but the users were able to use the features in their own way to create unexpected phenomena. The teleport is perhaps the prime example, as one developer described it:

> *We had the idea that, we thought the users would start creating homes: There would be a bedroom and a kitchen and that they would jump between these with the teleports, a kind of a door metaphor to the rooms. But they [the users] are much more inventive than we: They made up all those teleport racing games. ... There is this room, two teleports, and two users start running and who comes back first from the other teleport, they must run a race following a route.... And perhaps the first thing that emerged with teleports was the teleport centers, a whole room filled with teleports leading somewhere else, so it was quite a "wow" effect when I first saw it, so "Oh, they did it like that!" We hadn't thought about someone building link-places for everyone else.* (Game Developer 3)

On several occasions, many developers tried not to restrict the user too much. GD3 stated that he expects the users to do "*unexpected things*" with the features he develops, while GD4 noted that, "*We create the environment and the building blocks, letting the users exercise their own creativity*." Clearly there is an affinity between the *average user* of one developer and the *user* in other developers' speech. In addition, two particular configurations seemed to be widely known, stabilized, and discussed among the original developers.

First, there is the "Easy access, easy play" maxim: The users should be guided step by step into the game environment, without letting any step be too large. One developer explained it like this:*"[The] easiest possible login, you can create an character, basic navigation... the first contact to another user, first friend on the friends-list, all sorts of playing, then the own room and decoration, then various groups that you gradually join"* (Game Developer 2).

Second, there is the "Where else?" maxim: New feature developments in Habbo should be unique and personal. If something exists on some other site already, copying it directly to Habbo is not an option.

> *We have always regarded those [simple feature requests] critically. We want an intentional pursuit for something special in these cases. We don't make the obvious choices but rather something personal that gives the Habbo world oddity and its own thing, creates its own such persona.* (Game Developer 2)

This maxim was also called the "Habbo Way" by some developers. However, the "Habbo Way" also denotes the rules listed on the official Web site that new users should approve when becoming habbos.

Mixing "I-methodology" and Feedback on Experience

Akrich (1992, 1995) argued that successful artifacts depend on the ability of developers to generate user representations and integrate them into their design. She observed many different techniques for creating user representations, both explicit and implicit. The explicit techniques included market surveys and consumer testing, whereas the implicit were the I-methodology, experts, and other products. The term *I-methodology* exists when the designer puts him/herself in the position of the user and uses his/her own knowledge as a base for design.

On the one hand, the concept of the average user could be seen as manifesting Akrich's I-methodology: When things are uncertain, the designers go with their intuition or feelings based on their own experiences. On the other hand, their knowledge seems to be grounded in their proximity to the users: They can go and look at what's happening in the hotel and they can read the fansites. The fansites give the developers a way of getting a feeling for what the users want by reading between the lines, as a developer said when reflecting on how often he visits the fansites and which fansites he follows:

> *It depends on the situation. It might be a week or two that you don't have the time because you know that you'd become immersed totally in the wrong way. It's HabboForum ... and of course these Finnish ones, from them it is even easier to*

> *see between the lines the feeling, as they are domestic users: There's no language [problems]* .... (Game Developer 5)

The developers draw on their cumulative experience, as they were the users themselves in the early Habbo days, and they have been there since. One developer reflected on the developers' way of knowing the design history, compared to most users who have not been there as long:

> *An active user probably thinks about it [a new feature: rollers]—this is totally speculation—probably thinks about it in the context of his/her own rooms, what s/he has done so far and how could these [rollers] fit into that, reflecting on when you add a new thing, what more can it give. Whereas we think about it from a little broader perspective—where these and these phenomena have emerged previously and they were based on the teleport, and the dice and these, then reflecting on what if the roller is brought in, what could one do with it, from a different perspective but still....* (Game Developer 4)

As a consequence, here in the Habbo case, it becomes hard to tell the difference between I-methodology and feedback from use, since the designers' reflections repeatedly refer to feedback from experience of use over time. Those who follow the fansites and the activities in the hotel appear as legitimate representatives for the users. The designers balance being representatives for the users, for the business, and for their own interests.

DISCUSSION

As a usability designer and researcher, I have been taught that one should never design for the average user. Doing so would probably result in a design that does not fit anyone, because the users are always a heterogeneous group. My first reaction when the game developer started discussing the average user was to shut my ears because it did not make sense. The use of the term average user seemed to contradict HCI guidelines, such as "know the user" or "define the user groups." It seemed like the user opinions at hand were not followed, and the developer designed for the unknown average user. However, by using a membership categories analysis and extending the timeframe of the analysis, I realized that my initial reaction was wrong.

When considering the development history and the developer's experience of feedback from use, it made more sense to see the developer as a representative of the silent majority of the users. The developer brought in the users who did not voice themselves and denoted them by the category "average user." In this way, he accomplished his goal of not having to strictly follow the immediate user feedback, which may not reflect the opinions of the majority of silent users, but he also accomplished his goal of considering the previous user feedback based on his experience.

The rhetoric about the silent majority and the user is familiar from other contexts, for instance, in politics. The politicians often argue that they themselves represent the (mythical) citizen and give voice to the silent majority of voters. This might, or might not, be the case; it depends on the politician's own agenda and its proximity to that of the voters. While the citizen

as a concept decontextualizes individual human beings, it also makes it possible to talk about the broader concepts of the rights of citizens and human rights. It appears that the concept of the user works in a similar way, giving developers a way of discussing possibilities and restrictions for all users (e.g., in terms of user access rights, user profiles, and groups visible to the computer system). In addition, as some citizens need more empowerment than others, so do some user groups. In this case study, the “average user” was not literally the average user of the Habbo population, but denoted those who needed to be voiced.

This study on the developer–user dialogue highlights the importance of the fansites as one user proxy for the Habbo developers. In this case, rather than describing developers as “malevolent manipulators of users,” the case points out their role in balancing and governing different user interests. Digging into the practices of design brings forth its complexity and shows how design and use are intertwined. Over time, the knowledge of the designers is not easily separable into “own” knowledge versus feedback from use, as design and use knowledge becomes mixed.

The results of this study can be generalized to user categorization practices in the design of other heterogeneous and complex virtual worlds and communities. If the product or service becomes a commercial success, the sheer number of users makes the user categorization and control more difficult. Designers have to invent categorization strategies of coping with complexity: Fuzzy user configurations can work if there is frequent interaction between designers and users. The virtual world itself and the discussion arenas around the product are important sites for designer–user interaction and sources of user knowledge. Besides, as a company grows, the role of the user representations in the internal communication increases, since not everyone in the company can be tightly involved with the user communities. Implicit user representations, such as gut feelings and design intuition based on long-time experience with users, might need to be made more explicit to function as convincing arguments.

Finally, a small comment to the game developers who might ask what they can do about the situation where some user groups are not visible through the monitored fansites. Of course, keeping up with other user feedback channels, like spending time in the virtual world, is important. Another option is to find fansites that attract different user groups. In the Finnish Habbo fansite scene, for instance, the former official fansite Nefekala used to attract a younger age group and many girls. Even though this particular fansite does not exist anymore, new fansites seem to emerge all the time. Following a variety of fansites allows for more diverse user feedback, which can ground the gut feelings of the designers.

ENDNOTES

1. *Habbos* are what the Habbo Hotel visitors are commonly called. One becomes a habbo when checking in at the virtual hotel for the first time, then creates one’s own cartoon-like on-line character (avatar).
2. The standard definition of the user as a “person who interacts with the interactive system” (ISO, 2006, p. 3) leaves it open for the researchers and practitioners to contextually agree on whether the user is understood as particular human beings in particular settings, or target groups imagined by the developers. Standard context of use models (ISO, 1998) on the other hand, provide listings of potentially relevant relations: goals, tasks, equipment, and the physical and social environments.

3. Details available at http://mc2.soberit.hut.fi
4. For an introduction to the initial differences, and later convergence and extensions to the social shaping versus the social construction of technology approaches, see Sørensen (2002).
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6. I left the more exact job description out for anonymity reasons.
7. In Finnish, the *hän* pronoun is not gender specific and stands for he or she.
8. Actually once, but I interpret *normal* as a qualitative version of the more statistical *average* and analyze them together.

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Author's Note

All correspondence should be addressed to:
Mikael Johnson
Helsinki Institute for Information Technology
PO Box 9800
02015 TKK
mikael.johnson@hiit.fi

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USER ORIENTATION THROUGH EXPERIENCE: A STUDY OF HOBBYIST KNOWING IN PRODUCT DEVELOPMENT

Tanja Kotro
National Consumer Research Centre
Helsinki, Finland

Abstract: *Those who are involved in hobbyist communities and share the values and practices of these communities often also innovate new products. Users are important actors in innovations. Recently, a lot of attention has been paid to users in relation to product development processes and especially user innovations. This article points out that product development team members are often simultaneously users themselves and they can be important translators of "hobbyist knowing" into organizational practices. Hobbyist knowing refers to the practice of making sense of situations through concrete activities and participation in particular social and physical circumstances and practices. This article studies Suunto, the Finnish designer and manufacturer company of sports and precision instruments, and the product development team of wrist computers.*

Keywords: *hobbyist knowing, product development, sports instruments, knowledge management, user involvement, user innovation.*

INTRODUCTION

User orientation and user involvement are widely discussed themes in recent product development and design literature and practice. This paper discusses users and their knowledge *in* organizations and therefore also addresses the question of organizational knowledge. User-centered design, participatory design, ethnography, and contextual design are often-used terms connected to user orientation (Kujala, 2003), all aiming at developing usable products by taking both explicit and implicit users' needs into account. Participatory design also refers to the worker participation that is considered central to the value and success of projects within organizations (Kensing & Blomberg, 1998). In *participatory design*, according to Kensing and Blomberg (1998), workers take part, for example, in the analysis of

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needs and possibilities, the evaluation and selection of technology components, the design and prototyping of new technologies, and also in the organizational implementation. User-centered design, also referred to as *user-oriented design* (UOD) plays an important role in different phases of the new product development process: by enhancing collaborative product development, improving idea generation, producing superior products and services, and facilitating product adoption (Veryzer & Borja de Mozota, 2005). As von Hippel (2001, p. 247) puts it, "new products and services must be accurately responsive to user needs if they are to succeed." Moreover, studies show that many users engage in developing or modifying products, and innovations overall (von Hippel, 2005). Contemporary theorists and practitioners agree that user needs should be present in new product development.

This article considers how user needs are present in new product development when the product developers are users themselves. I study this through empirical fieldwork in the product development of the Suunto Corporation.

The concept of *hobbyism* in this particular study refers to the employees' passion for sports and the employees' relationships with sports communities as an important reference for understanding users in the product development process, when hobbyists are working for the company in different positions of product development. Through their involvement in these communities of sports enthusiasts, product developers are familiar with users' needs, including both the technical requirements and cultural values and practices of the sports communities of, for instance, climbing, mountaineering, diving, adventure sports, and hiking.

Hobbyist knowing is the term I use to describe the practice of making sense of situations through concrete activities and participation in particular social and physical circumstances of, for example, sports such as slalom skiing. Such hobbyist knowing allows for, I suggest, translating and bringing not only individual insights but also the values and ideals of communities—in this case of sports—into one's work and into the product development process. The concept of translation here emphasizes that insights, values, and ideals are not transferred as such without any changes but they are constantly negotiated and dynamic. In this study, by the term *hobbyist*, I refer to people working on the product development team in various positions, such as user interface designer or designing engineer, who are personally deeply involved in sports participation within the communities outside the company.

In this article I suggest that users are represented in product development through hobbyist knowing. Hobbyist knowing could also be developed to serve as a shared ground for overcoming negative conflicts between subunits and in finding balance between customer needs, design and usability issues, business needs, and sales goals. Having a common sphere in hobbyist knowing could be developed into a positive resource for product development, but not necessarily into a design method in the same vain as the lead user method. Therefore, I discuss in this paper the relation of hobbyist knowing to user-centered design methods and the lead user method. It should be noted that hobbyist knowing also can involve drawbacks, if, for example, it is merely used to legitimate decisions made for other reasons. This article draws on a study (Kotro, 2005) that was conducted within the frame of Suunto Corporation's product development process of the wrist computers for outdoor use.

THE CASE STUDY: DATA AND METHOD

Suunto is a designer and manufacturer of electronic sports instruments for skiing, hiking, diving, sailing, and golf, among others. Suunto's strategy is to focus on sports activities where measurement technology, data processing, and specific algorithms can create benefits for active participants.

The focus of the study was on the product line of wrist computers for outdoor use. Since the launch of the Suunto Vector in 1998, the wrist computer category has steadily grown and has been one of the most successful product categories of Suunto. Suunto's wrist computers are made for demanding outdoor sports but, as a watch-size and watch-like instrument, they are also used as accessories representing the sporty and exciting lifestyle of their owner.

Suunto was established in 1936 in Helsinki, Finland. What had started off as a garage start-up became a listed company on the Helsinki Stock Exchange in 1995, with three main business areas: outdoors, such as hiking; diving and water sports; and electronics. In 1999, Suunto Corporation was acquired by the Amer Group. Listed on both the Helsinki and London Stock Exchanges, the Amer Group is a global supplier of sporting equipment. The Group's operations are based on global brands: Wilson, Atomic, and now Suunto and Precor.

I started an in-depth study of the product development process in Suunto in 1999. The research procedure consisted of analyzing interviews conducted with the product development team, collecting and analyzing corporate documents and advertising material, and observing practices in the organization and the hobbies important to employees. I first interviewed the marketing manager who described the product development process of wrist computers and those who were involved with the project. That was the guide for selecting other interviewees. I interviewed 10 persons in a total of 16 interviews, which lasted around two hours each. A designer, marketing manager, and two product engineers were interviewed twice and one product engineer three times, because these individuals knew the most about the process and had been deeply involved with it. The interviews took place between January 2000 and March 2003 at Suunto. Interviews were conducted in Finnish with native-speaking Finns, and are translated for this article by the author.

Getting to know people in the organization was the most important way to understand what kind of knowledge existed within the organization and how the understanding of the users was created within the product development team. Hallway conversations and becoming adept at reading cues in verbal and nonverbal communication were crucial for this research. The 16 interviews were the more traditional part of gathering the data. The interview discussions were quite open and unstructured, because I found it fruitful to let the interviewee lead the discussion after my question. Therefore I used semistructured interviews as the method for gathering the primary data. The questions in the interviews varied from facts about the company to ideas about the brand of the company; later in the process, questions also were raised regarding outside knowledge of sports as part of the formal data gathering.

Right from the beginning of the empirical study, I received all kinds of material from the company. In the first meeting I was given a wrist computer, the Advizor, for my own use. It was important to wear the product to note the kind of attention it provoked at a time when wrist computers were new products. I also collected company newsletters aimed at interest groups, packaging in which the wrist computers are sold (both old and redesigned packaging), product manuals and different kinds of brochures and leaflets, and clippings from

magazines from all over the world presenting Suunto products or showing them in pictures. During the process, I regularly visited the Suunto Web site and read annual reports, brochures and company newsletters and followed the media coverage about the company. Whenever I visited the company, if it was not considered too intrusive, I also browsed through the magazines and books people had on their desks and in the coffee room. Sometimes I borrowed some of those magazines. This was an important way of getting to know the company's culture as expressed through its individual workers. In line with this aim, I also frequently followed writings on extreme sports and experience orientation among young people, through popular discussion themes in the media, books, and articles, as well as the academic discussion.

It is difficult to describe the exact quantity of the data in this research. What I suggest is that, in this kind of a study—aiming at developing an interpretation of an organization and its ways of meaning-making—what could be called a "dive" into the world of the organization is needed. And, in this case, the employees' life outside work also should be understood.

WHEN THE PRODUCT DEVELOPER TEAM CONSISTS OF HOBBYISTS

According to my analysis, the sports background of employees was traditionally not recognized as an important resource for Suunto. In the early interviews, employees put their professional knowledge clearly before any references to their personal background in sports: There was no discussion about the interviewees' interest in sport or other hobbies at this point.

When a designer mentioned casually that he is a climber himself, he at the same time emphasized that he tries to keep the role of a climber in the background so that it does not mix with his role as a designer in the process. When I asked the designer about his own strengths in the project, he said that he had gained his experience primarily by working as a designer with watch-size equipment for 10 years. Presenting one's sports background as a minor motive at work can be interpreted as an outcome of people wishing to present themselves primarily as professionals, that they hold a position because of their education and professional experience.

Interestingly, in subsequent interviews with the above-mentioned designer and the product design engineers, we talked frequently about their sports experiences. Discussions seemed to turn in that direction quite naturally after the interview was complete or between questions: Talking about sports was a kind of complement to other, more formal discussions. For example, I asked if the designer talked about products with his friends who climb. He explained that because product development projects must be kept secret, he avoids talking about them with friends. But, he added, after spending 15 years with people who climb, the community becomes so tight that one knows what others think.

When interviewing the engineers, their personal passion for sports came up later as well, as we became acquainted. At that stage, professional work experience was no longer emphasized as the most important or even the only resource for product development work.

> TK: *Where did you come from? And why did you come to work in Suunto?*
> Product Engineer 1: *I came straight from design school. I have this personal problem that I have a background in a sport that is close to Suunto, orienteering.*

> *I have done it since 1978. And I have made gadgets for my own use. And I thought that in Suunto I could make interesting products. At that time Suunto was looking for a mechanics designer, and luckily I had experience in modeling.*

After noticing in the interviews that the employees had a sports backgrounds, I started studying the issue more systematically by asking interviewees to talk about their personal sports history and interests. Frequent, personal conversations among the employees about sports were one aspect of how sports were present in the company routines. The other one was that people actually participated in sports every day. For example, the concept designer cycled to and from work each day, a 50-kilometer round trip and, if he did not, he did his free-diving breathing exercise. Moreover, when I spent three working days in the organization, I was asked to join the product development team in gym at Suunto early in the morning, as part of the routine they seemed to value.

Thus, the undervaluing of one's own sports enthusiasm as a reference for work can be interpreted as a question of professionalism towards one's education. In fact, when speaking of usability aspects at conferences or with my students who study industrial design, the designers emphasized repeatedly that they do not design for *themselves* but to make better products and environments for *other* people.

HAVING USERS *INSIDE* THE COMPANY: "HOBBYISM" AS AN EXPLICIT STRATEGY

During the research process, Suunto began to recognize at a more explicit level the sports background of the employees as a resource for the organization. In April 2001, Suunto announced job openings in the newspaper employment section for an interface designer, a software developer and a component engineer, and provided factual descriptions of each job.

The interesting thing was the layout of the advertisement, as well as its appealing title. In the left column, there was a picture of a sailboat with its crew on deck sailing in stormy water. The picture took up almost half of the advertisement, with the words *sailing*, *diving*, *climbing*, *tennis*, *golf* added to the picture. The title was "Do You Want to Become a Professional?" The association, because of the layout, addressed the question in this form: "Do you want to become a professional in sailing, diving, climbing, tennis or golf?" Also, the embeddedness of sports in this organization was articulated on an even more explicit level: The advertisement stated that "a background in sports helps you to dive into our challenging world," if you wish to become a user interface designer in Suunto.

Being a sportsman and working in Suunto were also linked together with the new Web pages in the year 2002, when a story of the company was provided there. Previously, on-line communications had focused on future developments rather than the history of the firm. The history of the company was built around the founding father of the company, who was—according to the story—a keen orienteering enthusiast, and invented the liquid filled compass in 1936.

The launching of a 'Net community in spring 2002 acknowledged the employees' sports background more explicitly by publishing the sporting records that the employees have broken. In an article (Salminen, 2002) in a Finnish business newspaper in June 2002, the

sports background of employees became an explicit marketing strategy for the firm. In the article, Suunto's managing director emphasized that it is important for the brand that both sportsmen within the company and sports professionals outside the company participate in the product development. Hobbyism remained an important element of the company's communications themes in subsequent years. Finally, in a February 2004 newspaper interview about the cooperation between Suunto and Microsoft, the managing editor referred to his own use of wrist computers to keep a diary of his training and workouts (Pirilä-Mänttäri, 2004).

More recently, Suunto has widened its scope from exclusive sports (e.g., world class slalom skiing) towards more accessible ones (e.g., jogging), by participating as an official sponsor and providing the official timing devices for marathon events. The current product range also covers fitness training products. These expanded product lines and marketing strategies have widened the company's exposure to new audiences.

My findings about the importance of sports to employees, and especially the labeling of the phenomenon as "hobbyism," were noticed within the company; in fact, some of the employees started to use the term themselves. During the course of my study, but also supported by my study, the sports backgrounds of the staff, particularly the product development team, was recognized as an explicit resource for working in the organization. This raises the question of what kind of knowing a sports background brings to the organization.

USERS' KNOWLEDGE INSIDE THE ORGANIZATION

Much discussion recently has focused on user innovations and users as innovators (Jeppesen & Molin, 2003; Lüthje & Herstatt, 2004; Shah, 2005; von Hippel, 2005). The point is that not only do individual innovators and manufacturers innovate, but users have been the source of many innovations across a wide range of products. Innovations have also arisen from users' practices of using products in an unpredictable way. Such users often form their own communities, and their innovative activities are sometimes supported by firms (Jeppesen & Frederiksen, 2006). But there have not been studies about users working inside organizations. Therefore I draw on a variety of theoretical resources to conceptualize the role of users within the product development team and the nature of their knowledge.

Nonaka's (1991, Nonaka & Takeuchi, 1995; Nonaka, Umemoto, & Sasaki, 1998) approach helps to understand different aspects of knowledge embedded in the product development process, and the dynamics between tacit and explicit knowledge in an organization. Tacit knowledge is highly personal, hard to formalize, and therefore difficult to communicate to others. It is rooted in action and in an individual's commitment to a specific context. Tacit knowledge involves technical and cognitive skills. In comparison to explicit formal and systematic knowledge, tacit knowledge covers the skills of a master craftsman as well as the mental models and beliefs that are taken for granted.

In Suunto, the employees are serious about sports: They have competed in them or are still competing. Most of them, in fact, are more than "Sunday soldiers"—occasional athletes—even though they present themselves more humbly. This level of personal involvement is significant for the kind of knowledge their hobbyist knowing they possess. For example, if members of a work team play tennis together occasionally, they probably do not have very specific hobbyist knowing that builds up the knowledge base for their work.

Playing tennis together may offer an important informal ground for discussions about subjects meaningful at work and for projects, but that does not constitute hobbyist knowing. Rather, hobbyist knowing is based on taking part in the sports that the company's products are made for but, more importantly, on a passionate and shared attitude toward the sports, a specific type of talking about sports that allows participants to understand the tacit features within the sports communities. Hobbyists in organizations tell stories of their sports performances and demonstrate their knowing of sport practices in everyday actions in organization with other hobbyists, and this is an important way of bringing hobbyist knowing from communities of practices within the sporting world into the business world. The product development staff members also do sports together and the most advanced players in a certain sport teach those who want to learn new skills.

The main outcome of my study is the concept of hobbyist knowing. *Knowing* refers to a practice-oriented perspective toward knowledge in organization studies. According to Orlikowski (2002), there are two distinct approaches to organizational knowledge. On the one hand, "many writers propose that organizations have different types of knowledge, and that identifying and examining these will lead to more effective means for generating, sharing, and managing knowledge in organizations" and, on the other hand, other approaches see "tacit and explicit knowledge as mutually constituted and essentially inseparable in organizations" (Orlikowski, 2002, p. 250). What Orlikowski brings into this discussion—based on a study of product development activities in a large, globally dispersed high-tech organization—is the suggestion that knowledge should not be seen as a "thing" or "disposition," but rather that it should be studied as "knowledgeability" (2002, p. 249).

From Orlikowski's point of view, it "does not make sense to talk about either knowledge or practice without the other," thus "knowledge (a noun connoting things, elements, facts, processes and dispositions) is replaced with knowing (a verb connoting action, doing, practice)" (2002, p. 251). Orlikowski notes that tacit knowledge is a form of knowing, and thus is inseparable from action because it is constituted through such actions (see also Schön, 1991).

I suggest that what is important for people in their private lives also follows them to their work. My finding was that, in Suunto, the product development team members' sports backgrounds follow them to work. The sports background of employees is consistently present at work: as a discussed and significant theme in the daily routines, as a reference for product development (e.g., technical and design solutions) and, eventually, as a fascinating marketing element for creating the company brand.

Brown and Duguid (2000a, 2000b), referring to a study of the Xerox Corporation (formerly the Rank Xerox Corp.) sales representatives by Julian Orr (1996), bring forth that the constant storytelling by employees inside companies—over breakfast, lunch, and coffee—can be worth hours of training. Storytelling is powerful way to understand what happens and why in organizations, and to discover something new. Brown and Duguid note that economists tell stories in their models, scientists tell stories in their experiments, and executives tell stories in their business plans. I found out that hobbyists in the Suunto organization tell stories of their sports performances and share their ideas and opinions through stories.

Other important forms of sharing and building up knowing, according to my findings, are concept designing, product designing, and decision making throughout the product development process. Hobbyist knowing becomes explicit in the organizational context when

visualizations, prototypes, and decisions are made based on this tacit knowledge inherent in communities of practices of sports.

HOBBYISM AS SHARED KNOWING

The outcome of my analysis is to suggest that business organizations need to recognize what tacit knowledge about users currently exists within their company, and how this knowledge works within the company. Companies should ask how their designers meet and interpret the culture of use. And, more importantly, how do designers meet the different needs of users if there is hobbyism within the company? Is hobbyist knowing tied to one specific sport or can it be used as a source for understanding users across different sports? In an example from a different field, Nokia's product development of the portable Internet tablet (Nokia 770) has involved hackers who have made changes to the product and hence influenced the product development process. Most of these hackers do not work for the company but some of them are also part of the official product development process because they work for Nokia on a permanent basis (Mäkinen, 2006). Hobbyism can thus be recognized as a resource for product development in other areas and products than the sport industry.

As I define hobbyism, the sports communities serve as an important reference for the product development team members in understanding peer users when designing sports instruments. Turning hobbyism into a method in product development simply means acknowledging those resources and experiences that the product team members bring into the design processes other than their professional backgrounds only.

The question of turning hobbyist knowing into a design method is complex and challenging because hobbyist knowing is partly tacit by nature. Based on the Suunto study, I defined hobbyist knowing as active knowing, in that knowing and practice are intertwined (Blackler, Crump, & McDonald, 1998; Cook & Brown, 1999; Orlikowski, 2002). It is an alertness and sensitivity within a social and material context (Schön, 1991), a knowing and doing together (Lave & Wenger, 1991; Wenger, 1998; Wenger, McDermott, & Snyder, 2002), and a stepping over and over again into the situations of use of a product (Schön, 1991; Suchman, 1987). Hobbyist knowing is difficult to communicate because it is embodied and embedded in action (Blackler et al., 1998; Carlile, 2002; Schön, 1991) but, at its best, it is interwoven into the product development process (Nonaka & Takeuchi, 1995; Nonaka et al., 1998) as a generative and creative resource of sensemaking (Weick, 1995) within an organization. Hobbyist knowing is thus defined as a type of knowledge—or rather a type of knowing—that emphasizes its active and long-term nature.

Based on the case of Suunto, I argue that hobbyist knowing is an alertness among product development people who are passionate sports enthusiasts to acknowledge the differences in practices and in physical environments among different sports, that is, an alertness in recognizing what these tacit and intangible differences are. It can, at its best, help in understanding the implicit user needs and requirements. Hobbyist knowing is not, however, a method among other user-centered methods for product development, or similar to the lead user method (Lüthje & Herstatt, 2004). Hobbyists are people who are voluntarily involved in the practices of users of a certain industry through their own long-term hobby activities and are working for the companies for years rather than for a few projects.

Researchers interested in users as innovators suggest that involving lead users in product development can be a successful method. Lead users are defined as individuals who have "sticky," use-related information, are ahead of the market with respect to needs-related trends, and are capable of conceiving substantial new products for future markets. The lead user method refers to the identification and involvement of lead users "in a multi stage [*sic*] approach aiming to generate innovative new product concepts and to enhance the effectiveness of cross-functional innovation teams" (Lüthje & Herstatt, 2004, p. 554). In practice, the lead user method means observing lead users or arranging workshops with these end-users when conducting concept designing in firms.

Hobbyists, therefore, are actually lead users who work within organizations. Both hobbyists and external lead users are at the leading edge of markets. The lead user method has been developed to bring to companies without hobbyists the tacit knowledge that hobbyists bring to their daily work. The main difference between hobbyists knowing in organizations and the lead user method and is that, through hobbyism (having hobbyists employed), hobbyist knowing is present on a long-term basis. This is important since, in relation to user-centered design methods, hobbyist knowing can lead to specified and concrete methods of user-centered design and to the lead user method being introduced into the product development process on a regular basis, and not only now and then. When there are changes in the target sports market, knowing well and being a hobbyist of one sport does not help in knowing intimately another sport, but it can help in appreciating methods for recognizing what is specific to other circumstances.

Hobbyism can be recognized as a phenomenon in other industries also—for example, in product development in mobile technology (Mäkinen, 2006). Although hobbyist knowing is not suggested as a substitute for design methods, it is possible that hobbyist knowing can serve—because of it is social nature—to overcome factors that hinder the use of user-centered design methods. Such difficulties include recognizing and gaining access to user communities and the knowledge embedded and embodied within them (Kujala, 2003).

Since my study, new design methods have been adopted in product development processes at Suunto. For example, Suunto design management, together with a group of researchers from the University of Art and Design Helsinki, developed and introduced a method called probes (see Mattelmäki, 2006). According to designers at Suunto, *probes* can be used to understand and define the sociocultural contexts of sports enthusiasts. For example, probes contain indirect questions of what kind of equipment is considered valuable among sports enthusiasts, such as by suggesting different brands. Probes view the socio-cultural context as including an understanding of the social practices, the specific terms used, the material environment, and the talent that is recognized in a sports community. It varies from wearing the "right" t-shirts to doing the "right" stunts and having a certain attitude, as illustrated by the following comment: *"Those guys who do snowboarding say that they do not practice. They do not consider themselves as sportsmen. However, they go skiing every day"* [Suunto Designer].

According to Schön (1991), practitioners work in conversation with the situation, which requires stepping into the situation. User-centered design methods developed to improve the usability of products are implemented to help analyze human-machine interaction, and they have thus been product-centered. It has been suggested that emotional and experiential properties should be taken into account alongside the rational product properties (Jordan,

1999). Recent studies also suggest that another important dimension of usability research is analyzing the situations in which the product is in use (Hasu et al., 2004; Keinonen, 1998, 2000; Koskinen, Battarbee, & Mattelmäki, 2003).

The crucial question to me is how local interactions within a given situation can be understood, for example, within the sport context. I suggest that hobbyist knowing involves a different understanding of local practices and communities than design methods. Attempts within design practice and studies to overcome the gap between designing products and understanding the contexts of their use can be helpful, but they are also different from hobbyist knowing, since they are mostly methods used for a short time only. The ideal of many user-centered design methods is to focus on users and tasks early in the product development process, do empirical measurements, and then work with iterative methods. What has been suggested as a practice for meeting these ideals is to allow potential users to use simulations and prototypes, so that their actions and performance can be analyzed. User involvement is considered to provide valuable knowledge about the context of use, the user's tasks, and how the users will probably work with the emerging product (Säde, 2001, p. 29), as well as help in analyzing the user experience. Among design method studies, there is also an interest towards not only user experience, but also users' co-experience (Battarbee, 2003a; 2003b). This means seeing the user not as one entity but as a member of group of people who share and create experiences together, and interpersonally and interactively with the products.

What remains to be discussed is the nature of knowledge produced by design methods. Does hobbyist knowing involve also knowledge that escapes the design and lead user methods? Brown and Duguid (2001) note that joining a community of practice gives access to that community's identity and, through that, its collective knowledge. They also point out that learning does not just involve acquisition of facts about the world; it also involves acquiring the ability to act in the world in socially acceptable ways. From their perspective, knowing is always linked to practice. Therefore hobbyists probably know more than can be fully understood by using design methods, although these methods acknowledge practice. Being simultaneously a user and a producer, that is, having users who work on the product development team, is different from studying users with design or lead user methods, most particularly because of the stickiness (von Hippel, 1995) of hobbyist knowing. This does not inevitably mean that having users on the design team is a *better* way to understand the use context of a product than using design methods or involving lead users into the design process, because hobbyist knowing can sometimes be too one-sided to fully understand the diversity of the context of use. The stickiness of hobbyist knowing means that hobbyist knowing is difficult to transfer (von Hippel 1995) and it is more than its current externalization—the transformation from tacit to explicit (Nonaka, 1991; Nonaka & Takeuchi, 1995; Nonaka et al., 1998). I would argue that hobbyist knowing covers areas that escape current user research methods and documentation and remain at the margins of consciousness although would be shared by hobbyists within their work practices.

CONCLUSIONS

The point in user innovation literature is that not only do individual innovators and manufacturers innovate but users are the source of many innovations across a wide range of

products. These users form their own communities, and are sometimes also supported by firms. This paper focuses on the subset of users who form their own communities but also work within companies designing and manufacturing products for those communities, sport instruments, in this case.

This paper details how user needs are present in the new product development process when the product developers are users themselves. Therefore the process of product design touches, on the one hand, user innovations and, on the other, the body of organizational knowledge. The concept of organizational knowledge is replaced with that of "knowing," thereby emphasizing activity. Orlikowski (2002) points out that tacit knowledge is a form of knowing that is inseparable from action because it is constituted through such actions.

Through hobbyist knowing in my case study of the Suunto sports equipment company, product developers are intimately familiar with users' needs, including the technical requirements and cultural values and practices of sports communities, because of their long-term participation in the communities of practices of sports enthusiasts. This paper discusses hobbyism in relation to design methods. Hobbyism is a long-term relation to the intended contexts of use of the product, while user-oriented design methods often form a short-term relationship in order to study users.

It was brought forth here that acknowledging hobbyism within the company can be a resource for successful product development. This means appreciating employees' personal knowledge as well as their professional knowledge. Stories about personal experiences told within the organization—and throughout the stages of concept designing, designing and decision making in the product development process—can bring forth ideas that originate in hobbyism. This means that hobbyist knowing becomes explicit in the organizational context when decisions are made based on this tacit knowledge inherent in the communities of practices of sports enthusiasts.

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Author's Note

The author is grateful to all those who contributed to the study of Suunto Corporation.

All correspondence should be addressed to:
Tanja Kotro
National Consumer Research Centre
Kaikukatu 3 (P. O. Box 5)
00530 Helsinki
Finland
Tel. +358 9 7726 7703
Fax. +358 9 7726 7715
E-mail tanja.kotro@ncrc.fi

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USER INVOLVEMENT AND ENTREPRENEURIAL ACTION

Eva Heiskanen
National Consumer Research Centre
Helsinki, Finland

Petteri Repo
National Consumer Research Centre
Helsinki, Finland

Abstract: *Involving users in the innovation process is a subject of much research, experimentation, and debate. Less attention has been given to the limits to user involvement that ensue from specific organizational characteristics. This article explores barriers to the utilization of users' input in two small companies developing interactive digital applications. We contrast our findings to earlier research involving large companies to identify features of entrepreneurial sensemaking and action that influence the utilization of users' input. We find that the small companies follow a distinct action rationality, leading to rapid implementation of some user inputs, and defensiveness toward others. Both sets of data also reveal common features that are often overlooked in the literature. We reconceptualize user involvement as a form of interaction between users and innovating companies that is facilitated and constrained by micro-sociological processes, on the one hand, and the nature of the competitive environment, on the other.*

Keywords: *user involvement, new product development, information systems services, organizational sensemaking, entrepeneurial action.*

INTRODUCTION

User orientation has become a popular catchphrase in innovation research and practice. Studies have documented the dangers of generalizing product developers' own experiences to a broader population of users (Oudshoorn, Rommes & Stienstra, 2004) and identified user involvement as a key success factor (Brown & Eisenhardt, 1995; Craig & Hart 1992). Many authors and institutions are popularizing new methods to involve users more closely in the product development process (see Goodman, Langdon & Clarkson, 2006; Kaulio, 1998; Leonard & Rayport, 1997, for reviews). The underlying assumption seems to be that designers' lack of awareness and knowledge of how to involve users are the main impediments to user orientation. We have drawn on this assumption ourselves, as we are involved in a project aiming to enhance user orientation in small entrepreneurial companies

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developing interactive digital applications. Yet there may be other reasons, apart from a lack of awareness of user involvement methods, for the current limited user orientation, and we believe these reasons should also be considered seriously.

This paper outlines some qualifications regarding user involvement emerging from different research traditions in business administration. (Different types of qualifications, such as those raised in the sociology of technology, have been addressed by others, e.g., Rohracher, 2005.) Within strategic management, the literature on *disruptive innovations*, that is, innovations that allow companies to open up new markets or to change value networks and industries, sometimes views customer orientation and innovation orientation as opposing poles. Users are often resistant to totally novel concepts that challenge their everyday practices, yet many disruptive innovations have transformed markets to the advantage of the companies introducing them. From a different perspective, studies in organizational behavior highlight the limits to organizational attention and sensemaking capacity. User orientation often implies a significant inflow of new information into product development, information that may be difficult to accept, process, or absorb. Information processing may also compete for scarce resources needed for action.

It is likely that these limits to user orientation might be most apparent in small companies dealing with new technologies. Such companies have limited resources in terms of time, funds, workforce, and sensemaking capacity. They also often deal with disruptive innovations, ones that are not meant to fit into existing usage patterns but actually to transform them. Such companies thus provide a critical case in which to test whether enhanced user involvement is helpful in similar entrepreneurial settings. Can the limits to user orientation be overcome by increased awareness and experience in user involvement methods and practices? Or are there cases in which user involvement is actually counterproductive, or at least a waste of time and money?

We start this investigation with a brief review of central points concerning user involvement raised in the strategic innovation management literature, and in the literature on organizational sensemaking and action. We then turn to investigate our research questions in the context of an ongoing project funded by the Finnish Funding Agency for Technology and Innovation (Tekes). We base our analysis on a survey of current sources of user information employed among technology entrepreneurs involved in the Tekes FENIX technology program for interactive computing, as well as on small-scale interventions to enhance user involvement conducted on our initiative with two of these companies. In order to understand some specific features of small entrepreneurial companies, we also contrast our findings with some previous experiences of user involvement with large companies. On the basis of these data, we identify circumstances and ways in which user involvement may be more or less pertinent for product development in different kinds of firms.

USER ORIENTATION IN NEW PRODUCT DEVELOPMENT

In recent years, methods and "tools" for user involvement have proliferated, and the community developing and propagating these methods has grown. In addition to conventional methods of concept testing and usability, product developers today employ field studies, participatory design, contextual design, and user participation (Beyer & Holtzblatt, 1998;

Greenbaum & Kyng, 1991; Kaulio, 1998; Kelley, 2000; Koskinen, Battarbee, & Mattelmäki, 2003). These methods involve intensified interaction between the world of designers and the world of users. Designers may go to visit the users at home or at their workplace, and use ethnographic observation to understand the users' world. Users may join designers "at the drawing board," for example, by participating in user groups (Tomes, Armstrong, & Clark, 1997). Workshops and various forms of idea-generating assignments for users provide a more streamlined version of intermittent or quasi-participation (Kristensson, Gustafsson, & Archer, 2004; Magnusson, Matthing, & Kristensson, 2003). Inventions by lead users are proposed as a source of innovation in both industrial products and some consumer products (Franke & Shah, 2003; Lüthje, 2004; von Hippel, 2005). For products like computer games, "user toolkits" even allow designers to outsource part of the software design to innovative users (Holmström, 2004; Jeppesen & Molin, 2003; von Hippel, 2001).

All this work on user involvement methods assumes that product designers are in need of a more intimate knowledge of their users. By launching these methods and experimenting with them in companies, academics and practitioners aim to promote and enhance user-involvement practice, and raise awareness among designers. Surveys and reviews (Bruseberg & McDonagh-Philp, 2002; Cassim, 2005; Goodman et al., 2006; Hanna, Ayers, Ridnour, & Gordon, 1995; Kujala, 2003) indicate that the available methods are often underutilized. Whether or not this results from a lack of awareness, however, is an open question.

Empirical studies on new product development include those that detail the dangers of excessive reliance on designers' own personal experience, but also studies that illustrate its successful application. Especially in the field of sports equipment and other products with clearly defined user groups, designers can often successfully extrapolate user requirements from their own experience as users (Kotro, 2005; Kotro, Timonen, Pantzar & Heiskanen, 2005). Sometimes, designing for oneself or imagining the user is actually a quite good strategy. Obviously, this depends on the distance between designers and users: In some product groups, early users have similar skills and preferences to the designers of the product. Thus companies with limited resources may actually find personal experience a cost-effective source of user information. They may, however, run into problems when attempting to expand their business model into the mass market, where user contexts and requirements may be very different from the niche market (Christensen, Anthony, & Roth, 2003).

Yet a brief glimpse at other literature, outlined below, indicates that some companies may behave quite rationally by not devoting their energies to acquiring and processing user information. We outline briefly two other strands of research that could justify a somewhat contrarian perspective on user involvement.

Innovation-orientation vs. Customer-orientation

There is extensive literature on the potential conflict between innovation-orientation and customer-orientation. While customer-oriented companies focus on fulfilling existing needs of existing customers, innovation-oriented companies may manage to create new needs and find new customers. There is debate over whether this conflict is irreconcilable or not: Some argue that both orientations can be effectively combined through dialogue with current and future customers (Flint, 2002) or by adopting a "market shaping" approach (Berthon, Hubert,

& Pitt, 2004), or by moving from a reactive to a proactive market orientation (Narver, Slater, & MacLachlan, 2004).

Creating disruptive innovations is a large organizational challenge in its own right (Damanpour, 1991; Lichetenthaler, Savioz, Birkenmeier, & Brodbeck, 2004; McDermott & O'Connor, 2002). In this context, involving users in product development involves further complexities, because users do not know what their requirements are for products that demand changes in behavioral patterns or that open up new applications (O'Connor, 1998). The literature on radical and disruptive innovations has stressed problems arising, for example, from the use of concept testing as a "screen" for new product innovations. Users are often resistant to totally novel concepts that challenge their everyday practices. It is argued that really new-to-the-world products and radically innovative concepts are discarded because users fail to understand them and thus to appreciate their benefits (O'Connor, 1998).

Disruptive innovations allow companies to develop products for which there is no (or little) competition, and potentially even to transform entire value networks to their own advantage (Christensen, 1997; Tushman & Anderson, 1986). Disruptive innovations may be (a) new to the industry, (b) new to the firm, or (c) new to the customers (Garcia & Calantone, 2002). The last type of innovation, new to the customers, entails a specific type of problem. Its impact on users depends on the degree of learning and adoption efforts required of them, rather than on the newness of the technology itself.

In spite of their lack of customer-orientation, many disruptive innovations created by innovation-oriented companies have in fact been extremely successful, and managed to transform markets to the advantage of the companies developing and promoting them. Digital photography has become dominant over chemical photography, as has electronic mail over telegraphy. Compact disks overtook audio cassettes and LP records, only to be seriously challenged by downloadable compressed audio files. The companies that recognized these changes early obtained strategic advantage.

Christensen (1997) has argued that this is because firms with disruptive innovations find new customers, while those that fail to innovate continue ensuring the satisfaction of their existing customers. In the IT industry, at least, Christensen et al. (2003) claim that the markets for disruptive innovations are found among nonconsumers (people who lack access or resources to make use of existing products), or among "overshot customers," those who are unwilling to pay for further performance improvements and who are targeted by new entrants with disruptive business models that offer cheaper and simpler solutions. "Undershot customers" (those frustrated with the current products' limitation and are willing to pay for refinements) will typically be served by companies focusing on sustained innovation that is not disruptive.

Furthermore, users are not always the primary customers of disruptive innovations. So, apart from the potential conflicts between innovation-orientation and customer-orientation, there can be a further and separate conflict with user or consumer orientation, depending on the industry. There are examples in which user benefits and enhanced product performance are not necessary prerequisites for competitive advantage (Ivory, 2004). Users have been highly resistant to disruptive innovations, such as automated banking and workplace computerization, yet these innovations have brought significant efficiency gains to the banks and workplaces adopting them. Users have gradually adapted to these technologies, even though they might have adapted more quickly and with better grace had the applications been designed with more attention to user needs (Prahalad & Ramaswamy, 2000). Yet it is clear

that the usefulness of user orientation—at least in the short term—depends on whether or not users have a choice in adopting the technology. This, in turn, depends on the structure of the competitive environment and on the relative market power of different players.

Knowledge, Sensemaking, and Action

Much of the critical literature on user involvement has focused on users' limited capacity to contribute to competitive innovations (Duke, 1994; Heiskanen, Koskinen, Repo, & Timonen, 2006; Trott, 2001). Yet user involvement also stretches the firm's capacity to absorb and make use of new information. Surveys, workshops, and tests—perhaps even field observations of the user context—are conducted, and developers are expected to make use of all the new information. Empirical studies have shown that users' contributions may be rejected by design teams as irrelevant, incomprehensible, or too time-consuming to deal with (Bruseberg & McDonagh-Philp, 2002; Holmström, 2004; Kujala, 2003). This is not a special limitation of design teams: Research on organizational behavior, organizational decision-making, and knowledge management show that there are limitations to organizational attention and sensemaking capacity (Brunsson, 1985; Cohen & Levinthal, 1990; Starbuck, 1983; Vopel, 2003; Weick, 1995).

Organizations deal with these limitations creatively, yet quite differently from the prescriptions of normative decision theory. Weick's (1995) work on sensemaking shows that organizations make sense of the flow of activities in which they find themselves as an iterative process of identity-construction—reinterpreting situations involves a reinterpretation of oneself, and vice versa. Sensemaking draws heavily on earlier experiences and existing interpretation frames. Yet it is also future-oriented: Organizations enact sensible environments. By deciding and taking action, they also create their own environments for future action. Sensemaking is social, negotiated, and interpersonal: It occurs in interaction. Sensemaking does not occur at specific moments of decision analysis; rather, it is ongoing, based on extracted cues (i.e., special triggers on which attention is focused at the expense of other information), and it is based more on plausibility than accuracy. Thus, new information is irrelevant unless it finds a place in the sensemaking process and becomes a part of how the organization understands itself and its environment.

Brunsson (1985) has identified two kinds of rationality in organizations: decision rationality and action rationality. Decision rationality involves a solid information base and is the ideal mode for making reasoned decisions. Action rationality, on the other hand, is often based on biased information about a biased set of alternatives, and seldom involves analysis or a weighing of the information. Yet action rationality is a fundamental feature of organizational life and a prerequisite for effective action. Organizational ideology gives members a distorted, narrow but practical view of reality, facilitating coordinated action. In contrast, a comprehensive and balanced analysis of alternative courses of action will easily show that there are problems and risks in all alternatives. Team energies may be drained by elaborate decision analyses, leaving no energy for implementation.

Action rationality has been found to be especially pronounced among entrepreneurs. Entrepreneurs exhibit more cognitive biases than managers (Baron, 2004). Avoiding "decision anxiety" is important to sustaining decisive action, so entrepreneurs prefer to err toward risk-taking, intuition, and personal commitment rather than risk analysis and objective

data (Sarasvathy & Dew, 2005). Berglund (2005, p. 45) has shown that such features are important because they allow entrepreneurs to "act on personal visions, inspire others and carry novel ideas through in the face of uncertainty and negative feedback".

From an objectivist perspective, it might seem irrational to disregard new information that might be key to a new product's success or failure. Yet years of research on sensemaking and action rationality show that information processing and critical analysis of the available options may come at a high cost. Information processing and action may compete for the same resources. Thus, the speed and format of user information flowing into the company needs to be balanced with the organization's absorptive capacity (Cohen & Levinthal, 1990) and its dominant mode of rationality (Brunsson, 1985).

We have thus identified a number of company-external and company-internal factors that may limit the utilization of user information. We next turn to consider our empirical work with entrepreneurial small-to-medium enterprises (SMEs), and the potential of and limitations to user involvement revealed by our own interventions into these companies' innovation processes.

CRITICAL CASES: SMALL ENTERPRISES WITH DISRUPTIVE INNOVATIONS

Our interest in user involvement—and its limits—relates to an ongoing project we are conducting for Tekes. Its purpose is to test the usefulness of enhanced user involvement in the innovation process, with a special focus on experience-based user input. The project aims to test the usefulness of this input for small and medium-sized companies participating in a technology program on interactive computing called FENIX. The ultimate goal of the project is to develop recommendations about how to involve users and promote customer-orientation among small technology companies. Small enterprises dealing with disruptive innovations are a critical case for user involvement because they typically have limited resources in terms of time, funds, workforce, and sensemaking capacity.

The first stage of the project involved a survey of how 14 SMEs in the FENIX program obtain and manage user information. The survey was conducted in mid-2005 by interviewing one representative of each company (their FENIX program contact person), in most cases the CEO or marketing manager. The interviews were short and structured, and focused on gaining an overview of how the companies defined their users, how they obtained information about users, and what needs for improvement in user involvement they envisaged.

Perhaps unsurprisingly, we found that designers' personal experience and impressions gained from the media were dominant sources of user information. Customers and previous studies were also frequently used as a source of information about future users. Some companies did engage in formal user research efforts, such as focus groups, testing pilot products, or market surveys. Yet most companies viewed learning about their potential customers the largest challenge. Many were eager to test their products with a broader group of users, and considered it important to develop systematic means for collecting and managing user information. As was to be expected, financial resources and time were the most frequently mentioned obstacles to user involvement, but lack of capabilities did play a role. For example, the CEO of a computer game company stated, "*There is certainly room for improvement, but it hard to say exactly how*."

We are now in the process of conducting four case studies that test the usefulness of enhanced user input for product development. We report here on two of these case studies: our cooperation with a company producing automatic speech recognition technologies and services and a company developing mobile blogging services for tourists. Both are potentially disruptive innovations in the sense that they can overturn existing dominant services. Automatic speech recognition has the potential of replacing manual call center services, which are labor-intensive; mobile blogging could potentially replace tourist guides and the sending of postcards. The services have been developed by entrepreneurial startups that are actively creating and commercializing new digital products for ordinary consumers. In this paper, we analyze the cases in terms of whether our interventions result in improvements in their design practice and whether increased experience with user involvement results in better design.

The case companies had recognized that consumer involvement was a key issue for the future successes of their innovations. We aimed to provide them with experience-based user information by having users test the service prototypes. Then we collected feedback and encouraged users to generate their own ideas about suitable applications or interesting variants of the services. In order to ensure the transfer of relevant knowledge to product development, complete product development teams were present in the focus group sessions we organized (cf. Bruseberg & McDonagh-Philp, 2002). In summary, the companies received a short-term intervention by knowledgeable consumers, and we conducted a short-term follow-up of how the companies made use of this intervention in their innovation process.

Case 1. Automatic Speech Recognition: Introducing the Users' Viewpoints

Speech recognition technology is being used more frequently for telephone applications, such as travel booking, financial account information, customer service call routing, and directory assistance. In practice, callers communicate with computers. What they speak takes them to predesigned sequences and further cues for spoken input that computers can recognize and process. Unlike in many English-speaking countries, such telephone applications are not yet widespread in Finland: Developing the necessary technology is complex and needs to be done separately for each language. The company we cooperated with, Suomen Puheentunnistus Oy, had developed small-scale speech-recognition services and service prototypes, in partnership with IBM. A common feature in these services was that they were aimed at organizational customers. Thus, the customers of the services would be companies or public-sector organizations wishing to improve the efficiency of their telephone services. The users of the services would be consumers or employees of other companies making use of these telephone services. Our case company had close contacts with its customers, but was enthusiastic about gaining more input from users.

This product development stage involved a mixture of concept development (new services) and refinement of existing service prototypes. There was a need to test the basic functionality of the speech recognition product, which required testing by a wide range of speakers representing different modes of speech and pronunciation. On the other hand, there was also a need to test the usability of the service: How logically did the service process proceed, and how easy was it for users to accomplish their tasks. The company was also interested in improving the acceptability of its service in different applications, and gaining

users' ideas on new applications. Finally, there was a need to gain feedback quickly in order to integrate it into the rapidly ongoing service development process.

Due to this wide scope of needs and expectations, we used fairly conventional methods in user testing, that is, prototype testing, an e-mail survey, and focus groups. These conventional methods allowed us to design and implement the user involvement in a timely manner, and to address the variety of rather basic information needs for the company. Furthermore, using simple and well-known methods allowed for transparency vis-à-vis company representatives: It was easy for them to understand what we were doing and how the results were obtained. We combined them into a three-layered study design.

- Testing of a service prototype. This stage served, firstly, to test basic service functionality. Members of the National Consumer Research Centre's consumer panel (845 members with Internet access) were asked to try out a service prototype for booking an appointment at the local healthcare clinic that involved a number of speech recognition elements. Respondents phoned a free-of-charge test service number on their own phones, on their own time, and followed the instructions given on the line. This also allowed us to build user experience, enabling users to take a more informed stand on the technology and its applications.
- Questionnaire survey. After trying out the service, users were asked to fill in an e-mail questionnaire within a week. This included both structured and open-ended questions about the ease-of-use and convenience of the speech-recognition-based service as compared to alternatives services, such as phoning a clerk or using the Internet, as well as about the users' evaluations of the suitability of speech recognition for different applications. The response rate to the e-mail questionnaire was 45.6 %, with a total sample of 408 respondents.
- Focus group discussions. In line with Boddy (2005), focus groups were employed to gain qualitative data on broader aspects of service acceptability and gain users' suggestions for improvements. Their ideas for future application areas were also solicited. We invited participants for the focus groups in connection with the questionnaire survey, and organized two focus groups in Helsinki and one in Tampere. Altogether 22 consumers participated, including both men and women from different age groups and with different educational backgrounds.

It turned out that users viewed the technology quite favorably. In the questionnaire study, 79% of the respondents rated using automatic speech recognition for the service as "rather" or "very" convenient. This figure compared favorably with alternatives such as using the Internet (67%) and phoning a clerk at the appointment desk (66%). Healthcare, of course, was a fairly convenient choice of service from the point of view of automatic speech recognition, as people are frustrated with queuing on the phone to access public healthcare services (Taloustutkimus, 2006). Open-ended questions in the questionnaire and the subsequent focus group discussions confirmed that people were happily surprised at how well the service prototype seemed to work. They saw a number of benefits in the technology, such as the possibility of around-the-clock service and a speeding up of the service process. Participants suggested a large number of applications for which the technology would be suitable, spanning from making reservations, renewing loans for library books, or booking a vehicle roadworthiness test to subscribing or unsubscribing to magazines, purchasing movie

tickets, or registering for a course. Yet both the questionnaire and the focus group discussions also brought up a large number of reservations and improvement needs:

- The service prototype involved a number of problems, encountered even by some people not trying to really test the limits of the service, and certainly identified by those who really tried to see how well the automatic speech recognition could work. So basic functionality issues remain. Many users also complained about lacking instructions and usability (e.g., slowness, misunderstandings). Improvements were suggested on how logically the service proceeded, its usability, and the way the service was presented.
- Concern was voiced about people with speaking disabilities or poor Finnish skills. People also questioned what users could do if the service doesn't work, and worried about potential failures. People hoped that automatic speech recognition would not become the only way to make appointments for healthcare services. Different alternatives (e.g., the Internet) should be available for different needs.
- The social impacts of the technology provoked extensive comments. People were concerned about whether traditional, personal services would be kept on as new alternatives are developed. In general, there was concern that automatic speech recognition would probably lead to job loss. Some feared that people would be, as one participant noted, increasingly "connected to wires," and that automatic services might reduce social contacts.

Close contact was maintained with company management and the product development team throughout the intervention, and each part of the study was discussed extensively before implementation. Two product development team members were present in two of the three focus group discussions. This proved to be the memorable part of the intervention, as direct interaction with users was a novelty for them. As the observations piled up, company representatives were encouraged by the positive outcomes of the studies, and focused on finding out more about why their service was appreciated.

Case 2. Mobile Blogging: Developing a Service for Ordinary Tourists

The other completed intervention in our project involved a small company, SeeFinland Ltd., which had been in operation for a few years. This company had successfully launched a mobile phone-based service for business customers. This service consisted of a guided tour via mobile blogging. The mobile application provided instructions for the tour and information on the sites to visit. Tourists participated by taking pictures and posting messages and comments on the Web site. The original service involved planned tours of the Finnish forest for the client company's employees, with a teambuilding activity involving assignments to be conducted with a camera-phone, a contest, and a Web site for viewing the collective achievement of the group. The service thus enhances an ordinary guided tour by adding interactive elements, group dynamics, and a Web-based record to be viewed after the tour. In essence, product development targeted social dynamics more than cutting edge technology (see McGuigan, 2005). This was in line with the basic service offered to consumers, which is a social, tourist activity and access to a personal Web gallery.

Our cooperation with this company focused on the company's desire to expand this business-to-business leisure service into a service for ordinary tourists, that is, individual consumers (Repo, Hyvönen, & Saastamoinen, 2006). The planned service was designed to target tourists wishing to get to know a location. Using the service, the tourists create documentation, as well as interact with other tourists during the service tour. The mobile phones would be used as tour guides and documentation devices. The service is first meant to be sold at places tourists frequently visit, such as hotels and travel agencies, to ensure that tourists receive the assistance they need to start their tour. The aim of the company is to design a number of different tours to address the different preferences of tourists.

With the first version of the consumer service, we piloted a sightseeing tour in downtown Helsinki. The tour consisted of visiting eight locations within walking distance of one another, and of completing assignments appointed at each site. The basic assignment was to use the camera-phone to take a picture of the site, comment on it, and send the picture to an Internet photo gallery. A picture of the sight and a brief description of it preceded each assignment. The photo assignments were playful, aiming to promote interaction between the tourists and the sights they were visiting.

We designed the pilot testing of this service in the following manner:

- Pilot groups, consisting mostly of members of the National Consumer Research Centre's consumer panel, took the tours with the purpose of testing the basic functionality and usability of the service. The tours were conducted in the city center on two occasions. Altogether, 19 users participated in the trial in groups of 2-5 persons, for a total of three groups on the first trial and four on the second. In addition to technical testing and introducing the users to the service, the tours served the purpose of participant observation for our researchers.
- Focus group discussions were organized immediately after the tours, in which all tour members participated. Here, we focused on unearthing the experiences of the participants, including both their views on basic functionality and technical performance of the tour, and the enjoyability and acceptability of the service idea itself.
- Individual questionnaires were handed out after the focus group discussions in order to assess each participant's individual viewpoints on both technical issues and the overall desirability of the service.

Product development team members were present throughout the pilot group tours, observing and providing technical support when needed, as well as during the focus group discussions. As the first pilot tour started, it became immediately obvious that a number of issues in the basic functionality with and usability of the service existed. Operability on the participants' mobile phones had not yet been accomplished and data transfer was unreliable (for sending the photos to the Web site). The users considered the use of the service technically difficult. Difficulties arose especially early in the tour, but they were evident throughout the trial. Part of the difficulties resulted from using an unfamiliar mobile phone provided by the service developers, but a number of usability problems also were identified in the user interface and the logic of the software application. The participants were Finnish and rather familiar with Helsinki, but they could successfully relate their experiences to traveling abroad.

The product development team responded to these problems very forcefully. In the discussion after the tour, there was some initial defensiveness about the unavoidability of the

problems. However, the product development team immediately set to work to improve the identified problems, and some additional ones, and made extensive changes to the service during the 11 days between the two trials. All in all, technical problems and suggestions for improvement were received very well, and gave rise to extensive efforts to solve the problems.

The users' overall evaluations of the service were quite favorable: The idea was considered fun, interesting, and up-to-date. Most participants thought that there was potential in using a mobile phone as a tour guide. The service was considered an active way to experience sights and obtain information on them. Some of the test users also liked the interactive and group elements of the service: They thought it might be a pleasant way to get to know new people by collaborating on assignments while taking the tour. Although the originality of the service concept was welcomed, its implementation received criticism—even among those who liked the concept:

- The basic usability required more development. In a business context, participants would have guides helping them use the service. Ordinary tourists would require a much simpler user interface, and better user instructions.
- The participants in our trials emphasized that there are many other ways to spend leisure time, and that they could do something more interesting with the time and money than use it for this service. From this point of view, the transfer of the service to a leisure context clearly called for more development of the basic business model. Suggestions included involving other tourist companies in the business network—that is, site operators, shops, and restaurants—and perhaps even having them subsidize the service in order to attract new visitors.
- Many of the assignments met with criticism. They were designed to create a playful atmosphere, and involved doing silly things in public, such as photographing a group member riding an imaginary horse beside the statue of a war hero riding his horse. Here, the transfer from the business leisure service did not appear to be successful: In the original service it was acceptable and even desirable to act foolishly in a "team spirit" exercise. However, the leisure service was used publicly in the city center and most of the participants were not happy with the performative tasks. Therefore, they suggested that the service should be redesigned with more intellectual tasks and theme tours.

Thus, while there were some encouraging findings, some fundamental features of the business idea required reconsideration. Linking the mobile tourism service to the overall tourism network of the location seemed to be an important challenge, which would flesh out the technology-based idea into a full-scale tourism service.

Company Responses to the Users' Contributions

The companies gained obvious benefits from the user involvement exercises that we organized for them. In the case of the mobile tourism service, product developers could enhance their product already during the study. Developers of the speech recognition technology obtained voice samples and recognized issues related to technological scalability. In other words, technical improvements were eagerly sought for and easily accepted by the firms.

Both companies also gained encouragement for further development of their services. Especially in the speech recognition technology case, company representatives were happily

surprised with the positive response their service prototype received, and with the wealth of ideas for new applications that the users suggested. Engaging in the user tests energized the companies to devote additional efforts to developing and improving the service prototypes, and to finding ways in which they might evoke positive responses among the test users.

Face-to-face interaction between users and developers was highly appreciated by the service developers. It has been previously noted (Kujala, 2003) that externally produced studies may be difficult to integrate into the service development process. It seems that direct interaction provides information that is more actionable. Tacit knowledge is transferred, and face-to-face interaction produces memorable and meaningful experiences.

Yet the limits of user involvement also became clear in the actual testing situations and in our follow-up sessions. Users' critical comments often met with defensive explanations of why a solution was the only feasible one, or how the technology was unaffected by the types of problems feared by the users. The technology developers were certainly not prone to problematization or self-criticism: Users' comments evoked gut reactions, and our later discussions with the companies centered on those reactions, rather than a comprehensive analysis of all the information obtained.

The technology developers were most impervious to fundamental criticisms of the service idea. This is understandable: The idea is what their company is about, and it is very difficult to accept that some people find it questionable or simply silly. In many instances, fundamental criticism was thus met with a deaf ear; it was simply disregarded. We see here entrepreneurial action rationality at work: These kinds of companies are extremely good at collectively fending off criticism toward the company's business idea, and thus combating the inherent uncertainties of entrepreneurship. Yet this strength can also be a weakness, if limited user acceptance turns out to be an important market factor and the company is unable to embrace the new, independent knowledge.

CONTRAST: USER INVOLVEMENT WITH LARGER COMPANIES

It is interesting to note some differences between our recent experiences with SMEs, and our earlier experiences with larger companies. We have previously been involved in testing and evaluating user involvement exercises with larger companies in the field of eBusiness (retail chains; Heiskanen, 2005) and mobile video streaming (a telecom company; Repo, Hyvönen, Pantzar, & Timonen, 2006). In many ways, we found very different benefits and problems in those cases. Our experiences are in line with previous research suggesting that larger companies can accommodate uncertainty and ambiguity in R&D, but are slow in implementing disruptive innovations at the operational level (Damanpour, 1991; McDermott & O'Connor, 2002).

In the following sections, we provide two brief examples of our experiences with larger companies in the fields of electronic grocery shopping and mobile video streaming. They serve to illustrate some contrasts to the previous cases dealing with small entrepreneurial companies.

Case 3: Electronic Grocery Shopping

Our previous user involvement intervention in electronic grocery shopping provides experiences of the ways in which large companies—in this case, retailer chains—deal with

users' suggestions for improved service design. The intervention was designed to promote user involvement in the development of environmentally and socially sustainable electronic grocery shopping services. User involvement was organized as an interactive, multistakeholder process involving representatives of two large retail chains (as well as a third retail chain not participating directly, but maintaining contact via e-mail). The intervention consisted of a 2-day workshop in spring 2002 attended by 31 consumers, eBusiness developers, and other stakeholders (NGOs and experts). Before the workshop, participants were sent an information package on the existing alternative operating models and studies on societal effects. At the workshop, participants worked in small groups with representatives from different interests, using group-work techniques, such as a modified SWOT analysis and brainstorming, to identify key problems on the first day, and then develop ideas for better designs on the second day. On both days, the groups' conclusions were shared at plenary sessions, and the entire process and its outcomes were transcribed in a memo distributed to all participants.

Some of the ideas developed at the workshop were actually not totally original, such as the various user interfaces (e.g., mobile phones and kiosks), new delivery solutions (combined deliveries of goods from different suppliers), and new solutions for supporting local food production. Other ideas were more novel, such as the "Internet-Supported Local Grocery Shop" and the "Suburban Delicatessen." These ideas centered on using eBusiness technologies to promote the competitiveness of local corner shops by reducing inventories (and hence costs) and increasing the range of products offered.

The eBusiness developers of the participating retail chains were interviewed about 6 months after the workshop. These companies had experimental eRetailing services running, and were wondering how to proceed from this experimental stage. For them, the best thing about the workshop had been how it had challenged their customary way of thinking. Their view was that electronic grocery shopping had been discussed in a much broader context than they were accustomed to within their own organization. One eBusiness manager contrasted the workshop with a large consumer survey they had conducted earlier. The workshop had supported some of their earlier findings, but had also alerted them to new issues, such as the ability of eCommerce to provide more product information, the problems of trust, and the impact of eCommerce on urban structure and corner shops. In his words, it helped combat the tunnel vision that organizations develop as they mature. Another noted that the workshop had raised some social impacts he had not been aware of, and concluded that, "*It was actually quite good that there were some people there from the extreme end of the spectrum*."

Although the knowledge sharing that occurred at the workshop was appreciated by the eBusiness developers, its long-term impact on actual service development was negligible. It was obvious that the two larger retail chains were not very serious about electronic grocery shopping. They were involved in eBusiness merely for the sake of experimentation, and to make sure they can keep up with the future competition if necessary. Yet they had spent quite a lot on R&D in the different distribution models, portals, and surveys. In the same vein, the results of the workshop were stored as a complementary learning experience. The third, slightly smaller company was more serious, due to a large captive investment in small retail outlets. As a result of the workshop, it refined and published a preliminary plan for an "Internet-supported local grocery shop," but the plan never materialized due to financial and competitive constraints. The market strategy of investing in large hypermarkets thus kept its

dominance, as the more alternative approach of combining eBusiness with local shops did not fit into the strategy of the incumbent firms.

Case 4: Mobile Video Streaming

This case of user involvement stemmed from a need to explore meaningful uses for the novelty service of video streaming on a mobile phone. Streaming is a way of providing multimedia, such as radio shows, television shows, and home videos over information networks. In 2002, we carried out a trial, in conjunction with a mobile operator, regarding individuals watching streaming video on their mobile units. Thirteen users of various ages, gender, and backgrounds from the Helsinki metropolitan area were provided appropriately configured mobile phones, with the request that they watch a set of preselected, streamed video clips on the phone over a 1-week period. They were encouraged to watch videos in various situations and instructed to report on their experiences, routines, and activities in a diary.

Two distinctly different contexts in which users considered it natural to view mobile video emerged. First, users were able to avoid boring situations by entertaining themselves. Second, mobile video made it possible to share experiences with other people by watching cartoons with children and by singing karaoke together. This second context of communal watching was something that product developers valued because it had not emerged in small-scale trials among industry professionals, nor did it comply with the stereotypical, solitary use of mobile phones.

It is important to note that a trial such as this was a rare experience. The ICT industry has a long tradition of involving in-company users or users from important customer bases—so-called friendly users—in their user studies. However, these user groups are typically professionally knowledgeable about the services they test. This might be the reason why the social context of use had not previously emerged as clearly. Professionals knew better what was expected of them, and had not been particularly encouraged to experiment. The results from such typical trials relate more to technical functionality and usability.

The results of the case study trial were discussed a number of times with product developers The knowledge sharing that took place was appreciated by product developers, but it did not lead to essential changes in the video service. It was rather obvious that streaming video was only one of several potential future multimedia services. Nor was streaming video expected to generate revenue in the near future. The mobile operator was involved in the video service for reasons related more to the scanning of future technologies and keeping up to date than with technological development. The case was the same for the mobile industry at large. Only recently has next-generation mobile multimedia, such as mobile television, video streaming, and mobile blogging, attracted any sizeable user base.

Similarities and Differences

All four cases provided here involved users who were not given strict instructions on how to behave during the trials. In other words, involvement was broader than in conventional usability testing or market research. The settings were explorative because the developers sought to learn something more than a technical understanding of users. The aim was to

produce usable knowledge that could synthesize contexts, reasoning, experiences, and action in product development.

The innovations were differently disruptive in the four cases (Table 1). Users were the target of disruption in all cases and the industries in two (Cases 1 and 4). The cases reflect well that the developers of disruptive innovations need not only to convince users. They themselves are drivers for disruption and have to convince their respective industrial partners, industrial customers, and even their own management. Disruptive innovations lead to a dynamic two-way sensemaking process. Developers need to understand the service and its new users. This is more challenging than conventional product development in which developers usually know more about existing products and existing users.

Both the small and large companies considered the user involvement exercise a positive experience. The benefits they gained, even though they were used differently, revolved around the intensive interaction with a group of users. Thus, the outcomes of the exercises were not merely (or even mainly) the information imparted, but rather the kinds of encounters created. In the process, the companies learned as much about themselves as about their users.

Additionally, both sets of cases also reveal that the need to respond to users depends on the competitive environment and the nature of the value chains. This aspect arose both in one of the small and one of the large company cases. Users may not be the principal customers of the service, and may be unable to obstruct its adoption (as in the case of automatic speech

Table 1. Comparison of User Involvement Cases with Entrepreneurs (SMEs) and Large Companies.

	Case 1: Speech recognition	Case 2: Mobile travel	Case 3: eGrocery	Case 4: Mobile video
Setting of involvement	Trial of a service provided by a SME	Trial with two SMEs	Workshops with large retailers and other stakeholders	Trial with large mobile operator
Description of involvement and innovation	Scheduling a doctor's appointment on a server using speech recognition	Using the mobile phone as an interactive tourist guide on a walking tour in the city center	Workshop focusing on alternative ways of developing electronic grocery shopping.	Watching videos on mobile phone for one week and reporting experiences in diary
Main target of disruptive nature of innovation	Industry, users	Users	Users	Industry, users
Sensemaking	Test of implementation	Assessment of commercial interest	Articulation of different needs & possibilities	Exploration of new ideas
Action	Better grounds for marketing	Further development of service concept	Improvement of personal expertise	Better understanding of service content
Overall assessment	Convincing business partners in value chain	Direct improvement of service	Understanding the possibilities and limitations of the service	Getting to know a novelty better

recognition). Users' desires and ideas can run counter to dominant producers' strategies (as in the case of electronic grocery shopping). Hence, there are clearly instances in which users' viewpoints have more significance and ones in which they are less influential, and companies may behave perfectly rationally in recognizing this situation.

Yet the cases also illuminate some distinct differences between SMEs and large companies. The large companies appreciated the alternative interpretations and novel uses that users made of their technologies. In fact, the critical and unconventional perspectives that users brought to their products were in many cases viewed as the most valuable input of user interaction. For those large companies, user involvement provided an opportunity to learn about the possibilities and limitations of their technology, that is, to expand their horizons, to get to know new kinds of users (and nonusers), and to envision alternative scenarios for technology and service development (see also Magnusson, 2003). On the downside, the results of our user involvement interventions disappeared into these alternative, potential future worlds, never to be heard of again (see also Olson & Bakke, 2001; Vopel, 2003). It seems as if for the large companies, adept at dealing with equivocality and ambiguity, the new experiences and new knowledge have intrinsic value irrespective of whether they lead to concrete action.

In contrast, the SMEs developing travel and speech recognition products shared a direct approach to user involvement. User involvement was expected to contribute something of direct commercial value. This focused the user involvement on practical issues, and also led to rapid implementation of a number of improvements. On the other hand, the SMEs were highly reluctant to question their points of departure, and they placed great value in their own experiences and personal convictions. User involvement was used to recognize potential issues, solve them (or forget them, if unsolvable), and promote products. Sensemaking and action were closely intertwined. Users were not valued so much for the full range of knowledge that they imparted, but rather for the possibility they provided the company for enacting new roles and relationships.

Overall, the cases with firms primarily seeking implementation of information (Cases 1 and 2) certainly show that user involvement can be used for practical aims as part of a regular product development process. On the other hand, the other two cases (Cases 3 and 4) show that many strategic questions may remain unanswered when firms take such a pragmatic approach.

DISCUSSION

The idea that increased knowledge about users leads to better design is implicit in much of the writing on user involvement (Hanna et al., 1995; Leadbeater, 2006). While not everyone would subscribe to such a simple interpretation explicitly, it is often assumed that raising companies' awareness of methods and approaches for user involvement will help them to get closer to users, to learn more about them, and hence to produce more successful innovations. If the exercises in user involvement do not appear to have been useful or to result in any changes, then the problem is attributed to the methods, and a call is raised for more sophisticated methods for user involvement.

Our experiences in promoting user involvement in SME innovation processes have highlighted some of the problems involved in such an objectivist perspective on user involvement. The interpretive and sensemaking processes that new knowledge and new

interactions give rise to in companies are too often considered unproblematic. From a sensemaking perspective (Weick, 1995), such processes involve reinterpreting what the company itself is, and enacting new user relationships. In our SME case studies, user testers helped to identify simple problems and hitches: things that anyone would have noticed—in many cases, even the product developers themselves. Yet it seems that having "real users" test the products made the feedback more urgent and provocative. This increased the company representatives' commitment to and accountability for the service prototype, which in turn provoked two types of slightly contradictory responses. The designers felt the need to defend their solutions, but they also felt urged to make improvements quickly. Interaction with users served to energize the product development process, to push it forward to the next stage, and to stimulate thoughts about the market launch of the product.

Thus it seems that user involvement can also be utilized in the context of action rationality, as defined by Brunsson (1985). When designing appropriate user involvement approaches for high-tech startup SMEs, it is important to understand that the companies are often highly committed to a narrow application of technology in which they have invested their work and their energies for years. At this stage, companies often are not interested in learning about the alternative visions of the user, and will often resist any fundamental critique of their chosen path. Larger companies can have more alternatives because they are not driven by such entrepreneurial action logic. They usually have multiple (even mutually competing) innovation projects, and are used to the idea that some projects are screened out and never materialize (Lichtenthaler et al., 2004; Product Development Institute, Inc., 2006).

In terms of organizational sensemaking, however, there was one fundamental similarity between the SME cases and our experiences with larger companies. Interaction between product developers and users was the most beneficial and important experience gained from the user involvement exercise. Much knowledge was transferred that is tacit by nature, and impossible to transcribe or report (see "sticky information"; von Hippel, 1998). This type of knowledge relates to key features of sensemaking: identity-construction, enactment, and plausibility (Weick, 1995). Accordingly, if firms wish to involve users, they should be prepared to involve themselves.

The cases also provide evidence on the more strategic-level limits to user involvement. The user involvement movement seems to assume a fundamental alignment between the users' and producers' interests. Our experiences (with both small and large companies) show that this is not always the case. Users can be more or less important for different kinds of companies and in different market situations. Companies, especially ones involved in disruptive innovations, can therefore disregard some user input for long-term strategic reasons (see Ivory, 2004).

Practitioners and researchers who wish to promote user involvement might draw two implications from this analysis. Better utilization of user involvement can be achieved by a better understanding of company-internal and company-external barriers to user involvement. In terms of internal factors, more attention should be devoted to the role of action rationality and sensemaking processes in integrating user inputs into product development. We have shown here which types of user input were helpful for SMEs developing interactive digital products. Other kinds of companies will likely have different needs.

In terms of external barriers, a close analysis of the nature of technological evolution and the competitive environment could help us identify situations in which user involvement is

more or less likely to be utilized. Our cases show that even though there may not be a fundamental gap between innovation-orientation and customer-orientation, there is no automatic alignment between these perspectives either. There may be genuine conflicts of interest between innovators and users, and user involvement will not make them go away. Thus, practitioners of user involvement may need to consider the broader circumstances in which they launch their interventions (see Kensing & Blomberg, 1998): Can they select contexts in which innovators' and users' interests are relatively easy to align, or can they change the innovators' operating environment through their interventions?

We thus conclude that the way the user involvement process is designed is important, and that different kinds of companies may benefit from different forms of user interaction. The SMEs in our study followed a distinct action rationality, leading to rapid implementation of some user inputs, and defensiveness toward others. By contrast, the larger companies in our prior studies were more open to user input yet less determined to implement it in product development. Yet good design of the user involvement exercise can promote, but not ensure, the implementation of users' suggestions and requirements. Firms also need to have an interest in implementation, and this depends on the competitive position of the company. Based on these findings, we have reconceptualized user involvement as a form of interaction between users and innovating companies that is facilitated and constrained by microsociological processes, on the one hand, and by market power and the competitive environment, on the other.

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Authors' Note

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All correspondence should be addressed to:
Eva Heiskanen
National Consumer Research Centre
P.O. Box 5
00531 Helsinki, Finland
eva.heiskanen@ncrc.fi

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eHEALTH SERVICES AND TECHNOLOGY: CHALLENGES FOR CO-DEVELOPMENT

Hannele Hyppönen
STAKES Unit of eHealth and eWelfare
National Research and Development Centre for Welfare and Health (STAKES)
Finland

Abstract: *The promises of ICT have been poorly redeemed in health care; many projects have failed. This article conceptualizes the co-construction of services and technologies in order to help future practitioners in the field to understand and find solutions to the challenges in ICT-enhanced service change. The conceptualization is created by structuring the findings of a case study with the help of theoretical concepts. The conceptualization then is implemented in another case to study its potential for finding challenges and suggesting solutions. Both cases demonstrate challenges for codevelopment that contributed to poor project outcomes. Participants in eHealth projects need a better understanding of development as the parallel shaping of multiple objects. They need better skills in managing the change process and a better understanding of methods for collaboration throughout the development. The projects would benefit from networking with actors who have adequate understanding of the process as a whole and of methods of codevelopment.*

Keywords: *eHealth, information technology, codevelopment, organizational learning.*

INTRODUCTION

Information and communication technologies (ICTs) have been seen as the current driver of economic development in Western countries (Freeman & Loucã, 2001). Social and health care constitutes an important factor in the national economy of welfare societies. Increases in national spending on health care due to rising demand for services has led governments over the last decade to turn to ICTs in the hope of rationalizing their health policies and improving the efficiency and quality of the services produced. Investments in health technologies are expected to bring benefits also to the societies at large, through enhanced productivity, economic growth, trade expansion, and increased competitiveness (Atun & Fizpatrick, 2005). For the citizens, equality, improvement in the quality of life, and support for disease prevention are promised:

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> eHealth applications have the potential to reduce costs, deliver healthcare services remotely and increase the efficiency of this delivery. Effective integration of eHealth applications and support services could improve citizens' quality of life of by enabling safer independent living and increased social inclusion. … eHealth provides access to health data that can promote healthier lifestyles and prevent disease. (Cabrera, Burgelman, Boden, da Costa, & Rodríguez, 2004 p. iv)

From the perspective of European Union, and using two Finnish studies as examples of European (and worldwide) eHealth development, the strategic, program, and financial steering has been strong for more than 10 years. Finnish national and European Union-level steering have pushed ahead the implementation of information systems and electronic patient data transfer in health care. Many projects have received considerable financing from EU research programs as well as from national sources. In Finland, the municipal autonomy in the development of services has lead to an array of various ICT solutions being adopted in different areas. Yet many projects have not produced anticipated outcomes (Hämäläinen & Hyppönen, 2006). The promises of ICT have been poorly redeemed, and the return on investment for health care organizations that have implemented ICT systems has been modest (Shekelle, Morton, & Keeler, 2006; see also Ministry of Social Affairs and Health, Finland, 2006). Among the difficulties experienced have been problems with the complexity of the implementation environment; a lack of focus on organizational transformation; a misalignment of interests, roles, and communication of social and technical partners, together with poor management of the entity of sociotechnical change; and a lack of usability and utility of the implemented technologies (see Clancy, 2005; Clarke, Hartswood, Procter, & Rouncefield, 2001; England, Stewart, & Walker, 2000; Gregory, 2000; Schoech, 2002).

McLaughlin, Rosen, Skinner, and Webster (1999) have concluded that technologies too often have been developed unconnected to the practices they were intended to improve. Work processes and technologies have been developed largely across different organizations having different professional orientations and interests, with actors using their field-specific tools, including concepts and models, to describe change (Ehn, 1992; Gregory, 2000; Kaulio, Karlsson, Rydenbrink, Dahlman, & Hallgren, 1995; Miettinen, Hyysalo, Lehenkari, & Hasu, 2003; Wood 1998). McLaughlin et al. (1999) have suggested a reason for this: a too simplistic notion of the interrelation of technology and work practices (see also Hyysalo, 2004).

There are similar experiences in the implementation of ICTs in health care in Finland. A ministry-led pilot project, the Macropilot, launched a nationwide 2-year implementation of the National eHealth Strategy in 1998 through numerous eHealth projects receiving approximately €4.5 million of national funding. The projects did not succeed in either developing eServices or generating new product development in IT companies. Cooperation between the social and health care services and technology providers remained weak (Ohtonen, 2002). Implementation of the National eHealth Strategy continued through new eHealth projects following an act issued in 2000 (laki sosiaali- ja terveydenhuollon saumattoman palveluketjun kokeilusta 22.9.2000/811; The Act on Experiments with Seamless Service Chains). The act extended the development of new health IT solutions and eHealth services to the whole country. A nationwide study was conducted in 2005, assessing the outcomes of these projects with respect to national goals (Hyppönen, Hämäläinen, Pajukoski, & Tenhunen, 2005). The results showed that the development had focused on

technologies, while little attention had been paid to re-engineering work processes. An in-depth case study analyzing the development of seamless elderly care services in one municipality revealed that there had been two major technology and 10 process re-engineering projects in 6 years, with little cooperation among them (Hyppönen, Saalasti-Koskinen, Perälä, & Saarikalle, 2005).

Those involved in these projects have done their own postmortems and learned important lessons. But the question remains regarding how to convince those who have not participated to develop systems in a more appropriate way. This article aims to produce a conceptualization of the co-construction of services and technologies that could help future practitioners in the field to understand the challenges in ICT-enhanced service change in order to find solutions to these challenges. This is done by a) conducting an in-depth analysis of an entire local eHealth innovation process from idea generation to an established eService provision, b) structuring the case study findings with the help of theoretical concepts from previous studies, c) applying the conceptualization in another case study (an ongoing project) to study its potential in the context of formative evaluation, that is, assessing the baseline status and the process of development and feeding the results back to the project managers for corrective action, and d) drawing conclusions on the challenges found in the projects with the help of the conceptualization, and discussing possible solutions to them.

CONCEPTS AND METHODOLOGY

Methodology and Methods of the Study

More rich, domain-specific accounts of both the technology and the organizational/economic environment in which it is implemented have been called for in innovation and technology assessment studies (Miettinen, 2006; Shekelle et al., 2006). In line with these demands, this study consists of two theoretically informed in-depth case studies. The empirical findings from Case I were reflected against existing theoretical conceptualizations (elaborated in the next section) and discussed with Case I participants to create an abstraction of the findings. This conceptualization was further used to abstract the findings from Case II. The findings from Case II were then discussed with the Case II project participants to help refine the conceptualization as well as to support the ongoing development project. The research design is illustrated in Figure 1.

The interrelation between the change of work practices and the development and implementation of technology is complex. This complexity sets the requirements for the data collection as well as for conceptual tools within which to structure the data. Some conceptual tools were found in the existing literature, but an existing, ready-made theoretical framework covering the entire sociotechnical innovation process was not found. Abandoning the existing theoretical concepts and adopting a purely inductive methodology—for example, phenomenography or grounded theory—was not an option since the study did not start purely from the empirical data: Theories were used in the data collection and as well as in the analysis. The same applied for purely deductive methodologies. According to Grönfors (1985), a deductive approach can make it difficult to interpret unexpected data. The methodology used in

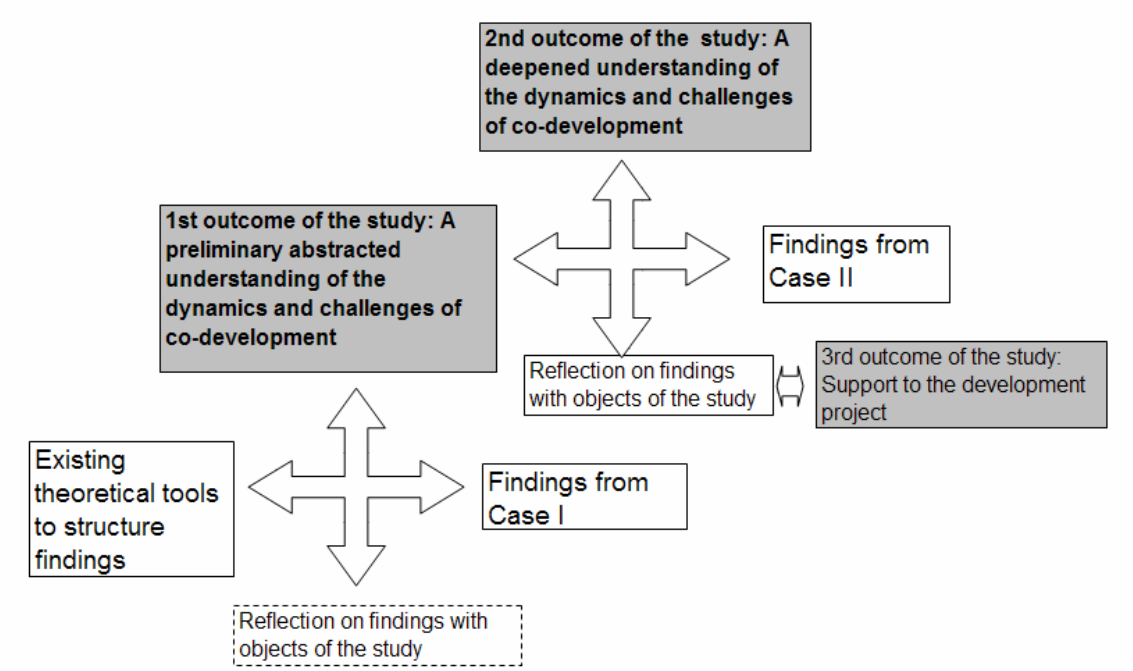

Figure 1. The design of the study. Findings from Case Study I were structured with help of the existing theoretical tools. The structured results were discussed with the informants. The outcome was a preliminary abstracted understanding of the dynamics and challenges of codevelopment of eServices and technologies in Case I. This understanding was further exploited to structure findings from Case Study II. The structured findings from Case II were discussed with the project participants and offered to the project in order to support the project work. The validated findings were also used to deepen the preliminary understanding of the dynamics and challenges of codevelopment of eServices and technologies.

this study can thus best be described as *abductive* (Grönfors, 1985; see also Thagard & Shelley, 1997): Some theoretical concepts and models were used as a sensitizing framework to direct data collection and analysis. The data collection and analysis proceeded as a dialogue between the concepts and empirical data, in which both affected each other.

Case Study I was partly retrospective in nature. The data about the origins of the innovation in 1994 and 1995, its construction in 1996, and its implementation in 1997 and 1998 were historical, consisting of documents (project plans, minutes, reports, letters, and other documents) and after-the-fact interviews with the key stakeholders in the project and service networks. Historical data were collected on the baseline status and the needs of the service activity, as well as the development of the service during the technology project. The historical data about the technology project focused on the innovators, idea generation, enrollment, activities, actions and operations of various stakeholders, the roles and cooperation between them, the tools used, and the different viewpoints of the development activity and disruptions to it. The development project had ended 2 years prior to the data collection for this study, which started in the year 2000. The first data collected in 2000 were empirical, focusing on the established use of the innovative, award-winning eService model that had been developed and piloted during the project. Historical data were collected after

this to study the needs for the innovation and its construction. Empirical data (i.e., data about the current eService model) included ethnographic participatory observation of the current and ongoing application of the eService, artifacts, and interviews with service providers and clients. Altogether, the key data in Case Study I consisted of historical interviews with 11 people, ethnographic interviews with 23 people, and 140 selected historical documents. The ethnographic data consisted of notes from one week of participatory observation, during which key events of the service provision in action were also videotaped for detailed analysis, and of artifacts (e.g., shopping lists and Internet shop interface printouts).

Case Study II was an ongoing project when the data collection started in 2004. The new tools or practices had not yet been implemented into the service practice when the study was initiated. Videotaped ethnographic observations were conducted of the preimplementation prescribing service status in three out of the four health care clinics that were to pilot the system (a North-Karelian central hospital, a Turku health center, and a Kotka occupational health unit), as well as two dispensing pharmacies, one cooperating with the North-Karelian and one with Kotka clinic. In the preimplementation stage, 16 workers (an equal number of doctors and pharmacists) were observed for 3 days while they were prescribing or dispensing medication, and then interviewed (see rapid ethnography, Bauersfeld & Halgen, 1996). Postimplementation observation of the practices and related interviews with the same individuals were conducted in 2005 in the first pilot organization that had managed to implement the integrated system (North-Karelia hospital) and in 2006 in the second area that implemented the system (Kotka occupational health unit and a pharmacy). Due to the scale of the project (a national pilot), questionnaires were also used to study the pre- and postimplementation service status and development needs in the pilot areas. The questionnaires were directed to doctors and pharmacists who worked in the piloting organizations and were selected to participate in the pilot. Altogether 74 questionnaires were sent in the preimplementation stage (response rate 50%) and 94 in postimplementation stage (response rate 50%). Also in 2006, a patient questionnaire was sent for all those patients in the national database who had been dispensed an electronic prescription (94 patients, of whom 54% responded).

Data about the origins of the innovation in Case II and the innovation construction process were collected from 132 project documents and 28 interviews with the key participants in the project. These data were partially historical, reaching back to the year 1999. Participant observation was conducted on the decision-making processes in the monthly project group meetings during 2004 and 2005. The analysis of needs of the network of actors participating in the service provision and contradictions found between the service and rules development activities were used as monthly feedback for the project group to be discussed and used in the decision making (see Westbrook & Gosling, 2002, p. 8). The initial analysis of the data in both cases was inductive in nature (open coding). Theoretical concepts were used in the second coding round (axial coding) to structure the analysis.

Theoretical Tools for Structuring the Change

Research on innovation and sociotechnical change has been conducted in various fields, including engineering, organizational sciences, history, economics, sociology, and psychology. Grudin (1990) has studied the evolution of the focus of information systems design since the 1950s. He found a continuous outward movement in the focus of the studies

from inside the computer to the interaction with the user (interface design) and work practices in organizational contexts. This expansion has required the simultaneous expansion of the expertise of the practitioners. Grudin (1990) shows the evolution of the disciplines involved from electrical engineering, to computer science, to human factors, to cognitive and social sciences and anthropology. Research methods have evolved from laboratory experiments to ethnographic studies to contextual participatory methods (see also Bødker, Kensing, & Simonsen, 2004; Ehn, 1992; Greenbaum & Kyng, 1991; Kyng, 1998).

The demand for multidisciplinary research has been recognized also in the studies on organizational development. According to Eason, Harker, & Olphert (1996), it is widely accepted that effectively implementing new technology in organizations requires the integration of both technical and social developments within the system, as well as the participation of key stakeholders in this change. The high failure rate of ICT applications in organizations is mostly due to a lack of attention to organizational issues. In their review of the available methods for studying sociotechnical system opportunities early in the design process, these authors concluded, "There is a paucity of methods to help in creation of integrated solutions… [and] "the examination of organizational and human issues must take place before technical investments are made, if they are to have real influence over the design of the technical system" (Eason et al., 1996, p. 402).

In order to conceptualize the entity of the sociotechnical development in Case Study I, theoretical concepts were needed that have been used in studies of technology as well as social change. This search led to studies using *cultural-historical activity theory* (AT). Three AT-based concepts or models were used in this study as the main heuristic tools to structure and conceptualize the findings: a) network of activity systems, b) multivocality and contradiction, and c) cycle of expansive learning. AT has been used to explore *networks of interacting activity systems* (Engeström & Escalante, 1996). Social and health care services are typically produced in collaboration with the client and often several institutions' professionals. This network is directly influenced by the financiers (e.g., the municipality), tools providers (research and technology organizations), and rules providers (e.g., legislators). In this study, the concept of a network of activity systems was used to conceptualize the activity and interrelation of actors participating in the production and development of the service to be developed within the eHealth project. Figure 2 shows the network of activity systems modified from Engeström (1987, p. 89; 1995, p. 54).

An *activity system* has been used to conceptualize the activity of each of the (institutional) actors participating in the network. AT sees human activity as a practice mediated by culturally evolved tools and artifacts. Human activity is also seen as a social, hierarchical practice, consisting of object-oriented activity of a community and goal-oriented actions and operations of individuals. Tasks (actions), divided among individuals, support the overall objectives of activity. Activity is influenced by different, culturally evolving rules and norms. When any of the elements changes (e.g., new tools are introduced into an activity system), this can impact other elements and processes of the activity (Engeström, 1987, 1995).

The concepts of *multivocality* and *contradiction* were used to conceptualize the needs for development of the networked service depicted in Figure 2. According to AT, all stakeholders bring with them their voice, that is, their interests and conceptions of the object

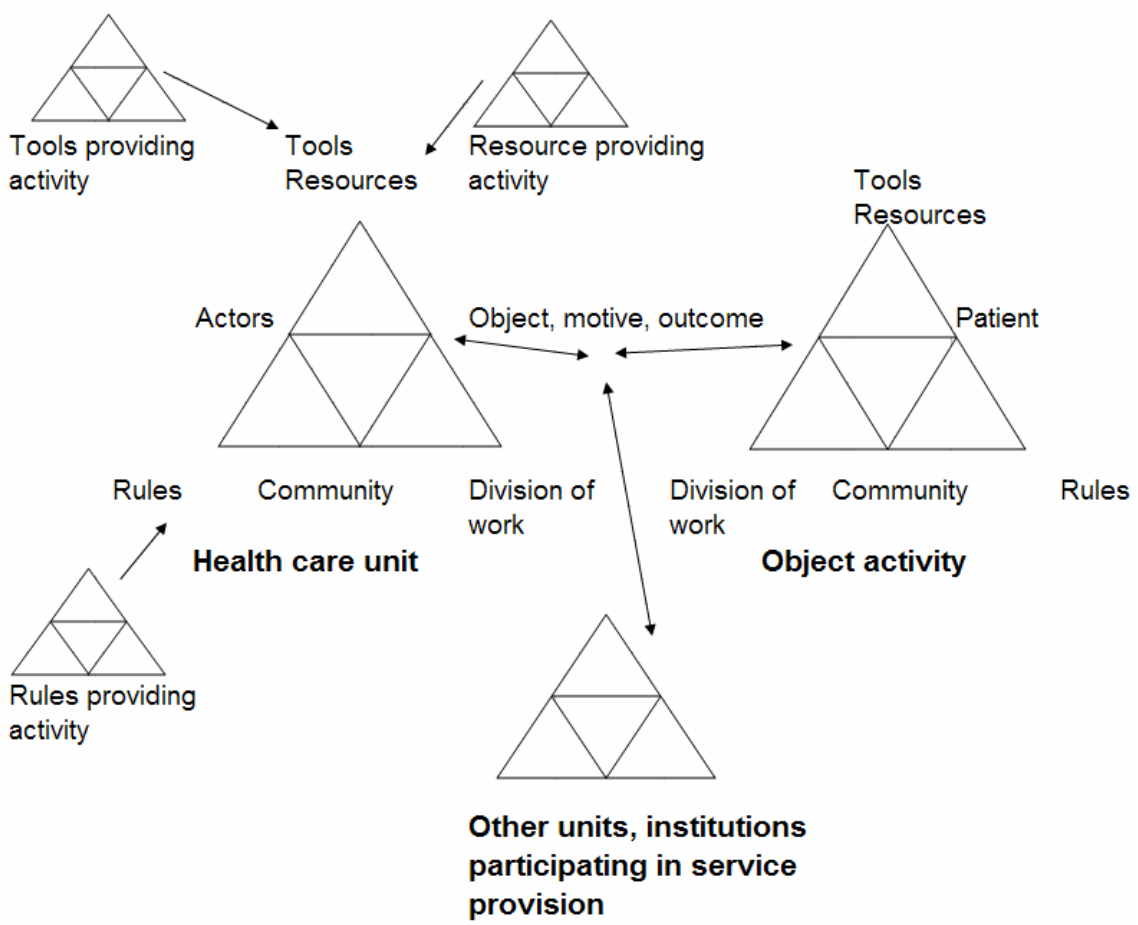

Figure 2. A network of activity systems as a conceptualization of the service activity to be developed (based on Engeström 1987, p. 78, 88; Engeström 1995 p. 47, 54, 55; used with permission). The health care unit is the central activity system, the viewpoint of which is taken to study the development. The actors are the workers providing the service to be studied. The object activity consists of the activity systems of the clients needing the care and medical services. The object of the activity is the common target of the actors' actions (e.g. a client's health problem) and the motive is why the activity is performed (e.g. to cure or prevent citizen's health problems). Different tools (concepts, artifacts, methods, and principles) are used by the actors to mediate interaction between themselves and their object, within the resources allocated for the service provision. The rules mediate the interaction between the community and the actors, and the division of work mediates the interaction between the community and the object. The other units (or, in fact, organizations) participating in the service are those with which the health care unit cooperates in order to work on the same object. These organizations can be depicted as similar activity systems with their own actors, tools, rules, communities and motives.

and its development in the network. The concept of multivocality therefore helps in directing attention to the different actors' varying interests, motives, and tools (including concrete technologies, knowledge, resources, and languages) for shaping the object (see also Miettinen 1999; Miettinen et al., 2003). According to AT, the transformation or change of an activity is triggered by contradictions. In activity-theoretical analyses, contradictions can refer to disruptions within or between the elements of an activity system, between whole activity

systems, or between an old and new service activity. Mismatches between the different voices are examples of manifestations of contradictions between activity systems in the network (Engeström, 1987).

A model depicting the gradual development of this network and its object/outcome through identifying and solving the contradictions through the *cycle of expansive learning* has been used within developmental work research to analyze and support the change (Engeström, 1987, p. 189; Engeström, 1995, p. 92). The model (see Figure 3) provided a conceptualization of the change process for this study. The development starts by an analysis of the existing model of (service) activity, which is conceptualized with help of the network of activity systems. The development is triggered by needs, the analysis of which is conceptualized by using the concepts of multivocality and contradiction. The cycle proceeds through the search for solutions to meet the needs and constructing a new model of (service) activity and tools for it. The new model of activity and its tools are conceptualized with help of the (changed) *network of activity systems*. These are implemented in practice. The final phase of the cycle is establishing and evaluation of the new model and its tools by comparing the old and new models of activity (see also Hyppönen, 2004).

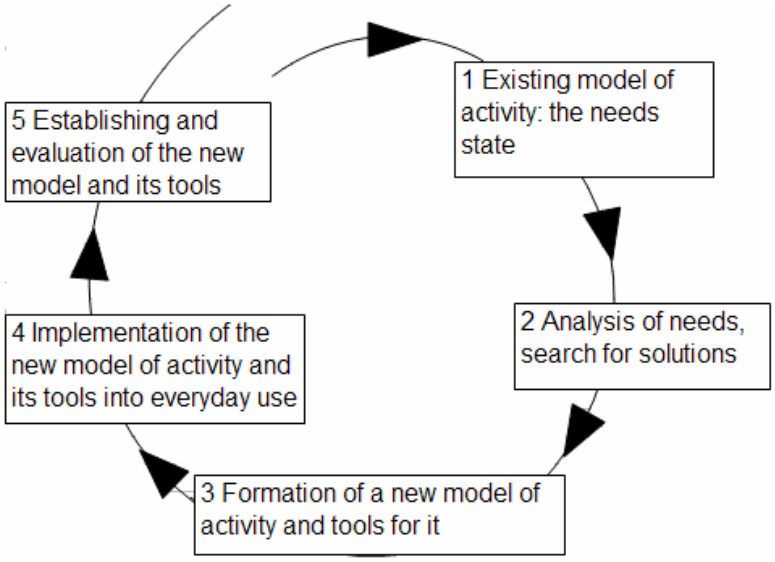

Figure 3. The model of expansive learning (based on Engeström 1987, 189; Engeström 1995, 92, 128). The line with arrows illustrates an open development and learning cycle of an activity (see Figure 2). The cycle leads to a qualitative change in the activity. The development is triggered by problems and challenges experienced by the actors in the current or existing service activity. (Box 1 illustrates this first phase of development.) Actors need to analyze the key conflicts in their activity in order to find solutions to them (Box 2). After this, a new model of activity and tools to support it can be constructed (Box 3). A new model is not just a set of corrections, but a qualitatively new way of defining the object and motive of work and related tools and division of work. The implementation and incorporation of the new practices into everyday use is depicted in Box 4. In this phase there can be contradictions between the old and new model of activity (change resistance), which is overcome by solving the contradictions. Box 5 illustrates transition into a phase, where the new practices are established into use and evaluated, leading gradually to the next cycle of development.

Activity theory has been used as a framework for enhancing design practices in computer-supported collective work (CSCW; Kling 1991; Kuutti & Arvonen, 1992; Redmiles, 2002), as well as the related fields of human-computer interaction (HCI), and information systems (IS; Bertelsen & Bødker, 2000; Bødker, 1991; Kuutti, 1991; 1995; Nardi, 1996). Use in social studies of health care technologies include studies of, for example, electronic health records (Gregory, 2000), diabetes programs (Hyysalo & Lehenkari, 2003), a neuromagnetometer (Hasu, 2001), and an automatic health care alarm system (Hyysalo, 2004). Applications in developmental work research and expansive learning include studies of the development of primary care work (Launis, Simoila, Saarelma, Punamäki, & Engeström, 1991; Saarelma, Launis, & Simoila 1994), specialized care (Kajamaa, 2005), occupational health (Engeström, 2003), and the development of joint work practices between primary and specialized care (Engeström, Engeström, & Kerosuo, 2003; Vähäaho, 1999).

Embedded in the model of expansive learning is an idea that the development is triggered by contradictions in the network and it proceeds by solving these problems. However, in both cases analyzed in this study, the actors who generated the ideas for (service) development and the new eService concepts as solutions to problems in the service activity were mainly different from those participating in provision of the service developed. Thus the (ICT) project networks were largely external to and independent of the service provider's networks (the networks of the potential users of the technologies). In either case, further understanding the interrelations between these two networks was needed. It has been suggested that the network conceptualizations of actor network theory (ANT) could be used to expand the AT network conceptualizations (Miettinen, 1999; see also Lehenkari, 2006). Studies applying ANT and AT in the analysis of innovations (Hasu, 2001; Hyysalo, 2004; Miettinen, 1999) offered a basis for reflection and further elaboration of the conceptual framework. For this study, Callon's ideas on the co-construction of the object and actor network with the concepts of innovator, enrollment, and translation of interests (Callon, 1986a, 1986b; Law & Callon, 1992) provided useful heuristic tools. These concepts helped to detect the shifts of control between the service provider's network and the ICT project network in both of the cases in this study during the different phases of development.

There are potential conceptual conflicts when combining AT and ANT, which Miettinen (1998) has analyzed. Both are interested in the simultaneous development process of an artifact and a network of actors connected to it: the shaping and being shaped of the social and material. However, ANT has adopted a principle of generalized symmetry in order to surpass the juxtaposition between the subject and object. The notion of the actor in ANT refers thus to both humans and artifacts (Callon 1986a). In this respect, the present study adopted an activity-theoretical approach. In AT, the subjects (humans) and the objects (technology, the law, etc.) do not possess a symmetrical position. This follows from a notion of object-oriented historically developing activity, which is mediated by cultural signs, tools and artifacts (Vygotsky, 1979, p. 54). The orientation of the activity of subjects (human actors) towards an object to be shaped is the key principle.

The empirical findings of Case Study I and II are presented in the next sections. The different phases of the development are numbered in the text with the headings "Phase 1" to "Phase 4" to follow the phases of expansive learning depicted in Figure 3.

CASE STUDY I: CONSTRUCTION OF A MODEL FOR STUDYING CODEVELOPMENT OF SERVICE AND TECHNOLOGY

The objectives of Case Study 1 were a) to provide an in-depth study of a sociotechnical innovation process in health care from the idea generation phase through to established use, and b) to structure the findings with help of conceptual tools in order to generate a conceptualization of the process of codevelopment of the eHealth service and technology.

An eHealth project was selected that had developed award-winning Internet-based service innovations (Internet shopping and Internet counseling) for home-care in one Social and Health Care Office in the Helsinki area. The project was part of a larger EU Telematics Applications Programme project (1994-1998). The aim of the Finnish subproject was to demonstrate the applicability of information and communication technologies in home-care and home nursing services. The project was completed 2 years before my study was initiated in 2000, which made the longer-term impacts visible for study and analysis. In the following, I analyze the development following the phases in the model of expansive learning (Figure 3).

Findings

Phase 1: The Needs State

In 1994, two researchers in the social and health care research institute began to innovate an ICT project, which later became a subproject in an EU project. Both individuals had expertise in medical informatics and service accessibility, which they wanted to exploit. They shared an interest in seeing how modern information technologies could be used to develop home-care services, as well as an interest in participating in EU-supported activities. Early on, they viewed Internet shopping as one possible application. The researchers enrolled the city planning office to obtain the municipality's support required for joining an EU proposal with a national substudy. The city planning office also was interested in the possibilities of the Internet and joined the researchers in drafting a project plan. The city's participating officer saw the project as an opportunity to use modern technology to improve the image of a particular city suburb that was developing into a problematic neighborhood. The city planning office had good cooperation with a teleoperator, a software company, and a hardware supplier, for whom the city was a big client. These technical partners joined the network in order to serve an established client. They also had products that they wanted to sell with help of the project. The city planning office finally offered the project to the social services office at the finalizing stage of preparing the project proposal. The social services office manager agreed, becoming the representative of the service network in the ICT project group. The office manager saw the ICT project as an opportunity to reallocate part of the increasing workload of the home-care workers to private subcontractors. To care for an increasing number of clients, the office had received some extra funding (resources) from the municipality for buying services from subcontractors, but not for increasing their own service production. Altogether, the office listed seven services where ICTs could be implemented, of which all but two were abandoned prior to or soon after the clinical trials started. Of these, the eShopping application addressed a specific problem: that of caring for an increasing

number of clients without increasing the number of agency's staff. The needs states for the other ICT applications were not so well defined, but rather were motivated by a general wish to see how ICTs could be applied in home care. Home-care shopping and home-care counseling were the only two services where the electronic applications remained in use after the project ended. The development of the eShopping service is addressed here in more detail.

Phase 2: Analysis of the Needs, Search for Solutions

The preimplementation network of the service activity systems (see Figure 2) consisted of three primary actors: the home-care workers employed by the social services office, their clients, and the local shops. The home-care worker made the grocery list together with the client, or picked it up from the client's home, and purchased the groceries. Sometimes the worker went to the shop with the client as part of the rehabilitation. Prior to implementing the Internet shopping application, tools used in this activity were the shop advertisements, workers' knowledge of shop products and clients' preferences, and the handwritten grocery lists. According to a client survey, home-care clients were very satisfied with the assistance they received from the social services office in terms of grocery shopping.

The home-care workers, clients, and local shopkeepers had not participated in planning of the project. The interests of some of the actors (the users) or inherent contradictions of the shopping assistance service were not analyzed to inform the decision-making about the solutions. No alternative solutions were sought for the problems experienced by the office manager. A year after the project had started, and when the Internet shop application was nearly ready to be implemented, it was calculated that each shop visit took an average of 1.5 hours of a worker's time, which added up to two person-years at the office level. If two years of work time could be saved with help of ICT, the saved time could be allocated for the care of several new clients. There was still no knowledge at that time about the competence and motivation of the clients and shops to implement the solution.

Phase 3: Creation of a New eService Model and Implementation Tools

The software provider in the ICT project had an Internet shopping application that the project planners believed local shops would be eager to implement as part of improving their service. In the eService model envisioned by the ICT project group, home-care clients would order groceries directly from the shop via the Internet from their home computers, and the shop would deliver the order to the client. The model would eliminate up to two person-years' time of the home-care workers currently used in manually providing such a service. The hardware provider would provide the equipment and the teleoperator the network connection. The project network operated for nearly a year to develop the technology for this envisioned service model.

When implementing the model, it became evident in practice that the envisioned service model in fact could not be realized: The shops were not interested in selling their products over the Internet and the clients, and even some home-care workers, were unable to use the technology. After many difficulties, the social services office managed to negotiate a partial deal with one shopkeeper. The store was willing to give its product data to the Web service maintained by the software provider. However, the shop did not want to receive shopping lists via the Internet nor to collect and deliver the groceries. The social services office

enrolled a delivery company to collect and deliver groceries. Yet, this delivery company did not want to receive the lists directly from the clients by phone or the Internet. Many clients were not willing or able to use the computer or Internet for ordering groceries. The only option left for the social services office was to designate one of the home-care workers to receive clients' shopping lists by phone, enter the data into the Web shopping application on behalf of the clients, and send the information over the Internet to the delivery company.

Phase 4: Implementation and Diffusion of the New eService Model

Receiving and mediating clients' shopping lists became a major part of one home-care worker's work. The Web shopping application was not designed to be used over the telephone in real time since it had thousands of products with poor search functions. The office worker ended up writing the clients' lists by hand on paper. After the phone call, she entered the data into the Web application. The service providers tried to make the best of the technologies, but the real needs of the actors participating in the eService provision did not coincide with features of the technologies. Feedback from the service providers to develop the software came so late that new developments could not be started within the project time frame. At the end of the project, the software company did not continue the innovation process in cooperation with service providers, due to the poor outlook on getting a return on their investments. They had no interest in redesigning the application. The shop had no interest in updating the product list, and the social services office had no interest in the double work. In spite of much effort put in the development, the social services office had to give up on the Internet application about a year after the project ended. After this, clients' telephone-generated shopping lists were written by hand directly onto fax sheets, and then faxed to the delivery company. The Internet technology was abandoned, but the service model that was created to use it remained. The new eService model did not spread in the organization.

Phase 5: Establishing and Evaluating the New Model of Activity and Its Tools

The fax-based shopping model ultimately established in the social services office did help to outsource part of the home care workers work to the delivery company, but other objectives and expectations set for the project were not met: to rationalize work, cut costs, and improve the quality of the service. From the social services office perspective, the idea of saving two person-years had turned into using one person-year on the phone and securing the other person-year from the private delivery company. By reducing the frequency of the service from 5 to 2 days per week, further resources could be saved and used for the care of new clients. The new IT-based service model revealed further needs to develop other aspects of the shopping service, such as tools and rules for assessing clients' needs and calculating service costs. These impacts had not been anticipated.

From the perspective of home-care clients, the service quality was reduced radically. Apart from the shopping frequency being reduced from daily to two times per week, the transferring of shopping lists via phone and hand-written faxes caused many misunderstandings. Clients' knowledge about the shop products diminished when they or their caregivers no longer visited the shop. Many clients also had difficulties in using the phone to order the groceries. The service operated inflexibly, serving primarily the needs of the

delivery company (to do the round as quickly as possible to make the service economically feasible). Clients had difficulties in matching the arrival time of groceries, the arrival time of the home-care worker, the timetables of other services, and their own everyday schedules.

Case I Conclusions: Codevelopment of Service and Technology Structured with the Conceptual Tools

Case Study I illustrated the ill fate of a technology-led implementation project. The service-providing network and the technology-oriented ICT project network remained mainly as two separate networks, with distinct objects of development and little collaboration. One cycle of expansive learning (see Figure 3) did not seem sufficient to depict the totality of the development. As depicted in Figure 4, two cycles were required: one depicting the development cycle of the shopping service (the larger cycle) and another one depicting the development cycle of the electronic application planned to be implemented in the service (the smaller). How these two cycles and actors within them interacted—or, rather, did not interact—became the main focus of interest in Case Study I.

The (ICT) project network that focused on developing the electronic applications was in control of the development until it was time to implement the eService application. The control is depicted by a solid line in the ICT applications development cycle. A broken line in the service development cycle in phases 1-3.1 illustrates the lack of participation of the actors in the service-providing network in shaping the ICTs and the eService concept to be implemented. When the implementation efforts failed, the control shifted towards the service network. The networks cooperated for a short time in order to create a solution that could be piloted. This is depicted by the solid lines of both cycles between phases 3.1-3.2. Once the solution had been created, the main control shifted to the service network (solid line). The project network trained the users, but the service network was left to incorporate the application into everyday use, develop alternative ways to make best of it, and give feedback to the project network. The project network did not update the technology to accommodate for the use realities (broken line), and the project cycle ended without the created technologies becoming established into use.

The lack of adequate collaboration early in the project and again in the implementation phase made it difficult for the networks to learn from each other. The ICT project network acted as the innovator. In Phase 1, the project network's view about the actual service activity and the needs within remained vague. Analysis of the old model of service provision was not done to provide the baseline information about the system and preconditions for its change. In Phase 2, an analysis of the actual contradictions in the service provision to find the development needs was not performed. The conflicting interests and needs were not found to inform solutions to be selected. The project network's view of the problems, needs, and conceptions of the different users was dictated by the technology available through the technical partners rather than being user focused. The lack of information exchange between the networks and the partially contradicting views about the needs and solutions within the service network (of which the project network was not aware until late in the development) is illustrated with the lightning arrows in Phases 1 and 2. The construction of the new eService model and technical solutions to support it was done by the project network. It was not grounded

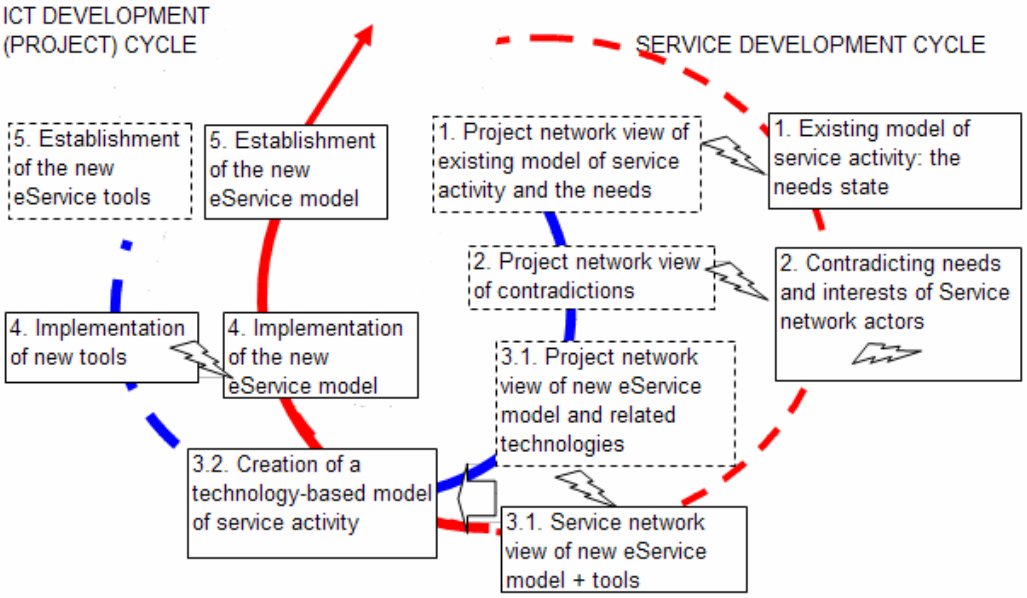

Figure 4. Codevelopment of services and technology in Case I, structured with help of the model of expansive learning (cf. Figure 3). The larger cycle (red) depicts the phases of development and expansive learning within the shopping assistance service. The key actors were home care staff, clients, and local shops. The smaller cycle (blue) depicts the phases of development of the new tools for the shopping assistance and expansive learning within the tools developers (the ICT project group). This group consisted of technology providers, researchers, the city council, and the manager of the social services office. The project group acted as innovators and leaders of the development. In each of the phases, there were problems the collaboration between the two groups of actors due to inadequate information transfer between them, depicted by the lightning arrows. Weak influence of the service providers on the tools development in phases 1-3.1 is illustrated as a broken line of the service development cycle during these phases. Weak input of the tools developers in Phase 4 (lack of updating and further developing the tools) is illustrated as a broken line of the ICT development cycle during these phases. Abandoning the ICT-based tools in the service is depicted by ending of the ICT development cycle before Phase 5.

in the needs, interests, and possibilities of the service network (the network of users). This became evident only when the project network model was to be implemented. The mismatch between the project network view and the view of the user network (of which the project was not aware at this phase) is illustrated by the lightning arrow in Phase 3.1. When the project network became aware of the mismatch, a new eService model was constructed with help of the service network. The eService model was redesigned, but the technology was not: It had been developed for the previous, unrealistic eService model. The mismatch between the piloted eService model and the technology implemented was realized during the piloting by the service providers. The mismatch is represented by a lightning arrow in Phase 4. The feedback was given to the technology providers, but they had no interest in updating the technology when the pilot ended, whereby it was abandoned. This is represented by the broken line at the end of the technology development cycle. An eService model was established, but the Internet technology designed to support it was not.

Prior studies have shown the need for cooperation of all network actors at early stages: Technology providers or IT researchers are not experts on everyday service provisions, with

their problems and challenges, nor on the planning and development of social and health care services. These are not the technology providers' core tasks. Service providers are not experts in the opportunities that technologies can offer (see also Eason et al., 1996; Schoech, 2002). Better cooperative planning between the project network and the service network from the start could have helped the project to ground the development of IT to the actual needs of the service network. Using effective methods for collaboration in analyzing user needs and selecting solutions could have helped the project to codesign the new eService model and IT to support it (Eason et al., 1996; Gregory, 2000; Hasu, 2001; Lyons & Kearns, 1997).

Previous research also shows the lengthy and demanding process of technology implementation, during which the technology and its use are reformed (Hasu, 2001; McLaughlin et al., 1999). At best, the cooperation will provide a continuous forum for improvement of technology and its use (Victor & Boynton, 1998). The technological development in Case I did not reach this state. Improving the implementation results could have been attempted by allowing time for the collection of feedback from users and an iteration of the service model and technologies to fit the needs of different stakeholders. This would have required commitment of the key project network stakeholders after the EU project had ended.

On the basis of Case I results, four questions about the co-construction of technology and eService could be formulated that proved important in determining the outcome of the development:

- Phase 1: Which and whose problems and needs is the eService development based on?
- Phase 2: How are the alternative solutions defined and by whom?
- Phase 3: How are the service and technology defined as objects of development and thus co-constructed?
- Phases 4-5: How does the co-construction continue after implementation?

In the next section, the conceptualization created in Case I is implemented in another eHealth project (Case II) in order to study the practical value of the conceptualization in the context of formative evaluation. Case II was an ongoing case where the conceptualization was used to produce information and feed it back to the project managers for corrective action during the development project.

CASE STUDY II: EVALUATION OF A NATIONAL ePRESCRIBING PILOT

The Finnish Ministry of Social Affairs and Health (STM) initiated a national ePrescribing project in 2000. The project was one of four strategic projects of the STM in implementing the National eHealth Strategy (Ministry of Social Affairs and Health, Finland [STM], 1995, 2006). The project developed and piloted a national concept for ePrescribing in Finland from 2000 to 2006, which was implemented in four pilot organizations and surrounding pharmacies in Finland. The piloting was arranged to guide the decision-making about the national implementation of the service and related ePrescribing legislation.

At the end of 2003, the STM called for an evaluation of the pilot project through its research and development organization, the National Research and Development Centre for Welfare and Health (STAKES). The aim of the evaluation was to help direct the project work

and to conduct interdisciplinary analysis of the outcomes of the pilot to inform the permanent legislation to be formulated (Hyppönen et al., 2006).

Findings

Phase 1: The Needs State

Since the late 1980s, there have been many local trials in Finland to test different technologies for transferring medical prescriptions electronically from doctors' offices to pharmacies. Most of these projects were initiated by technology providers. In 2000 the STM established a high-level project to collect experiences on the early trials, to list the stakeholders' needs, and to draft a concept for a nationally unified ePrescribing system. Representatives from all of the key governmental regulatory and administrative bodies and national pharmacy and doctors' associations were invited to the project group, together with a representative from two hospital districts. Patients and technology providers were not represented in the high-level project group.

The high-level group met several times in 2001 to define the needs, select a solution, and to draft a new, national IT-based prescribing concept. The group collected data from experts, visited three health centers or hospitals, sent a questionnaire to patient information systems providers, and arranged a working seminar for systems providers to inform the decision making. The group reported on normative requirements for ePrescribing, presented flow charts of work processes, listed the problems of the current system for different stakeholders, and envisioned benefits and risks from ePrescribing. Alternative concepts for ePrescribing were presented with conclusions for the model to be piloted in Finland. The report provided a good but still quite general basis for the development.

Phase 2: Analysis of the Needs, Search for Solutions

The high-level group report described the needs and a suggested a solution. In 2002 the STM asked the high-level group (henceforth, the high-level steering group) to continue to arrange and steer the piloting of the described system. Four regions were selected to implement the system for clinical piloting. Each district was to organize the local pilot at their own expense, and the high-level steering group was to steer and coordinate the development. The STM wished to keep the organization as light as possible to facilitate fast implementation and piloting of the system during 2003. It was seen as a straight-forward technology implementation exercise. The STM issued an experimental decree on ePrescribing in 2003, under which the clinical piloting could be done.

The four local piloting networks consisted of a health care unit or a hospital clinic, their patients, a couple of local pharmacies, and the local social insurance institution office. Each of the health care organizations used a different legacy system (Electronic Patient Record, EPR). The pharmacies used two different pharmacy systems. Each health care organization operated in a different health care sector (different fields of specialized care, primary care, or occupational health), with a different emphasis on prescribing activity. None of the pilot areas had done an analysis of their concrete prescribing activity, its challenges, preconditions

for change, and needs for its development. They justified their interest in participation with a need to "be at the forefront of ICT development."

One representative from each of the four regional pilots was invited into the high-level steering group. All four regional representatives came from the piloting health care organization. The four local representatives thus had to speak not only for their own organization but also for their clients, their technology providers, the local pharmacies, and the local social insurance institution office.

Phase 3: Creation of a New eService Model and Tools for It—Specification Round 1, with Stand-alone Prescribing and Dispensing Programs

The original idea was to test the technical feasibility of the suggested concept within a year. Since the EPR-integration would take time, the high-level steering group decided to pilot the concept with a stand-alone ePrescription authoring and dispensing program. It was completely separate from the practitioners' existing EPR and pharmacy systems, pharmaceuticals databases, and other tools that the users had for creating prescriptions and in dispensing the medication. The high-level steering group was the only forum where common requirements for the system rising from regulations, different technologies, and varying stakeholders needs could be generated. The steering group ended up wearing two hats: It made strategic decisions as well as acted as a national project group defining and redefining specifications for the different system elements and functionalities. Participants had different viewpoints in realizing the different functions, which slowed down the decision making. The problematic dual role of the steering group was frequently questioned by practitioners. The work was reorganized in 2005, but this did not bring the end users and the technology developers into closer collaboration.

Laboratory testing of the stand-alone prescribing and dispensing programs and the national database was initiated in 2003. Very soon after the first laboratory tests, the pilot areas reported that the stand-alone system would slow down the work too much, and the doctors were not willing to implement it in a clinical setting. Any ePrescribing system was required to be integrated with the pilot organizations' EPR-systems.

Phases 3 and 4: Specification Round 2, with Integrated ePrescribing Systems and Their Piloting

When the clinical implementation was delayed, the pilot period was extended by extending the pilot decree twice: first to the end of 2005 and later to the end of 2007. The integration of ePrescribing functionalities into four different EPR and two pharmacy systems took time. The integration took place separately in each of the local pilot areas. The EPR technology providers did not participate in the high-level steering group. There was also no common project group to harmonize the development of the different legacy systems and to implement the commonly defined requirements.

The city of Joensuu was the first site to start the clinical trial with the integrated EPR system and a stand-alone pharmacy program, in May 2004. The second site, Helsinki, started with its stand-alone authoring and pharmacy programs in October 2004. The third site, Kotka, started with an integrated EPR and pharmacy system in June 2005. The fourth site, Turku, had

not started by June 2006, when the management group decided to end the clinical piloting of the system. By that time, Helsinki had stopped the piloting due to lack of interest of clients and doctors, and Joensuu suffered equally from a lack of interest by clients and doctors, resulting in practically no use of the system. Only in Kotka had the system spread from one occupational clinic (3 doctors) to all clinics (11 doctors) and all pharmacies in the area. However, the efforts to spread the system to a municipal health center had failed. As a result, clinical use of the pilot system was very modest. In 18 months, fewer than 1,000 ePrescriptions had been sent to the database, many of which were for test purposes rather than for patients.

Phase 5: Evaluation of the Implemented Systems, Specification of the National Legislation

At the end of 2005 the high-level steering group was replaced by a high-level management group and several subgroups to draft national requirements, cost-benefit estimates, and legislation for the national system. A consulting company was hired to draft a dissemination plan and to lead the practical work of preparing the national dissemination of the system. In June 2006, the management group concentrated all of the remaining resources on planning the national implementation, and the local pilots were stopped without the system becoming established in any of the pilot areas. With the end of the clinical piloting, the development in pilot organizations seized in Phase 4. The development of the rules and a national level tools (the prescriptions database) has continued to pave way for nationwide diffusion and establishement of the system. The act on ePrescribing was issued on February 2, 2007. The act entered into force on April 1, 2007, allowing a 4-year transition period. Following the transition period, all prescriptions should be made in electronic format, thus forcing the local organizations to develop their local tools and practices to conform to the new national rules and tools.

Evaluation of the clinical pilots was done in 2004–2006 in the organizations where the integrated systems were implemented (Joensuu health care, Kotka health care, and a Kotka pharmacy). Helsinki had stopped the pilot without integrating the systems. Use in Joensuu clinic was so modest, that there was no point in conducting the postimplementation study in the local pharmacy. The systems still were not completely technically reliable. Lack of cooperation with users and designers had resulted in poor usability of the technology (e.g., slowing down work due to a feature requiring signing of each pharmaceutical separately with an electronic signing procedure and lacking required features of technologies). New service practices had not been redesigned in parallel with technology, leading to complaints from the doctors about time-consuming consent procedures and errors in the prescribing and dispensing process due to old working habits. Patients' means of managing their own medication had been decreased when they no longer had tangible documents of their complete medication (prescribed and dispensed) history. Patients' rights and possibilities to control the use of their prescription data also were diminished. The planned patient interface and the possibility for patients to conceal sensitive prescriptions had not been implemented. Many of these problems became evident already in 2004 and were given to the high-level steering group, but improvements to the pilot systems were not made because the changes were regarded as too expensive by the pilot organizations bearing the costs. In 2006 the pilots were stopped without any updates to the systems, when the high-level management group made a decision to focus all remaining resources on drafting the ePrescribing legislation and national requirements.

Conclusions from Case Study II: Conceptualization of the Codevelopment of ePrescription Service and Technology

The objective of Case Study II was to apply the conceptualization created in Case Study I in another case (an ongoing project) to explore its potential in the context of formative evaluation. The conceptualization was used to structure data from the ongoing Case II. The results were fed back to the project managers for corrective action.

With the help of the conceptualization created in Case Study I, the coevolution of the ePrescription service, the technology used, and the legislation to steer it could be delineated (Figure 5). It consisted of three objects of development rather than two, of which the development of legislation for ePrescribing emerged as the main object. The governmental actors (regulators) initiated the development, and the national high-level steering group was in strong control of the development throughout the process. This is shown in Figure 5 as a solid cycle of the legislation development. The other two cycles represent the prescribing service

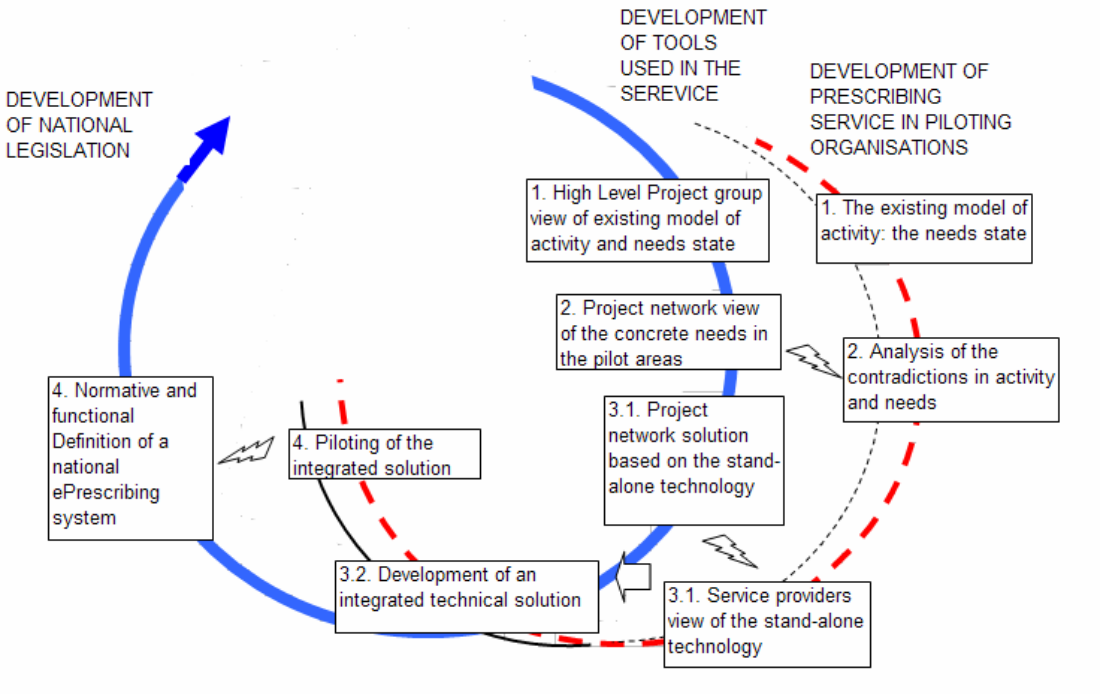

Figure 5. Structuring Case II findings with help of the conceptualization. The larger cycle (blue) depicts the phases of rules development and expansive learning within the members of the high-level steering group responsible for the development project. The smaller cycle in the red, bold broken line depicts the phases of development of the prescribing service, and expansive learning within the local piloting networks consisting of patients, doctors, pharmacists, and social insurance officials. The third cycle, in the thin, black broken line, depicts the tools development to achieve the prescribing service. The high-level steering group acted as the innovator and leader of the development. The broken line on the tools and service development cycles throughout the development illustrates the lack of focus on development of new eService practices and usable tools for the practices. The partially contradicting views between the groups of actors in the three different cycles, and lack of information exchange and collaboration between them, are depicted by lightning arrows in different phases of development. Abandoning the ICT-based tools and the ePrescribing service model after piloting is depicted by ending of service and tools development cycles after Phase 4.

and technology developments. They were supposed to inform the legislation development. Both of these cycles are drawn with a broken line throughout the development, illustrating the weak emphasis on these objects in the total process and the weak control that the service network actors in the pilot areas and their technology providers had over the development.

The challenges and possible solutions found with the help of conceptualization in the codevelopment of the ePrescribing service and technology were presented as a feedback during the project. Certainly, due to the strong participation of the regulators (policy makers, legislators, and standardization experts) in the national high-level steering group, the regulatory needs and requirements were well covered in the concept. However, the representation of the end users or their technology providers in the steering group was weak or nonexistent, which made it challenging to learn from the users and develop a useful and usable system to be piloted. Further, it was stressed that data from each of the pilot areas would be needed regarding their concrete prescribing activity and any key contradictions and preconditions for change in order to plan the needed changes in the overall ePrescribing activity and to specify requirements for technologies to support a new model of activity. The lack of this knowledge is depicted by text boxes framed with broken lines in Phases 1 and 2 in Figure 5. The feedback was regarded as important by the national high-level steering group, but it had little immediate impact, since the clinical testing was already about to start.

Feedback given to the pilot about Phase 3 emphasized the need to concentrate more on the development of new working practices and providing the tools to support them. This feedback also came too late to have any impact. The development in Phase 3 had included two design rounds, which are depicted in Figure 5. The first round concentrated on developing stand-alone prescribing and dispensing programs, the implementation of which was refused by practicing doctors. The mismatch between the project and user view of the solution is represented by a lightning arrow in Phase 3.1. A second design round was initiated to develop and implement integrated EPR technologies (Phase 3.2). However, this design round was nearly finished when the evaluation started.

The national requirements were drafted by the high-level management group. They were not entirely in line with the experiences from the pilots, depicted by a lightning-arrow between the cycles in phase 4. The pilots did not run long enough to demonstrate the utility of the system for different user groups. This was communicated to the project network (high-level steering group) in the final evaluation report. Local technology and service development cycles also ended with the end of the pilot. The legislation development cycle continued with the act on ePrescribing, with its issuance on February 2, 2007. It presents a new norm or rule for the service providers, leading to pressure to initiate a new cycle of development in the local prescribing services and the EPR systems used. The feedback from the different stakeholders collected by evaluators in the pilot study can be seen in the legislation and its background document (the bill). It remains to be seen how much the feedback is exploited in the local development projects.

DISCUSSION AND CONCLUSIONS

The starting point of this study was the vast literature documenting failures of health care ICT projects. The aim of this article was to conceptualize a process of co-construction of services

and technologies to help future practitioners in the field to understand and find solutions to the challenges in ICT-enhanced service changes. Case Study I provided an in-depth analysis of an entire eHealth innovation process, from idea generation to an established eService provision system. The findings were conceptualized with the help of concepts mainly from cultural historical activity theory (AT) in order to understand the challenges in the development. This conceptualization was applied in another case study (an ongoing project) to study its potential in the context of formative evaluation, that is, for analyzing an ongoing case and feeding the results back to the project managers for corrective action.

Depicting the development with just one cycle of expansive learning does not seem to suffice. In both cases, multiple objects were being shaped simultaneously by separate networks that should have collaborated tightly but didn't. In both cases, one network took over the development of the entity—focusing on the object that was in its core interest—at the expense of other objects and shapers. Adding parallel cycles to the model of expansive learning and focusing on the relationships between the cycles helped to depict this finding in Case Study I and to bring out challenges in the codevelopment of technology and service at each phase of the development. Case Study I was a retrospective study, and the results could therefore not be used to support the development.

Case Study II was already at the end of Phase 3 (see Figure 5) when my study was initiated. The conceptualization helped to structure the parallel developments of ePrescribing legislation, practice, and technology, and to extract challenges, which were fed back into the project. The results concerning Phases 1 through 3 were regarded as important by the project partners, but they came so late in the process that the project could not implement the suggested amendments. There was strong political pressure for quick implementation to demonstrate the feasibility of the concept. The conceptualization also helped in structuring the analysis of a new eService model implemented in the clinical pilot areas (Phase 4) and in providing feedback for its further improvement. However, this information was not fully exploited during the project because the piloting was stopped in order to focus on the development of the national specifications and legislation. The information is, however, reflected in the bill and ePrescribing legislation, issued on February 2, 2007.

There were some differences in the two cases that challenge the applicability of the conceptualization from Case I to Case II, and which also contribute to understanding the relatively weak impact of the support offered in Case II. Case I illustrated a local, technology-led project in which regulators did not play a big role. The user network was in control of the decision on diffusion of the technology and the new service model. Case II, on the other hand, was a normatively led national project in which the national regulators were in control of defining the diffusion of the system by making it mandatory by law. The success of the piloting was not a condition for diffusion in Case II, as it was in Case I.

The scale and overall purpose of the projects were also different. Case I was a local IT project aiming to improve the home care shopping service of a local social services office. Case II was a national-level project, where the final objective was to create a national solution for ePrescribing and the legislation to diffuse it. The conceptualization needed to be adjusted to accommodate for the shift from a local to national perspective and the emergence of political objectives. The ePrescribing concept was high on the (political) agenda, which also influenced the decision making in the project. There was political rationality in the decisions—for example, in the decision to stop the pilot in order to hasten the national

implementation of the system. Even if the pilot system was not yet working well in the pilot areas, there was a strong political will to go ahead with the rules development and expand the system to national level. The evaluation provided some indication of the reasons for poor success in the pilot areas, and some of the issues were addressed in the bill and the new ePrescribing legislation. Case II indicated that ongoing (formative) evaluation can provide useful information to steer decision-making but, if the information does not support the political objectives, it may not be implemented. Further research is needed in the context of policy implementation projects to study the applicability of the conceptualization. Case II raised questions about transferring methods used in local ICT projects to national level projects.

The study collected and analyzed data from Case II, and fed the results back to the project group to be used in the decisions about the development and to the national policy makers to inform the permanent legislation on electronic prescriptions. This approach can be likened to the approach of "constructive technology assessment," which attempts to extend technology assessment to all phases of technology development, including its earliest stages (Rip, Misa, & Schot, 1995). The approach builds a bridge between formal and informal evaluation conducted by different social groups. It places emphasis not only on "what impacts," but also on "whose impacts" gain attention (Freeman, 1995). The request from the STM to conduct a process and outcome evaluation on a national eHealth pilot can be interpreted as a wish to move towards a more dialogical approach in policy implementation practices, with a will to bring forward the voices of different stakeholders during the formulation of the permanent ePrescribing legislation. Collecting empirical data for decision-making during a national policy implementation project is not yet very common, which led to some mixed feelings in the high-level steering and management groups. This is at least part of the reason for the poor immediate impacts of the feedback. Another reason may be the late start of the evaluation and that the piloting project was not designed to be adjusted with the feedback. Further research is required in which the conceptualization is applied from early on (from Phase 1) to draw further conclusions on the applicability of the conceptualization in providing support for projects.

In spite of their differences, both cases shared the same challenge of balancing different objects of development. The project plans did not accommodate for the shaping of multiple objects or for changes in the direction or speed of the development. Both cases suffered from the lack of analysis of and learning from the practices in which the technologies were to be implemented. Both projects had inadequate forums, methods, and tools for a balanced co-construction of multiple objects. Importantly, however, neither of these cases is atypical for contemporary practices. Therefore, as the results indicate, eHealth projects need a better understanding of multiple objects of development (e.g., the service, its tools, and its rules) and how to co-construct them in a balanced manner. The projects also need concrete and clear skills and methods to manage the totality of change, to collaborate and learn from others throughout the development. This study suggests that eHealth projects need to build a balanced network of actors who have adequate knowledge about a variety of objects of development and the required skills for constructing and managing the entity so that they can surpass the challenges of codevelopment of eServices and related technologies.

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All correspondence should be addressed to:
Hannele Hyppönen
Stakes Unit of eHealth and eWelfare
Stakes/National Research and Development Centre for Welfare and Health
Lintulahdenkuja 4
FI-00531 Helsinki, Finland
hannele.hypponen@stakes.fi

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USING/DESIGNING DIGITAL TECHNOLOGIES OF REPRESENTATION IN ABORIGINAL AUSTRALIAN KNOWLEDGE PRACTICES

Helen Verran
School of Philosophy
University of Melbourne
Australia

Michael Christie
Learning Research Group
Charles Darwin University
Australia

Abstract: *Indigenous Australians are often keen to use digital technologies in their struggle to develop sustainable livelihoods on their own lands. This paper tells of gradually coming to recognize how an Aboriginal Australian elder struggled against the grain of digital technologies designed to represent, in using them in Aboriginal Australian knowledge practices where knowledge is always actively performative rather than representional. The performance of Aboriginal knowledge must express the remaking of an ancestral reality. At the same time, this man exploited possibilities the technologies offered for representation in achieving political ends in dealing with representatives of mainstream Australia.*

Keywords: *indigenous Australian knowledge; Yolngu Aboriginal concepts; use and design of digital technologies of representation.*

INTRODUCTION

Many indigenous people in northern Australia are beginning to use digital technologies in promoting the interests of their traditional groupings, clan lands, histories, connections, and places. In some instances they see these interests as coinciding with the incorporation of modern infrastructure into their life-ways, mobilizing resources—both cultural and natural—in exchange for money and/or to achieve recognition of their rights to participate in ongoing negotiations over resources. In these situations, they might find themselves using digital technologies in dealing with mining companies, government departments and/or tourism operators. At other times, they see the interests of their lands and peoples as best served using digital technologies in extending the ways they practice their own indigenous knowledge.

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Often strong emotional reasons are involved. Perhaps the most potent reason that some groups of Aboriginal Australians are beginning to engage in negotiations around use of digital technologies relates to the concern that Aboriginal parents and grandparents have for their youngsters. Some feel that many in the younger generation are growing up without a robust indigenous identity that is based in a strong grasp of their community's knowledge traditions. These elders endorse the use of computer databases and other digital technologies to work with audio files, texts, photos, videos, maps, lists, and so forth, to help with their work of teaching. They see possibilities in digital technologies for continuing the work elders have always done in Aboriginal family groups—using whatever resources come to hand in the work of regenerating clan and place as one, so as to ensure the continued health and well-being of both the land and the people.

Nevertheless a significant number of indigenous and nonindigenous people respond with horror to the idea of using digital technologies in indigenous knowledge practices. Many people feel that computers and other digital tools will do more harm than good. Are digital technologies compatible with Australian indigenous knowledge that maintains that all knowledge is performance by a particular person or group? Many people are concerned about disenfranchising Aboriginal knowledge authorities, further marginalizing legitimate Aboriginal interests, diverting energy and resources from Aboriginal priorities, backgrounding Aboriginal sensibilities and sensitivities about valid knowledge practices, and misappropriating intellectual property. In short, there is a widespread suspicion that digital technologies can only work by treating the knowledge of indigenous Australians as a commodity. The anxiety is well grounded, but so too are the worries of those who value the experience of being on their own lands and learning from today's generation of elders. They want to keep that experience in a useable form for generations to come.

This paper considers an approach to digital technology use and design grounded in this dilemma. We understand this process as work that involves the intersection of two quite different knowledge traditions, where little is held in common between the ways the traditions understand themselves. Our response is to problematize the process of use and design of digital technologies. We take each situation as and where it arises and adapt our ways of proceeding to attend as best we can to competing demands. The processes of the research are emergent and situated. This means that our research is and is not scientific, and likewise is and is not Aboriginal knowledge making. We feel the research project described in this paper is best understood as a form of philosophy.

Our approach is inspired by Lucy Suchman's writing. Informed as it is by the feminist studies of science and technology, she asks the seemingly odd question, "Where are designers?" (2002: 94). Suchman proposes that designers conventionally understand their work in one of three ways: as "design from nowhere"; as "detached intimacy"; or as "located accountability." The last of these is the most responsible, according to Suchman, and allows us to recognize that users too are designers (2002: 95–96). In this paper we develop this idea with reference to a project undertaken with a Yolngu Aboriginal Australian elder, Mängay Guyula, turning technologies that Western users generally understand as producing faithful representations to serve quite different purposes in Yolngu Aboriginal knowledge practices. We see this work as a form of design in use.

CONTRIVING WITNESS OF PLACE IN ABORIGINAL AUSTRALIA

Like most people in most places, Aboriginal inhabitants of northern Australia are concerned that development of their lands does not come to dominate the processes that renew the ongoing collective life within those places. Rather they are keen to deal with other places in ways that can be harnessed to enrich and strengthen their ongoing collective life. However, in Aboriginal places, ensuring that development remains contained within particular Aboriginal realities is often very actively pursued in Aboriginal ontologies: Place is pre-eminent. In those metaphysics, all meaning flows from place so that the knowledge practices involved in doing the collective knowing of place in Aboriginal life is of a different order than for other sorts of Australian places.

After 200 years of colonization, most of the ancient Aboriginal languages of Australia have been lost, and it is only in very remote places that Aboriginal youngsters grow up speaking pre-European languages, albeit with borrowings from languages of the English, Macassan, Afgan, and other visitors and invaders. In the far northeast of Australia's Northern Territory, organized into about 20 clans some 5,000 people, the Yolngu continue to speak traditional languages and practice traditional religion and culture, and generally run their collective life through Yolngu ontologies and epistemologies. Most Yolngu people live in small towns that have developed from Christian mission stations established in the 20th century. But many live in small settlements on their clan lands, which they own collectively through a form of freehold land title.

In this paper we use an image of one of our coresearchers, Mängay Guyula, as emblematic (Figure 1). For us it is an emblem expressing the profound ongoing relations between Aboriginal Australians and their lands. It shows how the histories of particular families and particular places are indissolubly linked.

Mängay is a Yolngu Aboriginal man of the Liya-Dhälinymirr clan that lives at a place called Mirrngatja, on the eastern margins of the Arafura swamp in central Arnhem Land in the north east of Australia's Northern Territory. In 2003, accompanied by his friend John Greatorex, Mängay visited 19 places around the edge of the Arafura swamp, a significant site in Australia's national heritage listings. In each place, while John filmed, Mängay spoke of its history, the ancestral journeys it features in, its location in the complex patterns of Yolngu land ownership, and the varied responsibilities for and interests in that place invested in different groups of Yolngu people. Mängay exhorted and instructed, demonstrated and explained. These short biographies of significant places were delivered in Mängay's Liya-Dhälinymirr language. Later, while working in the School of Australian Indigenous Knowledges at Charles Darwin University in Darwin, the Northern Territory's largest city, Mängay's younger brother Yingiya Guyula recorded an English language version of the talks or recitals that Mängay had recorded in each of those 19 places.

Having persuaded his friend John to help him, Mängay undertook the arduous work of doing this filming. He felt there was an urgent need to speak about these places in two separate cultural arenas or polities. Given the profound meanings of place in Aboriginal metaphysics, however, this description of Mängay's work does not really convey the work's cultural significance for Yolngu. We can better understand the importance of Mängay's project if we see his performances for the video camera while standing in various named places as acts of witness in the sense of giving testimony.

Figure 1. This is an image taken from a video clip (Indigenous Knowledge and Resource Management in Northern Australia [IKRMNA], n.d.-a). It shows Mängay telling a story of a place named Djilpin while standing in that place and speaking to a video camera. He points to an image of his father's father, Minyipirriwuy, who is wearing ancestral sacred objects that guarantee his grandfather's authority to speak and, in turn, legitimates Mängay's speaking. The photograph Mängay is holding was taken in the 1930s by anthropologist Donald Thompson. Mängay obtained the image from the Donald Thompson Collection at the Museum of Victoria (Guyula & Guyula, 2005). Image © Mängay Guyula. Used with permission.

These are the two cultural arenas Mängay sought to address. First, the project aimed at familiarizing Mängay's kin with their ancestral places. These mostly young Yolngu people have traditional claims to these various places but are not living on, and in some cases might never have visited, these clan lands. Mängay saw possibilities in using video footage for promoting familiarity between people and places, enriching the ways those links are celebrated both informally and formally. This work can be understood as contributing to processes that fold histories back on themselves, thus regenerating collective life, re-connecting families and places.

Second, and of equal immediate concern, was making sure that non-Aboriginal people who were planning the installation of a pipeline (inside a two-meter-deep trench across thousands of kilometers) south of the Arafura swamp knew that the land has a story, and that the places have people keeping the story alive. It is the Aboriginal people who need to tell that story and have an active, authoritative role in negotiations over access to those lands and to resources. Mängay was concerned about other strangers intruding onto the land. Like many Yolngu, he has a keen ear for the sound of vehicles and survey planes in the far distance, and the sight of unrecognizable vehicle tracks.

YOLNGU METAPHORS THAT HELP UNDERSTAND YOLNGU ONTOLOGY OF PLACE

In this section we articulate some of the metaphors that Yolngu Aboriginal people use to theorize their work of regenerating clan and place as one, something they see as crucial in maintaining the health of both their communities and the ecosystems that sustain them. Why

do we elaborate what seems like arcane anthropological detail in a paper about use and design of digital technologies? Of course it provides useful background to Mängay's project, but we see these metaphors as doing more than that: We understand this Yolngu theorizing as articulating allegories useful for understanding innovation in a general sense, as providing a basis for imagining the processes of design in use—the focus of this paper. They are means of imagining relations between producers, users, and regulators. This is as salient to technological innovation as it is to the remaking of place and clan as one.

Before we turned our attentions to digital technologies, our work with Yolngu had been in the context of schooling: elaborating processes known as "Aboriginalization" and "both ways learning." These emerged from a long process whereby Aboriginal people and the knowledge traditions that belong to them were gradually incorporated into the curriculum of government schools on Aboriginal lands and in Aboriginal communities. Long and careful negotiations between teachers in the schools and community elders had given rise to articulations of traditional Yolngu epistemologies, metaphysics, and ontologies specifically useful in innovation in cross-cultural and intercultural education (Christie, 2000; Marika-Mununggiritj, 1991a, 1991b; Ngurruwutthun, 1991; Watson, 1990a; Watson and White, 1993; Wunungmurra, 1989).

Two constructs that Yolngu have contributed to the public arena of indigenous education in Australia are particularly cogent in understanding Yolngu imperatives for digital technologies and knowledge of place. The first, the concept of *garma*, drew our attention to a distinctive Aboriginal epistemology that has something in common with European constructivism, except that place is a crucial determinant of knowledge in the Yolngu epistemology. The Yolngu concept of garma denotes, in the first instance, an open ceremonial ground where different groups (always necessarily representing different places and correspondingly different languages) come together for negotiated performances. It is this open, public space (usually alongside a closed secret/sacred space) where ancestral histories are performed in the context of contemporary issues, and where current truth claims are presented and assessed. Key to understanding the garma philosophy is the principle that each individual participates in the negotiation and playing out of a collective history, while carefully, publicly, producing a distinctive performance of his or her own unique provenance. Slight differences in the ways feet or hands dance, for example, can be read by the literate as an articulation (and a celebration) of something small but highly significant and distinctive in the particular history of a small group's land and its connections. In this epistemology, the actual place of negotiation is always ontologically prior to the work of making truth. Someone always already owns the garma site, and gives it up for the work of a properly supervised, properly accredited process of knowledge work.

The notion of garma has been used to describe the effective processes of intercultural schooling, where Western and Aboriginal knowledge traditions are choreographed to work together productively, with the integrity of each unimpaired, in education (Ngurruwutthun, 1991, pp. 107–122; Watson, 1990b), intercultural community building, and cross-cultural communication (Cass et al., 2002). The garma is interesting because it produces a unified truth from necessarily divergent perspectives, from different performers bringing their knowledge, experience, particular artifacts (ancestral designs, musical themes, shapes, colors, etc.), particular styles, and histories to the collaboration. Yolngu could use the metaphor of garma to describe what Mängay is doing holding the photograph, standing in front of sacred

water, performing for the camera, and prosecuting a succession of claims about the land, about intruders, about history, about connections, about accountabilities.

The second key concept was *galtha*, which marks the instantiation of a particular Yolngu metaphysics. In the Yolngu ontology, the originary ancestors moved across the country singing, dancing, talking, crying, hunting, cooking—doing everything human—and leaving behind the knowable features of the world and its people with their distinctive languages, histories, totems, and truths in place. Thus the world we see and know contains—in fact it *is*—the visible, identifiable traces of this work, the ongoing translation from idea/action to reality/place. When a ceremony is to be performed, there are long, complex, and often fraught, negotiations necessary to develop agreement on everything from where and who, to which images, which sacred names, which ancestral song lines, and which ritual acts are best for this time, these people, and this place. This is serious world-making work. Once the negotiations are complete, a small ceremonial act is performed: Something—a spear, maybe, or a spade—coming from the air and setting itself in the ground. This is called the galtha: The negotiations have finished and the performance has begun. If the galtha has been properly negotiated, and is properly performed, the ceremony is efficacious. Its work is not simply to represent an ancestral reality, but to produce it here and now. Effective Yolngu knowledge work does not produce effective representations of an external world; rather it produces effective worlds in place *as performance*. A Yolngu who shows outstanding capability to become his or her ancestral provenance is said, in particular contexts and at particular moments, to become his own galtha, a sort of self-actualization (Marika-Mununggirit & Christie, 1995). Galtha, in this sense, is a careful process for (re)producing places and peoples as one, making sure that histories stay in place.

WITNESSING YOLNGU ABORIGINAL PLACE USING TECHNOLOGIES OF VIDEO RECORDING AND DVD MASTERING

What exactly were John and Mängay doing out there, driving from place to place, and talking into the microphone with the wind howling? Mängay was making claims about himself and his connections; he was making comments on invasive species and die-offs; he was chiding Yolngu and warning non-Yolngu; he was presenting evidence for his truth claims, implicitly explaining how this new form of presenting truth claims using digital technologies should be read.

A major outcome of the use/design endeavor we describe in this paper is a DVD titled *East of the Arafura Swamp* (Guyula & Guyula, 2005). Copies of this DVD are held by Mängay, who opportunistically distributes them among his Yolngu kin. He also plays the DVD for contractors and government workers who come to his community. The DVD is readily available to back up his and his compatriots' interventions in mainstream Australian politics. Master copies of the DVD product are held on computers in the School of Australian Indigenous Knowledge Systems at Charles Darwin University, and a phone call from Mängay to John can have one ready for Mängay to hand over to government officials or representatives of mining companies, as required.

The DVD plays the 19 short videos that were filmed by Mängay and John in 2003. These are accessed through the map interface shown on the DVD slick (Figure 2) with the opening screen tracing the journeys Mängay and John undertook. A series of 19 small squares, each

containing an iconic image from the footage as a thumbnail that lights up when the cursor is passed over them, constitutes the menu. Click on one of these squares and Mängay appears standing in the place named and begins to speak. Soon after the video of Mängay speaking and gesturing in place begins to play, a small yellow square appears showing a "talking head," usually on the lower left side of the screen. Here the subsequently filmed video of Mängay's younger brother Yingiya speaking the English translation of Mängay's Liya-Dhälinymirr talk plays (see Figure 3). The sound track of this translation is set to run over the top of Mängay's slightly muted sound track, and timed to run slightly behind it. It was in fact recorded as a simultaneous translation, in real time. The sound tracks are distributed in stereo so that Yingiya speaking English emerges from the left-hand speaker and Mängay speaking in his Yolngu language from the right-hand speaker. English listeners can turn the sound balance to favor the English translation, and Yolngu listeners can turn off the English sound track and listen to the Yolngu language sound track. For Yolngu listeners, the image of Yingiya silently mouthing English words on the lower left of the screen disrupts the experience of watching and listening to Mängay's testimony of the place, but we argue below that this disruption is a significant element in the technology's working for a Yolngu audience.

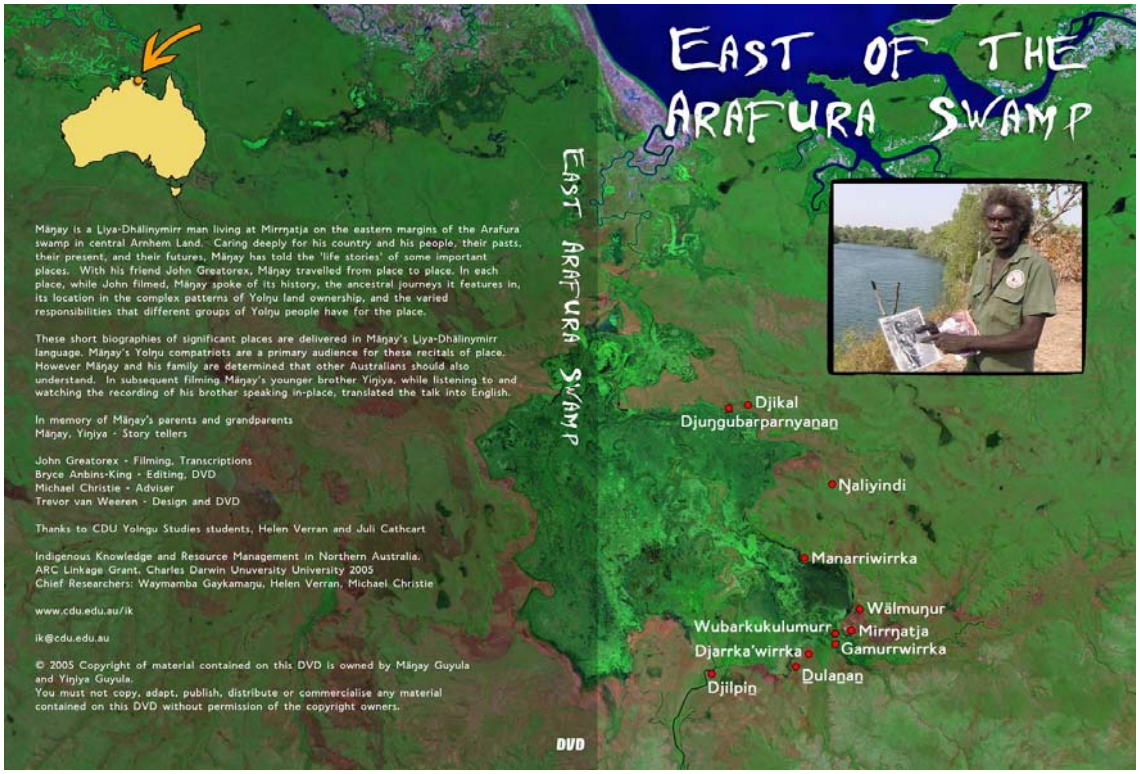

Figure 2. The slick of the DVD *East of the Arafura Swamp,* produced with Mängay and Yingiya Guyula, showing names of the places visited superimposed on a satellite photo map of the Arafura Swamp region in central Arnhem Land in Australia's Northern Territory. Copies of the DVD are available on request from John Greatorex in the School of Australian Indigenous Knowledge Systems, Charles Darwin University. Image © Mängay Guyula. Used with permission.

Figure 3. A still taken from the video of Mängay's witness of Djilpin, showing the "talking head" of his younger brother Yingiya translating Mängay's Liya-Dhälinymirr soundtrack into English.
Image © Mängay Guyula. Used with permission.

We are suggesting that the DVD *East of the Arafura Swamp* is a product of using and designing with "technologies of representation." We place this term in quotation marks to signal that the episode we have narrated up to now has redesigned the tools as "technologies of witness" of Aboriginal place. We see the episode as one of redesigning technologies in use. We claim that this redesigning work grew out of Mängay's endeavor to witness a series of Yolngu places he knows and loves, and suggest that Mängay was mainly concerned with assembling digital objects that could be used subsequently in what he understands as multiple unique performances of the places.

The audiences for this witness of Yolngu places are profoundly disparate. On the one hand, Mängay wants to induct his young Yolngu kin into knowing and loving these places as Yolngu places; he exhorts them to contribute to the ongoing collective life of these places. But, and this is crucial in Aboriginal knowledge practices, Mängay is not presenting, and must not claim that his testimony presents, the place in any definitive way. His is one form of witness among many. On the other hand, he intends the videos to make and defend a strong claim to the wider Australian polity: Mängay wants the DVD to articulate a sound basis for engaging with white Australia. But there is to be no misunderstanding: Yolngu owners are controlling the process of that engagement. For this audience he must make the claim that his witness is unassailable.

We suggest that in using technologies so as to simultaneously prosecute these two opposed sorts of claim about his witness of place, Mängay has invented what could be understood as a new genre in Yolngu Aboriginal life: A new form or genus of Yolngu communication using video technologies and DVD authoring came to life in Mängay's endeavour to give testimony of places for these two disparate audiences. This, first of all,

involved careful design of Mängay's performances in his acts of witness. Mängay needed to redesign the sort of performance Yolngu elders would usually give when those hearing the testimony and viewing the scene were actually there at the time. His performance needs to help people imagine themselves as actually in the place hearing the testimony of one of its custodians. In a second moment of design in using the technology, the video footage that had been gathered was assembled in a particular form in mastering the footage into DVD format.

In concluding our paper we explain how we see the DVD *East of the Arafura Swamp* as dealing with three problematic issues. We see managing these isses as a form of design in use. First we consider how the DVD manages the problem of video technology's designed-in capacity for graphic literalism. The characteristics of video footage are paradoxically both enabling and potentially fatal for Mängay's project of video witness of Yolngu place. He needs his Yolngu audiences to see the landscape shown on the screen, and to *see through* it, to experience and feel the journeys of spiritual ancestors. This genre of communication must transport a Yolngu audience, however briefly, from the secular time and place of their viewing to a transcendental eternal time and place, when they look at and listen to Mängay's testimony. Second is the issue of the inflexibility of DVD authoring software. Once a display of video footage is contrived using this technology, it cannot be changed by ordinary users, given the level of technical skill required. This stability and reproducability, so valued by most users of the technology, is both dangerous and invalid in the context of Yolngu knowledge practices, where each instance of witness is by definition a novel performance. The third element concerns the need for the video to work well enough through the criteria of acceptability within Yolngu knowledge practices of giving witness to place, while still making strong claims in a display to the wider English-speaking Australian polity for Yolngu ownership of and rights to control the places witnessed.

The technologies of video and DVDs, technologies of representation that were engaged within Mängay's project, have arisen in communities of practice imbued with sensibilities expressing a Western metaphysics, and they are salient to Western epistemological and ontological demands. We suggest that this results in an in-built graphic literalism that we see as simultaneously crucial and damaging for Mängay's project. In journeying, storying, and making the videos actually in place, Mängay and John can, in Yolngu terms, be understood as *performing* those places, not assembling representations of those places. Mängay's performances in place should not be understood as primarily generating a representation of the places that were visited. Performance of place is a form of becoming one with the spiritual ancestors whose journeyings made those places. And experiencing that performance—in this case by watching a TV screen—must likewise be an experience of becoming one with one's spiritual ancestors, from whom both people and place draw their life force.

With this understanding, using digital technologies in "doing" Aboriginal place can perhaps be seen as a new addition to an already established Yolngu repertoire of "technologies" for witnessing place—storytelling, family journeying and story telling, dancing, singing, forms of abstract painting, and carving. In both informal and formal settings, Yolngu people routinely variously witness place in ways that range from the popular and secular to the high culture of Yolngu religious ceremonies. However, unlike the display of video footage and photographs, all these traditional forms of doing Yolngu place express intimate and embodied knowledge of place while being self-evidently performative, recognizably partial interpretations of a transcentental reality that is glimpsed through the performance.

Mängay is keen to use the graphic literalism of video footage and photographs to familiarize others in an embodied sense, and has been doing so for some years now. He seeks to educate his young kinsfolk about places to which they are ineluctably linked but lax in getting to know in person. To achieve this, Mängay expects his Yolngu viewers to pay attention and learn how to read what they are seeing. For example, he stands in front of a rock in the shape of a turtle, addressing, and even caressing the turtle/rock, explaining its existence as an expression of the shared Yolngu ancestral reality *as something you can and cannot see*.

How is one to read, that is, understand the meaning of, this presentation of an image accompanied by a claim that it is in fact something you can and cannot see? Definitiveness, so valued by Western ontologies and epistemologies, actually works against Yolngu ontologies and epistemologies where explicit recognition of the possibilities of multiple expressions of ancestral reality is crucial. Mängay finds he needs to both show and tell the places, and also instruct. His viewers need to be told what they should not see and what they should see, as well as how to do the work of seeing and showing. The exhibit could be understood by analogy to a family photo album. No one sees one photo of their kin as definitive, as self-explantory of who that person is/was. They look at photos of Grandma and look for something inside, the spirit that animated Grandma. Mängay must make sure that Yolngu viewers treat the turtle/rock in the same manner. There is a fine art on display in Mängay's storytelling in his videos and, for many Yolngu, these do not make for comfortable or easy viewing. Mängay knows that some Yolngu may be harboring ill-formed or revisionist accounts of these places. There is sense of urgency about Mängay's witness of place, a clear determination to take care and do the work thoroughly, and in 19 different places.

To see a little more clearly the design work of Mängay's fine art of storytelling, we return to the inspiration provided by Yolngu knowledge and its metaphors that we elaborated earlier. Remember that in Yolngu ontology the originary ancestors traveled across the country bringing it into existence through talking, singing, dancing, crying, and so forth, leaving behind the knowable features of the world, like the turtle/rock. It is and is not a turtle, and is and is not a rock. Table 1 shows some of Mängay's carefully chosen words that, we suggest, signal that the video footage should be read as a galtha. Mängay is making a declaration that his video-making act is to be understood as an invitation to begin the collective work of world making.

In the serious world-making work of Yolngu knowledge practices that we described earlier, a small ceremonial act is performed: a galtha. If the galtha is properly performed, then what follows is efficacious: Its work produces ancestral reality here and now. A Yolngu person like Mängay, who embodies the outstanding capacity to become his or her ancestral provenance in particular contexts at particular moments, is his or her own galtha and has powerful agency. We see Mängay exercising that agency through his use of video footage, inviting commencement of careful processes for producing people and place as one.

Nevertheless, the technology of the *East of the Arafura Swamp* DVD, the array of digital objects that Mängay's and John's work with a video camera generated, has disadvantages. From Mängay's point of view, each copy of the DVD Media Pro display that is burned, distributed, and watched should be understood as a new performance of the choreographing work that he and John undertook in 2003. But proprietary DVD authoring software, even in the expert hands and with the eyes and skilled sensibilities of our design researchers, Trevor van Weeren and Bryce Anbins-King, inevitably renders the collection as stuck in a particular

Table 1. Text taken from Mängay's biography of Wubarkukulumurr on the DVD *East of the Arafura Swamp* (Guyula & Guyula, 2005).

Original transcription	Free Translation
Baŋam dhikayi djinaga ga ŋorra, dholkuma mak ŋayi munathay ŋarkulay, ŋarkulay mak ŋunhi ŋayi munygum bäy dhikayi ŋorra ŋayi ga, ga ŋanak miyapunu baŋam ŋunhi ŋayi ŋanak miyapunu.	Somewhere here inside, a rock is lying; maybe it has been covered by earth and water. Maybe the water has hidden it; inside here is the flesh of a turtle, that rock is turtle flesh.
Beŋurdja ŋunhi, ŋunhi ŋayi murrutjuwaldja ga rumbaldja, murrutjuwaldja	It came from there, this turtle bone, and the flesh of the turtle.
Beŋur walal märraŋal ŋanaknha nhakun, ga dhiyalna walal dhä-yuythurr, dhuwal gunga mala dhärra marrtji.	They brought the turtle flesh from over there, and here they sat cooking, eating and drinking the soup, here where these pandanus palms stand.
Yan nhakun yolŋu wuŋi̲li' ya' bitjarr, dhuwal gunga nhakun ŋayi ga ganaŋ'thun ya' bitjan, gäna ga dhärra, ga ŋunhiny bala.	These pandanus standing are Yolngu spirits standing in a group by themselves, separate, standing alone, and over there.
Ga wiripu ga dhuwal wuŋi̲liny nhawi, mokuy nhakun waŋarrwaŋarr ŋunhi, Mukarr, muka, Mukarr ŋunhi dhiyak miyapunuw walal dhä-yuythurr dhä-yuythurr walal gana l̲ukan, dhiyalaŋumi, ga ŋunha nhawi, n̲arra n̲i ŋunha dhärra ga, dhud̲iŋur	So you see these are the ancestral spirits called Mukarr. Yes, Mukarr spirits were here preparing and eating turtle; they were eating it here and over there around that bush apple tree, underneath it.
Wubarkukulumurr ŋunhidhi nhawi yäna nhakun walal gana l̲akaraŋal nhäwi mapu ŋayi miyapunu ŋunhiyiny ga dhuwal wäŋany ga dhuwal gunga mala, wuŋi̲li yolŋu waŋarrwaŋarr	Here at Wubarkukulumurr, that's what they used to call it, there are turtle eggs around this place, and those pandanus palms are the traces of those ancestral spirits.
Dhuwal gunga mala dhärra ga, yan nhakun dhuwal yaka ŋarrapi guyaŋi dhuwal dhaŋuny dhiyaŋ bala birr baman nyumukun̲inyŋur ŋarra ŋäkul dhäwu walalaŋguŋ ya' bitjarr?	These pandanus standing here, it's not just me thinking up this story: It was from a long time ago, when I was very small, I heard this story from them, you see?
Dilkurruwurru dhiyaŋ bala dilkurruwurru bäyŋu ga dhuwal ŋarra ga l̲akaram dhäwu, ŋunhidhi walalany yän wanaŋgum dhäruk ya' bitjan nhaltjarr walal marrtjin rraku rom l̲akaraŋal.	The old people, now those old people have passed away, and here I am telling the story, I'm just copying their words, whatever it was that they told me.

This text was transcribed by Janet Hopkins and translated by Michael Christie.

array. Its capacity to be tailored specifically for each type of audience and each time-place of performance is very limited. There is a very real danger that the performances recorded onto the DVD will come to be perceived as definitive, like a scientific report, because the display is set and stabilized. The DVD plays without explicit recognition that, like the stories Mängay tells, any particular viewing should be understood as also a particular performance of place. The freezing of one particular edit of the video material in a DVD display severely limits its usefulness and thus, among other things, makes the management of the paradox around the video's graphic literalism more difficult to manage.

Discussions of how to manage this problem filled many hours of meeting time (Indigenous Knoweldge and Resource Manaement in Northern Australia [IKRMNA], 2005) and led to work conceiving software that allows the user always to be the designer (IKRMNA, n.d.-b). However, on viewing the DVD later, we came to see that we had inadvertently ameliorated to some extent the problem in seeking to deal with what we saw at the time as a separate issue, the third issue we outlined above: how can one DVD can present video images that are to be taken by some (Yolngu Aboriginal viewers) as partial

interpretations, and by others (White Australians) as definitive valid representations. Mängay and Yingiya were determined to use the capacities of the video footage and DVD technology to come up with a product that would speak strongly to an English-speaking audience. Here they were quite comfortable with utilizing the apparent definitive representation of the places seemingly naturally achieved through using technologies of representation. The seeming linear connection between place and owner captured in the video footage, and the capacity of the video images to convey a simplification of Yolngu place, was to be mobilized to allow the DVD product to make strong claims in the wider Australian political context, promoting the interests of both place and people.

Increasing the efficacy of the DVD in achieving this end inspired the work John and Yingiya subsequently undertook in recording Yingiya translating Mängay's commentary to provide an English language voice-over, and Trevor's work in contriving a display that allows the two brothers to speak on screen almost simultaneously. The contrivance of two brothers sharing the one screen—the senior brother speaking Liya-Dhälinymirr while standing in place, the junior brother filmed in an evidently "other" context, speaking English—increased the capacity of the DVD to speak to the mainstream Australian polity promoting the interests of these Yolngu places and their peoples. It retained the powerful authenticity of Mängay speaking Liya-Dhälinymirr in giving Yolngu testimony of place while allowing English speakers to hear Mängay's message.

For Yolngu viewers, the contrivance of the two brothers speaking simultaneously disrupts the experience of viewing the footage—the already very difficult work of simultaneously seeing the landscape and seeing through the landscape to experience a transcendental reality embedded within it. The disruption worried us at first, but later we came to understand the disruption as useful. It speaks to the problem that the display inertia embedded in DVD authoring technology causes for Aboriginal knowledge practices, and it also adds force to Mängay's instructions to his Yolngu kin on how to read this new genre of witnessing place through viewing a DVD. The sight of Yingiya speaking English against a background contrived from a creased yellow bed sheet, contrasts powerfully with his older brother's witness while standing in place. It reinforces Mängay's exhortations to care for and know the many places that Yolngu viewers and their families have interests in, some of which Mängay is seen performing. It supports the urgency conveyed in Mängay's performance; implicitly it reminds Yolngu viewers of the dangers of neglecting to attend to, of becoming one with, their places.

In the terms of the second Yolngu metaphor we found useful, the inset square reminds Yolngu viewers that the performance they are currently viewing on a TV screen is *not* a garma. It is merely a prologue or an epilogue to a garma, where multiple interests come together in a spirit of serious negotiation and world making. A Yolngu audience watching *East of the Arafura Swamp* is powerfully implicated in significant work. The interruption of the silent talking head mouthing English words reminds viewers that, while it is the testimony of Mängay on display, it is they, the audience, who now must do the work. For a Yolngu viewer, the silent talking head of Yingiya is an unspoken reminder of difference, and provides a commentary on the inadequacies of technologies designed for Western knowledge practices when used by Yolngu for Yolngu purposes.

CONCLUSION

The Yolngu philosophy of garma makes clear the possibility of Yolngu knowledge work being achieved as performance in place by any number of diverse groups (with their own places, languages, and speaking positions), provided that the acceptable practices for the envelopment of place are rigorously observed. These possibilities are maintained and expanded in several ways when digital technologies are included. Our problem in supporting Mängay's use and redesign in use of digital technologies designed for representation was (and remains) that the digital technologies on hand could not—and can not—allow Mängay and others to fully negotiate their metaphysics in doing their knowledge work. Using the hardware and software currently available, he was and is limited to working against the use of technologies to make representations of place, a use that seems to fit "naturally" with the technology, a mode of doing a world that derives from and speaks to Western metaphysics. The technology cannot allow a fully achieved performativeness, one that embodies the uniqueness of each presentation so essential to the Yolngu metaphysics.

Our work in supporting Mängay would conventionally be called a project, but our understanding of what a project is differs from the common positive modern usage of the term. We take the term project rather literally, using it to allude to the planning, contriving, or designing of a "throwing forth." By using *project* more as a verb than a noun, we emphasize the uncertainty and vagueness pervasive in any throwing and lodging of a grappling hook on the future. This activates our configuration of the time and place of our research work: It helps it become a context where the future is brought into the present, and using technology becomes instead (re)designing technology. Characterizing this approach as located accountability, we have formulated our stories to reveal what (re)design implicit in use might be in a particular episode. In this instance, (re)design-in-use turned out to be assisting in working against the fully achieved capacities of the technologies to represent. We had to content ourselves with achieving just enough of an undoing to enable the technologies to be used in knowledge practices where each instance of performance is a unique bringing into being, choreographed for a particular momentary-situated purpose, while at the same time exploiting possibilities for producing definitive presentations of the Yolngu places for political ends when dealing with mainstream Australia.

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All correspondence should be addressed to:
Helen Verran
School of Philosophy, University of Melbourne
Melbourne, Victoria, Australia 3010
hrv@unimelb.edu.au

or

Michael Christie
Learning Research Group, Charles Darwin University
Darwin, Northern Territory, Australia, 0909
Michael.christie@cdu.edu.au

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VERSIONS OF CARE TECHNOLOGY

Sampsa Hyysalo
Helsinki Collegium for Advanced Studies
University of Helsinki
Finland

Abstract: *The importance of users for innovation has been increasingly emphasized in the literatures on design and management of technology. Less attention has been given to how people shape technology-in-use. This paper first provides a review of literature on technology use in the social and cultural studies of technology. It then moves to examine empirically how a novel alarm and monitoring appliance was appropriated in the work of home-care nurses and in the everyday living of elderly people. Analysis shows that even these technically unsavvy users shaped the technology considerably by various, even if mundane, acts of adapting it materially, as well as by attributing different meanings to it. However, the paper goes on to argue that such commonplace phrasing of the findings obscures their significance and interrelations. Consequently, the final section of the paper reframes the key findings of this study using the concepts of practice, enactment, and versions of technology to reach a more adequate description.*

Keywords: *design-use relation, technology use, version, elderly, information and communications technology (ICT).*

INTRODUCTION

Uses of technology have traditionally been assumed to have a fairly clear and straightforward relation to the characteristics of a product. In an economic perspective, products have been seen as bundles of attributes that yield particular benefits. From a symbolic perspective, products have appeared as vessels of meaning that signify similarly across consumers (Holt, 1995). Both views assume that users do not significantly alter the material characteristics of technology, but rather employ it in the manner designers have intended, with greater or lesser success.

These views about the use of technology have been gradually eroded during the last two decades. An important strand of studies has focused on postmarket launch improvements of technology. Results show that some users make and demand a significant number of modifications. Together these create a great proportion of the eventual economic and practical usefulness of the product, even when they often involve only routine engineering (Gardiner & Rothwell, 1985; Leonard, 1995; Rosenberg, 1982; von Hippel, 2005). Another

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key line of studies has been the ethnographies of work in the tradition of social shaping of technology. They have shown that technology-mediated action usually requires, by its very nature, work-arounds, artful integration of various technologies (Karasti, 2001; Suchman, 2002), articulation work to keep things on track (Bowker & Star, 1999; Clarke & Star, 2003), and sometimes also expansive reformulation of work practice, including reconfiguring the technology in question (Hasu, 2000; Hasu & Engeström, 2000; Karasti, 2001).

At the same time, ethnographies of consumption have demonstrated that consuming is an effortful accomplishment, underdetermined by the properties of the product, that varies from person to person (Holt, 1995). As Alfred Gell (1986, p. 112) defines it, "consumption involves the incorporation of the consumed item into the personal and social identity of the consumer," which makes technologies "domesticated in the social and cultural ends" (Strathern, 1992, p. viii). Silverstone, Hirsch, and Morley (1992, pp. 15-32) elaborate on four processes that take place in the consumption of technology within a household. The "appropriation" of technology into one's possession is followed by its "objectification," adjusting it into the existing environment and imposing on the new technology the values one desires the artifact is to represent. In parallel, the technology is "incorporated" into the functional sequencing of life, and "converted" into a means of enhancing one's status in the outside world.

While these lines of findings are complementary, they tend to remain detached from each other, both in research and in the practice of technology design. Ethnographies of consumption build on social anthropology, where goods are seen primarily as carriers of meaning and mediators of social relations (McLaughlin, Rosen, Skinner, & Webster, 1999, p. 53). While these studies may include detailed descriptions of how people shape material qualities of consumed objects, these findings are by default suppressed in discussion in favor of explanations in terms of shared rituals, tradition, authentication, and symbols, which are perhaps seen as culturally deeper by this tradition (Belk & Costa, 1998; Sherry, 1990; Wallendorf & Arnould, 1991). In contrast, ethnographies of work tend to emphasize how both work and technology are shaped, and have often accounted well for the organizational context of technology use (Karasti, 2001; cf. McLaughlin et al., 1999; Suchman, Blomberg, Orr, & Trigg, 1999). This emphasis is accentuated in innovation studies, which tend to focus solely on the modifications and additional inventions users have made, while saying precious little about any social and cultural context within which these changes take place (Gardiner & Rothwell, 1985; von Hippel, 1988, 2005).

Interestingly, there was a practical parallel to this theoretical disjunction in the high-tech company I examined in an ethnographic and historiographic study during the years 1999-2003. The engineers studied had developed for the elderly an alarm and monitoring device, called Wristcare. As is typical with innovative technologies, the early years of its use were marked by software bugs, hardware problems, redesigns, and new uses. Diagnoses of problems relied solely on examining the devices and the immediate situation where the problem had occurred. Other feedback from users was gathered, but mostly processed separately. Consequently, it took more than 3 years before the implications of users' varying needs for the reliability, usability, and functions of the device were met by building far easier tailorability into the system. The split between material changes, various complaints, and what designers labeled as "misuses" and "creative uses" was one of the matters that prevented acting on this problem earlier (Hyysalo, 2004b, 2006b).

The angle on this larger body of ethnographic work taken in this article is to look at one of the specific questions, namely, how the managers of rest homes, the home-care workers, and the elderly residents utilized Wristcare in their lives and work in sheltered housing. Particular emphasis is on developing a conceptualization that better accounts for the interdependencies in what different people did with devices, what having and using these devices meant for them, and how they altered the material form of these artifacts.

The key set of data analyzed here consists of interviews and observations in four separate rest homes during the years 2000-2001. Four managers, 14 nurses and home-care workers, and 17 residents were interviewed, and some observation of the use of the device was carried out. These events were audiotaped and detailed notes were made during and right after the observations and semistructured interviews. All interviews were conducted in Finnish with native-speaking Finns and translated into English by the researcher. Sorting this data in Atlas-Ti created 227 entries in 57 categories, which were further sorted in regard to different people and their personal and group projects. Data excerpts for the paper were chosen to represent the key features of the topics addressed.

TECHNOLOGY IN PERSONAL AND GROUP PROJECTS

Conceptual resources for exploring the above questions can most readily be found in approaches combining ethnographies in social shaping of technology with ethnographies of consumption (Lie & Sorensen, 1996; Williams, Slack, & Stewart, 2005). Some of the key insights can be summarized as follows.

1. While designers build their sets of meanings and values into a technology, it finds new purposes, sociotechnical configurations, and sets of meanings in the hands of its users. The relevant characteristics of the technology are then constructed within a different practice, although the material prefiguration in the technology is not entirely malleable (Akrich, 1992; Hasu, 2001; Hyysalo, 2006a).
2. Nothing happens after the introduction of technology unless it is somehow put to work and given meaning: appropriated by people and embedded and sustained in their social practices (Sorensen, 2002). This can happen in multiple ways and for multiple purposes, for users may not wish or may not be able to follow designers' ideas about the proper use of technology. The success of technology is thus dependent on the motives people have for utilizing it, and on the social and organizational constraints within which the use takes place. For instance, highly cumbersome technologies are nurtured and attended to when they serve an important purpose in somebody's life or work, or when an organization has effective regulation in place to enforce certain patterns of use, regardless of their inconvenience (McLaughlin et al., 1999).
3. Attention should be paid not only to the immediate human-technology interaction, but also to the socially, spatially, and temporally wider organization among people and technology that create its meaningfulness. Appropriation of technology typically includes shaping both the technology and existing practice (Berg, 1997; Hasu, 2001; Lehoux, 2006).

The key analytical term for this study—*personal and group project*—is adopted from McLaughlin et al. (1999), who pursued this line of research. In their use, project is a relatively loosely defined term describing the fairly independent tasks and concerns that people strive for in their work. In this paper, the term is made more specific. *Projects* are seen as reasonably independent and pervasive concerns that manifest themselves as tasks and strings of action that persist for years (in a sense of occurring regularly or frequently). Moreover, they are seen to do so within an activity, a relatively durable unit of technically, culturally, and socially mediated collective practice (Cole, 1996; Engeström, Miettinen, & Punamäki, 1999). Projects often do not have a definite goal or end point that could be met, but are oriented to particular objects. The information below indicates that such objects vary significantly, from managing one's life with a reduced mobility to projects related to work routines, such as the nurses' socializing with residents of rest home.

A further rationale for using the notion of project lies in the way McLaughlin et al. (1999, p. 56) connect it to the process of "valuing" technology in a local setting. By *valuing* they mean the gradual construction of the utility of the technology by the end users; thus they reject seeing usability or utility as inherent qualities of technology. Their study of management information systems demonstrates how achieving utility requires that people make an effort in "constructing the usability": the sociotechnical shaping of both the technology and the work patterns of users to render the system practically operable (McLaughlin et al., 1999; McLaughlin & Skinner, 2000).[1] In McLaughlin & Skinner's words, "When we re-interviewed a sub set of users at each site three and six months later, it was notable that these concerns [of usability] had—to a greater or lesser extent—been superseded by others around the utility or usefulness of the system. This shift reflects…the incorporation of the systems into the working lives of end-users. Many of the users we studied came to find the systems useful through an engagement with the problem of making the system usable" (2000, p. 418). The notion of project thus has a history of being used for elaborating the most important ongoing personal and group projects that a technology enters, as well as the roles it comes to serve within projects.

DESIGNERS AND THEIR ASSUMPTIONS CONSTRUCTED INTO WRISTCARE

The designers of Wristcare often referred to their device as the next generation safety phone.[2] Like previous models, it had a manual alarm button, but it also had sensors that gathered data about physiological indicators: various kinds of movement (body movement and smaller movements such as pulse and breathing), temperature and, from the second generation onwards, also skin conductivity. The algorithms in the wrist device and the receiver unit in the user's apartment combined these measurements to keep track of changes in the user's health. This data was then transferred via a telephone network to control software that provided messages for helpers. These messages included, on the one hand, alarm messages of differing gravity, such as an "acute disruption in condition," a "disruption in condition," or an "extraordinary passiveness." On the other hand, there were messages that related information about the state of the system. For instance, a message ensued when the device detected a poor connection to the wrist, when it was taken off entirely, or when good wrist connection was re-established. The variety of alarms the Wristcare system could generate changed throughout the investigation

period; the maximum number of different sorts of messages was around 50, roughly half of which were about maintenance and the technical state of the system.

Designers asserted that these messages would allow the caregiver to keep track of the gradually worsening health of an elderly user, and thus enable active measures to be taken (Company business plan 1997; 1998)[3]. To augment this, the control software provided the history of alarms of each user, and this was supposed to be checked with each alarm. In a more advanced version, the physiological activity of the user was also conveyed as a graphical illustration called an "activity curve" that could be of further use in diagnosing the state of the user.

Designers considered it necessary for the user to wear the device all the time to ensure reliable coverage and to allow caregivers to see trends in how their charge's condition developed (Wristcare functional description, 1993; interview with the company founder, October, 22, 1999). The control software was to help caregivers make a judgment about what to do in each case: whether they should telephone the user, or go in and check the user or the device, or eventually, whether to call an ambulance. An adequate response to each alarm was ensured by routing alarms via preprogrammed paths, for instance, first to the control room, then to the cell phone of the nurse on call, and finally to an alarm center located elsewhere if no one else had reacted (Wristcare functional description, 1993; Wristcare user manual, 2000). The device was thought of strictly as a safety instrument, and any other kind of use was strongly discouraged in manuals, marketing materials, and so on.

In the future, the company planned to create customized solutions for special groups of users, such as epileptics, diabetics, and those suffering from dementia. During the 4 years following the initial market launch in late 1997, the company reported having captured the majority of new installations of safety phone systems in sheltered housing schemes in Finland. Wristcare also entered the markets in, for instance, the UK, Germany, and Japan (company business plan, 2001). However, the initial design of Wristcare had to be significantly altered because of various shortcomings and problems in the reliability of monitoring and with its ease of use. The improvements included changes in the core hardware, as well as a gradual development of control software, instructions, manuals, training, and so on, all prerequisites for making the technological system work reliably in the practices of users. Exploring how people used Wristcare in their work and in their everyday lives sheds light on some of the reasons behind these changes.

WRISTCARE AND THE MANAGERS OF RESIDENTIAL HOMES

At the time I conducted my research, the device was mostly used in institutions for assisted living, in which the elderly residents lived in their own separate apartments, but shared common areas such as a dining room and lounges, and received help from home-care workers and nurses when needed. All the data below is from this kind of housing arrangement. In such settings, the alarms generated by Wristcare were routed to a computer in a nurses' office, and further directed to cell phones of the staff if not signed in at the office. The staff checked the alarms by calling or visiting the residents.

The managers of residential homes were key figures in the purchasing and market success of Wristcare. Managers perceived the utility of the Wristcare system in the organizational development more broadly than did the designers. Wristcare provided a means

to prepare for the technological transition in elderly care. This became a part of an ongoing project to develop the external relations of the organization. Internally, Wristcare was unanimously perceived as a means for the organization and its residents and staff to get connected with technological development. It also became part of the reorganization of work, particularly in breaking down the rigid procedures in care rounds and in minimizing staff on night shifts. The role of Wristcare as a part of a wider organizational frame governed how its problems and the needs for redesign were addressed. However, the technical details and the ways residents and staff perceived the devices were addressed only in rather general terms: as general doubts about whether the device really worked as claimed, and as concerns about how it affected social relations within the organization (see Table 1).

WRISTCARE IN THE PROJECTS OF THE SENIOR RESIDENTS

"Well, there would have been plenty of reclining to do [on the bathroom floor] before the morning meal would have arrived nine and half hours later" (Resident 1, Savitaipale). Similar grim humor about everyday life and concerns, and about the advantages of having Wristcare, were often voiced by those who had problems with movement and faced the fear of falling on a daily basis. These residents were by and large extremely satisfied with their devices. Wristcare had become their personal lifeline whenever they fell down or got stuck in

Table 1. Wristcare in the Work of Rest Home Managers.

People	Projects Wristcare featured in	Issue Wristcare was used for	Exemplifying quote
Rest home Managers	Managing the external relations of rest home	Building better appeal	*"This kind of high-tech can give the elderly as well as their care a status other than just being 'out of time.'"* (Manager, Espoo) *"Wristcare consolidates our good reputation, which gives us number of direct and indirect benefits: better workforce, latest knowledge in the field, collaboration with schools and universities, partner organizations, visits by public sector movers…."* (Manager, Turku)
	Developing organization	Keeping up with technical development	*"I see that this system raises the self-esteem of our staff, as they can use high-tech and show that they can do it."* (Manager, Turku) *"Its implementation and use lowers the threshold to implement new technology in the future."* (Manager, Savitaipale)
		Work Reorganization	*"This technology enables more natural communication between the nurses and residents than the scheduled rounds did.... And… maybe our residents have learned to want things a bit more than previously."* (Manager, Espoo)

some awkward position and could not get up. Some of them experienced these incidents several times a week. Even those who did not currently need the device were firmly convinced of its importance in the light of their previous accidents.

This fundamental utility in one of their most important life projects—literally giving access to mobile living in the sense of getting out of the bed in the morning—made these residents appreciate the other aspects of the device as well. Even though all my interviewees had used only manually activated alarms, a feature found also in other safety phones, they regarded the automatic alarms as good and useful. Moreover, their appreciation made them overlook the inconveniences and discomfort felt in wearing the device: *"I always try to rush from the shower within 15 minutes to get the bracelet back on so it won't generate an unnecessary alarm"* (Resident 2, Savitaipale), and *"It's good to wear even though it presses my swollen [and paralyzed] arm"* (Resident 3, Savitaipale).

Nor did these residents mind being woken up during the night or in the morning because of checking calls and visits for false alarms. The extra features of Wristcare were perceived as enhanced care and the inconveniences as indications that they were being looked after continuously. No one complained about the price of the device, or expressed doubts about whether the device actually worked the way it was said to.

As the device was designed to be what its developers called "foolproof," the opportunities for shaping it were thought of as being very restricted (interview with company electronics designer, November 25, 1999). Nonetheless, residents often opted for procedures that redefined the functionality of the device, such as wearing it on a paralyzed arm, or attaching it to bed post or a wheelchair to make the alarm button easier to press, even though this meant giving up all the monitoring functionalities.

Another extreme of the relationship to Wristcare was found among residents with a heightened risk of cardiac arrests and strokes. One resident had worn the device for over a year; there had not been any automatic alarms on occasions he had felt heart symptoms, and he had been able to activate a manual alarm. *"I don't know what generates these alarms in the first place, and the whole thing feels like humbug"* (Resident 1, Espoo).

He was also annoyed by nurses making between 5 and 10 calls to him to check if everything was all right when there were no symptoms at all. Similar doubts and concerns were voiced by other residents with cardiac risk. Uncertainty as to whether the device would be able to detect the emergency was accentuated by doubts about whether the help would arrive in time. The time required for the check-up call, confirmation of need, and the ambulance to arrive added up to between 20 and 30 minutes, which was felt to be too long (see data excerpt in Table 2).

The inconveniences of wearing the device irritated the cardiac patients more than, for example, people with reduced mobility. For instance, after being frustrated by having been woken up a couple of times in vain, one of the residents demanded that staff not be allowed to react to any alarms from her during the nighttime. Cardiac patients also made more critical comments about the look and feel of the device: It had to be worn too tight, it looked clumsy and repulsive, like an aid or prosthesis, or that they wore it underneath their sleeve. Part of this difference came from the fact that cardiac patients generally had more active and mobile social lives and often did not have many other aids. While Wristcare helped the people with reduced mobility to prevent major inconveniences as often as on a daily basis, the cardiac patients were protecting themselves against rare but potentially fatal incidents. The latter

faced higher stakes, but their daily usage gave them less reassurance that the device could indeed be trusted in emergencies.

While the two cases above represent the extremes of the personal projects the device was incorporated into, the interviews also revealed an array of more subtle ways of utilizing the device. The first was pleasing caregivers and relatives. *"I took the device when my son brought it, and a number of times he has demanded that I should have pressed the alarm-button"* (Resident 2, Espoo). *"I don't need the device for anything, but once it was put to my wrist, I did not have the heart to return it, because two others just did that"* (Resident 3, Espoo).

These users were not too concerned about how the device was worn or maintained. Two of them kept the device on the table by the bedside, and one wore it very loosely on her wrist, obviously more concerned about comfort than the fact that the device detected hardly anything when worn that way. The maintenance stories told by designers describe cases such as a user insulating the monitoring surface of the device with cotton to achieve more comfort. It seems, for some individuals, that just *having* the device was its sufficient utilization, regardless whether it could even in principle be used for sending an alarm. Wristcare also interfered with stabilized symbolic meanings in the lives of the seniors. The most common association for the Wristcare was that of the watch. Not only was the device often referred to as a watch or an "alarm-watch," but this also came to bear the symbolisms associated with it. Some users wished it looked look more like a regular watch and not so much like an aid that drew attention to the user's weakened state (see also Soosalu, 1996).

An overarching theme through the interviews was the sense of security. Even if there was no clearly identified physical threat, the device served as an assurance against threats: *"I haven't really got any tangible benefits out of it yet, but I rather see it as a warning sign, as a reminder to watch my step"* (Resident 1, Turku). However, the symbolism of security evoked by the design was not only positive. After giving away the device, one resident explained:

> *"The security I trust is in quite other hands…the span of our lifetime is decided elsewhere, and I have no need for this kind of device. If you can make it to the phone on your own, that is then a different story…This is not like the real [safety] bracelet that my friend wore* [earlier generation safety phone rented from the Red Cross], *got help with it, and was taken to a hospital where she died a couple of days later. I didn't like the clumsiness and ugliness of the device either, not that I regarded it as a piece of jewelry, which one should not wear anyway."* (Resident 4, Espoo)

Wristcare thus failed to match up to the sources of security—God, hospital, and technology established in her younger years—which she regarded as reliable. The religious frame of reference was employed also in relating to the appeal of the design, but again left room as well for evaluation stemming from everyday experience.

Most crucially, roughly half of the residents in all four resident homes chose not to take up the device even when it was included as part of their rent. To these individuals, using the device meant legitimizing checkup visits, an obligation in some places to check-out when leaving the building and, on a more symbolic plane, sending out a signal that one was in need of increased nurturing and surveillance and could no longer manage an independent life. Agreeing to accept the device was a big step for the majority of residents, both symbolically and as a practical arrangement (see Table 2).

Table 2. Wristcare and Elderly Residents' Lives: Projects and Purposes.

People	Projects Wristcare featured in	Issue Wristcare was used for	Exemplifying quote
Senior residents	Attending and maintaining mobile life	Recovering from the daily incidents caused by hampered mobility	*"Well, there would have been plenty of reclining to do [on the bathroom floor] before the morning meal would have arrived nine and a half hours later."* (Resident 1, Savitaipale)
	Guarding against cardiac problems	Getting help in the case of cardiac arrest or stroke	*"I'm not fully convinced about it. I would trust it more if it gave me alarms every now and then when I do have heart problems."* (Resident 4, Espoo)
	Pleasing the caregivers	Maintaining the significant social relations	*"I took the device when my son brought it, and a number of times he has demanded that I should have pressed the alarm button."* (Resident 5, Espoo)
	Refusing the device	Maintaining independence and sovereignty	*"Some residents feel they have lost some of their privacy, because of the checking visits for the false alarms and also because of having feelings of guilt for not wearing the device all the time, as well as having to check out every time they leave the building."* (Nurse, Espoo)

WRISTCARE IN THE WORK OF NURSES AND HOME-CARE WORKERS

From the perspective of the designers of Wristcare, the job of nurses and home-care workers, as users, was to respond to alarms and to ensure that the residents wore and used their devices correctly. When I observed their work, the reality was quite different. Wristcare entered an existing organization of work and a set of social relations that it somewhat reshaped. The most important of these collective projects for the caregivers was conducting daily tasks, such as care rounds, meals, washing, cleaning, and providing help on various requests. Intertwined with these tasks were the constant maintenance and activation of the (often deprived) social relations of residents through chatting and small visits, often on the pretence of just checking that all is well, which the resident could turn into a conversation if s/he wanted.

Nurses agreed that Wristcare enabled a more flexible and efficient patient rounds procedure. Wristcare also opened up new ways of gaining and maintaining control without engaging in time-consuming interactions with residents. One could just look at whether residents were present and how active they were. But as tasks and socializing were intertwined, this benefit was a mixed blessing (see Table 3).

The device provided a means to deal with reliability and responsibility, emphasized because the nurses worked within multiple commitments—to the relatives, the management, and the residents. Related to this, the increased control was expressed as a psychological improvement in their personal work. Reliability and responsibility were also emphasized because the nurses had to work for, and often on behalf of, patients who could no longer get by

Table 3. Wristcare in the Work of the Nurses and Home-care Workers.

People	Projects Wristcare featured in	Issue used for	Exemplifying quote
Nurses and home-care workers	Carrying through the daily tasks	Flexing the care-round procedure	*"We have agreed that they press immediately if they feel at all worse… and that also makes them more active, when they have to evaluate when they want something and not just wait for the round."* (Home-care worker, Turku)
		Rendering work more efficient	*"We can skip some unnecessary checking rounds, as looking at the activity curve reveals that the resident is alive and breathing, and has not called for help."* (Home-care worker 1, Espoo)
		(…but also interfering with work)	*"If you are doing something else, especially giving a treatment to a patient and the alarm goes off, it is not a pleasant situation. Just think of making stitches or sanitary operations: You have to stop, take off the plastic gloves, reach for the device, sign in the alarm, and rush to the computer to see how acute a matter it is."* (Nurse 2, Turku)
	Maintaining social relations to the residents	Managing time	*"We don't have to call to see whether people have made it in or are still outside. You know, when you call, you have to have a little chat, which easily takes 5-10 minutes, which adds up to a few hours a week."* (Home-care worker 2, Espoo)
		Managing responsibility	*"We can better control the nightly movements in the wing for demented residents, and compare the residents' explanations, events, and the details provided by the activity curve of the device."* (Home-care worker 3, Espoo)
		Managing anxiety	*"It gives you peace of mind, when you know everything is o.k. right when you arrive in the morning."* (Home-care worker 4, Espoo)

in their lives. The system was legitimized as being "good for the elderly," as it gave them a greater "sense of security."

Yet the use of the device also interfered with other work tasks, particularly medical or sanitary operations carried out alone during the night shift. Nurses saw the most crucial drawback of the device as the occasional strain it caused to relations between staff and residents. A typical instance was that a resident would get irritated with the false alarms, complain about the extra cost (in all institutions the cost of the device was included in the rent, notwithstanding whether the resident actually wore the device) and, most severely, complain to other residents about the device.

The organizational structure did not allow the staff to reject the technology without seriously disturbing their relations with the management and/or the residents. I find it

indicative that the managements' prime concern, keeping up with the technological modernization of care, was voiced as a good thing by only two young, technologically competent nurses—as maybe beneficial for older staff members.

These group and personal projects guided the way the staff made the device fit their work. Wristcare was designed to be a foolproof piece of technology for its end-users, the residents. This design logic transferred much of the responsibility and diagnostic work to nurses. Designers had issued strict instructions on how to use, wear, strip, and store the device and how its various messages should be interpreted. Yet, there were two main ways of altering the design logic in nurses' work procedures:

> *"The use of the program is based on knowing the personal rhythm of the residents… To many of the problems in the device and in diagnosing [the alarms], there has emerged a solution in finding a personalized solution with the particular resident."* (Home-care worker 2, Espoo)

In practice, some of the alarms were ignored and casually checked hours later to see if they were typical for that particular resident. In another words, the recommendations, alarm histories, and activity curves offered by the machinery were replaced by first-hand experience with the resident and memorization of typical incidents.

The system was also realigned by receiving calls to nurses' cell phones. Some nurses and caretakers saw the cell phone connection as *"the greatest benefit from the system, because it liberates us from the office, and we can go about our tasks more freely, as they can reach us all around the house or even from the neighborhood store"* (Home-care worker 1, Espoo).

At the same time, the cell phone enabled the nurses to bypass the diagnostics in the software. It often was quicker to visit the resident than to go into the control room. What grew out of this experience was that, in two of the sites, manual alarms were used as a nurse-call system. The end result was that the design logic (that was restricted to alarms and tried to help the diagnostic tasks by providing information on the gradually changing state of the patient) was replaced by personal knowledge, by visits that were not differentiated according to the nature of the alarm, and by turning the system into an alarm-paging hybrid. This was taken as far as using the system as a personal emergency button for the nurse on duty.

Nurses also gradually created their own prescriptions for using the device. Some institutions dropped the obligation for residents to check out when leaving the building. In a similar vein, staff did not react to information about the device not being worn on the wrist. Also the manual alarms from some residents were ignored because they had often "flicked it" unintentionally. With others, caregivers only reacted to alarms in the daytime, because some residents had demanded not to be woken at night. It was also common that caregivers encouraged their charges to wear the device however it was most comfortable (very loosely or on the more active arm) to ensure that it was worn at all, even when this completely contradicted the designers' prescriptions.

To conclude, Wristcare came to be appreciated by the staff only when they were able to incorporate it fruitfully into their two intertwined major projects: delivering assistance and socializing with residents. Its functional capacities were explored and evaluated from the perspective of these projects. This meant ignoring some of the major capabilities of control-program in diagnosing physiological condition, and led to the creation of work-arounds, and

local procedures and prescriptions that differed from those given by the manufacturer. This local process of valuing was also converted into the general features of the product system, as the rest home staff gradually convinced the designers that the technical system had to be redesigned to better fit the procedures in which the device was actually being used.

HANDLING FALSE ALARMS

False alarms allow us to clarify the extent to which people constructed differently the relevant functionalities of Wristcare. Seen in terms of collective and personal projects, a false alarm is an alarm that is deemed contrary to one's expectations of the technology: the appropriate behavior of the device and/or the appropriate role it should play socially and symbolically. These can vary therefore, depending on the project within which the appropriateness is judged. How much importance people placed on performance problems like false alarms is also strongly related to the "access" to the material and social resources available to them to reconfigure the system and eliminate the problem.

The designers' aim was to make Wristcare a commercial success and a product that worked well technically. How they defined a false alarm related to the technical specification: either an alarm under conditions not specified for an alarm, or an alarm different from the specification was indicated for the type of incident that had happened. Occasionally, there were also cases that raised considerations for long-term changes in the specification. For example, should some alarms be changed or made less sensitive? The typical ways designers could react to a false alarm, if clients insisted they do so, were to examine the incident, diagnose the problem, and either tinker with the device or transform it into a new one. If the problem kept appearing in various sites, a redesign of future models might have been worked out in the company. The key criteria for all these actions were the clients' demands and the engineers' estimates of how much work must go into reconfiguring a technology. While designers had very little direct access to how the use was organized socially, they had wide access to the technical configuration of the devices, granted by the sets of instruments, staff, and financial resources of the R&D company.

For the managers of rest-home units, the key project was to keep their institution running and to develop it. Within such a project, the primary criterion by which alarms were judged to be false derived from their impact on the organization. Whether an alarm went off according to the specification was not the key issue; the "falseness" derived from whether it caused pointless work or dissatisfaction among the workers or residents. Managers had a whole range of means available for handling the unwanted situations: for example, deploying more training, trying to reorganize work, complaining to designers, or appealing to the purchase contract.

For nurses and home-care workers caring for the residents and their environment, the key criterion became how well the alarm corresponded to their own and the residents' own immediate evaluation of the situation. An alarm was false when it was deemed irrelevant or irrational, or was activated unnecessarily by themselves or by the residents. In comparison to the designers' technical criteria for false alarms, the nurses' criteria shifted to the context of use. The harm caused by a false alarm was evaluated in terms of how much extra work or distress in social relations it had caused. The typical actions nurses took in dealing with false alarms were to match the situation to heuristic guidelines, to instruct the user or to find work-arounds (such as disabling the device at night) to prevent the problem in the future, and

finally to complain to managers, maintenance vendors, or the manufacturer. It is notable that the nurses' means for diagnosing and handling the false alarms were almost diametrically opposed to those available to the designers. Designers had access (in terms of means and legitimization) to the workings of the device, but only mediated ways to affect the situations of use, while nurses had many courses of action available to shape the situation of use, but almost none for adjusting the internal workings of the device (cf. Ratto, 2003).

The issue of access to means of change is further elaborated with the residents. There was practically no way the seniors could change the workings of the technology on their own. In the face of recurrent false alarms, they could only try to comply with instructions even more carefully or get out of being monitored altogether by, for instance, leaving the device on the table or wearing it loosely. Any other action had to be mediated through nurses. Even if a resident wanted to refuse the device, it required the nurses' consent and a discussion. In getting rid of annoying alarm types or finding work-arounds, the seniors were wholly dependent on the help of the nurses, their knowledge of the system, and their opinions on whether a change was desirable.

Even though the different seniors were equally constrained in the limited change they could bring to the technology, their criteria for false alarms and the projects within which these were considered varied greatly. Residents with reduced mobility seemed to consider false all alarms triggered in situations they could have managed themselves. This included both unneeded automatic alarms and alarms they had activated in situations they could have handled on their own. Nonetheless, as noted above, they considered false alarms of both kinds as an inevitable part of securing the project of managing their lives with various accessories and daily hazards. This is in striking contrast with cardiac patients, who employed the device to prevent or diminish the damage resulting from rare but serious arrests and strokes. Within such a project, the nonacute automatic alarms got the whole range of interpretations: They were seen as positive, as indications of the alertness of the monitoring; as unavoidable nuisances; or, negatively, as indications that the device was not measuring significant fluctuations in their condition and thus could not be trusted to provide help in an emergency.

Residents with reduced mobility, cardiac patients, and designers to some extent shared the idea that the falseness of an alarm is derived from the level of correspondence between the working of the device and the condition of the body under surveillance. This was not the case with residents who wore the device to please their relatives or nurses, or with those who refused the device. Here the validity of an alarm was determined by the way it helped maintain or enforce social relations. This opened up possibilities for a radical reconfiguration of the system: When alarms were not really an issue, the device could be left on the bedside, its underside could be insulated with cotton, it could be worn very loosely, and so on. For the refusers, the issue was mostly the system as a whole: Taking the device meant legitimizing checkup visits, accepting an obligation to check out when leaving the building at some residences, and sending a signal that one was in need of increased nurturing and surveillance and could no longer manage an independent life.

The importance of the device within each project seems to match well with how seriously the false alarms and inconveniences were judged. While indifferent users were fairly indifferent about the false alarms too, cardiac patients were much more irritated. In Table 4, false alarms are examined in terms of the key projects of the different people engaged with Wristcare, along with their criteria for falseness and its importance in them.

Table 4. What is a False Alarm? The Project, Criteria, Significance and Access Involved with False Alarms.

Constituency Group	Key project in which a false alarm gets its meaning	Criteria for what constitutes a false alarm	Options for handling a false alarm (access)	On what the importance of false alarm depends
Designers	Creating a technically valid and working configuration	The device performed differently than specified, or a false alarm ensued even if the device was handled exactly as instructed.	Examine the situation, diagnose the particular device, tinker with it to improve functioning, or, if the problem remains persistent, change the device and/or make a redesign to future models.	Urgency of customers' complaints and the amount of redesign needed
Managers	To run and develop the organization	The device causes extra work, loss of money, or dissatisfaction because people deem it is not functioning the way it "should."	Training, reorganization of daily work, complaining to designers, appealing to the contract	Its impact on the organization
Nurses and home-care workers	Carrying through daily tasks and maintaining social interaction with the residents	The alarm is deemed irrelevant or irrational, or was sent without a valid need, as deemed by themselves or by the residents	Matching the situation to heuristic guidelines, instructing the user, working around the problem to prevent it in the future, complaining to managers or to designers	The amount of extra work or distress in social relations that is caused
Residents with reduced mobility	Managing their lives with accessories and getting help when accidents happen	If one could have managed by oneself and occasions when the check-in visit is disturbing	Changing the way they wear the device, complaining to the nurses	The amount of inconvenience involved
Residents with a cardiac risk	Preventing or diminishing the damage of the life-threatening arrests	Alarms that are obviously not related to any rupture in condition	Pleasure that the device is sensitive and reactive enough, accepting it, complaining to the nurses, or withdrawing from use	The reliability of the device in emergencies
Residents wishing to please nurses or relatives	Maintaining and enforcing social relations	Any alarm that disrupts or weakens the relationships between staff and resident?	Insulating the device, leaving it on a table, wearing it as suggested, or other such work-around	The amount of damage to social relations
Residents who refuse the device	Maintaining independence and management of own affairs	Any alarm (for other residents) that suggests that the refuser should also start carrying the device	Refusing the device	Threat to independence

VERSIONS OF TECHNOLOGY-IN-PRACTICE

The literature review suggested that during the process of appropriating technology people are likely to alter its meaning as well as its constitution to suit the organization of their everyday lives. Indeed, the elderly and their care-givers reconfigured Wristcare in both material and nonmaterial ways. At the technical end, there were demands for changes from the designers and working around the system by using other technologies, using only some features of the device, or expanding the uses for Wristcare. Less material mechanisms included replacing the use of technical features by social knowledge and procedures, reducing the technology largely to its symbolic value (such as a sign of modernization of care), reducing it to its significance in social relations (such as in managing relations with relatives and personnel), or refusing the device because of the associations the device had with dependency.

However, framing the findings in this way runs a risk of downplaying the effects of these actions in appropriating the technology. The study could be read (and is in fact likely to be read by many, as pointed out in the literature review) as saying that the technology was interpreted differently, that different meanings were ascribed to it, and that there were *also* minor modifications and alternative uses of the technology. But both social constructionist and materially essentialist readings would miss the point. One is warranted to ask "So what?" that there are minor modifications of the technology. Minor modifications can quite sensibly be regarded as a matter of better instructing the users to comply with design or maybe a matter of fixing some of the worst bugs as well. It is equally inadequate to note that people interpret the same technology in different ways, as the technology does remain the same regardless of the ephemeral interpretations given to it. Indeed, in both types of reading, the findings would be interpreted as *merely* being about the social and cultural context of technology, context here understood as something that surrounds the technology.

These likely readings by both researchers and some practitioners remind us that social science concepts orient actors toward enacting certain realities (Law & Urry, 2004). A more full-bodied way to account for the findings of this paper is to conceptualize that there emerged multiple versions of the technology-in-practice (Mol, 2002; Sjögren & Helgesson, in press; Star, 1989, 1991). When we examined the projects in which users engaged with the technology, it became clear that Wristcare was never alone, but always enmeshed with other artifacts (cell phones, notebooks, sanitary gloves, beds, wheelchairs, etc.), procedures (care rounds, daily rhythms, etc.), conventions (in conversations, in conduct, in giving treatment, etc.) and pre-existing sets of people participating in events (nurses, residents, neighbors, relatives, etc.), as well as frames of reference and participation (consumption rituals, prevailing narratives about new technology, etc), to name a few.

Wristcare-in-practice was in effect an intertwinement, an "artful integration" (Suchman, 2002), of these elements that varied significantly from project to project. Users ignored and went as far as actively removing characteristics of Wristcare that conflicted with the version they preferred to enact into presence and which they preferred to allow to have effects on their action and interaction. When practice (or activity or conduct of work) is taken as the starting point, context becomes that which weaves together, and is woven together by, the elements that compose the actions performed (Cole, 1996). In this light, the various meanings ascribed to a technology or modifications to its material shape are only symptoms or re-presentations

of the material-cultural-social hybrid (in other words, the version or sociotechnical configuration in action) that is enacted into being (Cole, 1996; Mol, 2002).

But does not such practice-centered conceptualization run a risk of turning the examined phenomena into a "soup," in which different layers of practice, technical matters and social phenomena become indistinguishable, and thus risk losing explanatory power? Furthermore, is it not implausible to do away with vast differences between, for instance, things technical, procedural and social? Such questions, often targeted to actor network theory, are indeed valid concerns. Where does the heterogeneous network comprising practice ever end, and how can it thus be analyzed (Miettinen, 1999)? Clearly, to gain insight into how Wristcare became enacted, we need not, and should not, aim to understand all that is involved in a given practice. Midrange sensitizing concepts, such as project, allow patterns to be revealed from the practices examined so that we can approximate the minimal meaningful context relevant for the technology in question: in this case, relatively durable concerns and "strings of actions" within which versions of technology were enacted. This also reveals that while practices may be soupy by their nature, they are far from run through a sieve. There are clearly bigger and smaller chunks of the technical, the social, and the organizational that do not dissolve into the texture or the "taste" of practice. However, these chunks do not exist in isolation and may not straightforwardly follow pre-existing intuitions and assumptions of what must be technical, what is social or, say, economic. These patterns must be revealed by inquiry. Using another domestic metaphor, practice is less a big lump of clay to be molded at will than variously shaped and sized bits and pieces of a child's Lego construction kit.

Nor does talk about versions lead to seeing technology as utterly malleable or a matter of only social construction (Grint & Woolgar, 1997). Accepting the notion of versions of technology means that there is no finite, predefinable list of functionalities to a given technology, while at the same time it points to the very concrete constraints to different versions of technology that can be enacted in any given concrete practice in a particular time. The 35 people involved in the Wristcare use who were studied for this paper enacted a much smaller number of significantly different versions of this technology. The stark differences in resources the various people had for dealing with false alarms underscores the encounters, interdependences, limits, and resources needed to meddle with "material," "organizational," "social," or "cognitive" aspects of technology in concrete settings. Changing the algorithms inside the Wristcare technology to adjust its functioning remains impossible for its users without the expertise, resources, and finances found in a high-tech company. In fact, at the end of my study, the developers had spent more than 5 years making such adjustments to increase the reliability of the monitoring and alarms, and were still not certain they had sufficiently quieted customer discontent and regulatory suspicions (Hyysalo, 2004b). The insides of this technology appear recalcitrant to change. But the key message from this analysis in terms of versions is that the obduracy of a technology arises just as much from the interdependencies between the versions that nurses, different residents, and managers enact, versions that depend, in turn, on how individuals' projects are interlaced within the working and living in their collective activity in a rest home. More extensive discussion of such systemic dependencies and encounters between versions of Wristcare go beyond the scope of this article: The configurations and networks of activities are explored in a related paper (Hyysalo, 2004a), and the process of change and learning resulting from encounters between the clashing versions of designers and users in another (Hyysalo, 2006b).

CONCLUSIONS

People such as the elderly and their caregivers have received little attention in discourses related to the shaping of new technology. A closer look at their engagement with technology reveals that they can be active and inventive. At their simplest, such findings can be taken to debunk the view that only technically savvy lead-users are relevant to the development and improvement of technology. The extent and importance of the elderly users' shaping, however, only become fully visible when findings from their work-arounds, minor improvements, complaints, redefinitions, symbolic uses, interpersonal arrangements, and so on are examined not in isolation but as parts of the work and life projects within which the technology-in-use gains its significance. Such an integrated examination can reveal—as was the case with Wristcare—that users had enacted significantly different versions of the technology.

These findings highlight the importance of attending to the actual environments and practices of users when studying the uptake of new technology. This should be taken as a reservation towards the ecological validity of studies that resort to exploring and evaluating technology use in laboratory settings, for this detaches usage from the resources, constraints, and rationales that indeed seem to play a key role in how people actually employ technology. Usage is simply not reducible to how fluently a person can operate a device, nor is its usability or usefulness. In a similar vein, traditional ways of segmenting users, based on personal characteristics, dispositions, habits, and gross figures, appear vague and potentially misleading without a qualitative understanding of the personal and collective projects and the roles of the artifact in them.

ENDNOTES

1. The shift in defining usability and utility as functions of end users' work practice has also been made previously. One of the most eloquent approaches has been put forward in the evaluative studies of computer use in various organizations by the Laboris group in computer science (Eriksson & Nurminen, 1991; Mäkeläinen Nurminen, Reijonen, & Torvinen. 1996; Nurminen, Reijonen, & Tuomisto, 1994).
2. The design, product development and designers assumptions on the future use of the device have been described elsewhere (Hyysalo, 2003, 2006b).
3. The company business plans, Wristcare functional description and Wristcare users' manual are company internal documents, that are not, or are no longer, publicly available, and hence not listed in the reference section.

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All correspondence should be addressed to:
Sampsa Hyysalo
Helsinki Collegium for Advanced Studies
PO Box 4
00014 University of Helsinki
sampsa.hyysalo@helsinki.fi

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