HUMAN TECHNOLOGY

An Interdisciplinary Journal on Humans in ICT Environments ISSN: 1795-6889

www.humantechnology.jyu.fi Volume 3 (2), May 2007, 228–247

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

URN:NBN:fi:jyu-2007282

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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Author's Note

Many people have contributed to the analysis and theorizing reported in this paper. Along with the designers, the elderly people, and their care-givers, who generously gave their time for my study, my special thanks go to

Reijo Miettinen, C.-F. Helgeson, and Stewart Russell for our discussions and comments that shaped the arguments in this paper.

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

Human Technology: An Interdisciplinary Journal on Humans in ICT Environments
ISSN 1795-6889
www.humantechnology.jyu.fi