THE PATIENT AS SKILLED PRACTITIONER.

We challenge the limiting view imposed on interaction design by the concept of usability because we hope to bring more awareness of and sensitivity toward skilled practitioners to the forefront of the design process. This paper draws upon empirical research examples of patients who 'do' home hemodialysis and asks what happens when patients are considered skilled practitioners rather than as victims? In this paper we argue for a change of perspective, from users to skilled practitioners in the design of technological devices. We advocate to design tools for enskilment, allowing for a sense of empowerment.

A patient connecting the tubes before bed as part of the setup of every other day dialysis treatment he conducts within his home.

INTRODUCTION

The design of medical devices is dominated by Human Factors Engineering. Fries (2001) defines Human Factors as "the application of the scientific knowledge of human capabilities and limitations to the design of systems and equipment to produce products with the most efficient, safe, effective, and reliable operation." Take notice of the focus, not on skills, but rather on efficiency and usability. This comes from the tradition of designing work environments (Sawyer, 1996).

The medical device field has strengthened the focus on safety since the publication of the Institute of Medicine report "To Err is Human" (Kohn et al., 2000) in which they say that medical errors account for more deaths each year in the US than auto accidents, breast cancer, or AIDS. The goal of the report was to draw attention to this fact and it certainly has. The United States Food and Drug Administration, considered world-wide as one of the critical regulation bodies in medical device approval, now requires a human factors program and has responsibility to "take action in cases of bad user interface design" Wiklund and Wilcox (2005, p. 23).

There are numerous guidelines and best practices for labels and icons in an effort to reduce errors. Standard bodies require a symbol acceptance rate of 85% for symbols of safety signs and focus on first time use only (Wiklund and Wilcox, 2005). To be fair, other design approaches have recently made inroads in retaliation to usability. Jordan (1999, p. 208) sees usability engineering as dehumanization and advocates a focus on pleasure, where products "are not only usable but also enjoyable, exciting and meaningful". But the hedonistic perspective of pleasurable and emotional design might not work too well within healthcare.

CURRENT DESIGN TRENDS IN HEALTH

During the transition from physical tools like wrenches and hammers to technological devices, such as personal digital assistants and mobile phones, products increasingly place more emphasis on cognitive and visual skills instead of relying on motor and physical skills. Three trends become apparent when looking at the intersection of healthcare and technology and should be questioned if they should serve as the basis for future product design: *person-centric healthcare*, *digital demassification* and *knowledge over action*.

First is the move towards person-centric healthcare (Fauchet et al., 2004 and Kilbourn, 2005). In practical terms, this means healthcare wherever you are and not confined to location-based, centralized places like hospitals and clinics. But this also places a huge burden of care onto the patients in which they have to manage self-care tools and devices. Non-compliance of recommended treatment plans is already problematic. This creates an even larger gap between giving patients responsibility and empowering them with the tools to manage self-care. However, combining dwindling numbers of health workers with aging populations across the globe, it seems almost certain that healthcare will be diffused into the home as much as possible.

The second trend is towards digital demassification or the conversion of physical matter into an intangible information ether. This approach has dire consequences as it transforms our ways of working with objects. It has been suggested that use error, or the improper operation of the device, vastly outnumbers failures from the medical devices not working properly (Food and Drug Administration, 2003). Wicklund (2004) sees this as a consequence of being awash in information so that medical devices are mutating into computers rather than "hands-on, physically interactive tools." Interaction design researchers are working to counter this affect by moving from data-centred to perceptual-motor-centred interaction (Djajadiningrat et al, 2004). In a similar effort to ward off demassification, Ehn and Linde (2004) put forward the idea of mixed objects with various ways of integration from placing digital on top of the physical to full enmeshment as a way to design beyond the physical-digital divide.

As a result of digital demassification, the third trend of favoring knowledge over action surfaces. Social researchers Mol & Law (2004, p. 45) have identified the overvaluation of knowledge and ask "what are the consequences if action is privileged over knowledge?" They show how diabetes patients through doing enact hypoglycemia, while becoming self-aware of their bodies. Listening to one's own body may be a possibility in appropriate circumstances, while a product can be used in situations where this becomes impossible. Knowledge in this case might be considered information-overload and paralysis or the inability to choose a course of action.

In light of these design trends, especially when placing the burden of care onto patients, medical device design should maintain a focus on safety but it should not disregard becoming a self-care practitioner. Patients will use these devices as part of long term treatment and care, not just once. It is critical to account for the growth of skill in managing one's health.

DESIGN FOR ENSKILMENT

From our earliest experiences in the world, we learn to use and manipulate objects around us. This growth of skill can be re-conceptualized as the process of enskilment. In our exploration of enskilment for design, we found it useful to distinguish three overlapping themes: *Situated bodily learning*, *environment structuring*, and *sense-making*. The themes interconnect at various points framing a simplified body-centered process. As Pálsson (1994, p. 901) says "becoming skilful – means to attend to the task at hand, actively engaged with a social and natural environment". Our environment description starts within the seemingly familiar setting of a hospital, except in this case the patient is not simply being treated, but is learning self-care.

At a home hemodialysis department in a Danish hospital, two nurses prepare patients to take over the responsibility of the every other day task of doing dialysis, but while at home (see Figure 1). These patients have chosen to take the bulky hemodialysis machinery home for a variety of reasons, from getting a better cleaning due to the more frequent dialysis to the opportunity to hold down a job by eliminating the three times a week hospital visit. We followed a patient through for the first five days of a typically 12 day training process to see how he engaged with the machine in a situated practice of learning. Dialysis, in a simplified description, consists of setting up the apparatus of concentrates, tubing and filter on the lower half of the dialysis machine then inserting the two needles into one's arm and starting dialysis by turning on the pump. The machine then pumps the blood through a filter to remove any impurities before returning to the body. After a period of about three hours (during overnight home dialysis it can range from seven to ten hours) the machine is stopped and removing the needles or closing up completes dialysis. The machine then begins a rinse cycle unassisted and powers down. Entering the treatment time, the volume of liquid for removal, taking blood pressure, stepping through the process and dealing with errors are mediated through a moveable touch screen interface that normally sits above the rest of the machine (with a flashing light and high pitched beep when necessary).

Situated bodily learning by the patient occurs within this hospital setting, our first theme of enskilment. On the first day with a new patient, the nurse demonstrates the entire process while explaining what she is doing. The next time, she lets the patient attempt to setup the assorted apparatus of tubes from memory, guiding when the patient deviates or struggles. From there it progresses to gathering the necessary supplies from the cabinet and dealing with the alarms. It is not until several sessions later that patients become confident at inserting their own needles, calculating the multiple variables and progressing unassisted through the touch screen prompts. How is this home dialysis training structured? Lave and Wenger (1991, p. 96) in reviewing other apprenticeship-like situations notes "the initial "circumferential" perspective absorbed in partial, peripheral, apparently trivial activities – running errands, delivering messages, or accompanying others – takes on new significance: It provides a first approximation to an armature of the structure of the community of practice." It seems the same is true in home dialysis, although a stronger connection with bodily learning can be made in that the patient learns with and about their body. Using the metaphor of moving from the outside inward is not always appropriate when thinking about situated learning. For home dialysis this might even be inverted in the sense that these patients are already internal and part of the hospital environment and learn to move outward to the home as part of the skilled practice of learning to do home dialysis.

As part of setting up, a bottle of concentrate has to be placed by sliding up a lever and then in the reverse action pushing the lever to lock and puncture the bottle into place (see Figure 2). The nurse with experience in this movement can quickly and without fuss accomplish this trivial step. But for the newcomer there is a process of gaining dexterity necessary to obtain bodily attunement with the movement and force required to place the bottle of concentrate. This coordination of perception and action is also apparent when needing to string the machine with the tubing. One has to remember the correct lattice arrangement of tube placement. Like the step before, remembering the spatial layout seems to be not only a property of a mental operation but also of body memory. In our observations, the nurse dealt with the "conductivity" alarm by tapping the bottle of concentrate mentioned before. Through action mimicking the patient started to do this too when the nurse was further away and not quick enough to respond.

We follow in the footsteps of Lave and Wenger (1991, p. 29) when they rethought learning by situating it within a specific context and also attending to *legitimate peripheral participation* saying "we mean to draw attention to the point that learners inevitably participate in communities of practitioners and that the mastery of knowledge and skill requires newcomers to move towards full participation in the sociocultural practices of a community." When specifically looking at the learning of body movements within home hemodialysis, a similar situation presents itself.

Within a community of practice, developing a sense of

Fig. 1. The hospital environment setup for patient training.

Fig. 2. A bottle of concentrate being placed on a dialysis machine.

identity results when moving from a peripheral position to full participation or in this specific case from a patient to a self-care practitioner. As one experienced home dialysis participant explained, "I think I could tell some things which a doctor can't tell you because I know exactly how it feels, what to do and what you can't do. …The doctor, if he tells you, it's only because he knows it from somebody."

The second theme of enskilment is *environment structuring.* "Humans create their cognitive powers by creating the environments in which they exercise those powers," observes Hutchins as he describes how modern day navigators determine a ship's location (1996, p. 166). By structuring our environment with artifacts, ideas and social relationships, Hutchins shows that these tools transform the activity so that the solution is apparent as a form of distributed cognition.

The environment can also serve as the site of dialogic processes in that it is not only activity that structures the environment, but the environment itself having an affect on activity. Suchman (1987, p. 50) noticed that "every course of action depends in essential ways upon its material and social circumstances." An example in dialysis involves the placement of the machine. One patient refused to have it in her living room and explained that her friend is frightened by the sight of blood and continually asks before entering her home to see if she is doing dialysis. Also important in this theme is how the hospital space (the supply closet) transforms the place of home. Storage is needed for the abundant disposable equipment required for each cycle of dialysis.

The third and final theme for enskilment is *sense-making.* An experienced home hemodialysis practitioner tells of a time when the scale displayed he was at his correct dry weight (the target goal when removing excess fluid) and yet he started to get a headache, a sign he had gone too long on dialysis and removed too much water:

"…Somehow I really jumped pretty fast from 85 to 89 kilos. The same time also it happened, like I can't remember, but it happened, some point I couldn't control the blood pressure anymore. It got higher and higher. Actually pretty high until, when did we have a real high here...here [pointing to the data sheet]. It's not so long ago, two weeks ago we had a real high, 165 over 90. This I have to figure it out, but the problem was the weight was high and every time I tried to get my fluid further down with water, I got a headache. I thought this is strange. This is normally a sign that I have reached my bottom limit. But still my blood pressure was high. But why? Nothing else changed? […] I weighed myself and I said okay, now we take a chance. […]I took seven and a half liter in three days out. Then my blood pressure was down again, I was able to keep it down there since it was no problem. Okay, then I know that my real weight actually is down there, not 84 and 85, but 86. Maybe 86.5 and there the blood pressure is fine. So it was the water. […] But something happens that tells you can't go down. Also tells you it should be your limit. But actually it wasn't. Must have been something else, I don't know what it was but [it] gave me the headache."

The example above shows that, in dialysis, patients need to be attentive to weight fluctuations, as there can be conflicts between what the scale says and how they feel. Accounting for this difference is critical to resolving discrepancies between bodily sensations and external numbers gathered from sensors. The patient as a skilled self-care practitioner chooses treatment options in close connection between the body and technology. Through a means similar to mapping, inner pictures are generated of what to expect with associated ways of accomplishing an activity. Keller and Keller (1996, p. 91) call these "conjunction[s] of enabling ideas and physical components" *constellations* and emphasize that

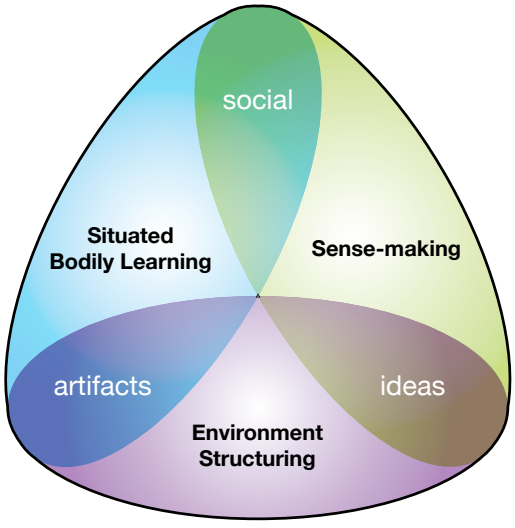

Fig. 3. Connecting the themes of enskilment.

they are dynamic in that they can be revised in novel circumstances.

Perby (1987) explores how local meteorologists are skilled in selecting and interpreting a large set of information to produce weather forecasts. Through an active process of fusing general knowledge common to a group and the experience of specific circumstances to generate an integrated understanding, Perby suggests that an inner weather picture forms when this understanding is in dialogue with sensibility or the "esthetic consciousness that a skilled person has regarding his work and also to an interplay between different kinds of intellect and our five senses" (p. 220). In our formulation of the term sense-making we emphasize the role of the body as well as the propensity towards acting on this knowledge in the world, which is not as obvious in earlier labels.

To have a feel of their practice, skilled practitioners are engaged in the process of sense-making as they go about the world. This requires an awareness of rhythm and change. Depending on how well one is mapping, external numbers can become a way of verifying and strengthening the reliability of this inner sense. One patient describes the role of a blood test: "you become aware of how you feel and then, in my case, you learn a lot about your disease and what it does. How do you feel with a high blood pressure. I can, more or less exactly, tell how my blood pressure [is by] the way I feel." On the other hand, these numbers can serve as the only way of knowing about one's health or even to be considered irrelevant. For example, when another patient was asked if the numbers confirm what she already knows, she replies "Sometimes you think now, yes, I'm wonderful. I'm very good. It's perfect and then you see your numbers here. It can't be true!" She continues by stating "you can't always feel if it's good or bad." This patient also has diabetes and a unique way of finding out when her glucose level is off. "I have an indicator, my eyes. […] Sometimes when I look at the telly and I'm sitting in the chair and then I usually can read everything on the telly. Perhaps one day I can't. Oh, my blood sugar is too high then. Then I get water in the eyes."

So why do some people have a better inner sense of health than others? Those that use the numbers to analyze their rhythms and try to map why and how this data is generated, or more simply, interpret seem to become skilled through the perceptual involvement of their body with the environment.

WAYS OF KNOWING THE BODY

The question of what is a body, what does a body do, and what meanings are inherent in a body has intrigued researchers in sociology, anthropology, and phenomenology. The rise of medicine in the last century has brought its own interpretation of the body as a carrier of disease and prescribes various methods of dealing with this connotation. For interaction design to change from a focus on usability towards a growth orientated perspective, we adapt and modify Turner's (1992, p. 40) three perspectives of seeing a body, namely *having a body*, *doing a body*, and *being a body*. To help make sense of the body's relationship with the world discussion starts with being a body in the world.

BEING A BODY IN THE WORLD

The theme of body in the world has recently been explored in the design research field by Dourish (2001 [2004], p. 100) where he introduces the concept from philosophy of embodiment or the "common way in which we encounter physical and social reality in the everyday world."

This view places a focus on the way meaning emerges from doing. People use tools as a way of getting to know the world (Ingold, 1993). It is through making and doing that meaning develops. As Ingold (1993, p. 433) says, meaning "is not imposed on the world but arises out of that engagement." While the theme being a body in the world encourages a relational perspective between people and their environment, it may be more fruitful to provide more details of how we engage with the world.

The body has been a rich source of study for producing an anthropology of movement. Mauss (1992 [1934]) introduced "techniques of the body" or ways learned from society that people know how to use their bodies. Numerous examples include swimming techniques, feeding, and techniques of rest. Patterns of body use, according to Jackson (1983) can be shaped by the interactions of everyday objects, for example how working at a computer all day creates the posture of the hunched office worker. Tenner (2003) looked at various body technologies such as baby bottles, shoes, chairs, keyboards and helmets in an effort to describe the effects these technologies had on the way we use our bodies. Tenner laments that while learning these new body skills, we have lost a great number of others. One example is that a single style of sitting is replacing the numerous other ways that anthropologists have documented in various societies across the world. Design's impact on the body is well documented, but not only for its detrimental effects. It is worth knowing the ways we become skilled with objects.

DOING A BODY AS SKILLED PRACTICE

Sudnow (2001) explores in his written account of learning to play jazz piano that skilled practitioners have difficulties explaining and teaching others the skills they have embodied. Jackson (1983, p. 328) highlights the problem of trying to verbalize skilled practice and

says “thinking and communicating through the body precede and to a great extent always remain beyond speech.” There is an inherent difficulty in getting access to this knowledge as it is not easily translated into verbal or oral descriptions and in a way resides in the body.

The culture of acquiring skills is denounced by Ingold (2000, p. 415) who says that “the novice becomes skilled not through the acquisition of rules and representations, but at the point where he or she is able to dispense with them.” He even suggests a stronger embeddedness of skill in that they grow with a body and are integrated within the anatomy itself (Ingold, 2001, p. 27). So while skill cannot be thought of as separate from the body, he also says that skill is embedded within the engaged world (Ingold, 1993, p. 463). Describing skill involves looking at the entire system which includes the person in an environment, not to be seen purely as a result of a disembodied mind moving a physical body (Ingold, 1996), “it is that what practitioners does to things is grounded in an active, perceptual involvement with them” (p. 178).

HAVING A BODY THROUGH HEALTH AND ILLNESS

The body can feel foreign and out of our control, especially when looked at through a medical science lens. In this instance, Turner (1992) says it is like “having a body” that is objective and external to oneself. Even within this idea of having a body there are several ways of looking at health. Nordenfelt (2000) illustrates the western concept where “health” and “disease” are thought of in the same way as “heart” or “lung”, basically as biological concepts. These are not subjective concepts, but rather can be characterized as impairments on function as statistically measured by a reference group. Health is then framed as the absence of disease. But even the ways of understanding disease has changed over time. Mol and Law (2004, p. 44) says that after Foucault’s work which documents the shift of looking at the body as an object/subject in “The Birth of the Clinic,” “disease could no longer be detected by listening to the patient’s words.” The medical gaze became the only sure way to detect conditions of the body.

The holistic concept, on the other hand, looks at the health of the individual and not of bodily organs (Nordenfelt, 2000). Two main phenomena are central in this concept. First, a feeling of either ease or well-being for health and of pain or suffering for illness and second is ability and disability, for health and disease respectively. Antonovsky also strongly supports an alternative to the Western health model. Antonovsky (1990) looks at “what moves people towards the health end of the health ease/dis-ease continuum” and suggests a huge gap in studying salutogenic factors and instead see a tunnel-focus only on pathogenic research. Much of his work has been in developing the *sense of coherence* or ways people cope. The first of the three components, *comprehensibility*, is how people feel what they go through makes sense. *Manageability* relates to having the resources to cope either within themselves or through the help of others. Looking at life as worth living defines the final component called *meaningfulness*. Antonovsky says that having a strong sense of coherence leads to engaging behaviors that promote health. In a similar call for looking at other factors than pathogenic, the New Economics Foundation (2004) in a “well-being manifesto,” calls for a revolution in thinking based on the idea of what makes people flourish and then creating social and economic systems around the notion of well-being or being fulfilled and satisfied. Perhaps skilled practice can provide the satisfaction of engagement.

In any case, the current Western view of disease construed as biology, although entrenched for over a century, faces strong resistance. Design researchers in healthcare have to be aware of this shift and look at what it means to design for well-being. Larsson et al (2005, p. 1) propose exactly this in that they “aim to help people make a transformation from an actual state of being to a desired state of being” in the “Design for Well-being” initiative.

INTERACTING WITH TECHNOLOGY

There have been a few studies that look at patients’ use of technology outside medical settings like the home. Lehoux et al. (2004) show how some patients take advantage of the technology to create a sense of autonomy from their disease by developing knowledge and skills in operating devices. They identify two attitudes towards technology as either *passive recipient* or *active user* and suggest that not all patients ultimately come to depend upon technology for maintaining health. This redistribution of knowledge and skills is not simple and can meet with resistance depending on larger social aspects in which the technology is situated. However, their study does not go into details about what skills the patients develop in their use of the technology.

Closely related to the sense of autonomy, healthcare has an actively changing power relationship. As technology and the cost of healthcare drive the care from location-specific treatment centers like hospitals and clinics towards home and mobile applications, this means healthcare and treatment wherever you are, not confined to the previously centralized care centers. Democratization of information access through the rise of the internet produces doctor offices flooded with patients bearing paper print-outs demanding to be treated with the methods they have found. Doctors have traditionally been the ones with the most training and expertise and so have commanded the most authority. Arras and Dubler (1995) describe doctors as the “captain of the healthcare team” in hospital-based

medicine, but technology has shifted this responsibility and that "the resulting power vacuum has been filled by a wide variety of home care "players," including nurses, …, home care agencies, technicians, home attendants, social workers, and case managers…" and the "patients and family have legitimate and powerful interests deriving not only from the fact that they are now on their own turf but also from their active participation in the delivery of care." But this also places an enormous burden of care onto people to actively manage self-care tools and devices. Some estimate that half of the people who leave doctor offices do not take the medicine as directed and non-compliance for chronic conditions is even worse (Beers and Berkow, 1999). While some of the factors cited include financial costs and misunderstanding, many of the causes of non-compliance center on motivation issues like forgetfulness, denial of illness, no faith in the medication and apathy.

Often people are thought of being unskilled or incapable of learning to take care of their own health. Even within the computer supported cooperative work (CSCW) field, the focus is not on helping the patient to deal with health technology at home, but designing ways to inform the nurse what the patient is doing from a remote location as Tap (2002, p. 12) says that "it is hard to see a future where one educates patients to be skilled as the nurses before they begin their remote treatment." One wonders why participatory design has not gained a foothold in healthcare in the design for patients, especially in light of the strong patient advocacy groups that exist in many countries, for example diabetes and heart disease foundations. Björgvinsson and Hillgren (2004) provide an example of participatory design involving patients, but they strongly situate their work towards helping the healthcare practitioners in the design of healthcare media. The roots of participatory design come from work practice so it is not surprising that it struggles to break away from the work place.

A strong contender as the main obstacle for participatory design's inclusion in healthcare could be the pivotal role "human factors engineering" plays in the design of medical devices and the institutionalized process of medical device certification. Bannon (1991) criticizes human factors as blindly looking at the physical and mental limitations of people while neglecting broader issues like values and motivation. As we can observe with the non-compliance rates, motivation and how people feel about taking treatments can have a large effect on whether to continue treatment. In contrast to a diminished view of people and healthcare systems, we have begun an exploration of people who actively manage their health through home technology. There have been limited studies on how devices become part of the healthcare experience of patients. As information technology becomes embedded within these devices, research into what people do and how they act to manage their health through this combination of physical and immaterial technology is crucial for designing future tools. Our exploration of home dialysis patients suggests that, while they cope with the complicated equipment, there are ways to improve the practice of home dialysis when looking at it from a skilled practitioner perspective by keeping engagement at the forefront.

INTERACTION DESIGN IN TRANSITION

The history of interaction design can be see as a "gradual expansion of the range of human skills and abilities that can be incorporated into interaction with computers" (Dourish, 2001, p. 17). Taking a stand against this "data-centered" view of tangible interaction, Djajadiningrat et al. (2004), have moved towards the "perceptual-motor centered" tangible interaction. Not only does appearance act as a carrier of meaning, but they also see action as providing this ability. Instead of always relying on semantics which use symbols and metaphors to give meaning, the direct approach uses feedback and feedforward (communicating the results of an action before hand). Tangible interaction design also looks at "traces of action" as important to having an expressive dialogue with a product (Wensveen et al., 2004, p. 60). Dourish (2001) brings together tangible interaction with social computing and coins it "embodied interaction," referring to the notion of embodiment in the world. While there is recently a body of work around tangibility in interaction design, there is not a strong connection to the previously mentioned theme of doing a body as skilled practice.

Currently, the way technologies are conceptualized to be "used" by people limits the range of possibilities that we commonly employ when working with non-computerized devices, objects and tools. In home dialysis, the way of working with the technology was with a touch screen. While the various tubes and bottles of concentrates would at first glance seem to be the most difficult part of the process, patients only complained about having to work with the computer interface. One patient in particular boasted about being faster than even the nurse when setting up the tubing. The physical setup became part of the skilled practice of home dialysis, while the technology continued to escape becoming a part of the practice.

Choosing to focus on the process of enskilment allows for another path in which to realize interaction with designed objects. Until now the overriding concept has been how to make what we design easier and usable. Bannon (1991, p. 32) exposes the paradox of designing for ease of learning as it results in the "decline of how to allow for the growth of competence and skill on many computer systems" or enskilment. What would be the consequences if we changed our perspective from designing for users to instead see people as skilled

practitioners? For sure, the focus would move from usability towards how to design for enskilment. It is not to exclude usability as a goal, but rather to see it as a starting point in an active process of becoming and being skilled.

Looking at skill and the body has several implications for interaction research. The first is that skill development occurs through the use of products. However, Ingold sees that technology "appears to do away with technique, rather than to back it up" (Ingold, 1993, p. 435). Designers should become interested in interaction that supports skill development, compared to the relatively simple interaction of touching a button as the style common in most modern technology products. The second implication is that skilled practice is not just about applying force but also "involves qualities of care, judgement and dexterity" and that products invoke values through use (Ingold, 1997, p. 111). Practitioners develop relationships with their tools through continual use. How designers make products that allow for enskilment will be crucial for medical devices if we view patients as skilled practitioners.

Yet another perspective to take would be to think of progression within the environment as consisting of trails and traces. Ingold's (2005, p. 5) idea of wayfaring incorporates a continual process of engaging and creating the world as the wayfarer "lays a trail on the ground in the form of footprints, paths and tracks" . Interaction design also looks at these "traces of action" as important to having an expressive dialogue with a product Wensveen et al. (2004). Seeing where you have been and where you can go by interacting with a product relates to Ingold's notion of moving along, where new views present themselves while previous trails fade out of vision at the same pace. There is a connection between the two frames of seeing.

Ingold (1993) maintains that the historical trend of technology creates a division between knowledge and practice and does away with skill by separating practical knowledge and knowledgeable practice. He says, "for acting in the world is the skilled practitioner's way of knowing it" (p. 434) and can be characterized as tacit, subjective and context-dependent. This is contrasted with technological knowledge that is explicit, objective, and context-independent so it can be taught. The movement from technique (skill) to technology means that devices have moved from tools to machines. Machines differ from tools in that do not depend on human agency and for the most part operate independently. Ingold characterizes this as a moving from the personal to the impersonal. It is time to critically look at this movement and see what it means to design tools instead of machines or devices and the impact on people's ability to make sense of their context.

Designing for enskilment conceptually requires designing tools rather than machines. Taking this cue from Ingold means that automation is not always the answer, but rather the objective is to find what is the appropriate role of the tool to allow for sense-making in the particular context. Representations of space have traditionally had priority over time, where designers have focused on the spatiality of tools instead of the temporality of them. There is a need for tools that allow growth, as enskilment happens over time. These tools to understand change would allow for an integration of knowledge and experience. Perby's (1987) study of local weather forecasters found that processed information is harder to "assimilate" into one's conceptual framework. There are interesting parallels to healthcare as designers are working on ways of bringing massive amounts of data to the fingertips of patients. But how do patients bring this all together to make sense of health? How do they develop an inner health picture or rhythm?

CONCLUSION

Why advocate for tools that allow for enskilment? In healthcare, the body is always changing or in a perpetual state of becoming. This constant back and forth between good and bad periods of health takes a toll on patients and contributes to their feeling of illness. It is this unplanned and without forewarning of health acts that deviates from what is considered "normal" that disturbs many patients (Kilbourn, 2005). Patients need awareness of fluctuating bodily states to remain reactive to these changes. Design for enskilment focuses not on ease of learning, but towards continual growth. This shift in design perspective requires a deeper understanding of people and body use.

Seeing patients as skilled practitioners links to Schon's (1983) "seeing-as" design moves and could be a way for design researchers to "see-as" and move forward in research terms. Medical devices require certain actions to facilitate their operation. A patient's body use pattern is structured by this context and may even reveal how they construct and evaluate the world. What happens when we take the stance that people who use medical devices are skilled practitioners? From a design perspective, it allows us to incorporate those embodied skills into the interaction with new product designs. However, if designers are not careful, they might design products in a "way that such disruption triggers changes in bodily and mental disposition" (Jackson, 1983). Jackson (p.334) also notes "altered patterns of body use may induce new experiences and new ideas" which can be positive as long as we balance the gains and loses of introducing a new way of living through the design of new devices.

IMPLICATIONS FOR TOOLS IN MANAGING HEALTH

As the research is situated in the personal healthcare

context and not in work and traditional craft settings, could adopting a tool perspective contribute in furthering an understanding of how to design for users of these devices? The body can be seen as the raw material that constrains the tools created. We can measure using sensors and other ways of looking inside the body to see internal mechanisms. This produces a wealth of data about discrete and separate processes that occur as part of an integrated system, but does this really capture what is happening? If we assume that measuring is the dominant and most acceptable way of understanding health, then this has implications for how to design the other property of a tool, it's user interface. Interpretation and sense-making is necessary to suggest possible courses of action.

One could advocate for empowerment in healthcare where patients are allowed more decision making power to choose to incorporate technology rather than being forced to accept it unconditionally. This could be problematic in the future, for example, when home dialysis becomes the norm rather than exception. In this situation, people could become forced to accept a machine into their home as the decentralization of all hospital dialysis units. A side effect of such a move, if the technology does not advance to a more portable form would be restricted movement by patients so that they could no longer travel more than a day beyond their home base.

NEED TO UNDERSTAND MOVEMENT FOR DESIGN

Donovan and Brereton (2004) introduce a gestural design game with dental students as a way to understand the movements in dental practice. There were difficulties in translating the words to gestures and so they were forced to rely on scenarios of practice. It might have been hard to act out movements without the dentistry tools. Situating the game in the context might not have been enough as they had hoped, and in a way left the gestures suspended in the air without the contextual basis of the artifact.

Buur et al. (2004, p. 189) say that to be able to "discuss quality of actions it is essential to be able to compare movements" and so introduce the "video action wall" as a technique to facilitate this comparison. The "video action wall" shows multiple clips of videos at the same time that can be grouped and labeled with words. They found that metaphorical descriptions of the movements provided the most interesting discussions. However, they also mention that there were difficulties in describing the qualities or "the experiences of an action" and instead focused on the actions themselves. It might be that the users featured in the videos, the one's who skills were captured, were not part of the analysis session. Trying to link metaphors and qualities, Jensen et al. (2005) briefly showcase a student interaction mobile that tries to give the qualities of "careful, supportive and controlled" in the interaction with the mockup. The mockup accomplished this through the use of the metaphor "4 Chimpanzees Passing a Kitten." Jensen et al. (p. 18) conclude that "user actions are skilled, they are situated in use context as well as in a historical context, and they carry emotions." Future design research should continue in this vein and bring forth greater awareness of and sensitivity of skilled practitioners as a way to appreciate the richness of our experience with the world.

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