Representing and constructing use - an activity theoretical perspective to design work

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ABSTRACT

In this paper, the design of a medical device is analyzed as an integral part of a wider interplay between the designers and users. Special emphasis is put on studying the ways of how user- related knowledge is constructed, mediated into and utilized in the design work. I shall elaborate on how insights derived from activity theory and science and technology studies could be utilized in connecting the dynamics of the networks of designer and user activities into an analysis of user consideration in a process of design.

Keywords

Design, users, activity theory, object construction

INTRODUCTION

A key question in participatory design is how to create genuinely useful and usable technologies for users. [1,2] Aside the ethos of user participation, this amounts to how the activities of users will be represented and technologies constructed to best assist users' activities. [3] The same questions are central for any process of design [4], and this study follows how a small innovation based company handles them. Moreover, the case allows for analyzing design work in connection with more long-term activities of product developers and users. This contextualization may provide insight on how design interaction and the dynamics of user consideration are linked with wider social interchange.[5] I shall emphasize two things, namely: analyzing the transformation of the driving motivation of a design process and the mediation of user related information into the process of constructing a technical artifact.

My analysis concerns the design and use of Wristcare, a wrist-held health-monitoring device, and is threefold. I have studied historically the whole product development process of Wristcare and, ethnographically, the design process of the latest release. Although this paper deals only with the analysis of history and design, I shall also follow ethnographically the use of the device. This enables me to see how the designer's solutions work for the users and how the device is evaluated and re-constructed by them. Linking these analyses to each other should give a more thorough understanding of the interdependencies of design work on wider contexts of design and use.

Theoretical background

My starting point - stemming from the sociology of science and technology [e.g. 6] - is that any design always takes place, and is implemented in ready existing socio-technical networks. Design is thus seen as a simultaneous construction of the technology and the networks in which the technology is being built and used [7, 8]. This starting point suggests the analysis of design and design interaction as integral parts of a wider trajectory in which technical, economic and social negotiation is carried out between stakeholders. [cg. 9, 10]

An additional theoretical impetus of the study comes from activity theory [11,12,13]. In activity theory design work can be conceptualized as a transformative activity conducted by a group of participants [8,12]. To further conceptualize what drives a design effort, I shall utilize the notion of the object of activity. In activity theory the "object" is the purpose of the activity, that which motivates the participants' goals and actions by giving them a social sense. [12]. At the same time, the object becomes manifested only in relation to a practical object of transformation, toward which actions are directed. During the process of object construction, this practical object takes many modalities and outcomes. In design, it may, for instance, first appear as a preliminary idea, then as sketches and drawings leading to test series and prototypes. [cf. 8, 14] Understood in this way, the object of activity unites the horizons of expectation and the materiality and resistance of things on which the expectations are realized and redefined into some outcomes. In this process, also motive and purpose are simultaneously evolving, instead of being fixed, predetermined or predetermining.

Contrary to many rationalized analyses of human action, the notion of object allows accounting for the multifaceted, contradictory and transitory nature of a technological project.

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These transformations may be elaborated with the analysis of cultural resources and artifacts used in connection with the historical analysis of design and use. [13, 15].

PRELIMINARY ANALYSIS OF DESIGN PROCESS AND INTERACTION

My unit of analysis is the trajectory of a new generation of safety phone, Wristcare by IST Ltd. The device monitors the health of the user and makes an automatic alarm in case of a severe disruption in condition. The innovation process is studied from the concept formation in the early 1990s to the releases of the second generation of the system in 2000-2001. The ethnographic focus has been on the design process of the second-generation wrist-unit. The use of the device is studied after the release of the second generation by interviewing the users and observing use situations. The main user groups are the elderly living alone at home and in service houses, but also care providers that transmit alarm calls or respond to them. My data consist of both historical and ethnographic material: documents, interviews, field notes and video recordings of design meetings and use-situations. Also interventions may by arranged in collaboration with designers and users to enhance the creation of further utility and acceptability of the system [15].

To illustrate some of the issues I am concerned with, I shall sketch here some preliminary results and methodological choices. First, I shall present a historical analysis of the evolvement of the object of the Wristcare development. Second, I shall consider how to analyze the design process with regard to the use of user knowledge. Third, I shall present considerations on how to enrich the analysis of design with simultaneous analyses of product development, in general, and the situated use of the device.

Evolvement of Wristcare technology

To grasp the transformations in the motivational field and the object of design, I have analyzed the trajectory of Wristcare development in relation to the evolvement of its object, in which the motive of activity is incorporated. Research so far suggests characterizing the changes in the object of design in three dimensions: 1. Who the design is for? 2. What is beign designed 3. Socio-economic considerations over the design. In relation to these dimensions, four distinct phases in the development of Wristcare may be identified.

Background: the need state

Many technical devices have been produced to help the care of the growing number of elderly people in the Western countries. Safety phones are one of the few applications that have found an established and needed position in this care. The background of the Wristcare innovation lies in the innovators' long experience with safety phones and with other alarm-transmitting devices. The innovators grasped that despite the success of existing safety phones, many users still considered the devices as clumsy and insufficient. Especially problematic were the cases in which the person was not able to make an alarm him or herself, for example in the cases of acute

attacks of illness, accidents and dementia.

These considerations led, in the early 1990s, to an idea to translate the features of many earlier devices to the monitoring of life functions by a singular wrist-held device. The object of activity consisted of loose studies into user needs and economic chances, but, most of all, of inquiries into the technical possibilities to sensor major deviations in human condition from the wrist. The user-concept was very general, as well; the elderly and ailing people requiring heightened safety measures for their health. The innovators believed that user actions and their organization will remain basically the same as with the older push-button safety phones with which the company already had gained experience.

Technological solution of a singular wrist-unit

During the first round of development between 1993-1997, the object of activity focused on the technological development of the wrist-device. Although some investigations on technology, market, and usability indicated that focussing only on the technical details of the wrist-device would be insufficient, this did not have much direct impact on the activity. Two reasons may be pointed out: There were strong signals for the need and potential market for the new technology, and, on the other hand, tight funding prevented straying from the chosen line of work. There, thus, seemed not to be enough reasons or resources to frustrate the object of activity. The singular wrist unit was seen as an easily handled and sold application in the safety-phone market.

Extending the object from the device to a network of care

The product was piloted and launched to market in the years 1997-1998. It was seen as a success in terms of an ambitious technology. However, it soon became apparent that more was needed than the wrist and receiver units in order to capitalize on the utility of the new system. Problems and suggestions became real, for the first time, as users explained and complained about their experiences with the device.

In the years 1998-1999, the company took various measures to improve on the deficiencies and malfunctioning. The object of the product-development activity extended to include training and developing tools for the care-providing network, especially for the alarm-transmitting centers. The object also diversified. It became apparent that rest-homes, diabetics, epileptics, the demented and elderly living in their homes had incommensurably different needs and capabilities. The development of the technology took many simultaneous paths. The disunification was reflected on in the visions the company had of its purpose. Wrist-monitors were seen as devices for "well-being" that could be used also by younger people in dangerous jobs, risk groups or people otherwise concerned with their health. The safety- phone market - in all its now perceived complexity - was seen also as a hindrance, owing to the feeling that safety phones were strongly associated with the very last years of life and had a limited appeal to younger groups of users. However, the company's funding was still running tight, and there was plenty of work with

the immediate improvements. It could be said that the object of activity was extending aimlessly to many directions without a clear concept of what would have unified the experienced phenomena integratively to a larger whole. [Cf.4] Correspondingly, the motivational background of the development work was clearly in turmoil, as most of the dimensions sketched above were under constant questioning.

An attempt to integrate the lines of development by the second generation

The fourth phase of product development is of special interest for my study. In 1999, a design process was launched to develop a new generation of the wrist-unit and, generally, to rethink the technology. While the end result of the second phase has been a working wrist-monitoring, and the end of the third phase led to an improved network of use, the recent development has been circling around how to configure the technology for diversity of uses and needs. In addition to specialized products for certain groups of users, the company developed a stripped model to overcome a pack of problems deriving from the novelty of the technology: price, errors in use, superfluous features and problems in alarm transmitting and interpretation. The idea is also to familiarize the elderly users to new possibilities without imposing on them too swift and radical changes. During the Wristcare development, the object of work has extended over the years from a device centered in to the inclusion of wider considerations over the societal use of the technology. Schematically this could be presented in the following manner:

Figure 1. A tentative framework for the qualitative extension of the dimensions of the object of design.

Focus of design	1. Orientation to users	2. What is designed	3. Socio-economic design
a. Device centered	Who are the users	The device	How to succeed in the market
b. Use centered	How do they use the device?	Use actions	What is the relation of ity and prof
c. Activity re-engineering	What do the users need device for?	Organization of user activity	Which element of the product system product the profit

It should be noted that the extension of the object has not been a straightforward, stepwise or goal oriented process. It has proceeded through qualitative changes in the scope and focus of product development. These changes have been prompted by adversities and necessities to alter the previous ways of conceptualizing and constructing the object of work. Moreover, the above schematic representation overlooks the fact that every extension has also led to reconceptualization in areas already worked on. For instance, changes in the

conception of what the users need the device for altered the understanding of how to divide the various users into groups.

An activity theoretical view to analyzing the consideration of users in design work

Although activity theory has often been considered a promising framework for understanding the construction, production and use of artifacts [e.g. 15], I have found no direct paragons to analyze the kind of design process that we have under scrutiny here. Activity theory does, however, suggest some features for special attention 1. The above mentioned object transformation 2. The processual and historical nature of activities 3. The social organization of work, and 4. The constitutive role of the means and artifacts that the participants utilize. [13,15, 8] On these premises, I shall sketch a preliminary four-step outline for analyzing user consideration in a design process.

Figure 2. Steps in analyzing the design process of wrist-care

1. Reconstructing the trajectory of the analyzing the formation and transformati
2. Tracing the perspectives and contr participants have brought to the process
3. Mapping out how the different featur are linked to each other
4. Tracing how information has been mediated into the design

Reconstructing the trajectory and transformations of object construction

A rather obvious step to start with has been to make a detailed analysis over the trajectory of the process. In addition to outlining the process, this first step of analysis brings to the fore the intertwined and contradictory motives driving the process and transforming its object.

In a nutshell, the design process took place in the tension existing between the needs to alter and improve on the system in accordance with perceived user needs and the strong economic and time pressures pushing the process. Reflecting this, the design- meeting discourse oscillated between long term changes and quickly realizable solutions, and their respective compatibility. The process seemed strongly driven by the closures that took place in the solitary work of the designers. Originally the developers wanted to gain new insight over the user activities also as part of the process. However, the opportunities were bypassed one by one with the designers' priorizing the tight schedule and being satisfied that there was already plenty of previously gathered information and vision to rely upon. By the midway of the six-month process, the designers had proceeded to a stabilized line of design that was a kind of a hybrid, incorporating in part various alternatives, needs and visions. The rest of the development work can be justly characterized as solution seeking in this line of work. The company has been rather pleased with

the end result, but unhappy with some characteristics of the process both as regards the time spent and the thoroughness of decision making in the process.

Tracing the perspectives and contributions of actors

To enrich the picture, I have looked into the perspectives and contributions that each of the participants brought into the process of transforming the object. [16]. Here, as is often the case in design, expertise and interests have been widely distributed. (The key participants were the chief engineer and CEO, the leading designer, usability designer, manufacturer, electronics and software engineers). It also seems that the effects of the participants' different backgrounds and agendas were accentuated by the nature of the work at hand. Various science and technology studies characterize design work as heterogenious searching and application of combinations of the social, economical and technical parameters, or, rather, their technical representations. [cf. 14, 17, 18]. This work can be further divided into speech-driven interaction of design meetings and speech-assisted work of "solitary" design outside the meetings [cf 19]. The case studied highlighted that people of different expertise had different means and ways of effecting the design. While company representatives dominated the design-meeting discourse, the designers made, in fact, most of the important decisions by incorporating their view into plans and drawings, which were seldom questioned due to the schedule. This draws attention out and away from the discourse to the material side of design interaction.

Mapping the interconnections between the parameters and features and tracing the paths of mediation of information

With the first two steps I hope to have achieved enough understanding over the process to connect it to questions of how knowledge about users was being utilized. My initial idea was to focus on those moments of design work and discourse when special emphasis was put on considering the use and users of Wristcare. Although this delineation proved helpful in identifying many key events, it had also a drawback of leaving aside relevant issues - that were maybe the more interesting ones. First of all, focussing only on explicit talk and work on use seemed to overlook the fact that almost every solution, not only the especially considered ones, had also some impact on the usability and utility of the system. Second, it is very interesting to see how other issues such as manufacturability, reliability, price, profit etc. related to user-centered issues in the process of design. And third, although many decisions and solutions seemed in the transcripts to be situationally produced, historical analysis suggests that most of them had been also previously considered and had certain origins and paths into the design discussion.

Two methods have been provisionally considered to overcome the above limitations. First, to some extent it is possible to go through the major features and solutions of the design and "map" how they relate to the various parameters that the designers considered. This way the interconnections between the features, user-relevance and other considerations should become, at least tentatively, visible. Second, this mapping can be enforced by looking at how information has been mediated to the design process. From historical material it is possible to trace some paths and origins of parameters as well as features dealt with in the design. I find it interesting to see whether these mechanisms can be elaborated further with regard to how information became shaped and filtered away on its way to be utilized in the transformation of the object. After all, it is clear that before being incorporated into the design, information is gathered, transferred by some means to the design process - either by artifacts used, by discourse or by drawings - and finally is to remain in the design drawings until the design is set for production. To my mind, this draws attention to various social and material means by which the mediation is accomplished, that is, how some entity is being transformed from manifesting under a knowledge-gathering activity to being part of the material transformation of designing.

To supplement these findings in the future, I shall seek to identify such characteristics of the Wristcare system that are particularly important for the users (advantages, problems, shortcomings) but have not been considered explicitly in the design process. These can be identified from two directions: first by looking at the investigation reports and pilots that the company has executed on the users in the years 1995, 1997 and 1999, and, second, from the ethnography of use-situations that I shall be conducting in the latter part of the year 2000. The ethnographical study will also enable reflection on how designers' decisions work in actual user-practices.

4. DISCUSSION

I have described an agenda for a case study and contextual analysis of user-centered efforts in a design process of a small high-tech company. The nature of my study is exploratory with an aim to further our understanding of design work and the way user-centered considerations relate to it. Inspired by activity theory, I emphasized connecting the user considerations to the driving motivational complex of design activity, namely, to the dynamics of how the qualitative transformations of both the purpose and practical object evolve in the process of object construction. The preliminary results from the case study suggest that this kind of dynamic understanding of development of designers' activity provide a useful perspective into how designers' representations and constructions of use relate to the design work. This way, the material transformation and the not directly user-related issues could be intertwined into user-centered work, in the analysis of design processes. The analysis shifts the focus from the design process or participatory interaction, into the systems of activities of participants. Analyzing design interaction as part of a process of the material and conceptual transformation of the object may increase our understanding of how wider networks affect the design process and how they thus need to be accounted for. Similarly, this scope of study enables consideration of the effects of the histories of designer

and user activities and may suggest ways of taking them into account to improve participatory efforts and their outcomes.

Furthermore, as is the case in many activity theoretical analyses [4, 5,15 16], my work is also based on a dialogical research approach that seeks to bring the results back into practices studied, thus directly contributing to the better design and use of this particular technology. One of the future challenges will be to find means to promote such measures that would be advantageous to both the users and the company.

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