

Field Design Sessions: - Augmenting *Whose* Reality?

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Abstract

This paper presents a design case in which Field Design Sessions are introduced to bridge the designers' imagination and the users' knowledge of the use context. This approach entailed immersing design teams in the environment of the product-to-be during the conceptual design phase. With a background in the Scandinavian tradition of participatory or cooperative design, the design team observed and talked to users, sketched and produced mock-ups, acted out scenarios and received user feedback during these field trips.

Moving design into the field provided the team with a number of advantages compared to traditional work in the design studio based on user field observations. Designers achieved direct physical experience of the circumstances and a non-represented, non-abstracted introduction to the problems at hand. Through mock-up design and user collaboration on the spot valuable insights into the essence of work and use were gained, and design suggestions embodied by these mock-ups were put on the line. Being aware or unaware of it, these suggestions contained personal assumptions, preconceived opinions or hypotheses about use and use context, but also contained suggestions of applied technology. The result was new valuable insights towards an understanding of what work really is (or is not) and how it could be supported (or not supported) in the future.

To make the most of augmented reality in the design of professional tools, we argue that knowledge of the state of the art of technology is a prerequisite but not in itself sufficient. It needs to be complemented by design approaches, which provide insight about the users, their work practice and use context, and support designers in aligning their viewpoints with the viewpoints and experienced reality

of the people they are designing for. This may form a cornerstone in the successful application of emerging technologies.

In the paper we discuss existing HCI-approaches aimed at engaging the field in design, contrast them with Field Design Sessions, reflect on the advantages of applying them, and draw attention to a number of method points.

Keywords

Augmented reality, design context, use context, user centred design, participatory design, situated actions

Introduction

The frequency converter or electronic motor controller that is the subject of this design case can be considered an exemplar of how interfaces of electronic devices developed in the last century. Originally its interface consisted of a single dial, which directly influenced a single parameter: The speed of the attached motor. Over a number of product generations frequency converters have been further refined.



Figure 1. A family of frequency converters and a close-up of the control panel

Frequency converters can be programmed to automatically adjust motor speed depending on readings from attached sensors and network with other components in larger control systems. These and many more refinements have led to today's microprocessor controlled frequency converters in which over 300 parameters are accessed through a display and push button interface, allowing the behaviour of a generic frequency converter to be tailored to diverse industrial applications (Figure 1). During this case we saw frequency converters controlling fans in a heating plant, pumps in a beer factory and folding machines in a newspaper factory.

It may come as no surprise that as the number of parameters further increases—and it is likely to do so in the future—it becomes more difficult to set up the parameter values for a specific application, to test and experiment with the settings to improve the performance of the overall process, and to troubleshoot efficiently if problems occur.

In addition, the described consequences are not only true for frequency converters, but also for the large number of industrial actuators, sensors and controllers that are part of the control system as well. A frequency converter is just one component among a large number of others that the operator must relate to during daily work. For designers of motor controllers this is a hard fact to realize, but necessary in order to form a sound basis for suggesting future designs.

One approach to the parameter problem would be to continue the effort of structuring the parameter list so that users need to adjust only those parameters, which are of relevance to their particular application. Another approach would be to challenge our assumptions and argumentation behind what constitutes the problem itself, and seek new ways to circumvent it. For instance by applying new knowledge about augmented reality and tangible interaction.

However, both approaches require the designers to have an intimate knowledge of the use context. Unlike with consumer products and office equipment, designers lack first hand experience of the diverse industrial use of frequency converters. Most often, they have none or only few personal experiences with family resemblance to the particular design challenge at hand.

To combat this lack of knowledge we experimented with a new design approach, which we call Field Design Sessions. Instead of merely using user interviews and visits to familiarize ourselves with frequency converter applications, we moved the complete conceptual design cycle of analysis, synthesis and evaluation as close to the environment and the user as we could. Our design team actually moved out of our office space to work in various use contexts, at least for short periods of time. The Field Design Sessions reflects our criticism of abstracted

experience. Instead of working with abstractions such as descriptions of use and system diagrams, we wanted to experience users and the use context ourselves. Abstractions often take form as categorizations that seldom show the argumentation behind them. We would like to explore how to bring these interpretations and arguments out in the open.

The approach also reflects our view that context and user are inextricably linked: One cannot understand the environment without the help of the user and one cannot understand the user's work practice and problems when outside his natural habitat. Facing industrial premises in terms of limited resources, primary time and money, approaches like long term field studies were not applicable. Instead, we chose to let the dialectic relationship between user and the use context frame our field study approach in order to engage our situated observations and experiences directly in our analysis and synthesis.

We start with a discussion of the concept of context in HCI followed by a general discussion of the impact of physical location on design practice. We then discuss the advantages of actually designing in a use environment and collaborating with users on their home ground. A description of a Field Design Session shows how things work out in practice. Finally, we reflect on the advantages of applying Field Design Sessions.

Use and Use Context

Recently Dourish has treated the notion of context by exploring the conceptual work that context is doing in much current system design research (Dourish, 2002). He advocates not to consider context as a representational problem, but as an interactional problem where *'context isn't something that describes a setting; it's something that people do'*. Dourish concludes that:

"Context and content (or activity) cannot be separated. Context cannot be a stable, external description of the setting in which activity arises. Instead, it arises from and is sustained by the activity itself."(Dourish, 2002).

In line with this, we understand the term use context as the material and social conditions that adds particular meanings to the user's work and interaction with products. It is formed in-situ and by the activity at hand. Its most important components include the physical location and environment, the process system and its components, the tools, the organisational setting and the social culture. Interacting with the product is part of the user's work practice, by which we understand the competence and activities of the user. A dialectic relationship

between work practice and use context exists: One shapes the other and vice versa.

When establishing an intimate knowledge of the essence of use and use context is a prerequisite for supporting designers in aligning their viewpoints with the viewpoints and the experienced reality of users, how do we support this process? Later in this paper existing approaches aimed at addressing this question are discussed and contrasted with Field Design Sessions.

Design and Design Context

Our work is based on Schön's understanding of design as a reflective conversation with the situation (Schön, 1983):

“In a practitioner's reflective conversation with a situation that he treats as unique and uncertain, he functions as an agent/experient. Through his transactions with the situation, he shapes it and makes himself part of it. Hence, the sense he makes of the situation must include his own contribution to it. Yet he recognizes that the situation, having a life of its own distinct from his intentions, may foil his projects and reveal new meanings.” (Schön 1983 p.163).

Schön challenges us to abandon the rational understanding of the use context being independent of the product, and therefore something that the designer can observe objectively from a distance. To design, we need to impose an order on the situation, while at the same time listening for the backtalk of the situation. This 'order' is an understanding that grows out of framing and reframing the problem, rather than a theory to be formed once and for all. When designing user interfaces, the 'situation' is the use context in which the product-to-be will reside, as well as the work practices of the people that will relate to it. Taking the point of Suchman that purposeful human actions are inevitably situated, shaped by the particular physical and social circumstances we must accept that also the activity of designing is highly situated (Suchman, 1987). Designing is shaped not only by the objectives (i.e. the product) and the plans that designers make, but also by the situations and contexts in which design happens.

From a case of re-designing the interior architecture of an industrial research lab, Horgen et.al. report:

“Efficient problem-solving, as experience indicated, did not happen in the conference room but at the machine or in the corridor outside the laboratory, where the right people could be gathered and the problem examined in the

presence of the equipment under discussion. The design challenge, then, was either (1) bring the work into the conference room or (2) bring the conference into the middle of the work.” (Horgen et al., 1998 p. 195).

The first option of moving equipment into the conference room (or the design studio) may be possible in the case of systems of limited size, but to transfer a plant-size work environment and recreate use and use context of people is not feasible.

Horgen et al. introduce the term process architecture to describe a way of working with interior design that seeks *”to co-invent the workplace and work practice in a dynamically coherent way”* (Horgen et al., 1998, p.277). This challenges us to think of our endeavour into use context not simply as a change of scenery, but as a reframing of the way we work with design in general.

Design and architecture studios have a tradition of staging the workspace to support creative work, a tradition that is replicated in the studio facilities of design schools. But designing user interaction in locations too remote from use and the use context can put a designer on the wrong foot. The material and social conditions that adds particular meanings to the user’s work and interaction with products are not present, and therefore not part of the designers interpretation of what matters in the specific situation at hand. Designing in an office or studio will influence decisions on what interface elements are acceptable for a product. So while working on an industrial machine for tough conditions, the clean, quiet and spacious environment the designer works in biases the mindset. Also, the type of interfaces that surround the designer in the studio environment (calculators, video recorders, computers) is likely to influence choices. As a result, the designer may end up designing for perceptual-motoric conditions that match his own environment, rather than that of the user. If one actually designs in the use environment, all of that changes.

Moving into the Field

During early explorations on how to design and apply computer systems, especially the Scandinavian approach of cooperative design gained wide acceptance. Rooted in twenty years of experiments with applying ideas about social democracy to the design of technical support in the work place, a variety of new approaches to systems design were introduced (Greenbaum and Kyng, 1991). Compared to traditional systems development, these approaches aimed at engaging users actively in the design process. A common source of inspiration was Wittgenstein’s concept of considering human language and interaction as language games. People are able to participate in human activities because the language game that they participate in has family resemblance with other

language games they have played before. The challenge for the designers is to create a design language game that makes sense to all participants. Different mediating artifacts were used as means to establish these language games between users and designers.

Inspired by industrial designers' long tradition for use of mock-ups, Ehn and Kyng introduced cardboard computers to set up design games in order to let users envision their future work situations with computers (Ehn and Kyng, 1991):

“It was our responsibility as professional designers to be aware of such future possibilities and to suggest them to users. It was also our role to suggest this technical and organizational solution in such a way that the users could experience and envision what it could mean in their practical work, before too much time, money and development work were invested.”

The emphasis is on letting users experience and hence understand the suggested design in a work-like use situation. Bødker and Grønbaek suggest a cooperative prototyping approach with the aim to establish a design process in which both users and designers are participating actively and creatively, drawing on their different qualifications (Bødker and Grønbaek, 1991). A prototype of a computer application was experienced in a work-like scenario, and when a breakdown occurred it was possible (for the designers) to modify it according to the users' preferences almost on-the-fly. Bødker and Grønbaek reports:

“We learned from this process that using prototypes as well as existing systems as alternative suggestions for the future allows the participating users to formulate their suggestions better. It was not necessary to come to a consensus about the understanding of the problem as long as some solutions could be found that made everybody comfortable with the future use.”(Bødker and Grønbaek, 1991).

Ehn and Sjögren introduces organizational design games as means to create opportunities for 'design-by-playing', involving participants in design discussions of the overall work organization, skill requirements, division of labour, and cooperation in the work process (Ehn and Sjögren, 1991):

“Playing organizational games with the Organizational Kit is basically a learning process. For all participants in a design group it serves as a means to create a common language, to discuss the existing reality, to investigate future visions, and to make requirement specifications on aspects of work organization, technology, and education.” (Ehn and Sjögren, 1991).

These three examples show how users can be engaged in the design process through the creation of design language games that add meaning to all participants.

The focus is on letting *users* fully experience a suggested technological possibility to envision their future computerized work. Following the idea that work tasks must be seen within their context, users were asked to recall and go through specific use situations to experience the suggested computer application. However, this was most often done in environments decoupled from the location in which these use situations would normally occur. Customer visits and interviews were conducted but little emphasis was put on letting the *designers* experience use and use context. It was the proposed design that was open for questioning, not explicitly the designers underlying interpretations and assumptions of use and use context. Although the described design approaches do not explicitly focus on improving designers understanding of use and use context, proper facilitation of user involvement is a first important step.

Beyer and Holtzblatt proposes an approach termed Contextual Design, which builds on the understanding of use context and which has gained wide acceptance in industry (Beyer and Holtzblatt, 1998). Central in this methodology is the notion of collecting and interpreting customer data:

“Contextual Design makes data gathered from customers the base criteria for deciding what the system should do and how it should be structured.” (Beyer and Holtzblatt, 1998 p.3).

Data are collected through interviews at the customer’s workplace and organised into a set of models to describe work: A flow model, sequence model, artefact model, cultural model, and physical model. The models are abstract diagrams that represent aspects of work. To help understand interviews across a range of customers, Beyer & Holtzblatt recommend Interpretation Sessions. In these sessions the team of investigators uses post-it notes to structure and generalise findings. Beyer & Holtzblatt stress the importance of building shared understanding of data in the team. They consider the design process an inherently cognitive process:

“Design is a cognitive activity. It is thought work. It begins with a creative leap from customer data to the implications for design and from the implications to ideas for specific features.” (Beyer and Holtzblatt, 1998, p.16)

This focus on data and cognition suggests that all relevant impressions of use and use context can be expressed and processed in words and diagrams. It is

recommended to iteratively use paper mock-ups and prototypes later in the design process to reveal future opportunities resulting from the new system, but we argue that creative leaps (and prototyping) are important parts of the data gathering process as well, not something that happens after data is gathered.

In an industry world of plants, machines, components and tools, tangible and motoric activities are dominating compared to office work. For these environments, the assumption that abstract data is sufficient to fuel design breaks down. Design also requires a bodily and sensory ‘understanding’ of movements and spatial relationships in the use environment. We therefore argue that design activities should not be entirely based on data analysis in studio environments. It is paramount for the success of a project to include design activities that are staged in the use context. In this way designers get immediate access to both the physical environment and the work practices of the people who will use the product-to-be.

With the growing interest in ethnographically inspired fieldwork, user centred design groups tend to spend more time with users in their worlds. They leave the traditional usability labs, trying to understand contexts and work practices, and what impact they may have on the design of future products (Sperschneider & Bagger, 2000). Mock-ups, cooperative prototyping, and design games are still widely used, but the aim of using them has changed.

Binder describes how electricians act out future scenarios of work, given the right context, props, and careful preparation (Binder, 1999). During observations in the field, rough foam blocks were handed over to electricians, which they added new properties and qualities to in-situ. Inspired by Binder, Iacucci et al. suggest a method called Situated and Participative Enactment Scenarios (SPES) where a designer provides a user with a simple mock-up and shadows him/her for a number of days (Iacucci et al, 2000). Interesting situations and incidents triggers idea generation for mobile devices and services. Iacucci et al. also introduce role playing games where 23 different future scenarios addressing design for mobility were co-developed by users and designers. The aim of both methods is to increase the probability of working with promising scenarios.

Moving design into the field is not a goal in itself. Buur and Bødker have suggested the term ‘Design Collaboratorium’ (as a reframing of the Usability Lab) to describe how to organise collaborative design events with users – in workshop facilities or in the field (Buur and Bødker, 2000). This framework proposes to carefully stage the combination of physical space, participants, props, and activities to create an open, physical and organizational space where

designers, engineers, users, and usability professionals meet and work alongside each other.

Co-design events like on-site improvised scenario play and collaborative game playing are strong means to open the design teams' eyes for new design opportunities. Our main critique though, is how observation and interpretation are treated separately. Observations, information, and inspiration are gathered from the field, but the interpretation and synthesis happens in environments (e.g. design studios) decoupled from the material and social context that adds meaning to the field material. Taking the point from Schön designers must include their own understanding in the sense they make of a situation. We therefore argue for the importance of offering own interpretation in the same situation in which it was inspired – or at least as close to it as possible - in order to get backtalk and in order to avoid stretching the loop of sense making over too long time.

It is not only use and work practice that designers try to understand. They are also trying to understand how to form and apply existing technology, its limits and potentials. This is often regarded as a separate activity, but designers also need to impose order on their technological understanding in order to learn its capabilities and properties. Often design projects live a long period of time as sketches, of course based on technical knowledge, but the actual application of technology is treated much later.

In line with Binder's work, we would like to take it to a point where not only designs are explored or questioned, but where the interpretations that sooner or later will form the argumentation becomes revealed and open for questioning. At least during parts of the design process.

The Site Provides Backtalk

In the tradition empathic design there have been attempts to recreate use environments in design studios. These typically serve as a playground for designers to act out scenarios with new design ideas. Burns et al. for instance created a replica of a hairdresser's salon in their design studio in a project to experiment with new computer applications (Burns et al., 1994). In a process they termed Informance Design, they playfully acted out situations, which they had previously observed in field studies of hairdressers at work. They then tried to support and enrich these situations with new computer tools. Using the same installation as a stage, they acted out scenarios with an audience of colleague designers to obtain feedback on their ideas.

Brandt and Grunnet report similar successful experiences with recreated use environments and drama in the design of user interaction, in part based on earlier work at Danfoss (Brandt and Grunnet, 2000).

In both cases the recreated use environment serves as a basis for the team to get a 'bodily' understanding of the work practices of people and to build empathy with them. It also serves as a source of inspiration for new design ideas, and as a test bed for acting out scenarios with non-existing products. In short, the build-ups are meant to recreate both the impact and the backtalk of real life use contexts. However, Brandt and Grunnet also describe how sets, scenarios, and props can serve to establish collaboration with users about design in use context.

Our position is that recreating use environments in the design studio, though inspiring and helpful, isn't sufficient. They can not substitute the real industrial settings in which Danfoss components are used. In line with Lehrdal & Pedersen they serve as a place for getting a bodily experience of the dynamics and complexity that characterizes user work practice or technical system behaviour (Lehrdal and Pedersen, 2002). Learning new things about work is however problematic, because the reflective activities are framed by what designers think of as important to describe users work and work context.

There is an increasing acceptance now that the understanding one achieves by being with users cannot be easily represented in text, diagrams and even full-scale models, and transferred to somebody who hasn't been there. These considerations inspired us to move from studying a use environment to actually sit in one whilst designing.

The use environment enables co-designing

So far we have mainly argued the importance of getting a feel for the use environment. Clearly there is another important aspect to the use context: the users themselves. In the Scandinavian tradition of user cooperative design, user workshops are the most important format for organising design activities with users (Bødker et al., 1991). When running such design workshops in a company meeting place or even in a boardroom at the user setting, there is the risk, however, that outside their natural habitat users feel uncomfortable about communicating their problems to 'expert' designers.

Experience shows that users tend to be much more motivated and creative, when designers visit them in their actual working environment. Binder's work show how electricians venture to act out future scenarios of work spontaneously, given the right context, props, and careful preparation (Binder, 1999). In a recent paper we proposed the metaphors of game playing and movie making to help facilitate on-site co-designing between a design team and the process operators at a wastewater plant (Pedersen & Buur, 2000).

With this as a challenge we set out not only to design in the use environment but also to involve ourselves with users on their home ground.

The Power Plant Case

To gain a better understanding of the applications and to identify opportunities for improvements, we organized two rounds of Field Design Sessions, with an intensive conceptual design week in between. Four different companies that use frequency converters were visited in the first round: a power plant, a brewery, a conveyor belt manufacturer, and a manufacturer of packaging equipment. The conveyor belt manufacturer and the power plant were visited again in the second round as well as a food manufacturer and a refrigeration contractor. To give an idea of how our Field Design Session approach worked in practice, here we describe the session in the power plant in detail.

The power plant burns refuse to generate electricity and heat for the district heating networks. It has about 10 employees. The people who install and operate the frequency converters are electricians and process operators. In this case we had a good relationship with John, an electrician at the plant. He had been involved in another design project with Danfoss three years previously (Binder, 1999). So he was tuned in to the kind of things, which interest us and he accepted our 3-5 year time perspective.

In this project we were a team of four: two interaction engineers, an industrial designer and a design anthropologist. Two days before the planned field design session, our team's anthropologist visited the power plant. The electrician gave a 1-hour guided tour showing him the different locations of frequency converters in use. Back in the office, the anthropologist edited a short video and prepared an application collage to inform the rest of us of what to expect, and to clarify characteristics of typical applications in use: hot water pumps, ash conveyors, chimney fans, chemical dosage pumps etc.

When we arrived at the plant early in the morning on the field design day, we suggested John to focus strictly on two applications which we found most of interest. But our suggestion was kindly but firmly pushed at side - it was clear that John had made other plans. John gave us a quick tour to show us different applications of frequency converters. The plant was spacious and clean, albeit noisy (gas turbines) and smelly (garbage combustion) in some areas. One application, which John explained to us in detail, was the chimney fan drive. It started out as an experiment two years previously and went through a number of alternative control strategies before it became a permanent installation.



Figure 2. Getting to work on the chimney fan frequency converter

At another location he actually had made re-arrangements in his work plan to be able to show us a specific frequency converter set-up task. He wanted to connect a remote potentiometer to the frequency converter. This should make it possible for a truck driver, who transports ash refuse, to stand by his truck and manually control the speed of the conveyer two floors up. Today the driver uses a walkie-talkie to communicate with an operator in front of the frequency converter control panel. After a general talk about work at the plant over morning coffee and rolls, we asked for some time by ourselves and split into two teams, each working at a location in the plant. One team worked on the chimney fan frequency converter, focusing on the possibilities for carrying out experiments to optimise parameter settings (Figure 2). The other team sat near the ash conveyor application and worked on ways of improving the set-up task introduced by John.

Both teams ‘camped’ close to the specific locations, sitting on camping chairs, wearing the compulsory hardhats and with our suitcase with mock-up material within reach. We started sketching ideas and creating quick foam mock-ups, both to reify our understanding of the situation and problems, and to explore new interaction opportunities.

About one hour later, we presented our ideas to the electrician, by handing over the mock-ups, asking him to re-enact the problematic situations he had introduced to us earlier in the morning.



Figure 3. John providing feedback on one of our proposals

His comments and scenario play gave both feedback on the interaction as it unfold and the contextual meaning that arised because of it. (Figure 3). Some of the ideas he liked, some he didn't. A few of them he found hard to relate to at all. The mock-ups at the ash conveyor initiated a particularly rich dialogue about how to complete his set-up task with the present product (which wasn't easy), and how this could be improved in future designs. This ended our 4-hour Field Design Session and we returned to our design studio to reflect on our experiences of that morning.

The same approach was used during all four field trips in the first round. All observations, design activities, and scenario play were video taped for later use. The outcome was a large number of observations, interpretations and ideas which has been through the whole loop of analysis, synthesis, and evaluation as close to the use environment and the user as we could.

The first round of Field Design Sessions were followed up by a week-long, interdisciplinary in-house design session. Two industrial designers, another anthropologist, two interaction designers, an engineer, and a marketing engineer joined the team during this week. The aim of the week was to inspire people to come up with new conceptual designs or ideas based by video material, sketches and mock-ups from the Field Design Sessions. To serve properly as design material the material was reshaped into video clips, storyboards, and idea-cards for inspiration. Each day was concluded with presentations of new mock-ups and scenario play. New ideas were developed together with an increased understanding of how technology could be applied to specific work situations. The last day was spend on identifying the most promising ideas from the teams

perspective and to represent the core of them through the use of rough foam blocks. In this way they served as pre-fabricated but still highly shapeable parts of the modelling kit to be used in the second round of Field Design Sessions. Our understanding of the essence of use, the use context and ideas of applied technology developed within one context could, if the situation at hand seemed to match, be reshaped and suggested in another field, to increase our understanding of how technology could be applied. Armed with knowledge of augmented reality and tangible interaction, our team frequently saw new design opportunities whilst in the use context.

Designing in the Field

The experience of being there in the use environment while working with new ideas was remarkable and challenging. First, understanding the complex process that a frequency converter forms part of is much easier if one can see the equipment with one's own eyes, rather than trying to understand it through a diagram or somebody else's explanation only.

Second, the environment serves as a source of inspiration for generating ideas and new interaction patterns. Artefacts of the domain are within easy reach; one can physically interact with handles and feel the available space. The environment provides both inspiration and an immediate feedback on ideas. If scenarios are enacted contextual meaning is added and revealed. This is what Schön refers to as backtalk.

The design artefacts we brought along (post-its, modelling materials, mobile phones, video camera) introduced a kind of tension, which instigated and supported design thinking. They allowed us to reshape the environment to imagine the future. We also learned how important it is to establish a team working rhythm that alternates between intense periods of creative, bodily activity and breaks of silent reflection. All in all the experience of working on location sufficiently compensated for the absence of spacious design desks, meeting tables, whiteboards, natural light—at least for the duration of the sessions. From this experience we conclude that three preconditions will help make a Field Design Session staged in the use environment a success:

Establish a common understanding of what is there

Users introduce the site and the equipment from their point of view. But to create a sound basis for discussing new design opportunities, the team must be granted the opportunity to familiarize itself with the equipment in the environment. A shared understanding of what is there is the basis for designing.

Create the opportunity for reshaping

The use environment and the equipment should not just be a passive set for a meeting taking place, it must be involved actively in the discussion. We found it particular useful to carry materials like cardboard, foam, post-its to create quick mock-ups and to 'decorate' the existing equipment.

Engage in scenario acting

Actually going through the motions of prospective user activities triggers backtalk. It is important to get beyond just talking about action.

Creating co-understanding: Aligning experienced realities

With regard to collaboration in the use environment we felt we got close to actual work practices of the user. John directed us towards use situations with specific problems that he was presently struggling with, or which had previously occupied his mind. This forced us to reconsider our pre-assumptions of what users might need. The basic ethnographic preamble "You must build your argument on what is there, and not on what you brought along" seemed highly applicable to us (Sperschneider, 2000).

And we got immediate feedback on our assumptions and ideas. The user was very motivated and creatively involved whenever we got close to things that mattered in his daily work. Sometimes we struck a dead end: When some of our ideas didn't draw any reactions at all from the user, it was clear that our understanding of the problem as such was lacking. In this way the ideas served to check our understanding of the situation at hand. This was very much 'learning through designing': Did we attack relevant problems?

We felt there were some important differences between the session at the Power Plant, the brewery, the conveyer belt manufacturer, and the packaging equipment manufacturer. The number of users varied from two to five, and in one session we got close enough to learn about the social interaction between several electricians. On two occasions we had not met the users previously, which meant that the collaboration was rather formal. Also, the time we had for ourselves to condense the input from the guided tour into design varied greatly. During one session, two supervisors representing the users participated in the design process. This changed our team design rhythm dramatically: The supervisors lacked a direct, hands-on understanding of the problems on the shop floor and presented us with a generalised view. Because solving the problems discussed did not impact the supervisors' work directly, we found we had less of a social relationship with them than we had with the shop floor people in previous sessions.

We learned that in particular four preconditions are of uttermost importance to support designers in aligning their viewpoints with the viewpoints and experienced reality of the people they are designing for:

Exemplify and express own understanding

The importance of establishing a social relationship as a basis for fruitful collaborative design is not new (Greenbaum and Kyng, 1991). If people are to share their problems with you and are to criticize the products you help design they not only need to trust you, they also need to understand how they might be able to help you. We had met John before and therefore he felt reasonably comfortable. Comfortable enough to share his problems and criticisms and even re-arrange his planned tasks to show us a particular one. The lack of a social relationship is hard to catch up with. Therefore the preparatory visit is very important.

Worship change in plans

Rather than to seek reassurance of own understanding during Field Design Sessions it is important to worship when users change one's plans. To get the necessary richness needed in order to develop a deep understanding of the essence of use and use context it is important that such changes are embraced. Experiences fresh in mind are much more rich in detail than general situations that the operator needs to recall.

Reserve time with your team

The interaction with users is very valuable, but the team also needs time by itself to reflect and concentrate on expanding ideas. And the pressure of accomplishing something visible within the short timeframe encourages one to work frantically. It is hard, but necessary, to take time to simply sit back and reflect on what one has seen.

Be prepared for the un-prepared

Rather than asking users to evaluate ideas, we need to create an open atmosphere where criticism and new ideas are sought. Throughout the sessions it was remarkable how we extended our use of mock-ups. For the users they served as a model of improved work practices. They exemplify ideas but also made a clear contrast of how things were done today, and how we could see them be done in the future. For us the mock-ups serve as a model of our understanding - we learned through designing.

Perspectives

For new technologies such as augmented reality to migrate from research labs to the real world, methods are needed which allow designers to blend in these technologies with existing use contexts. The Field Design Sessions organised in use environment and in collaboration with users provide first-hand experience of

the use context and rapid feedback on early design proposals. There is a second motivation for taking design out into use environment too, though. In an industrial corporation like Danfoss, with highly specialized departments, the contact to customers and users is taken care of by sales agencies, marketing departments and application specialists. There is no immediate opportunity for R&D members to meet with users face to face and learn about their work and views on the product. Field Design Sessions are part of an ongoing strive to improve collaboration with users. First we moved usability testing out to the users, then we moved out in the field to observe and analyse. Now the time has come to move design too. But there is still much to learn about when and how to co-analyse, co-evaluate and co-design with users in their context.

About us

The Mads Clausen Institute for Product Innovation is a research and teaching facility of the University of Southern Denmark. It is also home to the User Centred Design Group of Danfoss, a major Danish manufacturer of industrial components for controlling heating and refrigeration systems, motion systems, and hydraulic machinery. The users of Danfoss products are electricians, heating installers, refrigeration mechanics, and process operators etc. who work with complex technical installations in machine rooms, plants, process environments and manufacturing shop floors. Since 1992 the Danfoss User Centred Design Group has made an effort to build competence in this area and to develop the work practice of the development departments towards user/customer orientation (Buur and Bødker, 2000). It is based in the Scandinavian tradition of user cooperative design.

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