Constructing Representations of Users Needs – A Living Lab Approach

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Abstract. The difficulties of understanding system requirements early on in the systems development process is an issue being discussed in the information systems discipline for several years. The requirement elicitation phase is seen as the most important phase, but it is still the least understood activity during the systems development process. Little research has been published which clarify, discuss and theorize user needs and its characteristics and how these could be used as implications for design of new IT-systems. In this paper, we aim to generate general insights about users and their situations by elaborating with situational user expressions and by this start developing theory about users' needs and requirements. During our studies, we have found that users express their needs and desires that are both dependent on the current situation they act in, but users also express their desires in general ways. Following a constructivist perspective, we have found that the users' experiences and the use of stimuli material influence what users express.

Introduction

There is no secret or overwhelming news that IT-systems both mobile and stationary, must answer to what users need or want in order to succeed in an increasingly competitive market. Flynn and Jazi (1998) say that the process of identifying user requirements is, without a doubt, the most important phase within

system development since errors made during this phase have significant impact on the final system, In addition, the cost for correcting system errors escalates by a factor ten for each phase during the development process (Gupta 2000). It is also common that systems fails, and the primary reason that has been identified for this is poor and inadequate requirements (e.g. Ovaska, Rossi, and Smolander 2005; Sharp, Rogers, and Preece 2007). One motive for why this situation occurs, recognized by many authors (Benyon, Turner, and Turner 2005; Bergvall-Kåreborn, Holst, and Ståhlbröst 2008; Bergvall-Kåreborn and Ståhlbröst 2007; Bergvall-Kåreborn, Ståhlbröst, Holst, and Mirijamdotter 2006; Fitzgerald, Russo, and Stolterman 2002; Gupta 2000; Holst and Ståhlbröst 2006; Hyysalo 2003; Imaz 2006; Kaasinen 2003; Kankainen and Oulasvirta 2003; Kaulio 1998; Larsson 2004; Reiss 2004; Salovaara 2004; Ståhlbröst 2006; Ståhlbröst and Bergvall-Kåreborn 2007; Ståhlbröst and Holst 2006a), is the complex and difficult task of gaining knowledge about what users want and need. Pitts and Browne (2007), say that even though the requirements elicitation process is one of the most important activities during the systems development process, it is still the least understood activity. In the same spirit does Maiden and Hare (1998) state that identifying users needs and establishing requirements is a complex technical, social and cognitive process and it is the difficult phase of the development process.

In accordance, Ovaska et al. (2005) declare that rigorous research on tools and methods supporting the process of requirement elicitation has not yet delivered tools or techniques that guarantee foolproof success in systems development project. In addition, traditional requirement elicitation approaches offer poor understanding of how to specify and manage requirements in evolving systems, how the requirements could be understood and what kind of problems in the context that actually exists (Ovaska et al. 2005). The importance of understanding user requirements is also emphasized by Imaz (2006). He say that users requirements must be understood, and the data must be presented in such a way that all the various competencies involved in the development of the system, such as those who will interact with the system, those who will program it, managers, customers, clients, and so on can understand it.

One approach to gain data about users' requirements is to involve them in the development process. This is nothing new on the agenda, through the years a vast amount of methods to support these processes have been developed, for example; participatory design (e.g. Bodker, Kensing, and Simonsen 2004), focus-group interviews (Adams and Blandford 2005; Bloor, Frankland, Thomas, and Robson 2001; Bruseberg and McDonagh-Philp 2001), contextual inquiry (Holtzblatt and Beyer 1998), experience prototyping (Strömberg, Pirttilä, and Ikonen 2004), and cultural probes (Gaver, Dunne, and Pacenti 1999; Gaver 2007; Gaver, Boucher, Pennington, and Walker 2004) just to mention a few.

From our point of view, the challenge in requirement elicitation processes is not to gather a large amount of data about users' actions and situation, it is rather to know what to look and ask for, to interpret and understand the data, and to generate information and knowledge about users' requirements, needs, wants, values, actions, and situation based on the data. This knowledge about users should then be used creatively and mindfully as a base for developing IT-systems throughout the whole development process since identifying needs and

establishing requirements is an ongoing process. To design IT-systems that users actually will use and enjoy we need to gain deep insights into what they need and want, and then constantly check that this is considered throughout the whole design process (Bergvall-Kåreborn et al. 2008; Bergvall-Kåreborn and Ståhlbröst 2007; Bergvall-Kåreborn and Ståhlbröst 2008; Ståhlbröst and Bergvall-Kåreborn 2008, 2007; Ståhlbröst and Holst 2006a, 2006b). An iterative process is of outmost importance since user's needs are dynamic – they evolve continuously and are influenced by trends and knowledge. Nevertheless, even though the significance of knowing the future users needs is obvious, little research has been published which clarify, discuss and theorize user needs and its characteristics and how these could be used as implications for design of new IT-systems (Oulasvirta 2005).

Hence, one important issue in the area of systems development in the nearby future is to develop deeper theories about human needs. These theories will *"contribute to innovations in mobility, ubiquity, and community. Innovation and communication tools will become pervasive and enable higher levels of social interaction. /.../ researchers who understand human needs are likely to come up with innovation that help physicians to make better diagnoses, enable shoppers to find what they want at fair prices, and allow educators to create more compelling experiences for students."* (Sharp et al. 2007 p. 682).

Von Hippel (von Hippel 2005) declare that empirical data about users differing needs related to development of products and services are sparse. This combined with the need for theories about user needs, points to the matter that more knowledge about users is sought to support the processes of requirement elicitation and to increase the possibility for system success. Thus, the aim of this paper is to generate general insights about users and their situations by elaborating with situational user expressions and by this start to develop theory about users' needs and requirements. In this paper, we will base our findings on three user involvement cases. The aim of these cases were to generate and develop new, innovative, mobile services from the basis of what users need, want and dream about in the future.

The reminder of this paper is designed as follows. We will start by presenting our perspective on requirement generation, followed by a description of relevant concepts. After that, a description of the Living Lab context in which we have been involved and the cases were we have gathered our user data is given. Following that, a discussion of the findings from the user studies is presented; focusing on both situational aspects and general insight, and finally the conclusions from this study will be presented.

Perspectives on Requirement Activities

The activity of understanding what a system should do has been given many different labels, such as: requirements gathering, requirements elicitation, requirements analysis and requirements engineering (Sharp et al. 2007). To explain different perspectives which aim to understand and identify systems requirements, Imaz (Imaz 2006) uses different descriptions. These descriptions are extracting,

capturing, gathering, constructing and generating and they represent different perspectives on how requirements can be identified.

Requirement extracting can be seen as a process in which the requirement engineer have to "dig" down, clear away all the mess and rubbish until the requirement is located and can be pulled out and presented. The description of requirement capturing represent the perspective that the requirements has to be trapped and that they might slip away if you do not grab them (Imaz 2006). Within the requirement gathering description lies the assumption that the requirement are lying around waiting to be picked up with little interaction between designers and users (Benyon et al. 2005; Imaz 2006). While the requirement constructing description represent the view that requirements consist of elements that need to be put together, hence, the analyst creates something new. Related to that perspective is the requirement generating description where the requirements are seen as being generated from a deep understanding of peoples needs. Benyon et al, (Benyon et al. 2005; 2006) state that requirement generation tend to de-emphasize links to users current practice and they add the description, requirement elicitation, which they believe support interaction between the user and the designer.

From the basis of these descriptions, we can discern two different perspectives on the process of identifying requirements; the locating perspective and the constructivist perspective. Requirement gathering, elicitation, capturing, and extracting represent the locating perspective assuming that the requirements are something that actually exist, they merely has to be found. Based on that perspective follows that requirements can be expressed by someone and they are stable and recognizable. In some cases, this is true; users might be very aware and familiar with the requirements they have on a system, but often they are not. The other perspective on the requirement activities is the constructivists view (Imaz 2006; Sharp et al. 2007). This perspective is more sensitive to users needs and it represents the view that requirements can be generated, or constructed, from understanding and interpreting the user data and activities. The constructionist perspective also includes creating something new by combining identified elements in new and unexpected ways. In our studies, we have been following a constructivist perspective.

Included in the constructivist perspective is the position that the outcome of any study is not a description of how things really are, or a representation of how the reality functions (Guba and Lincoln 1989). This means that there is no reality except the one people creates as they try to make sense of their situation. With that perspective, the findings from any constructivist study are not facts in some ultimate sense, rather the findings are being created through an interactive process, and what emerge from this process are constructions that represent the reality of that specific case. Following this line of thoughts, it is also acknowledged that the constructions which are being shaped are influenced by the values of the constructor (Guba and Lincoln 1989). Thus, questions regarding whose values to take into account, and how different value positions might be accommodated become important to discuss. The constructions are also dependent on a certain physical, psychological, social and cultural context which form the constructions (Guba and Lincoln 1989). The basic thoughts of the constructionist view can be related to Suchmans (Suchman 1994) concept situated actions. She says that the

situated action concept emphasize that every course of action depends upon its material and social circumstances. She mean that in general people do not foresee alternative courses of actions, or their consequences, until some course of action is already on its way. Possibilities, veiled in the current situation, become clear only when people act in that situation. Hence, people can not know ahead of time, at least not specifically, what future state they desire to bring about (Suchman 1994).

Our approach to the requirement process is related to the constructivist perspective and in correlation with Flynn and Davarpanah (Flynn and Jazi 1998) we see this process as a social process in which requirements are not objective artifacts rather they evolve, which means that they are socially constructed in the interactions between users and developers.

Definition of Requirements

Before we go any further, we want to explain our view of the concept requirements. The common definition of requirements is that they describe something that the product must do, or how the product should perform in a certain situation (Benyon et al. 2005; Flynn and Jazi 1998; Imaz 2006; Pitts and Browne 2007; Robertson 2001). For example, one requirement for a website can be that teenage girls should find it appealing. Inherent in this perspective is the approach that the final solution is known, it should be a webpage. Thus, to express system requirements the final solution has to be known to the actors. We argue that is systems development projects aiming for innovative and new solutions, the focus on a definite solution delimits the innovation sphere early on in the development process, hampering the development-team and the users from being open-minded for new and creative solutions.

Requirements are not only a statement about what a system must do in a certain situation, there are also different kinds of requirements. By tradition, two kinds of requirements have been focused; it is the functional requirement, which say what the system should do, and it is the non-functional requirement which determines the constraint on the system (Imaz 2006; Robertson 2001; Sharp et al. 2007). From a software engineering approach, requirements are usually expressed in terms of functionalities and features of the system (Gupta 2000) while, within interaction design, requirements are expressed as scenarios and user stories (Benyon et al. 2005; 2006) focusing on the tasks the user will have to undertake to achieve their goals when using the system to be created (Imaz 2006). This shows that when requirements are being established, the system is already defined which leaves little room for innovation and changes.

Sharp et al (Sharp et al. 2007) has enriched the concept of non-functional requirements to include data requirements, environmental requirements (physical, social, technical and organizational), user characteristics, and, usability and user experience goals. They also state that requirements comes in many different forms and appears at different levels of abstraction (Sharp et al. 2007). We interpret these perspectives as focused on what the systems should do, or how the system should perform. From our perspective, we need to include aspects such as why the users want a certain requirement, and what would motivate them to use the system in the first place in systems development activities (Bergvall-Kåreborn et al. 2008;

Bergvall-Kåreborn and Ståhlbröst 2008; Ståhlbröst 2006; Ståhlbröst and Bergvall-Kåreborn 2008, 2007; Ståhlbröst and Holst 2006b).

We want to stress that we correspond to the conception that requirements are important aspects and guidelines which must be generated in systems development processes. In this paper, we do not want to argue about whether to focus on requirements or not, instead we want to stress the importance of broadening the perspective. This approach enhances the requirement generation process and improves the common understanding of the requirement construction process by highlighting the importance to include other user-oriented aspects as well. These user-oriented aspects can be their needs, wants, values, actions, and desires, which we consider should be the driving force behind any design decision and from which requirements should be generated.

Our User Study Context

The user studies being referred to in this paper have been carried out in a multi-contextual experimental setting, a so called Living Lab. This is a rather new phenomenon that has started to become established across Europe. The Living Lab concept is an innovative approach in which all stakeholders in a development process are included and it refers to an R&D methodology in which innovations are created and validated in collaborative real-world environments in which potential users play an important role.

The Living Lab approach consist of characteristics which are not unique as such, however, the combination of these parts into one approach is what makes Living Labs unique. For instance, in Living Labs it is assumed that the development and innovation process should be open for all relevant and interested stakeholders. This part is influenced by the open innovation approach posed by Chesbrough (Chesbrough 2003), and by the emerging Web 2.0 approach, aiming to facilitate creativity, information sharing, and, collaboration among users. Included in that approach is also the distributed aspect aiming reach and inspire people independent of where they are, or what time it is. In addition, Living Lab activities are carried out in real world contexts and this approach is influenced by ethnographical approaches such as contextual design (Holtzblatt and Beyer 1998) and field studies (Preece, Rogers, and Sharp 2002; Sharp et al. 2007; Ståhlbröst 2004). In addition, Living Lab processes are closely related to, and should support, research activities and this distinguishes Living Labs from ordinary market research approaches.

However, the overarching objective of these experimental settings is to, in close cooperation between involved stakeholders, develop products and services that end-users really want and need. Hence, the purpose is to enhance innovation, utility, usefulness, and usability of IT applications in society (Eriksson, Niitamo, and Kulkki 2005; Ståhlbröst 2006).

Since the activities in Living Labs are applied into real-world contexts, the innovation and user involvement activities take place 24/7. This means that users can participate in the innovation and development process in their private context in real usage situations, hence the users gain an understanding of how a new

product or service function and correlates with their use context based on their own lived experience (Eriksson et al. 2005; Fahy, Ponce de Leon, Ståhlbröst, and Schaffers 2007; Mirijamdotter, Ståhlbröst, Sällström, Niitamo, and Kulkki 2007; Mulder, Fahy, Hribernik, Velthausz, Feurstein, Garcia, Schaffers, A, and Ståhlbröst 2007; Schaffers and Kulkki 2007; Ståhlbröst 2006). With this approach, the risk of developing IT-systems from a technology driven approach can be reduced in favor for the user-centered approach ensuring that users' needs are considered in every development phase (Ståhlbröst and Bergvall-Kåreborn 2008). This means that peoples use of technology, the people and their needs and desires, the activities they want to achieve, and the context in which they operates, creates a situation from which a future solution should be inspired and co-created. There is a constantly ongoing discussion about whether development should be driven by users or by technology (Barnard, Yi, Jacko, and Sears 2005; Hyysalo 2003). From a Living Lab perspective, we argue that development should have four-wheel drive, namely; humans, technology, context, and activities. These four elements facilitate innovativeness in development processes and needs to be studied and interconnected to understand the possibilities inherent in the current situation.

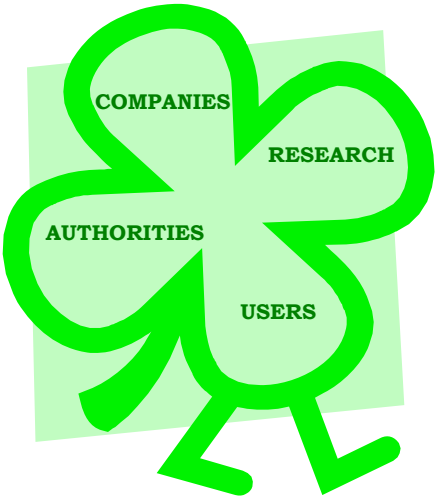

Figure 1. The Living Lab concept

The Living Lab we have been part of aims to harmonize the development process, and the innovations, among four main stakeholders; companies, users, authorities, and researchers, see figure 1, and the closeness between research and development is one important characteristic. From a research perspective, these experimental settings enables, for example, research on methods for user involvement where different approaches can be elaborated with and compared. This new approach also requires new distributed methods for user involvement since users are involved in the development process independent of their location. In addition, since users are involved in the development processes, these experimental development settings adapt a user-centered approach which means that representatives of the users are included in all the stages of the development and design process.

Another important aspect of these Living Labs is the "living" aspect, this means that the people involved in any development project live with the process and constantly check how the process proceeds, hence being prepared for any necessary adjustments to ensure that, for example, users are stimulated to participate, or that the development process proceeds as planned. If the process does not proceed as planned, the aim is to gather data about what has happened and how the plans can be adjusted accordingly. The Living Lab organization, in which we are involved, is based on the development project that are currently running,

hence, the projects aim and process highly influence the Living Labs activities, participants, and structure. This can for example, mean that if a certain competence is missing in the organization, SMEs can be involved to fill that spot.

During our studies, we have applied an action research approach. This approach is an established research method that is often used within the IS-discipline and it produces relevant results since situated in practical action with the aim to solve immediate problem situations while informing theory (Baskerville 1999; Baskerville and Pries-Heje 1999; Baskerville and Wood-Harper 1998; Rönnerman 2004; Starrin and Holmer 1993). Hence, it is a process supporting interaction between action and theory.

Analyzing User Expressions

During our user studies, we have acknowledged that generally, users cannot express their needs and requirements, related to new technological solutions, explicitly and rationally. Following that, in our studies we aimed to encourage users to tell rich stories about their situation and their experiences of using technology. With this perspective follows that the task to analyze and generate understanding about users´ situations, which should form the basis for the final solution, ends up being the design-teams responsibility. This process could be performed with users as co-designer, but in the cases we have been involved in this process has been the design-teams task.

The analysis of the user data in this study has been carried out in four steps. Firstly, we read all the transcriptions from all focus-groups interviews, which thereafter were analyzed openly. This means that we marked the expressions we interpreted as interesting from both development and user perspective in the transcriptions. Secondly, the interviews were read again, now with the aim to name the markings with tags such as respect, or safety. Thirdly, we clustered the data into overarching themes partly based on the names of the tags, but in some cases other more overarching theme names were chosen to represent the data cluster. First this was done within each interview and then within each case with the aim to identify patterns within the data. The result from this step of the analysis is summarized in the following section aiming to discuss and explain situational aspects.

The User Studies

The data presented in this paper stem from three different projects, SMART, M2M (Mirijamdotter, Runardotter, and Ståhlbröst 2007), and CroCoPil. In the following, a presentation of the projects together with some of the issues being discussed during the studies is given. We have chosen not to include all the aspects users discussed. This presentation illustrates our final step of the analysis of the user aspects that are strongly related to a specific situation.

SMART

The aim of the SMART project was to develop IT-services to facilitate citizens' possibilities to actively influence and improve their society. The development of these services aimed to be carried out in an interactive manner in cooperation between citizens, companies, and government. Through this interaction, the companies got the opportunity to solve their probable problems.

The SMART-project had three different, but intertwined purposes, namely (1) to give product-, place-, and service developers the opportunity to engage citizens and user groups in their change-, quality-, and innovation processes, and (2) to give citizens and individuals the opportunity to engage in these processes regardless of development process, and finally (3) to create opportunities for a dynamic region where boundary crossing cooperation becomes usual in the change processes on all levels from product development to community building. In this project, we carried out user studies in six focus-group interviews with the aim to collect data about users, their activities, experiences, and dreams. The objective was to gain deep understanding of users needs and to design a mobile and stationary service that would fulfil their needs related to communicating with local government.

In this project, many aspects concerning citizens' willingness to communicate with the municipality in their community were discussed among the users. In this case, when the users talked about communication with the local government, they emphasized that feedback was very important. If the users are expected to give suggestions or alarm about something in their surrounding, feedback from the local government is of utmost importance. In this case, the users also expressed that they want to know what is happening with their suggestion. As one of the users expressed it, *"It is a matter of respect and empathy"*. The users also demand that representatives of the local government are competent within their area of responsibility. They had a lot of bad experiences from communicating with the local government and being shoveled around in the organization. The users also desired that the persons they get in contact handle their matter in a competent manner, meaning that they document it in a traceable way.

Other factors that highly influence users' willingness to start using a e-service for communicating suggestions and alarms to the local government, is that they must feel they have the ability to influence decisions being made in their society as well as influencing other important things occurring in their environment. Citizens are willing to alarm about something in their surrounding if it is a matter of security. The users said that they would be motivated to alarm if they feel threatened or if they believe that a situation is hazardous for other people. In addition, the local government must confirm that the citizen's suggestions are important. In relation to the factors influence and security, it became recognizable that users are motivated to contribute with suggestions and to set of alarms if they have the ability to get some kind of reward if it is a good suggestion. These rewards do not have to be of monetary nature, they can just as well be in terms of attention or acknowledgement in some way. One aspect which we want to put emphasis on in this context is the significance of the receiver's actions in order to motivate users to contribute to their community.

In the relation between users and government, the users said that they want the technology to help them find persons, information, telephone numbers, and competencies. They expressed that they had difficulties to find the right person, with the right competence. The users said that they experience it as harsh to find relevant information or right phone-numbers. *"I must know who to contact and how I can get in contact with him or her, otherwise I believe that it is too difficult and I will not have the energy to contact them if it is not a matter of life and death"* as one of the users said. The "find" factor is also related to information, however we have chosen to analyze the factor information separately since users´ do not only want to find information, they also want to share information with other and they want to get informed.

The users did not only talk about information, they also wanted to interact with other about society issues such as suggestions. The users stated that they wanted to interact with other citizens as well as with the local government, here they suggested a politician chatt and discussion forums where they could give input to other suggestions.

In this case, we have observed that the users express their needs, desires, and requirements on two identifiable levels. The first level, being described above, refers to the users' expression related to their needs *of* the service as such, whiles the second level, being described below, refers to user expressions related to their needs *in* the service.

When the users talked about the service as such, they talked about certain characteristics that any future solution must have. The characteristics they stressed were mobile and that it should be democratic and offer a great amount of freedom for the users. They also said that any future solution focusing on interaction between citizens and local government must be very easy to use and free of charge; otherwise, they will not use it at all.

In our analysis, we found that the factor efficiency is strongly related to a future technical solution and can be seen as a requirement. In this case, efficiency meant that the users wanted to communicate with the local government directly when they see a hazardous situation or when they come up with any suggestion. In addition, efficiency can be related to the characteristic easy to use since the users want to put as little effort as possible on their interaction with local government.

An interesting observation one of the users expressed during the interviews in this case was that he did not think of solutions that he did not use himself. This became obvious for him when we discussed how this kind of service supporting citizen interaction could function. We asked if they would like to use a camera. He directly said that he did not think of camera solutions for any mobile solution since he was not accustomed to use a mobile camera himself.

Through this project, we identified aspects that are highly relevant not only in the context of the SMART-project, but aspects that can be expected to be relevant when developing e-government services on a general level. The citizen expressed that it was important to get support to locate the right person with the right competence and to get feedback from the local government.

To sum up, in this the final step of the analysis ended up in eleven themes or needs, these were *find, information, feedback, efficiency, competence, freedom, mobility, reward, influence, security* and *interaction*.

CroCoPil

Within the CroCoPil-project, the development of new technologies was driven by user requirements and user involvement in order to test and evaluate evolving technologies, aiming to identify crucial user requirements for communication, co-operation, and services that are not met today. The overall objective of the CroCoPil-project was to apply user needs as requirements for technology evaluation, development, and adaptation. The purpose of the project was to create and test a "CroCoPil solution toolbox" with descriptions and evaluations that makes new services accessible to rural communities, to strengthen the awareness and attitude of rural people with regard to technology and technology-based services and to establish some service pilots that shall be tested and demonstrated.

In this project, much of the discussions during the focus-group interviews became centered on, or related to their lack of physical security. For the users, who in this case oftentimes worked by themselves in sparsely populated areas, technology that function or not can sometimes become a matter of life and death for them. Based on that circumstance we recognized that users, who do not have their desired physical security in their context, had difficulties to appreciate solutions that were not directly related to enhance their security and safety. Hence, they thought it was hard to see an added value of technological solutions that did not strengthen their safety.

However, the users also talked about technology access for righteousness reasons. They expressed a demand that they should have the same right to mobile phone coverage, and Internet access, as all other citizens in Sweden. They should not have to climb to the top of a mountain to be able to call their friends, families, or colleagues, for a very short and expensive satellite-phone call in which they have to shout in order to get heard.

Except security aspects, these users talked about different kinds of support they would like to get from technology in their everyday practice. They expressed that they wanted to be able to interact with customers, families, and the surrounding society even when they are out working in the field. Talking to their significant others does not only include interactions as such, it also includes feelings of wellbeing. This means that their families can feel contented, knowing that everything is good and the fieldworkers can feel good when they know that everything is all right at home. For the reindeer herders and the tourist guides, being able to interact included a business perspective, for them it is of outmost importance to be able to interact with customers while they are working out in the field if their businesses are to survive.

Within this case, the users did not only talk about interaction, they also talked about their needs for synchronous interaction to coordinate their work. They must be able to coordinate to do their work efficient. For example, the reindeer herders needed coordinating tools to make it possible to herd their reindeers to the same place, at the same time in the mountains. They also needed to coordinate themselves to keep a straight line in the mountains to make their herding efficient.

Besides the needs for interaction and co-ordination, other directly work related support the users talked about was support for documentation while they worked in the fields so they can feel that they are efficient. The reindeer herders wanted

support for documenting data about their reindeers, economy etc, and the rangers wanted to document all their work tasks. What unites them is they desire to complete as much of the necessary documentation while they are working in the field and sit alone in the evenings, so that the time spent at home could be concentrated on personal contacts and relations. They said, "*what we value most about our work is the feeling of freedom of working out in the field in close relation to nature, but when we are at home we want to have contact with other people*". This indicates that the development of any future solution must take that into consideration when they develop any solution. If an inherent aspect of a future final solution would be that they would spend more time in their office and do documentation and make their observations with cameras, there is a great risk that these users would not accept that solution.

During the interviews, the users also talked about control. The aspect of control in this case with field workers meant that they would appreciate a solution which makes it possible for them to monitor their reindeer herds to protect them from predators existing in the area. The rangers wanted to be able to have control over tourists and animals moving around in their area of responsibility, and they wanted to monitor animal nests. Control for the rangers also meant to have control over their collected information in terms of safe storage of both manual and digital information.

To sum up, the analysis of the data in this case ended up in seven overarching themes namely, *security*, *freedom*, *control, interaction*, *co-ordination*, *efficiency, support*, and *access*.

M2M

The machine-to-machine (M2M) project was another project in which we collected data about users and their needs. In this project, the aim was to gain users feedback about future IT-services. These IT-service should mainly be designed is a machine-to-machine fashion. This means that the future situation the users were to place themselves in, were one where a machine communicated with another machine with the aim to support the users in some way. The objective was to gain knowledge about how the users saw a future situation. To stimulate the users to see themselves in this new situation, three short user scenarios were developed showing how machine-to-machine IT-services could be used in the future home, for future travel and for future shopping. The purpose of this user participation study was to analyze the users' reactions, needs, and ideas related to future M2M IT-services. During this project, we carried out three focus-group interviews.

In this project a lot of the occurring discussions concerned technology for support in users' everyday life. These users expressed that they expected the technology to support their days with the aim to make it more efficient, for example, they wanted technology to support them with their purchases, "*something that keeps track of what I had in my refrigerator and based on that rendered a purchase list"*. The users also expressed that they wanted to get a reminder of what they need to buy on their way home from work. The users did not only expect technology to help them with their purchase, they also wanted technology to give them the freedom of having an adjustable home. One of the users said, "*I want*

adjustable shelves and lamps that are turned of automatically when I look my door". In this situation, the users said that they wanted technology to help them keep track of things they need to remember. In short, the users expected that the technology would make their weekdays and workdays more efficient. The users also wanted and needed support with and while they were shopping, this was clearly expressed by the users. Here they said that they wanted support on different levels, they wanted the process of shopping to be smooth with all their loyalty-cards gathered into one, with home-delivery of voluminous products, and with automatic scanning of the groceries, they put into their hamper. The users also expressed a desire to get support when they shop for clothes. They wanted to get suggestions about suitable models, which colors to wear based on their look, etc. Hence, support while shopping included support on an individual level were they wanted help with what to wear, or what to eat, and on a more general level where they wanted a smooth and efficient shopping process.

Also in this case did the users talk about control. The things they expressed in relation to control were for example, in the home environment. Here the concept control includes aspect such as getting help to have control over things that might lead to a hazardous situation if it is not monitored and controlled. This concerned issues such as forgetting to turn of the stove or the iron, or forgetting to lock the door, or not being at home to un-plug the TV when a thunderstorm comes and so forth. The users wanted support to remember these things and then have the freedom to decide how they wanted to respond.

Security is another aspect that the users discussed frequently; they talked about how they would like to get help from technology to prevent crimes and burglaries. They mentioned solutions such as their apparatus loosing their functionality outside their home, or thieves who would get looked inside the house once they have entered it, or cameras that record everything that goes on in their home. Security could also be related to physical security where the users, for example while traveling, wanted to know where it is safe to be at their specific location.

While analyzing these interviews we found that user expressions related to traveling are strongly related to the process of traveling. They said that before they go on a journey they want information about what they can expect from the place they are traveling to, and they wanted the process of traveling to be smooth with digital tickets, online databases for passports, suitcases being delivered to their hotel and information about delays. When they are at their traveling goal, the users said that they want information of local character such as information about restaurants, and tourist attractions that are worth visiting.

During the discussions of all the things users might want to get help with, they also started to reflect on what they would do if they had all the technical support they talked about. Then they started to express a fear of getting totally lacy.

Some important aspects we want to highlight is that the users expressed a desire to get technological support for boring routine tasks in their homes such as cleaning and shopping for groceries. They also wanted help with keeping track of devices that might cause a minor disaster in their homes such as locking doors and controlling the stove. When it comes to traveling, the users want to get help with the process of traveling as well as getting support with things that might enhance the experience of traveling, such as ideas about interesting attractions. The users

also express a great skepticism towards using technology to much; they express a fear that they might become too lazy.

To sum up, the themes users expressed in this case were *support, control, security, information, freedom,* and *efficiency*.

Discussing Situational Aspects

With the aim to discover patterns and to learn more about users what user express we will explore how the findings from the situational data relates to each other. The aim here is to generate some general insights about users needs and desires related to technological solutions.

In the SMART project our analysis ended up in eleven themes, these themes were find, information, feedback, efficiency, competence, freedom, mobility, reward, influence, security and interaction. In the CroCoPil project the analysis ended up in nine themes namely, security, control, freedom, interaction, information, co-ordination, efficiency, support and access. Finally, in the M2M project, the analysis ended up in six themes related to the home, traveling, and shopping. These themes were support, security, information, control, freedom, and efficiency.

The clustering of these themes, se table 1, shows that the aspects information, efficiency, freedom, security, support, interaction and control are aspects that are not only applicable to the current situation in focus, but they can also be found in other contexts. Based on that, these themes generates interesting insights about users and their needs, desires and expectations on new technology which are important to consider in the future development. The clustering also show that aspects such as find, feedback, competence, mobility, reward, influence, and access were dependent on the situation

When we analyze the clustering, we can see that none of the themes in the M2M case was situated; all the themes could be discerned in the other cases. One plausible reason for this might be the character of the user study. In that project the aim was very broad, namely to gain users feedback about desirable future machine-to-machine IT-services.

Table 1: Overview of Projects and Themes

SMART	CroCoPil	M2M
Find		
Information	Information	Information
Feedback		
Efficiency	Efficiency	Efficiency
Competence		
Freedom	Freedom	Freedom
Security	Security	Security
Interaction	Interaction	
	Control	Control
	Access	
Mobility		
	Co-ordination	
Reward		
Influence		
	Support	Support

Due to users difficulty of foreseeing the future until some course of action is on its way, as acknowledge by Suchman (Suchman 1994), the users in these cases were only able express themselves in general terms, which in turn ended up in generally applicable findings. In the M2M case, we could also see that similar discussions occurred in the different focus-group interviews; hence, the findings from these different focus-groups became alike. This situation is explained by the influence of the courses of action on what users can express (Suchman 1994). Every course of action depends on its material, social circumstances, thus users need to act in a situation to discover alternative possibilities, and in this case we interpret the course of actions as being represented by the presented scenarios. The scenarios being presented in this case affected the users' mindset hence; their ability to generate new solutions was hindered. The hampering effect of prior experiences on users ability to generate innovative possibilities has been highlighted in earlier studies as well (e.g. Duncker 1945; Luchins 1942). Due to this, we want to stress the importance of considering possible effects of the scenarios, or stimuli, on the data the users´ generate.

Another reason for the generality of the expressions in the M2M-project can be explained by the aim of the project, which was not to contribute to improve a specific situation; instead, the aim was to gain insights about users' situation which in turn were expected to give inspiration to future innovations. In table 1, we can see that the themes that could only be found in one user study are related to the motivation for the projects as such and its current situation. For example in the CroCoPil project, the theme access is related to the purpose of the project. In the

SMART project, the theme influence is strongly related to the motivation for the project. The situation which any project aims to improve is therefore an important source of inspirational data.

The users in the SMART project also expressed other aspects dependent on the situation such as find, feedback, competence, mobility, and reward. We interpret the themes find, feedback, and reward as being related to what the user want to experience, i.e. a non-functional requirement. The theme competence can be interpreted as an environmental requirement and the mobility theme can be related to functional requirement. We suspect that one factor, influencing the users involved in the SMART project to talk about requirements, can be the stimuli-material we used in the interviews. In this case, the stimuli were a description of possible use situations of a future solution. Again, the users' difficulties to foresee a future use situation without being influenced, and maybe hindered, by the stimuli presented to them was noticeable.

The users in the CroCoPil case on the other hand did not discuss either functional or non-functional requirements. In that case, the situational data, access and co-ordination, is related to their work practice activities. The users need to have mobile-phone, or Internet, access to do their work properly and they need to be able to co-ordinate their work with others.

Discussing General Insights

With the aim to generate some general insights about users and what they express, we will discuss the aspects information, efficiency, freedom, security, support, interaction, and control. When categorizing the themes, we can see that aspects such as information, security, freedom, and efficiency, are themes users discussed in the three cases. The nature of these aspects can be interpreted as related to current trends in our society and the character of the themes are rather basic. For example, users use information on a daily basis, but the fauna of information is enormous, hence they want help to find and use information they interpret as relevant in their current situation. Another example of an aspect which can e related to a social trend is security; today many people have an increased urge to protect themselves and to feel secure due to an acceleration of crimes being committed. The theme efficiency can be related to peoples feeling of not having enough time to do all the things they want to accomplish. This shows that the social context have impact on the issues being discussed in user studies (Guba and Lincoln 1989).

In all the user studies we have been part of, the three presented here as well as other, one thing that users always stress is to have freedom of choice. This freedom can be about what technology they should use, or when and how they should use it. The notion of freedom is also related to what the technology can offer them. If the technical solution is designed in an insightful manner, it can provide and enhance users' freedom. In addition, the opposite is also true, if the solution is not designed and used in an insightful manner, the users can feel constrained and trapped by the technology, thus, their sense of freedom might decrease.

During our studies, we have found that the term freedom often becomes a bit contradictory when users talk about it in relation to technology. Users claim that they want to be able to have the freedom to adjust services, offers, technology, and information. At the same time, they expect that all technological systems are flexible and intelligent enough to know automatically, for example, what kind of information the users want and need in a certain situation. In addition, the users have expressed that they want information when they ask for it, or in case of emergencies. This is a representation of Suchman´s (Suchman 1994) view that users, in general, cannot foresee their actions consequences until some action is on the way. The users cannot express exactly what information they want when, or how they want a particular system to be designed until they have become introduced to it. Hence, requirements cannot be settled in one interaction with users, it needs to be an iterative process in which the requirements can evolve (Flynn and Jazi 1998).

Another aspect, which confirm Guba & Lincolns (Guba and Lincoln 1989) perspective that the findings from an constructivistic study are not facts in a ultimate sense but rather representations of a reality related to a specific case, is when users talk about security and control. Users say that they want control over things, not people. As one user expressed, "*You do not want control over everything. It is kind of creepy with cameras and controls everywhere*". This is probably true as long as nothing dangerous happens, but if it does, the users said that they wanted control over everything, humans, animals, as well as things. The users´ expressed that in situations where they feel that their security can be threatened, such as in dark parking houses, they are willing to accept, for example camera supervision to ensure their security. Hence, to accept a certain level of control it needs to be balanced against security and a probable threat picture. Consequently, if they users want to be controlled, or have control, is dependent on their situated actions.

During these three studies, users have talked about information. In these discussions, they usually talk about how they want information, meaning by which means. They do not talk about why they need it, or explicitly describe when they need it, instead they talk about situations in general terms, for example, they need information when they are shopping or when they travel. We have also found that when users talk about information, they do not spontaneously talk about what kind of information they can provide to others, unless their work concerns handling information aimed for usage of other. Again, the users' inability to see courses of actions they have not experienced themselves became noticeable.

Conclusions

The aim of this paper was to generate general insights about users and their situations by elaborating with situational user expressions and by this means start developing theory about users and their needs and requirements. We argue that even though this study is limited, it is a start for theory building about users and their needs related to technology development.

In this paper we have found that users' spontaneously have a rather limited solution space. We have found that what users usually do in their work or private life gives the foundation for what is possible to express without being stimulated to expand their boundaries. Users talk spontaneously about what they have experienced themselves, not what they could do, but what they actually do. We have also found that users, or a more appropriate label would be humans, talk differently technologies to support their situation dependent on their current perspective, or role.

In the analysis of the user data, we identified themes that users express as important in technical solutions independent of context, namely, information, efficiency, freedom, security, interaction, control, and support. These themes are applicable to a broader context than a development project as such, hence these should form the basis for user studies in the future. Having these themes as a starting point for the user study enables deeper knowledge about how users perceive these themes in the particular context. Users' general needs are applicable to a broad market hence, if the technology is targeted at a mass market; fulfilling general needs should be the focus for the developer.

In this study, we can conclude that themes such as freedom is not only applicable to a specific case, rather it can be seen as a general design implication. However, how the theme of freedom takes its form in a specific case is situated. Hence, the meaning of a theme, and implications for design can only be found in the situational data. We can conclude that general insights as such, do not give deep insights into, for example, what kind of information that is right in a particular situation, or what level of control that is preferable in a certain situation for a specific group of users. From that follows that in order to develop systems that users will use and enjoy, they still needs to be involved in development processes due to the influence the situational aspects have on what the user are able to express.

The aspects we identified as situationally dependent were find, feedback, competence, access, mobility, co-ordination, reward, and influence. Among these situational aspects, we conclude that find, feedback, access and mobility is highly related to technical requirements on a future system, while competence, co-ordination, reward and influence is strongly related the goal the users want to reach when using any future system. We interpret these aspects as being more dependent on situational circumstances than the technical requirements and as such they becomes important to understand in depth to facilitate the design of a future system which users will appreciate to use in their specific context, performing their activities. To conclude, situational aspects are applicable to a small market with specific needs, hence if the technology is targeted at a defined market, understanding situational aspect should be in focus.

Based in the findings in our study, we also want to put emphasis on the influence stimuli-material might have on user' expressions of their thoughts, needs, and values. Due to this, it is vital to notice the level of sensitivity that is required when developing and selecting stimuli-material in user studies. It is also important to be aware of, and to consider the influence of the stimuli-material on the final

data and to continuously involve users to ensure that the requirements are interpreted correctly and that they are valid without the stimuli-material.

We also want to highlight the fact that the motive for the project is a factor which influences users' expressions in relation to new technological solutions. Hence, the importance of being clear about what the project aims to achieve in the beginning of the project is crucial. In addition, we have found that in each study, there are some aspects that needs to be given specific attention; we call these aspects motivators and these are related to the motive for development projects. We interpret these motivators as being the driving force behind the actual usage of the future solution. For example in the M2M case, the overall motivator was the expected effectiveness in terms of support and help with tiresome routine matters in their everyday lives. In the SMART project, the overall motivator is the users' willingness to have influence over their society, and in the CroCoPil project, the overall motivator was physical safety. From our perspective, to increase the probability that a final design solution will succeed and users´ will actually use it, the solution most answer to these motivators.

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