

# Design Ideas for Everyday Mobile and Ubiquitous Computing Based on Qualitative User Data

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**Abstract.** Academic research in mobile and ubiquitous computing has been mainly technology-driven. There is not enough understanding on what everyday needs are related to future mobile and ubiquitous computing. In this paper we will demonstrate that qualitative user data can be successfully utilized in designing for everyday activities of largely neglected user groups like the elderly. We will show how ethnographically based research can benefit the innovation of product concepts.

## 1 Introduction

Academic research in mobile and ubiquitous computing has been mainly technology-driven (for recent reviews, see [1], [6], [4]). One apparent drawback for such approaches is that the invented applications are restricted to use contexts and user groups that the inventors are most familiar with. Common examples include office and university environments, researchers and businessmen. Consequently, academic research groups seem to have no solid understanding on what everyday needs, expectations, or motivations are related to future technologies.

On the other hand, corporations have traditionally used market research methods, e.g. surveys, to investigate people's needs. Those methods have worked well in quantifying customers' preferences among existing solution options but they cannot really help in discovering needs that cannot be articulated [7], [9]. Consequently, more qualitative methods have recently been drawn from sociology and anthropology. These social research methods have provided rich information on people's behaviour, interactions, and environmental conditions. However, they tend to be more descriptive than prescriptive. That is, even the most detailed description of user behavior will not help product developers if it does not expose an opportunity for design.

Acknowledging these problems, there has been a growing interest in studying needs related to information technology [7], [9]. Discovering needs can be useful for entire business, providing value beyond the development of any single product. Following reasons can be provided in support for this argument:

- Human need lasts longer than any specific solution. Thinking of the company as a provider of solution might lead to continuously improving that solution and

forgetting to create completely new offerings that satisfy the same need in different ways [9].

- Human needs are opportunities waiting to be exploited, not guesses at the future. Strategic product development does not have to depend only on predicting future because a crucial part of that future already exists in the form of human needs [9].
- Human needs provide a roadmap for development. A company may not have all those capabilities to satisfy needs but discovering them can help it to determine what corporate skills, strategic alliances, and core competences should be developed to grow its businesses [9].
- Empirical data wherefrom the needs are interpreted is valuable in all later stages of user-centered user interface design process [3], [2], [8], [12].

Our ambition is to demonstrate that qualitative user data can be successfully utilized in design for everyday activities of largely neglected user groups like the elderly. We will show how ethnographically based research can benefit the innovation of product concepts. In the remainder of this paper, we will present a three-staged study in user needs: In the first stage, we conducted user studies with five different user groups representing large demographical clusters. We focused on everyday activities occurring during moving through places that were occupied by other people and/or technological devices. In the second stage, we analyzed the data in order to elicit user needs underlying the behavior. Finally, we drew the two together by considering what kinds of services would be motivated and how they should be designed in order to be usable.

## **2 Understanding user needs**

### **2.1 User research participants**

Altogether 25 people from five different user groups participated in our user research. The groups were defined in a workshop that was organised for our industrial partners. The selected user groups were the elderly, young singles, journalists, amateur actors, and middle-aged apartment house neighbours. We selected groups who knew each other well, because we were interested in socially dynamic situations.

### **2.2 User research methods**

We started our research with focus groups. Before coming to a focus group session participants were asked to do a pre-assignment. They drew a map of their personal places and related activities (i.e., paying, memories, travelling, personal issues, common issues, safety, identification, free time, and goofing around). In the focus group sessions, activities and locations were then discussed and the participants were asked to tell concrete stories about them.

At the end of a focus group session, participants were given photodiaries and asked to photograph and write down events occurring while they were mobile. After two weeks participants were interviewed on the diaries.

From the diaries we selected activities that would be interesting to observe. Every participant was observed for one or two four-hour sessions. For example, we followed a middle-aged woman working in a community park and an elderly woman going swimming with her grandson.

### **2.3 Using narratives for prompting design ideas**

The qualitative user data that was collected by using focus groups, diaries and observations was documented in the form of narratives. Narratives are recognized as good design tools because they are memorable and their informality is suitable for design-related knowledge that is often uncertain (Erickson, 1995).

Several afternoons were spent in reading and classifying the narratives in order to understand user needs. Sessions were guided by a researcher with a background in psychology. Needs were discussed in pairs and a common ground was established and documented. No particular need taxonomy was employed. Instead, needs and motivations driving the behavior described in a narrative were approached from a “common sense” point of view. After the classification of narratives several design idea generation sessions were held. The narratives including a recognized need were used as a basis for idea generation.

## **3 Results**

We now present some of the most interesting results we gained from our study. In the following, a need is accompanied with a short description of a technological solution and preliminary discussion on user interface issues.

### **3.1 Mobile shared workspace**

We noticed some problem solving situations in which participants had a need to be continuously aware of other people. For example, the theatre hobby group members had to decide on their new training schedule by selecting suitable dates from several choices given by their supervisors. Not all of the group members were present when the decision took place. It was therefore decided that those members who were present at that meeting, should inform those who were absent. The actors set up a call ring: Yasmine promised to call Effe, Effe should then call to Cira, etc. Mobile phones were mainly used. Of course, somebody had forgotten to call, and some of the actors did not come to the first training at all.

Our solution to this need was a shared mobile workspace, acting in a way similar to shared desktops but in mobile phones. Another example illustrating the need for mobile workspace came from our elderly users. Namely, a husband and a wife handled their daily shopping by writing shopping list before going to a shop. However, it often happened that when one of them had already gone to the shop the other wanted to add something onto the list. If they could have wrote the shopping items on a mobile workspace, the adding on the shopping list could have been possible afterwards.

From the user interface point of view, flexibility in information media should be strived after. Handwriting and drawing, audio clips, and pictures could be added in addition to keyboard typing.

### **3.2 Location-based system encouraging spontaneous meetings**

Some of the users had a need to meet other group members when moving around the city. For example, some of the young people moved around in the city quite often, and they had some unexpected free time between the activities they were doing in the city (e.g. when waiting a train to come or when dropping by for a cup of coffee after shopping). In such situations company of friends would have been nice. Consequently, we propose a system that either presents the location of friends or automatically invites them to join the user when they were nearby. From the point of user interface, we believe that it would be important to make the requests for joining a friend uninteruptive for the current activity.

### **3.3 Location-based messaging**

Some of the users had a need to gossip and to seek exceptions of everyday life. For example, the elderly users liked to comment on their everyday surroundings. They wished that others could see the same things as they did or the others would know if the place was good or bad regarding e.g. the service. Therefore, a system that could allow the users to attach comments with certain places could be a successful application among elderly. The young users who were moving a lot around the city could have found use for a system that informs them about local happenings while they pass by. The user interface should provide efficient means for selecting messages from the environment, for example by pointing the object of interest.

### **3.4 Route guide**

Some of the users had a need to know new routes. For example, an elderly user went to pick up flowers in an unfamiliar place by bus. She wanted to come back by walking but got lost. She could have had use for a system (see figure 1) that would have told her the walking route back home.



**Fig. 1.** A handheld route guide that finds the best route by walking, bike, public transportation or car. The system recognizes the user's current location. The user needs to determine the destination and the form of moving.

Another example illustrating the need related to digital route guide came from our group of journalists. They often got email invitations to events related to their work. The problem was always how to find the place of an event. If invitations would have included route instructions (see figure 2), the places would have been easier to find. In designing the user interface for route instructions, it should be kept in mind that most of the time these instructions should be useful when driving; hence, a map format could be more usable than list format.



**Fig. 2.** An electronic invitation that is attached with route guide. The user can choose the form of moving, then the system suggests the best route to the place where the event will be held.

### **3.5 Friendship manager**

Some of the participants demonstrated a need for keeping in contact with old friends. Especially, the middle-aged users had several friends that they needed to keep touch with, and they used several devices in order to do so. For example, a woman told us: “And then we have this common friend with Arja...a Greek Erasmus friend. I write text messages to her quite a lot because she does not have time to write personal messages since she is a student. Text messages were exchanged a couple of times per week and the connection remains. It is exciting that the contact needs to be maintained all the time.”

Those participants who had several relationships to maintain could have use for a system helping in relationship management. The system could monitor how often the user is in contact with a specified group of friends. If it would seem that they do not do that often enough, the system could propose to send a message to a friend or friends who had been neglected. The user interface could provide statistics in a form

of graphs to visualize how contacts have evolved. This would help in determining whether a friend should be added to the friendship manager.

## **4 Conclusions**

Our results indicate that there are uncovered, everyday needs for mobile and ubiquitous services. The methods that we used in user research were suitable for exploring social and mobile everyday situations that provide new opportunities for new technologies. Discovering needs was beneficial both for innovating new design ideas and understanding general requirements for user interfaces.

Our future work will concentrate on prototyping our design ideas. The design ideas work as hypothesis that we will test by conducting user evaluations in real life settings.

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