Utilizing Contextual Data in Mobile Applications Development

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Abstract
Understanding the context of use is crucial in developing successful applications for mobile devices. However, filtering the relevant information from the vast amount of context data is often challenging. We have noticed that collecting participants' own stories and utilizing context categories in data collection and analysis pave the way to effective utilization of the most important context information for mobile application development.

Keywords
Context of use, Mobile context, Ethnographic studies, Contextual Replay Inquiry, Observations, Mobile Internet, Mobile Journalism

Introduction
Whenever collecting information about users and contexts to feed system design, a holistic understanding about the typical usage situations gives the development team a solid basis for dealing with daily design questions. An optimal way to immerse the team in contextual information would be to have each of them participate the user studies as observers. This is impossible, however, since a large team cannot act as observers in the actual contexts of use, especially if the development team is in one location and the users all

over the world. There has to be another way to transfer the contextual data to the team. In this paper, we describe some of our experiences with collecting, analyzing, and disseminating user data with a development team.

Data collection

Even if it is impossible for the whole team to attend the user studies, it is recommended to have one team member participate all user study sessions. In cases where different development team members participate different sessions, it is often hard to get a consensus in design debates, because each team member has a one-eyed view to the debated issues. Therefore, it is important to have one person act as a user advocate that has a holistic view to all collected data and can analyze the differences and the similarities across all cases. The most important findings are the ones that come up frequently or have a strong impact to user experience, but it is important to understand the variety of contexts as well.

The methods for collecting contextual data vary case by case. The more unfamiliar the contexts of use are for the development team, the more important it is to have the user advocate go to the target culture and understand the context not only on individual but also on cultural and infrastructural level. In mobile contexts, this means that we study the statistics on mobile usage and the network infrastructure even before recruiting participants to the study. In the actual user study, we then collect information on individual level from each participant e.g. with contextual inquiry [1] or with observation sessions followed by interviews.

In our studies in the context of mobile journalism, where mobile phones are to be used by journalists and photographers for making news stories, we have used participant observations and shadowing methods for data collection in the field. We have had from one to five team members observe real use contexts. This is essential in giving a good understanding of the context since the participants may not be able to articulate and explain their activities fully in relation to contextual issues when asked outside the context.

In the beginning of the observation session, we typically explain the participant that we are interested in and want to understand participant's work, communication and actions, and that the participant is the best expert in providing this information. In addition, asking "dumb" questions and discussing with the participant whenever possible during the observation provides a deeper understanding of the contextual issues than just observing. Using combinations of methods like observations, interviews, photographs, video clips, and questionnaires provides a rich view to contextual issues. However, the amount of collected data grows easily to amounts that are hard to handle efficiently to serve design and development. Therefore, it is important to plan and focus the data collection properly, to collect the data systematically on selected topics and in a consistent way by all observers. As the team gets more familiar with the context, less effort is needed on contextual studies and "lighter" and faster methods can be used for data collection.

When studying infrequent or irregular mobile application usage, it may be difficult, intrusive and uneconomical to follow the participant during several

days to catch the few real use cases. When studying Web browsing on mobile phones [3], we developed a method called *Contextual Replay Inquiry*, a retrospective replay of a set of use cases in an interview session. Before the interview, we ask the participant to pick a location where she typically uses mobile applications and where it is possible to conduct the interview. In the interview, we first try to get an overview about the participant's life by asking her to tell about her daily routines. We then start to replay recent use cases with the mobile applications of interest. The replay starts with a description of the context of use and the motivation. If the participant does not do it spontaneously, we ask about the different context categories: physical, social, temporal, task, and technical. We then ask the participant to show what she did on the mobile device, as far as it is possible. After showing the actual interaction, we conclude the story by asking about the outcome and user experience of the use case.

Combined with the general cultural and infrastructural context data, the individual stories from Contextual Replay Inquiry help us to see what contextual information matters most to users and why. The context categories help the researcher to ask and report the different aspects of context and verify that contextual data is collected as well as possible in a retrospective interview.

From raw data to design decisions

Once we have the raw data collected from the study, we need to analyze it and communicate the results to the development team. We have used different means for analyzing and reporting different kinds of contextual data:

1. General information on culture and technical infrastructure are filtered on the basis of interest to the team. This information is typically disseminated in an introductory presentation, possibly highlighting the differences between the different contexts of use.

2. Information on the participants is presented on paper, preferably with photos of the participant and the contexts of use. The papers are hanged on the wall during the dissemination session and preferably also on the wall of the team's workplace.

3. Information on the individual use cases can be processed in several ways, below some :

    a. The user research team can meet and discuss their notes and insights right after each session and highlight the most important findings from the session. If the development team is located near the study location, they can join the discussion to get fresh insights and to ask questions. If they cannot join this session, the research team can send a short description of the session with highlights to the team e.g. by email. Although reporting preliminary findings may be dangerous sometimes, the team feels more involved when they hear about the user sessions instantly and unofficially. When the information comes to the team piece by piece, it is also easier to absorb it.

    b. Affinity wall [1] is a great way to get the team immersed in the user data. We have noticed, however, *wall building* to be time consuming and teams quickly learn to avoid this phase.

They rather do just the *wall walking* where the data has already been categorized and the results are visible.

c. Results presentation session is the most lightweight way to share user data with the team. While it is least time consuming for the development team, the level of immersion is low. Still, if the team is active in asking help from the user advocate when doing daily design decisions, the results presentation may be enough to communicate the most important user data to the team. The detailed information can then be used during the development work as design questions occur.

In the last case (3c), the user advocate has potentially a lot of power to the design decisions. The more the team is involved in the actual user study, the more independently it can do the design decisions. If the user study is exploratory, whole new product concepts can be created based on the results. In this case, it is very important to have the whole team immersed in the user data. If the user study is more specific, e.g. evaluating a prototype, a light process such as 3c may be enough.

A list of do's and don't's helps designers to address the various aspects of mobile contexts. Pre-existing guidelines for mobile application development[1] also help in taking mobile context into account in design.

Conclusions

We have not had major problems in filtering the essential information out from the collected data. This is probably because of the data collection methods we use. In Contextual Replay Inquiry, the participants tell about the contextual factors themselves. While retrospective data has been criticized for unreliability, we have found that people are very good in describing the most important contextual information in this kind of an interview. The participants filter out the irrelevant information themselves, mentioning the relevant ones often spontaneously. The interviewer has the possibility to ask further questions about the different context categories such as "Where were you?", or "Were you alone?" or "Why did you choose to use this application in this case?". The goal is not to collect each and every detail about the context, but the aspects that do have an effect on user experience. Also other retrospective methods such as Day Reconstruction Method (an example study in [2]) are promising for collecting the most meaningful data from study participants.

Another aid in managing complex contextual data is to categorize it. Although the affinity wall does not use predefined categories, we have collected the information on the use situations based on context categories. We can then describe the most typical physical, social, temporal, technical and task contexts and draw design guidelines based on them.

[1] http://www.forum.nokia.com

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Dr. Virpi Roto

My background is in Computer Science, but since I graduated 1993, I have investigated human-computer interaction rather than computers. I joined Nokia 1995 and spent the first years evaluating usability of various kinds of Nokia products and helped teams to ensure usability in the early phases of product development process. The topic of my PhD thesis was mobile web browsing user experience (2006). Lately, I have moved to investigate the foundations of user experience and the means to evaluate it.

I am spending a year as a visiting researcher in Tampere University of Technology, Human-Centered Technology, 3/2009 - 2/2010. I'm still employed by Nokia as a principal scientist at the NRC Helsinki office.

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is a researcher at Tampere University of Technology, Human-Centered Technology. Her current research interest is mobile HCI, specifically field studies concentrating both on formative and summative evaluation of novel mobile systems and methodological issues as well as on ethnographic studies for novel mobile system development. She uses mixed methods research designs in her studies. Her ongoing PhD work is related to user experience of mobile multimedia phones used for mobile news journalism.

Before joining Tampere University of Technology, Heli worked as a research engineer at Nokia Research Center (1995-2007) and Technical Research Centre of Finland (1990-1995). She has about 25 publications in the areas of HCI, open innovation, signal analysis, audio simulation as well as telecommunications and one granted patent.

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