

Scenario-based Design Methods in Mobile Appliance Development: A Case Study in Industry

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Abstract

This paper investigates how scenario-based design methods can better support the development of mobile appliances. We report the results of an industry case study in a telecommunication organization. Insights were gained into the use of scenarios in current design practice in industry. Because changing use context is a main characteristic of mobile appliances, one focus was on the problems and possibilities of capturing context in scenarios. Initial suggestions are proposed for encoding use context and changing use context in scenarios.

Keywords

Methods, scenario-based design, mobile appliance development, mobile use context.

DEVELOPING MOBILE APPLIANCES

Mobility in the current literature is no longer seen as 'geographically independent' (Makimoto & Manners 1997, Tamminen et al. 2003), but a complex concept that includes social interactions in work and private contexts that are poorly differentiated (Carroll et al. 2003). Interaction itself becomes mobilized. The traditional segmentation of context dissolves, so private life can interrupt working life and vice versa (Soerensen 2002). The user wants to be supported by mobile appliances that are able to respond to these changing contexts in the environment within which s/he is moving. This complex understanding of mobility leads us to the importance of context and the need to explore it in detail when designing for mobile use. Vetere et al. (2003) have attempted to categorize different relationships between mobile devices and their context of use. They describe this relationship as being 'amid' (context is where interaction happens), 'in' (context has provisioning role) or 'with' (context is part of the system and without it the device lacks utility). This last class is the one we are concerned with and that has high demands on a method to support mobile device development because the context has a real impact on system design.

Few system design methods focus on the use and are able to envision design (Howard et al. 2002). Scenario-based design (SBD) methods are able to do so (Rosson & Carrol 2002) and appear the most promising approach to represent the rich and changing context of mobile use for the following three reasons: Firstly, SBD methods already allow focus on context. Scenarios provide the context within which action will take place and initial design ideas can be evaluated in the context of real world activities. Secondly, scenarios enable envisioning design in a flexible way. Ideas and different contexts can be trialled and can be revised quickly and easily. This is important because the nature of mobile use seems to be flexible and scenarios in their flexible way seem to suit this nature. Thirdly, scenarios are good at facilitating participatory design (Carroll 1999) and supporting communication of different disciplines within a team. This makes design activities accessible for different stakeholders. Given that mobile use is generally not well understood, it is important that any limited understanding of mobile use be effectively communicated during the development.

Although there are numerous advantages of using SBD for mobile appliance development (e.g. Preece et al. 2002), there are also several problems. Firstly, context as described in current scenarios seems to be dependent on activity and goals of the actors. Currently the focus of scenarios is on the system design according to the actor's goals. If a scenario is to reflect the use of mobile appliances in changing environments, the context itself has to become more prominent within the scenario. For Rosson and Carroll (2002) context is not the focus of the scenario, but a kind of frame or background for the action happening. Secondly, the number of scenarios necessary presents as problematic. Mobility implies that more than one context, and a connection of different contexts, has to be represented. With different contexts a myriad of possible usage scenarios have to be captured and linked to each other in a way that provides a basis for discussion and guidance for designers. Thirdly, there are different interpretations of current scenarios. It is essential that a common interpretation is found so that different members of a design team are able to communicate about content and context and to establish a shared understanding. In doing so it is important not to restrict the creativity at early stages of the development process. In order to achieve this, a method is needed that expresses context in scenarios differently for different stages similar to Rosson and Carroll's (2002) problem, activity, and interaction scenarios to capture activity. Summarizing the problems, we have to capture context more explicitly in scenarios, control the number of scenarios while expressing changing contexts and facilitate a shared understanding in different project phases.

Our aim is to create tools that help design teams to clearly express user requirements for mobile appliances in scenarios. To achieve this, a combination of empirical and conceptual stages is planned. The empirical stage, reported here, consists of a case study that offers insights into the problems and successes of using SBD methods in an industrial project developing a mobile application. Specifically, this paper answers two questions:

1. *How are scenario-based design methods used in practice when designing for mobile appliances?*
2. *How do scenario-based design methods represent context in mobile appliance development?*

The case study firstly helps us to understand the use of SBD methods while designing for mobile activity in industrial practice, and secondly provides guidance on how “changing use context” can be captured in scenarios.

METHOD

The case study reports on a design process in the Corporate Technology department of an international IT company. The project was carried out from November 2002 to August 2003. The aim of this industrial project was to build a prototype of a Shopping Assistant running on PDA. Some members of the design team saw the use of SBD as one of their core competencies. This project was chosen because of this and the agreement with the company to give access to all project documents during the design process and provide time for interviews.

Data

The analysis was based on three sets of data (i) design documents; (ii) project communication; and (iii) interviews. Firstly, twenty-nine critical design documents were collected throughout all phases of the project. The documents span from early planning to the final design stage. The analysis took place after the project ended and included the following types of material (number of documents in brackets): *minutes* (7) containing agreements and reflecting the status of the project, *agendas* (2) describing the content of two focus groups, and *contributions of team members* (20) such as scenarios, interaction concepts and visual design drafts. Secondly, the researchers regularly communicated with the project manager (eleven contacts in total) to clarify the design documents. All communication, email and telephone conversations were transcribed: phone *conversation transcripts* (5), and *e-mails* (8 descriptions of project status). Finally, the project manager and a team member were interviewed for about 1.5 hours to get more information about the project process and the use of SBD methods: *interviews* (2).

Analysis Procedure

The documents were printed out, sorted, and numbered in chronological order. We firstly identified process phases i.e. planning, requirements, design and evaluation. In the next step specific project conditions were identified (e.g. resources, timeline). Finally, within each process phase, evidence of scenario-based design was

SET 2 Questions about the nature of SBD methods

- (i) Methods: What are the used SBD methods?
- (k) Kind: What kind of scenario is it e.g. problem scenarios, activity scenarios, use cases?
- (l) Nr.: What is the number of scenarios?
- (m) Decision: What is the reasoning for decision making?
- (n) Purpose: What is the main purpose of the scenario?
- (o) Relation: How are the relations/interdependencies between the different scenarios?

SET 3 Questions about the nature of scenarios

- (p) Content: What is the content?
- (q) Elements: What elements (setting, actors, goals, plans, evaluation, actions, events) does the scenario contain?
- (r) Additional Elements: What additional elements can be identified?
- (s) Context: How is context represented?
- (t) Dynamic: How is changing context represented?

examined against three sets of analytical questions (Table 1). Only the results of the second and third set are reported here. The first set (a) to (h) focused on conditions of mobile projects in industry. The second set examined the SBD methods used for developing the mobile application. The third set addressed the nature (structure and content) of the scenarios themselves and focused in particular on the representation of context and changing context. Questions (i) to (r) were derived from Rosson and Carroll’s (2002) framework and used to characterize the scenarios. Emphasis was on the structure of scenarios and different content elements they propose for scenarios. Questions (s) and (t) were added to focus on the representation of context and changing context. The questions were applied to the individual documents.

Table 1. Questions for analysing the documents

RESULTS

This section answers the previously formulated research questions concerning the use of scenario-based methods in practice and the capture of context for mobile appliance development. Additionally, we provide initial implications of the results for the use of SBD methods for mobile appliance development.

SBD in current practice in an industrial case

Results of this case study show, that scenarios take different roles partly due to different process phases in mobile appliance development in our case. This is in accordance with Rosson and Carrolls’ (2002) different types of

scenarios at different design phases. However, we propose here scenarios being facilitating tools on a more general level. We found in this fast paced industrial environment that the roles of scenarios are closely connected to the needs of the team at different design phases, to provide shared understanding, facilitate creativity or guide the visual design.

Using scenarios for a shared understanding. Scenarios facilitated communication of possible mobile functions and the sharing of ideas about the mobile application throughout all phases in a suitable form. However, we discovered some needs that seemed to have an influence on an efficient and clear communication of scenarios:

- Agreement on decision criteria why certain problems in a scenario are agreed upon,
- Communication of the role of SBD methods to everybody - especially unexperienced team members,
- Update of scenarios after every design step and discussion to provide a clear status quo,
- Elaboration of scenarios as clear episodes to provide a common understanding.

It seems important to have a certain recording of ideas that are made accessible to all team members to maximize resource use and make better use of the experience in the team in not leaving less experienced team members behind. Decisions that have been discussed and made specific should be discerned from issues that are unsolved. The more explicit the scenarios, the better less experienced team members can understand the scenarios and add their own ideas. The project manager expressed the fear that more material would increase the length of discussions and reduce flexibility. We think this is unlikely and it would rather help to focus the discussion in a constructive way.

Using concrete scenarios as a creativity tool. In *the early requirements phase* scenarios served as a creativity tool used to brainstorm possible mobile functions and their implications on the system. However, there was not sufficient 'playing around' with possibilities. In our opinion the team restricted itself in early thinking towards the realization of the prototype and design using formal language. Although some people work well with abstract ideas, most, especially inexperienced people, need concrete descriptions to trigger the imagination. Interestingly, none of the scenarios were formulated with a concrete actor or persona. The acting person was exclusively referred to as "the user". This is only one example towards this system oriented view. SBD techniques with its creativity potential was not exhausted and quite conservative scenarios were implemented. This common practice leads to a restricted view and would benefit from allowing room for more ideas.

Using scenarios as a flexible visual design tool. In *the requirements phase* scenarios were used in combination with design drafts or photographs as a visual design tool. The whole project emphasised on visual material. There appeared to be a strong sense that a visualization of ideas was perceived similarly by all team members. First design drafts were introduced early on and short textual interaction scenarios complemented them. In *the design phase* scenarios were mainly used to discover gaps in the design drafts, but no longer lead the design process at this stage. It would be helpful to use scenarios to support design decisions being made in a convincing way before the interface is designed in detail.

Capturing Context and Changing Use Context

This section focuses on how the scenarios represented context and dynamic use context in the development process. The overall project was a great success according to the team manager. However, SBD methods focusing more on the mobile aspects especially changing context could have supported the team better. Scenarios were not used to guide the mobile aspects of the project. Instead, they represented the agreed functions of the mobile shopping mall assistant that did not express the activity contexts in a systematic way. Here we propose initial suggestions to better focus and encode use context and changing use context in scenarios.

Gain knowledge of the context. Overall context did not play an important enough role, especially considering that the Shopping Mall Assistant is meant to support the user while moving through a changing environment. Only a few descriptions of the shopping mall environment and conditions the user is in while using the system could be found in the scenarios (such as "on a Saturday morning"). No systematic observation had been done at the beginning of the project. It is essential to gather information about what people are doing while they are in a shopping mall, for example observations in order to better imagine what users will do with a mobile application that increases their shopping opportunities, but also the complexity of context.

Consider different aspects of context. When context was expressed in the scenarios, it was in a general manner as background knowledge, e.g. the user needs some milk. Different aspects of context such as time, location, social context were not differentiated and captured in a systematic way in the scenario. Giving context a more important role means addressing the different aspects that better express the interplay of context and the user's needs and therefore what function is needed.

See context in relation to the users' goals. The focus of the design was very much on functions such as "product search". What exact products are looked for might depend on the partner calling and asking to bring a certain product, on the mood the user is in, or on an evolving desire triggered by the appearance of a shop e.g.

“does this bakery over there still have my favourite bread?”. This means we have to explore these goals in their relation to the changing context for mobile appliance design. Additionally, when exploring social interactions it is important to consider different perspectives and goals within the scenarios and not only the single user.

Acknowledge context as an actor. The results showed that use context indeed “acts” in the form of social offerings and raising opportunities and interacts with the user of the system in a dynamic way. Instead of simply being ‘background’ to an activity (as it is commonly described), context is in the Location Based Services a provocateur of events and a player in ongoing activity. Context such as the arrival of a “coupon for a free coffee” changes actor’s goals and provokes new activity. Context should therefore have a far more central role within the scenarios, and needs greater elaboration than is currently given. It also seems to be important to keep the focus and express context explicitly through the different design phases. In the final design only single moments of changing use context were captured in contrast to a strong focus on location based services in the planning phase.

CONCLUDING COMMENTS

Scenarios have great potential for mobile appliance development. However, their use in the investigated project was not exhaustive and not tailored enough to the characteristics of mobile appliance design. From these preliminary results, we see some possible needs and opportunities for the creation for an extended SBD method. In relation to afore mentioned problems regarding scenarios and context from the literature the case study gave important clues how these could be met. The results show that visual material was very helpful in capturing rich context and complementing written scenarios. A very “rich picture“ of context can be captured this way, and there is also the possibility to explore different contexts more systematically using a series of changing photographs in scenarios. In addition, the use of combined media such as text and pictures seems to be very efficient and suitable for current design practice and offers the possibility to express changing contexts without increasing the number of scenarios. A combination of more than one medium in addition to more detailed scenarios might improve team communication and help to prevent misunderstandings, as ideas are expressed in multiple ways. Furthermore, in order to provide better support for incorporating multiple contexts in the design activity for mobile devices, it is essential to learn more about the concept of dynamic use. Clear recommendations have to be put in place concerning how to use SBD methods in certain development phases.

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ACKNOWLEDGEMENTS

We would like to acknowledge the financial support of the Smart Internet Technology CRC. Special thanks to Fritjof Kaiser for supporting the data collection and to Andrew Gordon for valuable discussions.

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