Applying Usability Methods to Concept Development of a Future Wireless Communication Device – Case in Maypole

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Abstract
The development of next generation products is difficult because the development team needs to define both the product direction and the product requirements, while there is no clear understanding of who will use the product and what are their requirements. There also is new or not-yet-existing hardware and software technology involved, the product features are constantly evolving and there is no comparable existing product to benchmark against.

Usability methods can be used for defining the product direction and product requirements from users' point of view. Moreover, the user-centred approach can inspire creative and innovative design of the product concept by expanding the developers' understanding of the users' world.

In this paper we will present a framework for applying usability methods to the concept development of a future communication device. The framework is based on experience gained by the authors in an ESPRIT Long Term Research project called Maypole.

Introduction
The user-centred design process is often considered to start with a brief, which describes what it is that will be developed. Stanton (1998) presents a simplistic model of a user-centred design process. After receiving the brief and other design constraints, user needs are analysed and information on user requirements, user goals and user tasks is collected. All this is put together to create the system specification. From the specification the process proceeds to prototyping and testing.

However, when developing new products the designer do not have a clear starting point.

Smith (1998) describes the development of new technology with the following characteristics: the development team needs to define both the product direction and the product requirements, there is no clear understanding of who will use the product, the user requirements are undetermined, there are new or not-yet-existing hardware and software technology involved, the product features are constantly evolving and there is no comparable existing product to benchmark against.

There are some methodological approaches and frameworks that describe the concept design phase and take the users into account. According to Ulrich and Eppinger (1995) the concept development phase in product development should be conducted by an interdisciplinary product development team. They should identify the customer needs, generate alternative concepts in response to the needs, and select one or more concepts for future development by evaluating and comparing the concepts with respect to customer needs and other criteria.

Scholtz and Salvador (1998) separate the product definition (what the product will do) from the product design (how the product will do it). They have created a model called Systematic Creativity for developing new software products based on new technology. It consists of two parts: a method to gather user requirements and a framework for collecting, storing, and using the gathered requirements information inside the interdisciplinary product development team.

The method for gathering user requirements in Systematic Creativity is called as "engineering ethnography". The idea is to visit users in their own environment and interview them with rather unstructured questions. The user data can be collected in several phases: a first pass to collect goals and objectives of the users and a later set of interviews to collect actual task information.

The data from interviews is then structured in text form and according to the framework of Systematic Creativity. The framework separates goals, objectives, objects, tasks and subtasks. According to Scholtz' and Salvador's (1998) experience having the user data as text is a good idea, because it allows concentration on the real issues (what functionality can and should be supported in the product) and not on arguing about the form of visual information. They think that when the user requirements are generated and viewed in a systematic way the result will be a more complete product definition and design.

Smith (1998) divides the design process of new-generation products into three stages: Exploratory Design, Concept Refinement and Analysis, and Formal Design stage. The first two stages are related to the concept development and the last one concentrates on the system level design and testing of the product.

The purpose of the Exploratory Design stage is to identify and conceptualise potential new high-value products and services that will satisfy the key user needs not being met by today's solutions. Users are observed or interviewed in their actual "work" and "play" environments. The emphasis is on the creation of a large number of diverse sketches illustrating new product value and functionality without any attempt at critical analysis. Unlike Scholtz and Salvador (1998), Smith considers visualising of product

ideas very important. He thinks that the use of analysis techniques can overly constrain the creative thinking of the design team.

The goal of Concept Refinement and Analysis stage is to verify the key user values and define the attributes required of successful product. A second series of concepts are designed and developed. The user feedback for the new concepts are gathered in one-to-one interviews or focus groups by presenting the concepts in a form of storyboard scenarios.

Moreover, analysis of antecedent products is conducted in the Concept Refinement and Analysis stage in order to define the current work models. Smith (1998) thinks that there is a large gap between the existing work model and the enhanced work model. Therefore, an effort to do a detailed task analysis of the new model on the basis of the design team's own assumptions is useless, but conducting limited task analysis of the current work model can be useful for identifying new product opportunities.

Beyer & Holzblatt (1998) advise to concentrate on existing work and antecedent products, too. When the design is addressing a new work domain they think that it is useful to define the user goals and then gather data on how they are achieving them with current tools. Moreover, if the emphasis is on taking advantage of new technology, they think that by looking for analogies of the new technology and studying how they are used in the real world helps to find new markets for the technology.

Designing a future communication device in Maypole

The experience in applying usability methods to concept development (see fig. 1) of a future wireless communication device described in this chapter were gained by HUT research team in a project called Maypole (Maypole, 1998). It is a two-year project, member of the European Network for Intelligent Information Interfaces (i3net, 1997). Its partners are CURE, Helsinki University of Technology, IDEO, Meru Research and Netherlands Design Institute and Nokia.

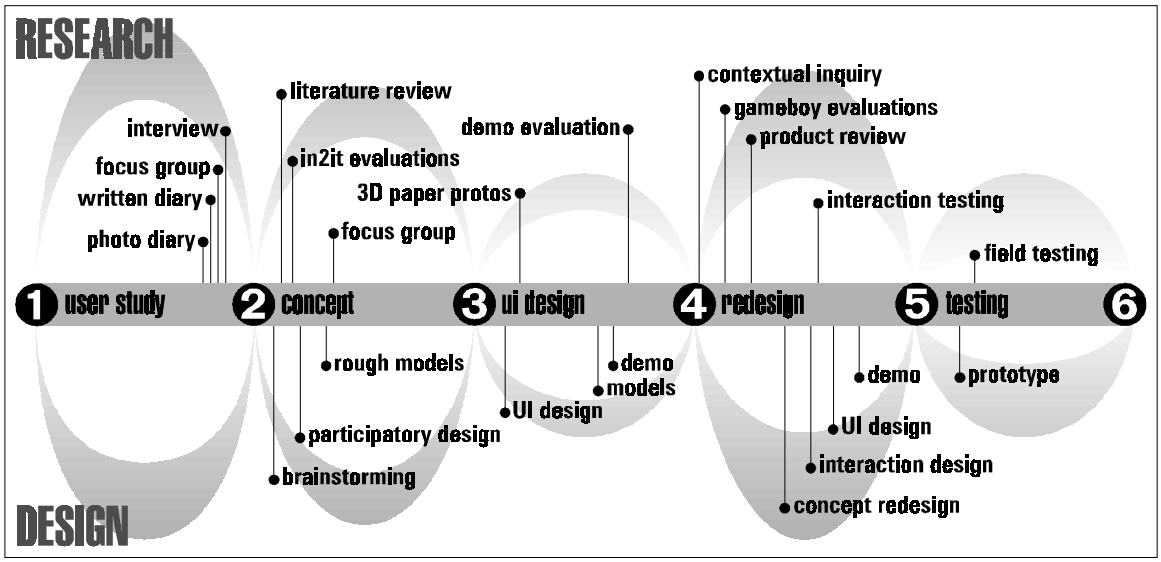

Figure 1. Research and design process of a future communication concept in Maypole. This paper focuses on the steps 1 to 3.

The aim of Maypole was to design new communications concepts for children age 8 to 12 years and for members of their social networks. First, explorative user studies were conducted to find new product opportunities. The aim of the explorative user studies was to get an overview of the users' current goals, environments, tools and communication patterns. Focus groups, informal but guided interviews, artifact interviews, diaries and photo diaries were used. Observation or contextual inquiry (Beyer & Holtzblatt, 1998) were not used because it was felt that the focus was still too wide for using them.

The results of the exploratory user studies were first written in a form of user profiles. Then the raw material (user profiles, pictures that user had taken by themselves, diaries) were analysed by the researchers and two of the designers in the project. They wrote down on post-it notes the insights they got from the raw material. Then the post-it notes were categorised together, and the categories were labelled.

Brainstorming

A creative session was organised to create ideas for concepts based on the user studies. Several product ideas of a wireless communication were born in the session. The data from the community studies – typical user profiles - had been sent to the participants beforehand and were presented briefly also at the beginning of the session. Participants formed groups and were given a schematic drawing of the users and their environment, which worked well for creating scenarios of communication needs. The resulting concept ideas were presented in form of user scenarios and rough sketches, and were used as material for the first participatory design sessions. After the participatory design session the concepts were combined and develop further.

Field trial of an antecedent product

In order to get more insights about the users current work and play models a field trial of in2it designed by Philips were conducted. With the help of Netherlands Design Institute, we were sent six in2its by Philips Electronics. The in2it was designed in a user-centred

process to especially meet the needs of young girls, a fairly undiscovered market niche Oosterholt et al, 1996).

The children participated in the field trial were five siblings and a friend, aged between five and twelve, a good age range of children in the same social network. They were given the in2its and translated manuals and invited back a week later to return them and discuss in the focus group what they had liked about them and what they had done and where. A large part of the discussion was also about their interests in general and their everyday lives and social activities. They were also asked to give improvement suggestions about the in2its (see more in Mäkelä & Battarbee, in process).

Low-fi prototyping

The concepts were tested several times with users in a focus groups. They were presented as rough models – foam, cardboard buttons, a picture, some paint. The functionality was explained using the models and was also supplied on paper along with a picture of a concept. The users were given the models and asked to evaluate the concepts for the features and imagine where and how they would use them. The models were clearly rough enough to emphasise the message that they were was still on an idea level, no more. Users were encouraged to also criticise the concepts. Moreover, after having evaluated the concepts, users designed their own favourite with absolute freedom regarding feasibility. The concepts they designed expressed some needs that had not emerged during the concept evaluation.

UI testing

One of the concepts focusing on pictorial communication was decided by the Maypole partners to be combined with another pictorial communication concept designed by IDEO, and to be developed further. After that the user evaluation of the concept proceeded with the development and iteration of the user interface, through 3D paper prototypes to an simulative computer demo. The 3D paper prototypes were tested by applying Retic's low-fi prototyping method. The PC demo testing followed the structure of a typical usability testing session. It was discovered that users were not able to evaluate the concept anymore at that level although that had been the intention. The users said very little about the concept, and only evaluated the interface – which was yet at an experimental level and received very poor feedback. User testing the interface was torture to designers and users alike.

Another concept of Maypole project designed by IDEO was tested by with a different approach. The used method was reminiscent of Co-discovery exploration method presented by Kemp and van Gelderen (1996). The concept was presented to the users with a storyboard and a blank model with possible accessories. The results were much more useful and inspiring and focused on evaluating the concept and features, and not the actual (and experimental) user interface as such.

Further development

The concept was selected second time for further development in the project. More user studies were conducted by using artifact interviews and contextual inquiry (Beyer & Holtzblatt, 1998). The focus was on existing work and play models and on the usage of antecedent products. As the design process was taking place in a different country, the

results of the user studies did not have maximal impact on the design. The researchers were not able to react to the needs of designers fast enough. At this time when the paper are being written the concept is at a rough prototype stage and field trials will be conducted within the next six months.

Results

The case showed that the field methods, such as diaries and interviews in the users' own environment, and antecedent product studies were useful for finding interesting phenomena in the user world and consequently, indicating new product opportunities. The most fruitful sources of user data were the past stories users told about their daily communication and product use.

Scenarios were very useful tools for communicating the user study results, and iterating the design ideas among the multidisciplinary team members and between the team and the users. Moreover, blank models presented the ideas in a concrete form and therefore they were easier to discuss with users. It was noticed that the way a concept was understood depended a lot on the size and the shape of its blank model. Models of concepts should be designed to communicate the product's use and possibilities as well as possible. Also, one model can only map one range of possibilities, so one concept should be explored with more than one model, as is common in design practice.

There was a strong need for user studies during the whole concept development process. First, to find interesting phenomena and then to conduct a deeper study into user's goals and tasks. However, there were problems in synchronising the research and the design. It took time to conduct user studies and it was tempting to start the design work without them. Designing is a creative thinking process whereas research is more of a structured and pre-planned activity. As long as the research and the design were done physically in the same place by same project partner, there were no major difficulties. However, when the more detailed design was done physically in a different locations by different partners, the synchronisation problems started and research could not keep up with design anymore.

One of the main difficulties in managing the design process was the fact that even before the concept had been decided on, work on the user interface design was begun. This was partly because the concept exploration was still going on in the project, but the group wanted to experiment with usability methods, which required the existence of a user interface. The result was that the functionality of the concept was evolving continuously and people had different understandings of what the concept was and should do, which made designing the user interface difficult. Finally, the design of the concept was restarted almost from scratch.

Discussion

Usability methods can generate inspirations and define requirements for concept design. When used in a right way they can provide inputs for design during the whole design process, which requires synchronised collaboration between human factors experts and designers (see fig. 2).

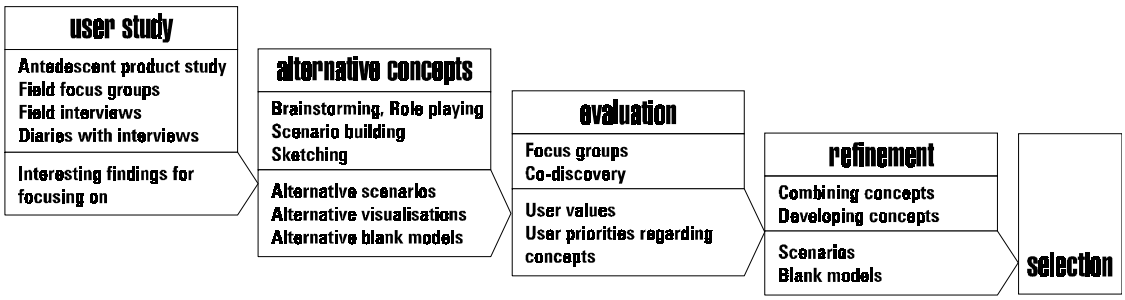

Figure 2. Proposed framework for applying usability methods to concept design of future technologies. Usability methods provides inputs for design. Inputs work as inspirations and they deepen the understanding of the user during the process. The approach requires synchronised collaboration between usability or human factors experts and designers.

According to the experiences gained in this case, new products should be created by first defining "what" and then "how". We agree with Scholtz and Salvador (1998) and their separation of product definition and design. Nevertheless, we disagree on presenting user data systematically as text. Smith's proposal (1998) for visualising findings is good as understanding user data is not only a cognitive process, but more of an empathic inspiration, for which visual presentations are instantly understandable.

Smith's (1998) way of mixing the product definition and UI design in concept design phase did not work. However, the usability methods can be used for generating and evaluating the concept without having UI design. According to our experience scenarios and blank models are good tools for that. Scenarios are useful for evaluating product functionality in focus groups and co-discovery exploration sessions. Blank models which merely sketch a product idea in 3D are also needed, especially in the case of hand-held or wearable devices, because the shape and size of the model affect the perception of the concept as a whole and with alternative models the optimal solutions can be found. Different design solutions for one concept can help to map the product expectations and unidentified (also social and emotional) needs of users.

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