

Investigating the usability of mobile phones

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Abstract

In this study we tried to explore available usability criterions. We wanted to see if they can be used for mobile phone. In order to investigate the usability of mobile phones we looked closer at both literature in the HCI field and also conducted interviews with the usability expert, user tests and surveys with mobile phones end users. During our research we noticed that designers need to take consideration to context of use and the target group the phone is designed for. Moreover we discovered that usability goals that are defined in the literature are very general and they can be adapted to design of every artefact but need to be adjusted when being used to design mobile phones. In addition to the goals mentioned by Preece et al. (2002), the designers have to take consideration to context of use, worth of use and attractiveness.

We also studied the functions; Calling, SMS, Phone book, MMS, Camera, and WAP to see how mobile phones end users experience these functions and also investigate which criterions are important from the expert's point of view. No differences have been found between mobile phones end users and the usability expert of mobile phones points of view. Both studied groups pointed out to the same problems in using mobile phones and its functions. We did find that our user test participants carried out the functions Calling, SMS, Phone book, and camera very easily and quickly. On the other hand they had problems in using MMS and WAP functions. The reasons behind this could be the configuration and the cost of using these functions. In addition we found that the users are not motivated to use WAP and MMS functions due to the fact that mobile phone have small screen and these functions are not worth the effort.

Keywords:

HCI, usability, mobile phone, context, mobility, Calling, SMS, Phone book, Camera, MMS, WAP.

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Chapter 1: Introduction

The purpose of this chapter is to give the reader an introductory understanding about the aim of our thesis. We will present our thesis background, research objectivity, research question, delimitation and disposition in this chapter.

1.1. Background

During a course in our education we became aware that “usability” is a significant factor for developing high quality products. Later on, in the same course, we read an article, “Introduction to the new usability”, written by Thomas & Macredie (2002) that introduces the motivation for and concept of the “new usability” and it positions against existing approaches to usability. According to the Thomas & Macredie (2002) the current version of the “usability goals” is not enough for designing new high quality artefacts. It needs adjustment and to respond quickly to emerging technology and applications, to the users, the context in which the product is used, the competitors and to other additional facts in order to be adaptive to the context at hand. This was the reason that made us interested in studying the usability of mobile phones.

When a system is implemented, it doesn't really matter how good its functionality is if the users, of any reason, can't or won't use the system in an effective way. Usability of an artefact is decided mainly by its characteristics and its users. Some factors like user acceptance, user's competence and a user-friendly system are essential so that the artefact is considered to be useful (Allwood, 1998). Usability is an important concept when designers develop products that are easy to learn, effective to use and provide an enjoyable experience for the users (Preece et al., 2002). According to Preece et al. (2002, p6) the aim of the interaction design is “Designing interactive products to support people in their everyday and working lives” and by fulfilling the usability principles one gets a user-friendly product.

Mobile phones develop quickly and we use them in our every day life as tools and for entertainment regardless of our gender, or our age. Today more and more functions like camera, mp3, radio calendar, voice recording etc, are added to mobile phones and it makes it possible for the users to use it for more than just making calls (Ketola, 2002). The new generations of mobile phones, 3G, has a new dimension of use. It means that mobile phones change more and more from their initial purpose of use as a voice communication on distance, from being a relative stable and predictive to more and more varying with a lot of functionality, a pocket size and integrated tool with other techniques. Therefore, it is important that mobile phone user-interface is designed in a way that facilitates and helps the users to get information and do a specific task easily. Due to the fact that the current usability definitions approach computers we think therefore that those definitions are out-of-date and needs to be adjusted in order to be applicable for usability of mobile phones.

In this work we are interested in the usability of mobile phones because we think that the usability of the mobile phones interface is just as important as its functionality. If users have difficulty understanding and using the interface in the mobile phone, then what is the benefit of that function?

1.2. Research objectivity

We seek in this study to identify the elements that influence usability aspects that are found in mobile phones. In order to approach this objectivity we would explore current usability definitions concerning computers. By this we aim to investigate whether they can cover the usability of mobile phones and not just approach computers. This is done to explore the matching and distinguishing between the current usability criterion's and today's mobile phones and to aid us to come up with more suitable new criterions that can be used in evaluating the usability of mobile phones in the future.

1.3. Research question

In this study our primary aim is to come up with suitable usability principles concerning mobile phones. We aim to investigate which usability issues does the mobile phone user experience and expect in his/her phone. In addition we also want to study the conformity and divergence of the way both the users and the experts look at the usability issues of mobile phones. In order to accomplish this, few questions at issue need to be encountered:

- How do users interpret usability in their phones and how do experts work with usability criterions when designing a mobile phone?
- Is there any difference or similarity of those two parties point of view?

1.4. Delimitation

We have chosen to examine user-interface for mobile phones and not other mobile products. We will look at the interfaces usability; i.e. we will not look at the physical parts of a mobile phone like button pressing etc. According to an individual study carried out by the National Post and Telecom Agency (PTS) in 2005, 92 percent of the Swedish population in the age between 16 and 75 years old use mobile phones. Furthermore, the study reveals that today those who are in the age 21 to 30 are those who mainly have only mobile phones, 31 percent of this group states that they only use mobile phones. Based on these facts and in order to get a more focused view on the studied subject we have chosen our target group in the user tests to contain students at age 16 to 30 in order to study how usability of mobile phones is experienced by this group. The underlying purpose of delimitation of participants in our user tests is that we want to get a deeper

understanding about the studied target instead of getting a broader understanding about different target groups.

We have also chosen in this thesis to study six functions; Calling, SMS, Phone book, MMS, Camera, WAP. They are chosen based on the first interview with the experts. Unfortunately we were not able to find relevant literature concerning the functions we aimed to study and therefore lack relevant studies dealing with MMS and phone books functions. We will also start out from the litterateurs that exist in HCI field that describe and evaluate the usability aspects. Furthermore, we are more interested in looking into the relation between the mobile phones interface and the user. Questions about how the interface should be designed technically, who have to design them, and the economical calculations of any possible profit are outside the boundaries of our research. Despite this, the thesis is foremost aimed to be written for those who are in the field of HCI.

Chapter 2: Method

In this chapter we will describe the scientific methods that we have used in our thesis. We will also discuss the ethical issue that have been taken into consideration in our research.

2.1. Scientific approach

The purpose with this master thesis is to explore the field of available usability criteria 's. Together with investigating if those criterions are optimal or a more suitable principles would be needed to in a mobile context. We have decided to use several different methods to be able to find answers on our question at issue and to be able to achieve our purpose with this master thesis. In our case we have chosen to use a multidimensional method, Method Triangulation (Djurfeldt et al., 2003; Yin, 2003), which is a kind of hybrid model. In order to use method triangulation we have chosen to combine litterateur study with user tests, surveys and qualitative interviews.

2.2. Research strategy

We carried out a theoretical-empirical study. With theoretical-empirical study we mean that we first studied relevant litterateur in the HCI area about usability and also mobile phone. Based on the examined literature we did a qualitative and a quantitative study where we got empirical data based on interviews with the experts, user tests, surveys and in the end interviewed the experts again.

We interviewed experts in the field twice; once in the beginning of our study and once in the end to get a more understanding about usability of mobile phones and also about which functions were most interesting to investigate in our study. This means that we have studied those functions based on interviews with the experts. Furthermore, the purpose with the second interviews was to get their opinions on our collected data from the user tests and the surveys.

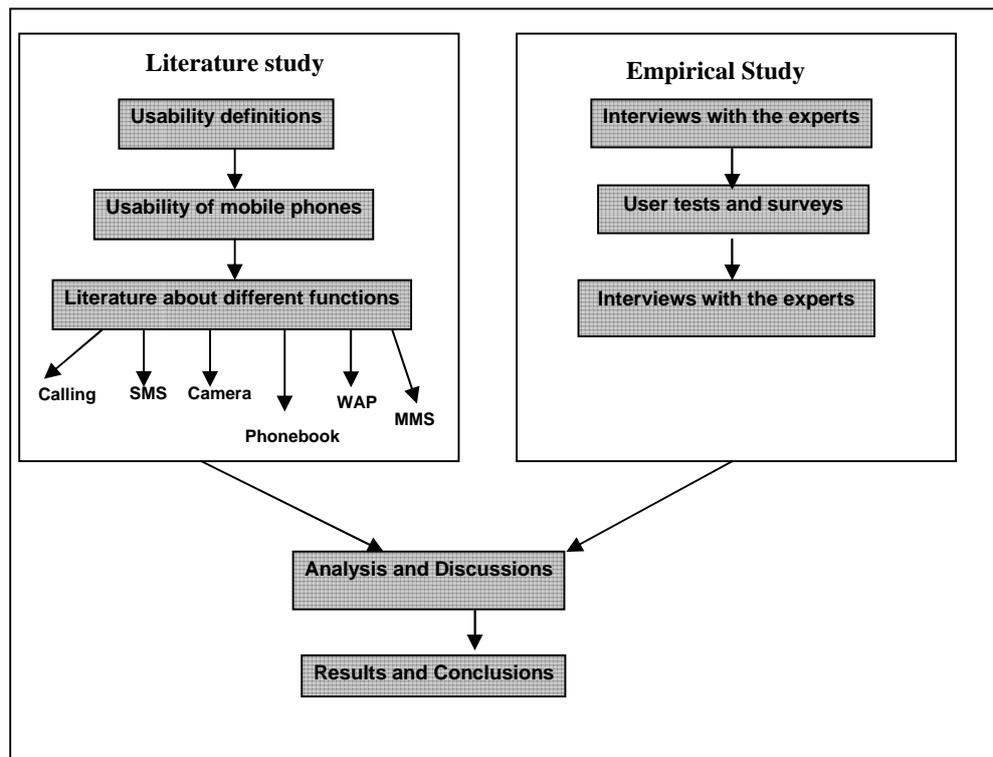


Figure 2.1: The structure of the thesis

We have also carried out user tests by giving the users some specific tasks that they performed. User test is a structured method for evaluating usability factors and measuring usability goals. The tests can be conducted in formal labs, but also in the users' real working environment. User tests can provide valuable feedback on how users perceive e.g. an artefact or any other kind of user interface (Preece et al. 2002). After that the users were given a survey form to fill. In this form we asked them about those tasks they performed and their opinions about the usability of their mobile phones. In the end of this paper we will present, analysis and discuss the theoretical and empirical data and conclude this thesis with presenting our results and conclusions. The structure of this study is illustrated in figure 2.1.

2.3. Quantitative and qualitative studies

Knowledge on the empirical study can be collected through different ways. Data collection procedure establishes data that reflect different properties in different phenomenon. Phenomenon's properties can we say are quantitative or qualitative quality and they reflect in form of numerical (quantitative) or non-numerical (qualitative) data (Creswell, 1997; Kvale, 1997; Miles & Huberman, 1994). According to these authors there are two ways to see the social world, the quantitative and qualitative world picture.

As mentioned earlier we have used Method Triangulation. According to Yin (2003) and Kvale (1997) triangulation means that the researchers look closer to the problem area from different points of view. With the help of triangulation we give a deeper and broader perspective of our study (Kvale, 1997; Miles & Huberman, 2002). Triangulation is the use of different research

methods or sources of data to examine the same problem. If the same conclusions can be reached using different methods or sources then no peculiarity of method or source has produced the conclusions and one's confidence in their validity increases. According to Miles and Huberman (2002) a link between quantitative and qualitative study is a good way to explore the research questions when the researcher is interested in enable confirmation of both methods via triangulation, to develop analysis, providing richer detail, and to initiate new lines of thinking through attention to surprises or paradoxes, "turning idea around" and providing fresh insight.

In order to achieve triangulation we have used and combined literature study with quantitative and qualitative research methods because we think the nature of our research question are in such way that needs both quantitative and qualitative examination (Miles and Huberman, 2002). The problem that we aim to study is directly connected to people's subjective experience of the usability feature in mobile phones. To be able to capture those factors that are difficult to gauge we have chosen to carry out qualitative study. And these have been reflected in our user test and interviews. According to Miles & Huberman (1997) this is more suitable to obtain deep and rich information. Quantitative research is according to both Crosswell (1997) and Miles & Huberman (1997) on the other hand difficult to use when deep information are required but are more suitable in large-scale studies where the subject under investigation is easier to quantify. In order to get a wider and a some what general understanding of how users experience usability in mobile phones there is a need to collect data from a wide range of end users. This will be difficult to carry out using a qualitative method. We have therefore chosen to use quantitative study by conducting survey study with the end users after carrying out the user tests. Moreover we think that the two research traditions complete each other and a mixture of both can help us end with more appropriate and trustworthy results to be presented especially when examining the usability phenomenon for mobile phones both in deep and broad level (Kvale, 1997; Miles & Huberman, 2002).

2.4. Data collection

2.4.1. Primary data

Our primary data collection consists of user tests, surveys and interviews. We began with interviewing usability experts in the mobility field to get more knowledge about our research subject and also to get information about which functions are most important and interesting to investigate, from the expert's perspectives. We interviewed designers of mobile phones to see how they take usability goals into consideration. According to Kvale (2002, p 125) the research interview is "an interpersonal situation, a conversation between two partners about a theme of mutual interest". The reason why we have chosen to interview designers of mobile phones is that it is them who have significant knowledge about the important aspects needed for designing a more usable mobile phone. We wanted to discover the world from mobile phones designers' point of view.

After that and based on the first interviews we collected data from users with help of the user tests. While performing the given tasks the users were asked to think aloud. Here they described what they were doing, about to do, what they were thinking about, and their opinions (Preece at al., 2002). Then after we gave the user's survey forms that they had to answer. In the end we

interviewed the same experts again. The reason why we interviewed the expert twice was that we wanted to compare the data we got from the user tests and the surveys with the interviewers opinions and knowledge. With the help of the second interviews we asked the experts about what could be unclear in our user tests and surveys. We interpreted the interviews as a complement to our surveys. We wanted to get information from both sides, those how design mobile phones and those how use them. Thereby we can get a better understanding about the usability of mobile phones.

2.4.2. Secondary data

In order to elaborate an empirical study of a specific problem which can then lead to satisfactory results we consider that we need some degree of understanding of the problem area. Bryman (1997) states that a qualitative research ought to be initiated without any previous knowledge. Miles & Huberman (1994), however, state that in the real world there is always a need to some form of initial understanding of the subject at hand. Personally we believe that it'll be difficult to gather empirical material from only our knowledge about the problem area that we have when the research initiated. We therefore have decided to let theory and empiry go hand in hand. Prior to carrying out our user tests, surveys and interviews, we think that it is necessary to paint a picture of the current research on the usability area for mobile phones. We have used our course books in HCI master program in Lund University, ACM digital library, LOVISA and ELIN@Lund and others nonfictions, where journals and proceedings from major conferences are filed. We have also studied the reference lists in the papers to locate additional publication.

2.5. Why we've selected semi structure interviews

We have kept the interview questions semi structured (Kvale, 1997). By semi structured questions we tried to ensure that we are given the answers to the questions being asked. Furthermore, we have maintained an open mind for opinions, feelings and thoughts from the interviewed. We believed the choice of a semi-structure interview is suitable for our purpose of this study. Semi-structured interviews have both advantages and disadvantages. The advantage is that if there is any need for deeper discussions for some questions the interviewer can give more space for that. It will give results in a rich material. Another advantage with a semi structured interview is that interviewer discusses the same interview guide with all interviewees, on the contrary the unstructured interviews where there is a much wider space for the interviewer and the interviewee can discuss all possible issues related to the subject at hand (Bryman, 1997; Kvale, 1997; Yin, 2002).

The disadvantage with semi-structured interview is that the interview can very easily go out from the interviews' actual direction (Bryman, 1997; Kvale, 1997; Yin, 2002). Partly when the interviewer, by mistake, leads the interviewee to other questions that have no relevance to the research subject. Interviewers may distort an interview. As the interviewer may not ask questions that makes him uncomfortable. He may not listen carefully to the respondents on topics where he himself has strong opinions about. He may make the judgment since he already know how would the respondent answer a question based on their prior responses, even though that may not be true. The interviewers' attitude to the artefact could influence the respondent. We have

tried to avoid these problems through forming our interview guide to be as structured as possible, but on the other hand gave space for more discussion. In addition we have carried out all the interviews individually; i.e. we have not carried out any group interview.

2.6. Creating questions for the user tests

A brief survey has been conducted with the users that participated in our user tests to explore their experience about the usability of their mobile phones. A survey is a set of written questions requiring a written response (Troost, 2001)

Surveys can be used to assess subjective judgements, attitudes, opinions, or feelings about the usability of the mobile phones and we can focus on those parts of mobile phones that we want to test in our user tests (ibid). In addition surveys are cheap and easy to apply to large samples of users and quickly provide both quantitative and/or qualitative data. We have chosen to use questionnaires after our user tests. In this way we were able to address usability attribute domain, and usage context.

Further we have chosen to have both open and close questions in our surveys because we wanted the test to be as simple as possible for the users that participated in our user tests. Further with help of open questions users can express their feelings and thoughts openly about the usability of their mobile phones. According to Troost (2001) closed survey facilitates even the analysis phase because all participants had to choose between the same answers. It is important that questions measure the information that need to be collected to answer the research question (Yin, 2003). Another reason for choosing closed answer survey was that we, as researchers, will insure that we understand the participants' answers (Troost, 2001).

2.7. User tests

In this study there were 20 participants all were students at age 16-30 in Malmö and Lund region. The users were videotaped and we also wrote notes while they were carrying out the given tasks. This was in order to be able to catch every detail of the process so that we could have a whole picture of the users interaction with their phones and their feelings, thoughts and attitudes towards what was been done.

According to Troost (2001) the test person in the inquiry can be collected via some specific criteria like age, gender, accessibility and mobile phones model. Due to the fact that a mobile phone is a tool that is used by different and almost all groups of people we have evaluate our user tests and surveys on users based on age, 16-30. Test persons have been chosen in the geographical closeness of the convenience reason (Troost, 2001). In our user tests our participants all carried out the given tasks by using their own mobile phones to avoid learning's period for a new mobile phone. At the same time we chose the users with mobile phones that contain those functions we wanted to investigate.

When we tested our test persons we didn't give them any instructions because we didn't want to affect the result of the test (Preece et al. 2002). On the other hand we just gave the test persons some information about the purpose of study (Kvale, 1997). The tests were done in different environments and not in the specific usability lab due to the fact that mobile users use mobile phone in different environments and also in different conditions like walking and biking.

2.8. Analysis of the collected data

We have documented the material we got from the interviews by writing them down. This has facilitated dealing with the gathered data. Before moving and initiating the analyze phase all the raw data were treated. This treatment has been done through making a summary of each interview. According to Trost (2005) it is not recommended to make a summary of the interview material during the interview. The researcher should wait with the interpretation and analysis until after the interview. Kvale (1996) in contrast points out that it's approved to use interpretive questions. The reason behind this step is that there are always differences between speech and written language. This aspect was not ignored and therefore we transcribed all the interviews so that they could then be understandable. The transcribing of the data had the advantage that the data by this way became more valuable and by that aided our analysis and conclusions. We have also presented the relevance parts of the interview material in a matrix, tables 5.1 & 7.1, in order to give the reader a clear picture of these materials (Miles & Huberman, 1997). Some diagrams have also been used in chapter 6 to present the data collected from the user tests and surveys. This was in order to rapport some statistical measures, foremost the average, so that we can be able to compare the different data that was collected. By this way we believed that there will be a possibility to see the patterns and trends (Djurfeldt et al., 2003; Robin, 1994). After that we evaluated those combined materials and then tried to find any relations along with finding any conformity and divergence between the data gathered from our user test, the interviews and the facts mentioned by the reviewed literature.

2.9. Validity and reliability

Both quantitative and qualitative methodologies are generally concerned with the quality of collected data in terms of applicability, validity, reliability and accuracy (Miles & Huberman, 2002, Kvale, 1997).

2.9.1. *Validity*

Validity is about measuring what you intend to measure (Yin, 2003). An important fact that concerns validity which we have shown consideration for is to try to retell the interview materials in an objective way. We have also transcript the interview materials so that we can control what we have gathered and in a trustworthy way be able to refer to the interviews. We have sent a written draft of the interview materials to the respective respondent. The reason behind this it to make sure that we have understood the materials we have gained from the

interview session in a right way. By this way we believe that the validity of our work will be high.

2.9.2. Reliability

2.9.2.1. Reliability in general

Reliability refers to the meaning of trustworthiness which means that the researcher measures what he/she is studying in the right way (Yin, 2003). Reliability is a way to judge to which limit the performance of the research can be repeated in a different time point and give the same result in each time. Reliability as a notion can be hard to achieve in a study similar to ours. Due to the fact that other researchers cannot perform the qualitative methods we have used in this study, in the same exact way again and come to identical results. When it comes to the user tests the same users may behave in a different way the next time they participate in a similar study and therefore even change their answers to the survey questions. The interviewed experts might also change their perspective towards the interview questions when asked in another time period and therewith also change their answers.

The possibility to generalize our theories in other situations than the one we have used is therefore low. This is why we believe that a careful documentation is of a big importance in order to be able to repeat a previous study (Miles & Huberman, 1997). To gain a higher reliability in the data we have controlled the interview questions together with our supervisor and our colleagues in our course. By this way we believe that we would be able to gain other perspectives upon the prepared questions and by that decrease our subjectivity in them. We have also by that avoided the possibility of missing something important and relevant to our study.

2.9.2.2. Experts reliability

The interviews were performed with design experts that work within the mobile phone field. We have chosen to interview two experts working with usability of mobile phones because they are active in working with usability issues of mobile phones. Moreover we have interviewed another expert that has worked with usability of mobile phones antenna and now is working with usability at the Design Center in Lund.

Our first usability expert was Peter Waller. We have chosen Peter because we wanted to combine opinion of usability expert's within the university and research world together with the opinion of expert's within the practical world. In this way we could reach a broader understanding of usability issues concerning mobile phones from both parties point of view.

Our second choice of expert was based on her practical knowledge about usability. Anna Schömer is a usability expert that works at a mobile phones software developing company in Lund and has worked since the beginning of 1994 with usability. Thenafter she has worked as e.g. consultant of usability expert. We thought that the choice of Anna Schömer is trustworthy because she has worked with usability of mobile phone for many years and she has designed many software applications for mobile phones.

Our last interview was with Anette Sandegård. She is an interaction designer at Sony Ericsson in Lund. She has studied interaction design from 1998 to 2000. She has worked with usability and interaction design at Sony Ericsson in Lund since year 2000 and she is today a team leader for Team Multimedia at Sony Ericsson. The team that she is a leader for is responsible for all multimedia applications in the phone like for instance; Camera, Camera album, walkman music player, video telephony and browser. We think that her background makes her a reliable usability expert for participating in our study because she has worked with usability issues of mobile phone for one of the biggest mobile phone companies in the world. In addition her design has a direct effect on the design of future mobile phones. The fact that all the interview participants have practical knowledge about usability of mobile phones makes them reliable to take part in our study. We think that they can enrich our findings with more valuable information concerning the usability of mobile phones.

2.10. Ethical aspects

According to Kvale (1997) and Miles & Huberman (1994) ethical issues are of importance in any research. The researcher has from the initiation of the research to take the ethical issues into consideration. We have taken Kvale (1997) and Miles & Huberman (1994) recommendations about ethical issue that can follow with doing a study into consideration to be sure that our study will not affect any participant in a negative way. Therefore we have from the initiation and even during our evaluation thought about the informed consent, the possible danger and harm and all possible consequences that our research can have. Another ethical issue that Kvale (1997) and Miles & Huberman (1994) mention is confidentiality. To ensure that we have guaranteed confidentiality in our research we have asked the participants from the beginning their permission to write their name in our thesis. We have also got their permission to quote from their answers when needed. Even we have not shown out empirical data before we had get respondents permission for publishing data in our thesis.

Chapter 3: Different usability definitions

In this chapter we will present different relevant usability definitions to give the reader an insight in the area of usability definition.

According to Weile et al. (1999) there is not any common definition for usability. As you can see in this chapter many researchers has suggested different definitions for usability. We will here look closer at the most common usability definitions that exist today in order to make it easier for the reader to understand our research subject.

3.1. Usability according to ISO- standards

The international standard organization, ISO, has grounded a number of standards that handle usability and the agronomy for systems and software. According to Dzida (1995) the standards "ISO 9241 – ergonomic requirements for office work with visual display terminals (VDTs)"^{10 – 17} brakes down the concept of usability by giving general and specific usability requirements. Weile et al. (1999) mention also that standard ISO 9241-11 introduces a quit abstract definition of the concept of usability as to be a function of the factors; efficiency, effectiveness and satisfaction. ISO 9241-11 defines usability as to be;

"Extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use." (Usability partners in 2005, p2).

In ISO 9241-11 effectiveness is defined to be how precisely and totally users can achieve the intended goals. However, efficiency is the available recourses that are aimed to be utilized to achive effectiveness, in other words how precisely and thoroughly those intended recourses' objectives are achieved. Satisfaction stands for how accepted and pleasant the system is for its users. Weile et al. (1999) mean that usability in this definition is seen out of a highly theoretical perspective, thus it may not be so much usable in practice.

According to Usability partners (i2005) usability deals with those factors that are found in ISO 9241-11 but those elements are influenced by who uses the product, the user's goal together with the context of use. They call to attention that one shouldn't mix up usability with functionality, since functionality only is a measurement of functions and fitnesses. A better functionality of a product doesn't necessary mean that the usability of it will be better.

Figure 3.1 describes those components ISO 9241-11 contains and the components relationships. The figure has divided the construction into small parts in order to make it possible to measure

usability. In order to be able to specify and measure usability according to the figure it is required that an identification and documentation is made of the context and those goals of the using of the product. The figure's left side shows the product and the context of use in which the product is in.

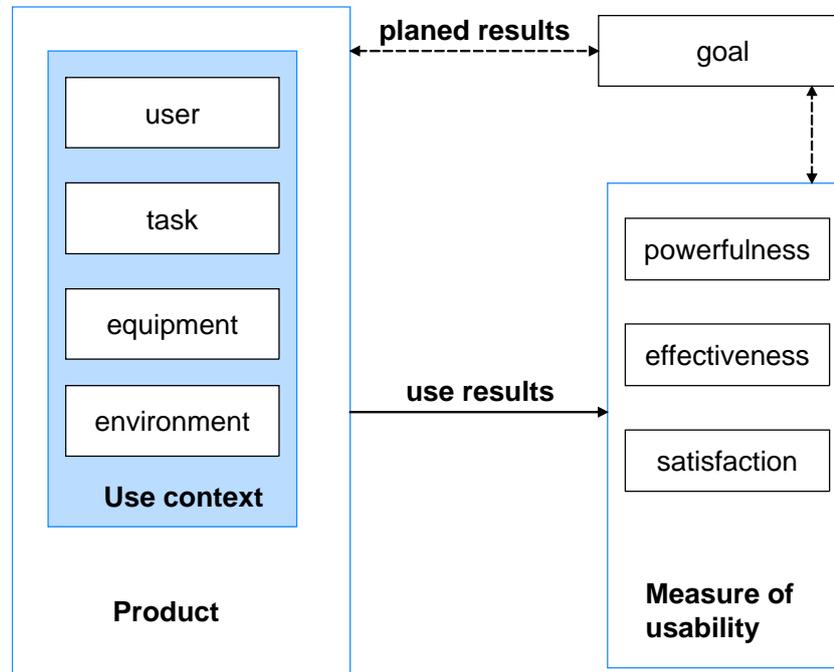


Figure 3.1: ISO 9241-11, the framework for usability (after ISO 9241-11, 1998, p.3)

The use context contains four parts;

User: everything that concerns the user is described here. It can be for instance the user's knowledge, experience, educations and their abilities. It can also sometimes be important to categorize the users when they have diverse experiences and when they have diverse tasks and purposes to use the product.

Task: the activities needed in order to achieve a goal are described here. It can be activities that effect usability, for example the regularity and the duration of the tasks. The descriptions should be related to the goal which is going to be achieved. The description shouldn't contain only a report of the functions or the functions the product offers. Even a description of those activities and required steps to carry out a task should be related to those goals that will be achieved.

Equipment: a description of the hardware, software and those materials needed are described here.

Environment: this part is a description of the physical and social environment which the planned product is going to be used in. Here for instance the networks environment, furniture that lies in the environment, the temperature of the room and the noise level are described.

The goal (the upper/ see right corner of fig 3.1) describes the objectives that the target users have with the project, what do they want to achieve through using the product etc. the goal is described from the users perspective. These goals should be formulated in a way that they can be measured. In order to be able to accomplish the planned results a dialog must take place with the

users. The goal formulation should be a result of the dialog with the users. There should be a possibility to modify the goal. The connection between the goal and the usability requirement (right under part of the figure) are how the goal can be achieved with powerfulness, effectiveness and satisfaction. Even the product should fulfil the usability requirements (results of the usage) with powerfulness, effectiveness, and satisfaction.

3.2. Usability according to Nielsen

According to Nielsen (1993) it is important to understand that usability is not just a simple one-dimensional quality at a user interface. With this Nielsen (1993) means that we have to make usability to something that improves and evaluates systematically. Traditionally usability consist, according to Nielsen (1993), of five factors; efficiency, learnability, memorability, errors, and satisfaction. These factors can be used to measure usability in a system or, as Nielsen (1993) writes, as praxis to show how usability in a system can be measured.

Learnability is according to Nielsen (1993) the most fundamental factor for usability. This is due to the fact that in order to be affective in carrying out a task the users today need to learn to use the system to be capable of using it in a more affective way. Therefore it is important that learning how to use the system is a simple process for the users so that the users would be able to use the system and perform those tasks that he/she wants to carry out in a short time.

Efficiency is according to Nielsen (1993) a concept that describes how productive a system is when the users have learnt to use it. When measuring efficiency it's important to make a definition of how experienced the users are because the definition is related to experience.

Memorability aims to how easy a temporary user of a system has to remember to use the system. It is a measure about how much a user that didn't use the system for a while can remember to use the system and how much the user has to learn again (Nielsen, 1993).

Rate of errors describes all the activities that don't lead to those objectives the user has when using the system. The system has to make it easier for the users to correct those errors that they have done. For achieving good usability it is necessary to design the system that prevents the users from making mistakes (Nielsen, 1993).

Satisfaction is the last usability factor according to Nielsen (1993). This factor describes the personal satisfaction of using a system. A system should be enjoyable to use so the users are satisfied with using the system and also like to use the system.

3.3. Usability according to Allwood

Allwood (1998) suggests that one should define usability as an interactive property, that usability is decided by the co-operation of different characteristics in a context of use. He means that the most important characteristics which should be taken into consideration are the characteristics that lie within the program itself, the characteristics in the task together with the characteristics the present users have. Other parts of the context of use can nevertheless even be of a great significance. This in according to Allwood (1998) leads to that there are at least four elements that influences usability; user-friendly, user-competence, adjusting and user acceptance.

User-friendly: The concept user-friendly is divided into four different elements; accessibility, help resource, individualization and consistent with and support for peoples mental functions. Accessibility means that the users must have the possibility to use the present system but even that it should be easy to move between different functions and that, for example, response time from a server is not too long. Help resources are those resources which exist for disposal if the users have problem when using the system. These help resources can be for instance documentation help functions in a program or support personal. Individualization means that users have the opportunity to adjust the system according to their characteristics, the opportunity to adjust the difficulty level of the menus, the opportunity to change the language and so on. Consistent with and support for peoples mental functions means that those requirements the program places on the users, which concerns the mental functions; as memory, previous knowledge, problem solving and so on shall be in a sufficient level for the users.

The users' competence: Adequate understanding and adequate knowledge is what characterizes the users' competence. In order to be able to achieve the users' competence it's required that the users get a good learning about the system.

Adjusting: The system or the program should adjust according to the task that the users shall carry out.

The users' acceptance: It is required in order for the system to be used and furthermore to be used affectively that the users are positively prepared to use the system. By high motivation to use the system one can decrease the risk that it may arise unnecessary errors. One can even reduce the risk that the assignments take unnecessary long time to be carried out caused by reluctance.

3.4. Usability according to Preece et al.

The concept usability is a keyword within the field of HCI (Human Computer Interaction) and is about making the system easy to learn and easy to understand (Preece et al., 2002). According to Preece et al. (1994) usability is a result of relevance, effectiveness, attitude, learnable, trustworthiness and functionality.

Relevance means that the system should be relevant to the users needs. A system which can't satisfy the user's needs loses its trustworthiness in the user's eyes.

Effectiveness shows how well the system is at doing what it is supposed to do. In other words it should be easy and swift to use a system. A homogeneous system design can enhance the systems effectiveness.

Attitude stands for that the information system shall be positively experienced by the users. A positive attitude can enhance the user's motivation.

Learnable stands for how easy it is to learn how to use a new system. The system should be easy to remember.

Trustworthy means that the system shall have a low error frequency so that the users believe in the system in order to be able to utilize those resources the system offers.

Functionality means that the system contains those functions that the user needs in order to carry out his/her work assignments. It is important that the user is acquainted with basic functions in order to be able to use all the functions the system encloses.

In addition to the above mentioned criteria Preece et al. (2002) mentions the goals of usability to be:

Efficient to use (efficiency): refers to the way the system supports users in carrying out their tasks.

Safe to use (safety): this goal is about how to protect the users from dangerous and unwanted circumstances.

Have good utility (utility): involves the degree to which the system affords the right kind of functionality so that the users can perform what they want to do.

There are also user experience goals Preece et al. (2002) states that are important to have in mind when designing an interactive system. The system should be:

- satisfying
- enjoyable
- fun
- entertaining
- helpful
- motivating
- aesthetically pleasing
- supportive of creativity
- rewarding
- emotionally fulfilling

The figure below represents the above mentioned goals:



Figure 3.2: Usability and user experience goals (Preece et al., p. 19)

3.5. Usability according to Löwgren

According to Löwgren (2005) usability is a result of relevance, efficiency, attitude, and learnability.

Relevance for a system is about how well it fulfils a users needs.

Efficiency is about how effective the user can perform their task when they use the system.

Attitude is about what the users have for the subjective opinion about the system.

Learnability means how much a user has to learn to use the system and how well the user after a while remembers to use the system.

3.6. Summary and comparison of different definitions of usability

In table 3.1 we have summarised all the usability definition from different usability perspective in one definition. In this way we want to show which usability criteria are the most important one from different points of view. These will show an outlook of this chapter about how litterateurs define usability. We will also compare different usability definitions that have been presented in this chapter from our own point of view in order to mark the similarities and differences between these definitions.

Table 3.1: Summary of different definitions of usability

Different definition	Usability according to the different definition	Placing together usability from different definitions
ISO- standards	Efficiency, Effectiveness, Satisfaction, User, User's goal, Context of use	Context of use, User's goal, User, Efficiency, Learnability, Effectiveness, Satisfaction, Relevance, Attitude, Safety, Adjusting, Errors, Functionality Memorability, Trustworthiness, User acceptance, User-competence, User-friendly, Utility
<i>Nielsen</i>	Efficiency, Learnability, Memorability, Errors, Satisfaction	
<i>Allwood</i>	User-friendly, User-competence, Adjusting, User acceptance	
<i>Preece et al.</i>	Relevance, Effectiveness, Attitude, Learnable, Trustworthiness, Functionality, Efficiency, Safety, Utility	
<i>Löwgren</i>	Relevance, Efficiency, Attitude, Learnability	

Different usability definitions that have been presented in this chapter have either been written about the same attribute or a similar attribute but with a different name. For instance Nielsen's (1993) error is the same attribute as Preece's et al. (2002) safety because both attributes mean that the system should minimize the error that users could make. Löwgren's (2005) attitude, Nielsen's (1993) and ISO-standards satisfaction all are attributes that deal with user's experiences of the systems. Preece et al. (2002) utility and Löwgren's (2002) relevance are also attributes that mean the same thing because both definitions refer to how well the system fit what users want it to do.

We think that those attributes that most of the above authors have agreed about are learnability, efficiency and satisfaction. Nielsen (1993), Preece et al. (2002) and Löwgren (2005) have agreed that they are important attributes within usability and even have the same definitions for that i.e. the systems should be easy to learn. The same authors and even ISO-standard have considered that efficiency is an important attribute. Nielsen (1993) and Löwgren (2005) have defined it as a concept that describes how productive a system is when the users have learnt to use it while Preece et al. (2002) have defined efficiency as a concept that means how well the system supports the users in performing their task. Satisfaction is a definition that ISO-standard and Nielsen (1993) talk about and stands for how accepted and pleasant the system is in its user's point of view.

The definition of Allwood's (1998) was unique, as we think, in that it depends on his psychological perspective of usability. It is important to emphasize that the majority of attributes

that have been presented above are about the properties that makes it possible for users to use the system, while users subjective understanding of the system is hardly mentioned in more than one attribute.

In addition we would like to mention that context of use and users and their goals with the system that just ISO-standard talk about is the most important attribut while other authors, to our surprise, don't mention anything about it. In our thesis we have tried, with help of expert interviews and user tests, to explore which usability criterions for mobile phones are most important in order to see if available usability definitions can be used for usability of mobile phone.

Chapter 4: Usability and mobile context

This chapter is going to deal with our literature study. Here we'll emphasize the literature that has discussed usability factors of mobile phones. We will also in this chapter look closer to the existed theory about those functions: Calling SMS, Camera, and WAP that we want to evaluate in our study.

Unfortunately we were not able to find relevant literature concerning the MMS and phone books functions. The choice of these functions was based on the interviews with the mobile phones expert in the field that you can read more about in the later chapter.

4.1. Usability and mobile context

4.1.1. Mobility

The rapid and accelerating move towards the adoption and use of mobile technologies has increasingly provided people and organizations with the ability to work and be reachable away from the office and home and when being on the move. The new ways of working and being contactable afforded by these technologies are often characterized in terms of the access to information and people 'anytime, anywhere'. "Mobility is one of those words that are virtually impossible to define in a meaningful way. You either come up with a definition that excludes obvious instances, or your definition is too vague; it fails to shed light on important aspects. At the same time we all have a feeling of what it means; the newsboy and the travelling salesman are mobile, the secretary and the cook are not. Thus, we can conceive typical situations in which people are mobile and when they are not." (Kristoffersen & Ljungberg, 1999, p 1).

Mobility has become an important aspect of our computing devices in the current fast paced life that most of us live. Such developments are at both the level of emerging technological infrastructures for connectivity (e.g. WAP, Bluetooth, Sun's Jini, and HP's JetSend, location pinpointing technologies, 3G and GPRS) and mobile information appliances such as mobile phones, personal digital assistants (PDAs), and laptop computers. It is becoming more and more normal in our daily and professional lives to carry those various mobile devices.

One of the common and most used types of mobile IT are the mobile phones. Interaction between people who constantly are on the move is possible with the help of this technique. With other words people can be reachable and in contact via mobile phones even if they are on the move. Telephone booths roll have to a high extent ended up in the periphery. People no longer need to be at home in order to be reachable. As Nilrud & Wollerfjord (1999) express it:

”With help of mobile phones one can be on the move and be mobile and at the same time be able to be called by friends and acquaintance.” (p. 13) [Translated from Swedish]

Mobile phones have been described by the manufactures to be a terminal with multimedia functions. The mobile phone can be used too much more than just to make phone calls with. Today the “common” mobile phones compete with hand computers and “smart” telephones. The functions develop continuously in order to meet the user needs and desires. The concept mobile indicates “to be movable”. Besides the function of being a telephone to ring with, new central functions have arisen as well. Today’s Mobile phones are equipped with a calendar, telephone book, SMS, MMS, Internet, camera, FM-radio, thermometer and touch light (Wadenström, 2003).

4.1.2. Mobile systems context

There are several different definitions of what context is. According to Dix et al. (2000) context is generally used in the meaning of location and with that means primarily the physical environment context. Dix et al. (2000) mean that mobile devices are located in a space;

- (1) Mobile devices have a location in the space,
- (2) Mobile devices have an effect on the space, devices, and users within it, and
- (3) Mobile devices are issue to influence events from the space, devices, and users.

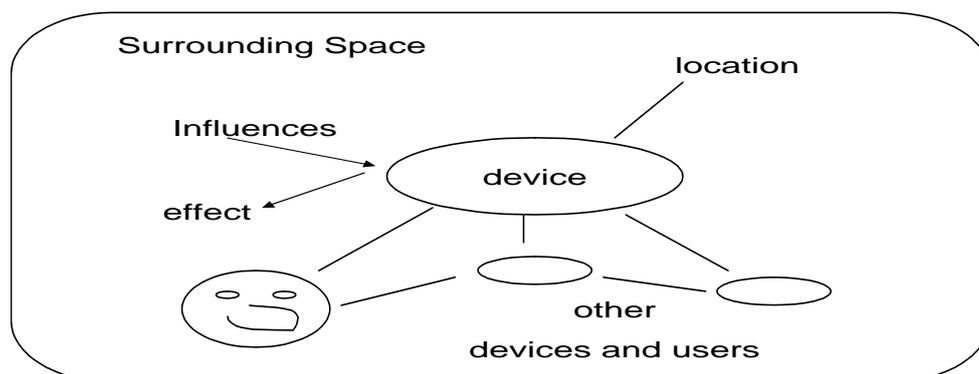


Figure 4.1: A device situated in space. (Dix et al. 2000)

In addition Dix et al. (2000) mean that basically, devices are located and surrounded within a space, and their interaction is connected through this space (Figure 4.1). As Dix et al. (2000, p 293) emphasize, “Understanding the nature of their location in that space is key to understanding the nature of the mobile system being designed and provides a means of reflection on the context.”

According to Dix et al. (2000) the interesting and challenging nature of mobile interfaces is the changing nature of interaction between mobile device and other devices. Accordingly, to have a general model of spatially situated interaction, designers need to understand the following:

- location in space (of the device and other bodies)
- mobility through space (of these)
- the kinds of bodies populating the space (which the device may interact with)
- the awareness (of the device) of these other bodies.” (Dix et al. 2000, p 293)

Dix et al. (2000) mean here that understanding mobile devices in the suitable contexts within their design space enables designers to develop better systems for users. Context can also be defined as

a much broader concept e.g. information that somehow effects both the user and the use of the Mobile phones.

4.1.3. Multitasking

Multitasking is a primary component of successful real-world behaviour; even the highest user skill for a particular task can become useless without accurate integration with other interdependent tasks, e.g., dialling a phone number on a cell phone while driving. Consequently, a careful understanding of human multitasking is critical to the design of systems involving interaction between humans and devices. Multitasking is defined as the choice of the user to engage in two or more tasks concurrently by either switching back and forth between two tasks or performing the two tasks simultaneously (Wickens and Hollands, 1999).

Wickens and Hollands (1999) proposes four classes of mechanisms that explains the inconsistency in the achievement of multitasking, divided attention or time sharing, to help understand multitasking. The first, introduces the concept of automaticity and resources. Mental resources demanded by each task, which includes effort and difficulty, are useful in predicting the level of task performance possible in a multitasking environment. A more difficult task requires more mental resources so that it could be carried out successfully. This may result in the user choosing to perform the task with the least amount of effort with greater resources; therefore, depriving the more difficult task of the resources it needs. Moreover, it may delay each task completing time than if the tasks were carried out in a single task environment, which reduces the efficiency of both tasks.

This leads to the second class of mechanisms, resource allocation and switching Strategic Control, which can only happen under multitasking circumstances. This concept is related to the users' capability to apply task management expertise (ibid.).

Confusion and similarity is the third class of mechanisms. This concept is also important in order to understand the context of why users differ in their accomplishment of multitasking (Wickens & Hollands, 1999). If two tasks appear too similar, with different outcomes, this can be confusing and result in task interference.

The fourth class of mechanisms, structural factors in time-sharing efficiently, limits the ability of the user to engage in concurrent processing, therefore, they are likely to change to a sequential task switching policy (Wickens & Hollands, 1999). For instance, a user can only focus their vision on one object at a time. There are two approaches to this concept: bottleneck theory and multiple resource theory.

The bottleneck theory states that stimulus can be perceived simultaneously, but responses to those stimuli can only happen separately. Until one of the responses is completed the other has to be delayed. Therefore, it is necessary to use separate limited mental resources for the two processes of human perception and response. This will allow more efficient simultaneous processing when both processes are required. The multiple resource theory builds off this idea that there is more than one mental resource needed to meet the demands of multitasking (ibid.).

4.1.4. Design and usability principles

Preece et al. (2002) describes another way of conceptualizing usability in terms of design principles. Preece et al. (2002) means that these design principles are general abstractions that are intended to help designers with thinking about different aspect of their designs. These design principles are derived from a mix of theory-based knowledge, experience, and common sense. Further, Preece et al. (2002) describes that a number of design principles have been presented. The best design principles are about how to decide what users should see and do when performing their tasks using an interactive product. Here we briefly depict the most general ones: visibility, feedback, constraints, mapping consistency, and affordance. (Norman, 1998)

- *Visibility:* This principle is about making relevant parts of the interface visible. According to Norman (1998) the more visible functions are the more likely users can distinguish what to do next. In contrast, when functions are “out of sight”, it makes them more complex to find and know how to use. To emphasize this point Norman (1998) describes the controls of a car. The controls for different operations are clearly visible (e.g., indicators, headlights, horn hazard warning lights), including what can be done. “The relationship between the way the controls have been positioned in the car and what they do makes it easy for the driver to find the appropriate control for the task at hand.” (Preece et al., 2002, p 21)
- *Feedback:* This principle according to Norman (1998) is strongly connected to the concept of visibility. Feedback should give every operation an immediate and clear effect. The operation of sending back information and describing what action has been done, what has been accomplished, and allowing the user to continue with the activity is called feedback. There is various kind of feedback available for interaction design e.g. audio, tactile, verbal, visual, and combination of these. It is important to use and combine an appropriated kind of feedback in the right way to provide the necessary visibility for user interaction (Norman, 1998).
- *Constraints:* According to Preece et al. (2002, p 21) “the design concept of constraining refers to determining ways of restricting the kind of user interaction that can take place at a given moment.” There are different ways for achieving this. One of these ways is to deactivate certain menu options by shading them and thereby restricting the user to only actions permissible at that stage of the activity. In addition Norman (1998) describes that the different kind of graphical representations can also constrain a users interpretation of a problem or information space. Constraints can be classified into three different categories: physical, logical and cultural. Physical constraints refer to the way physical objects restrict the movement of things e.g. key on a mobile phone can usually be pressed in only one way. Logical constraints rely on users understanding of the way the world works, it rely on users common-sense reasoning about actions and theirs consequences. For example, making performance and their effects clear enables users to logically deduce what further performance are required. Cultural constraints, however, rely on learned conventions, e.g. the use of red for warning, the use of certain kinds of audio signals for danger, and the use of the smiley face to symbolize happy emotions.
- *Mapping:* “Mapping refers to the relationship between controls and their effects in the world.” (Preece et al. 2002, p 23). Preece et al. (2002) mentions that almost all artifacts need some kind of mapping between controls and effects e.g. the up and down arrows used to represent the up and down movement on a computer keyboard is a good example of good mapping.

Further Preece et al. (2002) refers to Norman (1998) when he writes that the mapping of the relative place of controls and their effects is also important. If you, for example, see different musical playing devices e.g., MP3, CD player, etc, you can see how the controls of playing, rewinding, and fast forward are mapped onto the desired effects.

- *Consistency*: According to Preece et al. (2002, p 24) “consistency refers to designing interfaces to have similar operation and use similar elements for achieving similar tasks”. Preece et al. (2002) mean that a consistent interface is one that follows rules e.g. using the same input actions to highlight any graphical object at the interface, for example, always clicking the left mouse button. One of the advantages with using consistent interface is that users can easily learn and use the interface. In this way users need just to learn one way for handling all the operations that works on all the objects (Preece et al. 2002). In addition there is external and internal consistency. External consistency means that a product is consistency with the user’s expectations from other similar interfaces or tools and internal consistency means that a product is consistency with other similar product from the same manufacture.
- *Affordance*: is a term used to refer to an attribute of an object that allows people to know how to use it e.g. a mouse button invites pushing by the way it is physically constrained in its plastic shell. Affordance on a very simple level means, “to give a clue”. When affordance for a physical object is clear it is then simple for user to know how to interact with the interface (Preece et al. 2002, p 25).

4.1.5. Categorization of Mobile-Service users

According to Constantiou et al. (2005) the mobile phones users can be divided in different categories based on the technology in use. Constantiou et al. (2005) defines four categories of mobile phone users in the Danish market; talkers, writers, photographers and surfers.

1. *Talkers (TA)* adopters of voice services only
2. *Writers (WR)* adopters of SMS in addition to voice services
3. *Photographers (PH)* adopters of MMS services in addition to voice and SMS
4. *Surfers (SU)* adopters of GPRS data services in addition to SMS, MMS and voice services” (Constantiou et al., 2005, p 5)

According to Constantiou et al. (2005, p 5) “it follows from the four categories that while ‘talkers’ have taken one primary learning step in terms of mobile communications use, ‘writers’, ‘photographers’ and ‘surfers’ have experienced one, two, or three additional changes in their behaviour.”

4.2. Literature about different functions in mobile phone

4.2.1. Calling

In a study concluded by Klockar et al. (2003), the authors evaluated the usability of mobile phones. Klockar et al. (2003) ranged the tasks from simple daily functions, such as finding a number in the phone book, to more uncommon and difficult tasks, such as adding an activity to the calendar, personal phone directory, alarm clock and games.

Klockar et al. (2003) found that the test participants were able to do frequent functions, such as calling or sending an SMS message, without problems. However the participants did have some difficulties performing the uncommon functions like personal phone directory, alarm clock, appointment calendar, and games. Accurate access for infrequently used functions was also problematic. In particular, they found that it was complex to search the menu systems for an infrequently used function. Further according to Klockar et al. (2003) their finding suggests that interface design could be improved on newer cellular telephones. The mobile phones could have large screens to give a better clue of the menu structure, the structure itself could be enhanced, and the difference between SIMcard memory and telephone memory could be hidden.

Korhonen (2005) evaluated audio feedback on a mobile phone for number dialling when mobile phone user is driving a car. According to Korhonen (2005) mobile phones are often used in situations in which user's attention is unfocused on the screen. Talking on the phone while walking or driving a car is uncomplicated, but dialling a number without looking at the screen or keypad is much harder. In many situations users cannot fully focus on using their mobile phone because their attention is focused on something else. The attention required while driving, for example, makes using a mobile phone difficult and dangerous.

Korhonen (2005) developed two different interaction models to support eyes-free use of number dialling task. Speech and non-speech sounds were used as a substitute for visual feedback. The test was carried out with a prototype application installed in Nokia 6600 mobile phone. Providing participants' in-car feeling, Korhonen (2005) had a driving wheel and pedals at the front of users. The mobile phone was mounted to a cradle located slightly on the right, as it would be in the real car. According to Korhonen (2005) dialling a phone number was a pretty simple task and the participants did not have any problem in performing it. Dialling a phone number while driving makes the task more fragmented and it took more time. The audio feedback was a very good substitute for visual feedback and it reduces the need for looking at the screen radically. With using audio feedback users were able to dial phone numbers without being disturbed because the audio feedback was brief, understandable and interruptible for users.

4.2.2. SMS

According to the Soriano et al. (2005), Short Message Service (SMS) is a relatively new area of study. In a study performed by Soriano et al. (2005) the authors investigated the usability of short message service on middle-aged users, aged between 35-60 years, with varying SMS skill levels and from various backgrounds. The usability goals that they evaluated were learnability, efficiency, memorability, errors and user satisfaction. Soriano et al. (2005) examined the ease of use and difficulties experienced while engaging in SMS functionalities.

Soriano et al. (2005) found that the acceptance of SMS technologies by middle-aged users is influenced by factors such as the ease at which SMS activities are supported by mobile phone handsets, the level of efficiency experienced while engaging in SMS tasks, and that of the believed utility provided by text messaging. In addition Soriano et al. (2005) found that middle-aged users looked for a keypad layout that is easy to understand at once, is clearly marked, and is easily accessed and pressed, especially concerning the navigational keys. Another issue concerning using the mobile phone by participants with large fingers was the size of the keys and spacing between them. In relation to screen features, many of the menu objects on the small displays were not completely clear for the users because of their positioning, naming conventions, the amount of

emphasis placed on certain menu objects and mapping of the suitable navigational key to the desired object.

Additionally, the Soriano et al. (2005) established that middle-aged users were reasonably concerned about the efficiency at which SMS related tasks are conducted. Here the Soriano et al. (2005) discovered the need for guaranteed delivery as a participant expressed the users concerns that they were “not sure if the person has received the message” p. 4. They also found that the physical representation of textual and numerical input as well as navigational simplicity play an important role from the initial point of user interaction with various mobile phone handsets. Therefore middle-aged users need to be considered in improving the design of current handsets.

Soriano et al. (2005) mention a study on the usability of SMS by Groot & Welie (2002) that have found that due to the high level of utility employed by SMS, which refers to the service and value SMS provides to its users, users of SMS are willing to tolerate poor usability in terms of an insufficient interface and hardware designs. The Groot & Welie (2002, p1) described that many experienced users of SMS are “willing to invest time in a poor user interface” as SMS provides. This is due to the fact that SMS function offers social interaction and at the same time offers a discrete, accurate and efficient means of communication. According to the Groot & Welie (2002) this means that there is competition between the utility of SMS and the usability of mobile phone handsets. Groot & Welie (2002) suggest a possible solution to offer a service with a high level of utility that overcomes usability constraints and at the same time minimizes usability problems. However, by simply hiding the fact that usability constraints exist does not eliminate the existence of such problems which may still result in an unsatisfying user experience.

Furthermore Soriano et al. (2005) mention another study concerning the usability of SMS conducted by Axup & Viller (2005). The study shows that “many handsets have small screens and slow text-entry mechanisms” (Axup & Viller, 2005, p 1) which eventually may hinder the adoption of SMS amongst many users. According to Axup & Viller (2005), Soriano et al. (2005) identify other usability issues such as screen glare which made it difficult for the users to read the text on small screens, the multiple key presses involved in accessing characters, small key sizes and keypad layout.

4.2.3. Camera

Today's camera- equipped mobile phones and PDAs merge a large numeral of features and offer computing and communication capabilities comparable to those of earlier desktop PCs. Yet much of this functionality is difficult to utilize. If we think about the input abilities of camera phones, we will soon realize that mobile device technology has outgrown the capability of the interface to support it. For example, small keypads are ill-appropriate for input tasks of moderate difficulty. These input problems are only to some extent moderated with the integration of joysticks and touch screens (Rohs & Zweifel, 2005).

In their study Rohs & Zweifel (2005) suggest and assess interaction techniques for camera-equipped mobile phones. According to the authors (2005, p 3) their work can be seen as “an instance of an embodied user interface, in which the user directly interacts with the device itself – for example by tilting it – and both the manipulation and the virtual representation are integrated within the same object.” Further Rohs & Zweifel (2005) designed a qualitative usability study to comprehend the strengths and weaknesses of the individual interaction techniques, as well as the approach as a whole. The result of Rohs & Zweifel (2005) study was that when using the parameters of the visual code system as a means of input, their framework improves the currently limited input abilities of

mobile phones. Furthermore, their framework facilitates users to interact with real-world objects in their current environment.

Further, Wilhelm et al. (2004) in another study, "Photo Annotation on a Camera Phone", explain a system that allows users to annotate digital photos when they capture them. In their study they present usability issues that they did meet when using a camera phone as an image annotation device directly after image capture and users' responses to use of such a system. With the increase of the number and use of consumer digital media capture devices, more personal digital media is being produced, especially digital photos. In other words users take more and more digital images, finding a specific image turns out to be more complicated. Often, images are effectively lost within thousands that are only defined by sequential file names. One solution to this image management problem according to the Wilhelm et al. (2004) is to facilitate users to create annotations of image content i.e., "metadata" about media; therefore Wilhelm et al. (2004) suggest allowing users to find their photos by searching information, instead of simply filenames. Wilhelm et al. (2004) built a framework, "MMM" for "Mobile Media Metadata", that allowed image annotation at the point of capture using Nokia 3650 camera phones over the AT&T Wireless GSM/GPRS service (Sarvas et al., 2004).

Further Wilhelm et al. (2004) discover in their evaluation that due to the fact that users were able to carry their camera phones much of the time, they reported taking funnier or ad-hoc images than they would with their "normal" cameras, which they often only carry to specific events or for particular reasons. The result of their evaluation was that user interface and system designs for mobile image annotation need to overcome the challenges of text entrance and hierarchical display and navigation on mobile devices. There is also a need to develop hybrid solutions that combined desktop and mobile application components into more comprehensive and suitable solutions that neither can offer alone. More generally, Wilhelm et al. (2004) emphasize a need to understand and design for the emergent behaviour resulting from changes in technology. Digital imaging in general and camera phones in particular make new kinds of imaging behaviour possible, according to Wilhelm et al. (2004).

4.2.4. WAP

Buchanan et al. (2001) states that WAP based services have endured a vast deal of criticism from both the popular press and technology experts. This is especially when this service is accessed via the very small screens on WAP-enabled mobile phones. They mention here two examples; Nielsen (2000) and Weeks (2000). Based on all this negativity towards WAP, Buchanan et al. (2001) studied the usability of this service in order to discover what the essential usability problems of WAP are. The Buchanan et al. (2001) primary focus in their study was WAP information presented on the small mobile phone screens. In the research Buchanan et al. (2001) believe from their experience that it is possible to develop much more usable WAP-based services on mobile phones. As a result of their previous studies the researchers identified three key problems with WAP-based services in mobile phones; screen size, navigation and site structure, and input methods.

The small size screen is inefficient in the way the information is presented on it. Buchanan et al (2001) refer here to Nielsen (1999) that stated: "Experience from many other user interface platforms indicates that a bigger screen leads to better usability than a small screen and that a graphical user interface adds even more usability". In spite of that Buchanan et al (2001) believe that the screen size problem can be solved by changing the way the information is presented. To support their statement they mention the usage of the Post-it note, as an example of a way of presenting information, which is

used according to the authors successfully when wanting to leave a curtain message and state therefore: “If one tried to use a Post-it note to write a letter, one would understandably be frustrated; thus, the negative comments about small screens are at least in part inappropriate user expectations, perhaps fed by over-enthusiastic marketing claims.” (p. 4)

The criticism towards navigation and site structure according to Buchanan et al. (2001) is that the early WAP sites involved too many selections and too many moves the user needs to go through in order to achieve their goals. Their study together with other researches came to a result that the users find some difficulties when using the WAP and finding its site navigation did not function in the same way as the hierarchical phone menus the users are used to. This makes the users meet another structure than the one they are familiar with, option- suboption-subsuboption. In order to solve this, the authors (2001) suggest having non-hierarchical WAP interactions where the user can press on the phone’s ‘back’ button to returned to the previous site rather than to a higher-level in a hierarchy, as might have been expected.

The last problem with the WAP service was input methods. Buchanan et al (2001) mention that the main problem here is that the input process on most WAP phones require great effort from the user. Buchanan et al (2001) suggest, based on their quantitative results, that using the vertical scrolling method was best for most users. They also suggest simplifying navigation and replacing text input with other types of interaction method like list selection for example and stat: “By implementing this scheme we would be able to speed up the access to information and provide better overall satisfaction.” (p. 7)

4.3. Summery of previous studies about different functions in mobile phone.

In the table 4.1 we have summarised all the problem and suggestions from previous study that we have presented here. The idea behind this is to give a clear view about what problems that have been found in other previous study and what suggestions to those problems have been presented before. In this way we want to show an outlook about how different literature present different functions in our study.

Table 4.1: Summery of previous studies about different functions in mobile phone

Author	Research	Problems	Suggestions
Klockar et al. (2003)	Calling	<ul style="list-style-type: none"> ▪ Performing the uncommon functions ▪ Accurate access for infrequently used functions, ▪ Searching in the menu systems for an infrequently used function, 	<ul style="list-style-type: none"> ▪ Large screens ▪ The structure itself could be enhanced, ▪ the difference between SIMcard memory and telephone memory could be hidden,
Korhonen (2005)	Calling	<ul style="list-style-type: none"> ▪ In many situations users cannot fully focus on using their mobile phone because their attention is focused on something else, 	<ul style="list-style-type: none"> ▪ Using audio feedback for visual feedback,
Soriano et al. (2005)	SMS	<ul style="list-style-type: none"> ▪ The size of the keys and spacing between them, ▪ small displays, ▪ The need for guaranteed delivery, ▪ Physical representation of textual and numerical input, 	<ul style="list-style-type: none"> ▪ Middle-aged users need to be considered in improving the design of current handsets,

Groot & Welie, (2002)	SMS	<ul style="list-style-type: none"> ▪ Poor usability in terms of an insufficient interface and hardware designs, 	<ul style="list-style-type: none"> ▪ A possible solution to offer a service with a high level of utility that overcomes usability constraints and at the same time minimizes usability problems,
Axup & Viller (2005)	SMS	<ul style="list-style-type: none"> ▪ Screen glare, ▪ Small key sizes and keypad layout, ▪ Slow text-entry mechanisms, 	<ul style="list-style-type: none"> ▪ Overcoming these problems
Rohs & Zweifel (2005)	Camera	<ul style="list-style-type: none"> ▪ Small keypads are ill-appropriate for input tasks of moderate difficulty, 	<ul style="list-style-type: none"> ▪ Suggest and assess interaction techniques for camera-equipped mobile phones,
Wilhelm et al. (2004)	Camera	<ul style="list-style-type: none"> ▪ Due to the fact that users take more and more digital images finding a specific image turns out to be more complicated, 	<ul style="list-style-type: none"> ▪ To facilitate users to create annotations of image content, ▪ Overcoming the challenges of text entrance and hierarchical display and navigation, ▪ A need to develop hybrid solutions that combined desktop and mobile application components,
Buchanan et al. (2001)	WAP	<ul style="list-style-type: none"> ▪ Small screen size, ▪ Navigation and site structure, ▪ Input methods 	<ul style="list-style-type: none"> ▪ A bigger screen, ▪ A graphical user interface, ▪ Having non-hierarchical WAP interactions, ▪ Using the vertical scrolling method, ▪ Simplifying navigation, ▪ Replacing text input,
Nielsen (2000) and Weeks (2000)	WAP	<ul style="list-style-type: none"> ▪ Small screen size, 	<ul style="list-style-type: none"> ▪ A bigger screen,

4.4. Summary of different factors that can affect mobile phones functions

As you can see in the figure 4.1 there are different factors that can affect mobile phones and its functions. The figure is our own summary of different factors that we have presented in this chapter. By placing together different factors that influences usability of mobile phones in one figure we wanted to get a clear insight into our thesis theoretical part. Factors that can affect usability in the mobile phone can be divided into six parts which is a result of our own combination. These factors can also be divided in the sub factors but as you can see this is not reflected in the figure.

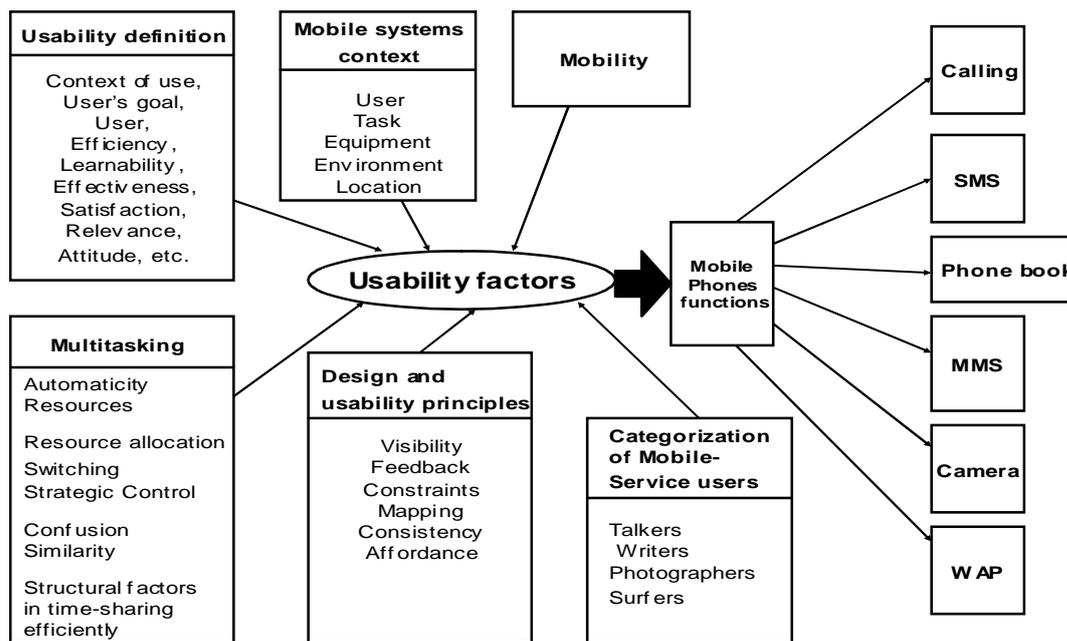


Figure 4.1: Summary of different factors that can affect mobile phones

The boxes in the figure 4.1 show the factors that we have found in the literature that affects usability. The usability factors all can influence the usability of the mobile phone and its functions. The functions mentioned in the figure are the functions we aim to explore in this study.

Mobility is one of those factors that will affect mobile phone and its functions. As we mentioned before a mobile phone can be used in different context and users can use the mobile phone when being on the move. Mobile gadgets are used and managed differently from the stationary computers. The mobile devices are smaller and the screens size is just like a fraction of a stationary computers screen size. Therefore there is a need to take mobility into consideration when designing mobile phone (Nilrud & Wollerfjord, 1999).

Another factor that we have studied in this chapter is mobile systems context which is affected by the environment, devices and users. When designing a mobile phone designers have to take the context of use into account (Dix et al. 2000).

The concept usability is another important issue that we have presented before (see chapter 3 for more information) It is a keyword within the field of HCI (Human Computer Interaction) and is about making the system easy to learn and easy to understand etc. (Preece et al., 2002). These usability definitions are general criteria for designing a usable system and designer have to depending to the e.g. context of use and target group take consideration to these usability definition.

In order to be able to successfully accomplish a desired goal, from the most extreme situations to the most routine tasks in the real world requires multitasking e.g., prioritizing, managing, and integrating multiple tasks. For instance, car drivers must perform many tasks at once, often in situations where several tasks are time and safety critical, e.g., changing lanes on a busy highway. Consequently, a careful understanding of human multitasking is critical to the design of systems involving interaction between humans and devices. (Wickens and Hollands, 1999)

Design and usability principles can also affect usability of mobile phones and its functions. These design principles are universal abstractions that are intended to facilitate designers with thinking about different aspect of their designs. These design principles are like written prescriptive rules, and suggest the designers what to provide and what to avoid at the interface. The idea behind these principles is to help designers to explain and improve their design. (Preece et al. 2002)

Mobile phones users can also be divided in four categories. Talkers, adopters of voice services only, Writers, adopters of SMS in addition to voice services, Photographers, adopters of MMS services in addition to voice and SMS, and Surfers, adopters of GPRS data services in addition to SMS, MMS and voice services. (Constantiou et al., 2005, p 5) How users use mobile phones and its function will also affect the user's experiences and use of mobile phone.

Chapter 5: Empirical study, first interviews with the experts

In this chapter we will present the material gained from the first interviews with the three experts in the field of usability

As we mentioned before in this thesis we tried to investigate available usability criteria. In this way we try to investigate whether they cover mobile phones and not just approach computers.

In order to accomplish that we conducted two interviews with the usability expert, user tests and surveys with mobile phones end users. This empirical part was done hand in hand with reviewing the relevant literatures. The interviews were performed with design experts that work within the mobile phone area. This first interview was mainly about getting more information's about usability of mobile phones and also about which functions were most interesting to investigate in our study.

5.1. The first interview with Peter Waller

Peter Waller is a PhD student in rehabilitation engineering research, specializing in supporting elderly people in remembrance, communication and planning. He has a licentiate degree in electromagnetic theory, specialized in antenna technology. He has also spent some time working with humanitarian organizations in developing countries with doctor without borders.

When asking Peter about does evaluating of mobile phones are carried out today. His answer was that some companies carry out usability testing at the usability lab that is located at the Design Centre in Lund. For instance at Sony Ericsson, selected persons carry out testing in the city in the natural environment, which he prefers more than carrying out tests in the lab. The reason behind this is that usability labs don't catch the everyday situation in the same way that the evaluation in the natural environment and everyday life does. Besides evaluating the interface in the natural environment it is important to have a clear target group to design for.

Furthermore Peter believes that usability criterions are very much depending on which target group the mobile phones are design for "if you want to design mobile phones for elderly people you have to have other usability criterions than if you want to design mobile phones for younger people" states Peter. In addition he says that there are some universal design rules for how designers should design mobile phones so that as many people as possible could benefit from them, but he believes at the same time that they are diffuse rules. He means here that it depends on for whom you want to design a mobile phone.

In addition Peter believes that usability goals are very general and they can be adapted to every situation. Here he means that it is important that designers design a mobile phone for a certain situations and states: “when you are situated you have more possibility to find problems with the interface”. He adds here that it is important that, as soon as possible, go out to those who are going to use the mobile phone and try to be in their shoes. In this way one can find the possible problems with the product. For the usability goals of mobile phones Peter thinks that it is important that a product is worth to be used. He means that there are some functions like SMS that are worth using in spite of difficulties. Therefore Peter believes that a function, artefact etc. should be both usable and worth using. When asking Peter about functions he thinks that are both important and interesting to investigate he mentions that SMS, making a phone call and the phone book are important functions but he also thinks that video telephony and taking a photo with help of the mobile phone and publishing it on the Internet are also interesting functions.

5.2. The first interview with Anna Schömer

Anna Schömer is a usability expert. She has worked with usability since the beginning of 1994 when she through a school project became familiar and interested in working with interaction design. After that she has worked as e.g. consultant of usability expert.

According to Anna Schömer, at her company, they evaluate their products with a variety of expert evaluation methods and usability testing. She explains further that she thinks that an interactive product have to be effective, flexible and be at the same time satisfactory. The end user has to be able to reach their intended goals with the product in a satisfying way, i.e. sometimes it is very important that the product works fast, but in other times it is more important that the end-user finds the work flow smooth and logical. When asking Anna Schömer if they use any usability framework when designing she states that the usability of anything depends on the context of use. In her company there is no special standard framework when dealing with usability. The reason behind this is the difficulty of having a framework that can be used in all contexts. It's difficult to use a framework when working with a new product. However there are always some important criteria that should be considered when evaluating any product for instance the user should be able to carry out the task the product is designed to achieve.

Anna Schömer explains further that it is important that there is a use quality e.g. if you want to have music in your mobile phone it has to be of a high quality and enough memory to store a relevant number of songs along with a satisfactory user interface and workflow. In addition to the use quality the design of the product, all from how one can save files, is there any clear structure, is it easy to use and navigate in, where files can be found, is there any structure to be able to have overview of what the product contains. Not least what experience and feeling the product gives the user.

The interaction has to be flexible and the end-user must be provided with sufficient feedback on what is happening at every stage of the interaction. For the usability goals of mobile phones Anna thinks that all the usability criterions that literature such as Preece et al. (2002), Allwood (1998), mention can work together. A function should be worth using, flexible, and in the same time it is fun to use it and all these three things should work together. In addition Anna states that the current usability goals for mobility mostly concerns computers. That doesn't, however, mean that they can't be used for mobile phones but there is a slit difficulty here. Therefore there should be

added specific criteria that are suitable to the mobile phone and the context the phone would be used in.

Furthermore Anna Schömer thinks that it is important to have a good convention for interaction between mobile phones and people. By that she means, that the different mobile phone companies have different conventions and this makes it difficult for people to use mobile phones from other brands than they are used to. So she thinks that it is important to find a good convention for interaction between different mobile phone software that people can recognize.

At the end when we asked her what the most important functions would be to evaluate, she answered that she thinks that it would be information handling, e.g. saving files, moving files between different maps or sending files, and maybe downloading a picture from internet.

5.3. The first interview with Anette Sandegård

Anette Sandegård is an interaction designer at Sony Ericsson. She has studied interaction design at K3 “art, culture and communication” at Malmö college. She has an artistic background. She has studied interaction design from 1998 to 2000. After that she has worked with usability and interaction design at Sony Ericsson in Lund since year 2000 and she is today a team leader for Team Multimedia at Sony Ericsson. The team is responsible for all multimedia applications in the phone like for instance; Camera, Camera album, walkman music player, video telephony and browser.

According to Anette Sandegård at Sony Ericsson they have their head office in Lund but also development at other Sony Ericsson sites around the world such as Kista, UK, Japan, China and USA. She says that due to the fact that mobile phone is a global market it is important for them at Sony Ericsson that a mobile phone works globally. It is the reason why they evaluate their mobile phones globally. According to Anette at Sony Ericsson they have a “User Experience”, lab where user tests are being done and they also carry out field studies. They even use focus groups for testing their mobile phones. Their focus group sometimes write diary about using mobile phones. At Sony Ericsson they often work with different projects at the same time.

Anette Sandegård explains further that it is important to work with two different aspects of mobile phone usability. The first one is “the out of the box experience” and the second would be in the long term of use experience. Further the phone has to be easy to use, intelligibly and attractive. At the same time it is also important that when the user wants to use the mobile phone under a longer period it works on a satisfactory way. For example if I have many pictures in my mobile phone, it is important to know how I can manage them, if I want to save them on the computer, or just browse them easily.

In addition Anette says that it is important with “ease of use”, but what it means and how you can measure that can be different depending on how you are asking. She adds that ease of use and having many functions on mobile phones are not always hand in hand with each other. At Sony Ericsson it is very important that mobile phones and its functions really work. It is also important that the integrations between different functions are connected to each other even if there are different groups that have worked with different functions. Moreover some user scenarios are important to work further with and try to find out what the user wants to carry out easily, fast

and clearly, e.g. I want to take a picture and quickly delete it or I want to take a picture and easily save it or send it to other people.

Anette says in addition that the interaction designers at Sony Ericsson are the ones within the company that are closest to the end users. When designing the interaction group have three different stakeholders; the company's internal product planners, the suppliers, and the end users. They can't all the time make all of them satisfied. She means that they have to make them all as happy as possible. Further she thinks that it is important to make mobile phones more usable and focus on user experience. It is important to critically evaluate new functions that are being added to the mobile phone to see if they are usable, well integrated with other functions and worth using.

At the end when we asked her which functions she thinks are most important for us to evaluate she answered; calling, phone book with different numbers, different contact information, how it should be designed, contact book with different languages, text input, and SMS could be interesting to evaluate. She thinks that it is important to render SMS function more effective which allows the user to switch between different languages within the same message. Camera, picture managing i.e. sending a picture, browsing between the pictures or saving a picture in the phone; on the computer, or blogging over mobile phone is also interesting according to her.

5.4. Summary of the interviews with the experts

Table 5.1: Summary of the interviews with the experts.

Interview questions The experts	The important usability criteria in the design of mobile phone	How do you evaluate usability of mobile phone?	What do you think about reviewed literatures usability criterions?	Usability qualities in current mobile phones	Usability goals	What are the most important functions that should be investigated and evaluated?
Peter Waller	It depends very much on which target group the mobile phones are design for	Prefers usability testing in the natural environment	The universal design rules are diffuse rules. It depends on to whom you want to design a mobile phone Usability framework is very general and it can be adapted to every situation	It depends very much on which target group the mobile phones are design for	It is important that a product is worth to be used A function, should be both usable and worth using	Calling SMS Phonebook Video Telephony Camera Publishing a picture on the Internet

Anna Schömer	<p>An interactive product has to be effective, flexible and be at the same time satisfying</p> <p>The end user has to be able to reach their intended goals with the product in a satisfying way</p>	A variety of expert evaluation methods and usability testing	All the usability criteria can work together, But there are some extra difficulties just for mobile phones	A function should be worth using, flexible, and in the same time it has to be fun to use it and all this three things should work together	<p>The interaction has to be flexible and the end-user must be provided sufficient feedback on what is happening at every stage of the interaction</p> <p>It is important to have a good convention for interaction between mobile phones and people</p>	<p>Information handling, e.g. saving files,</p> <p>Moving files between different maps, sending files,</p> <p>Downloading a picture from internet</p>
Anette Sandegård	<p>“The out of the box experience”</p> <p>In the long term of use experience</p> <p>It has to be easy, intelligibly and attractive</p>	<p>“ User Experience, Lab tests Field studies Focus team User tests</p>	<p>Mobile phone is used in different context</p> <p>It is important to take consideration to the different mobile context</p>	<p>“ease of use”</p> <p>Integrations between different functions</p>	Functions in mobile phones have to be usable and worth using	<p>Calling,</p> <p>SMS</p> <p>Phonebook</p> <p>Contact book</p> <p>Camera</p> <p>Picture managing</p>

Chapter 6: Empirical Study, User tests

In this chapter we will present the results from the user tests and surveys that we carried out in this study. The functions that were studied in these user tests and surveys were selected based on the first interviews with the experts.

6.1. The surveys

As mentioned in section 2.7 our user tests and surveys were carried out with 20 users. All participated users were students at age 16-30. The study was carried out in Malmö and Lund region. All users used their own mobile phones when performing the tasks that were given to them.

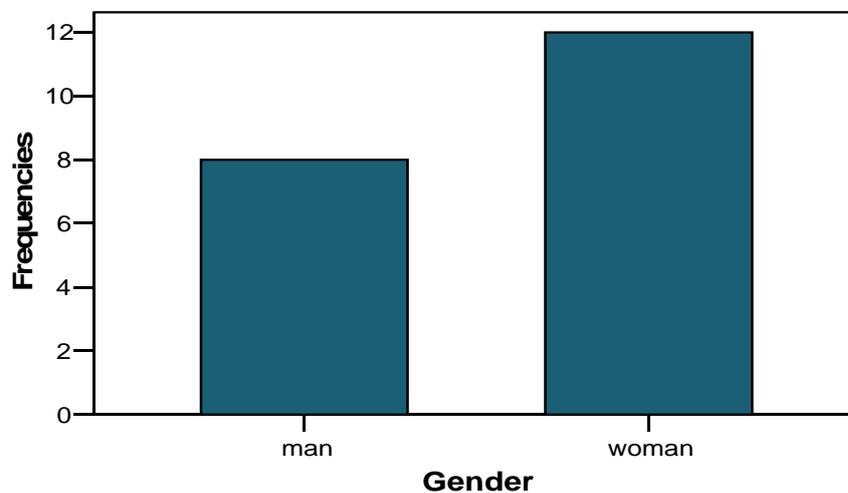


Figure 6.1: The gender of the participants in the user tests

The figure 6.1 shows the gender of the participants in our user tests. As you can see there were eight men who participated in our user test as well as 12 women.

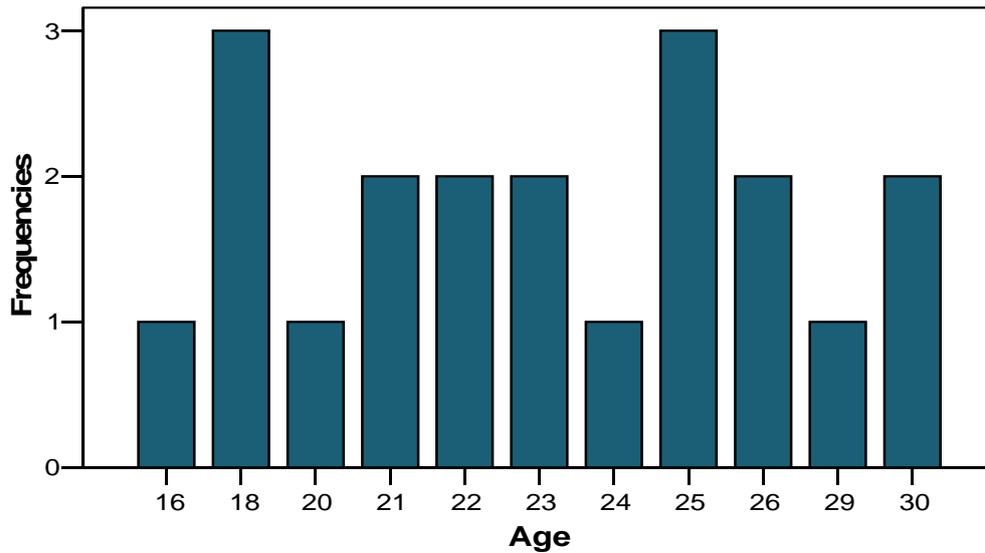


Figure 6.2: The age of the participants in our user tests

Figure 6.2 shows the frequencies of the ages of the participants in our user tests. As mentioned earlier the ages of the participants in our user tests were between 16-30 years old. The figure shows that there were three participants in the age 18 and three in the age 25. However, there were two participants in each age 21, 22, 23, 26 and 30. Meanwhile there were only one participant in the age 16, 20, 24 and 29.

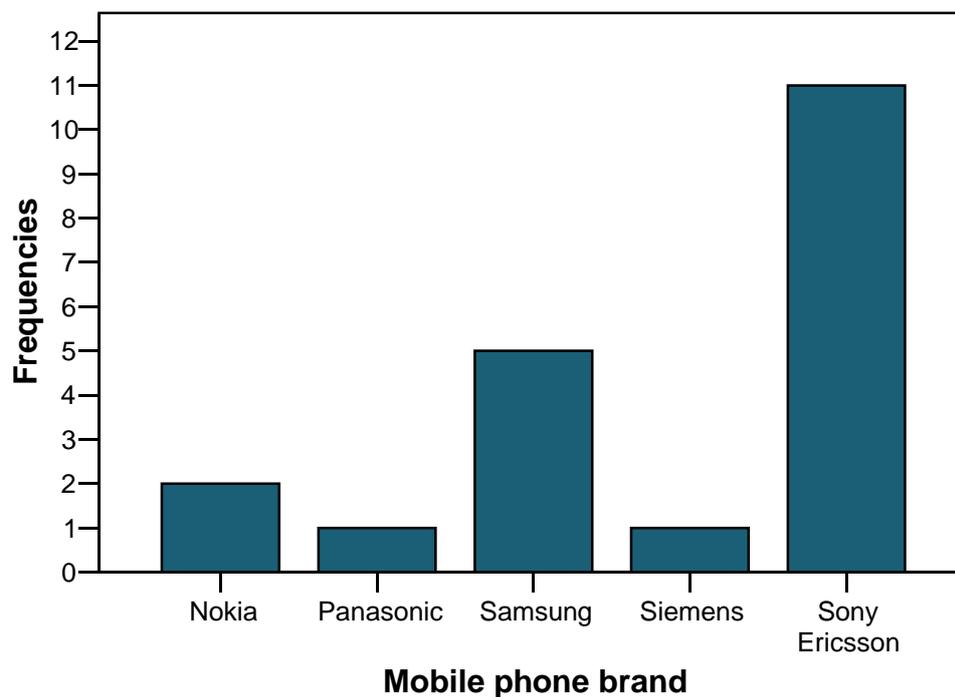


Figure 6.3: The mobile phone brands that the participants have

Figure 6.3 presents the frequencies of the mobile phone brand the participants in our user tests had. As shown in the figure most participants, eleven participants, owned Sony Ericsson phones.

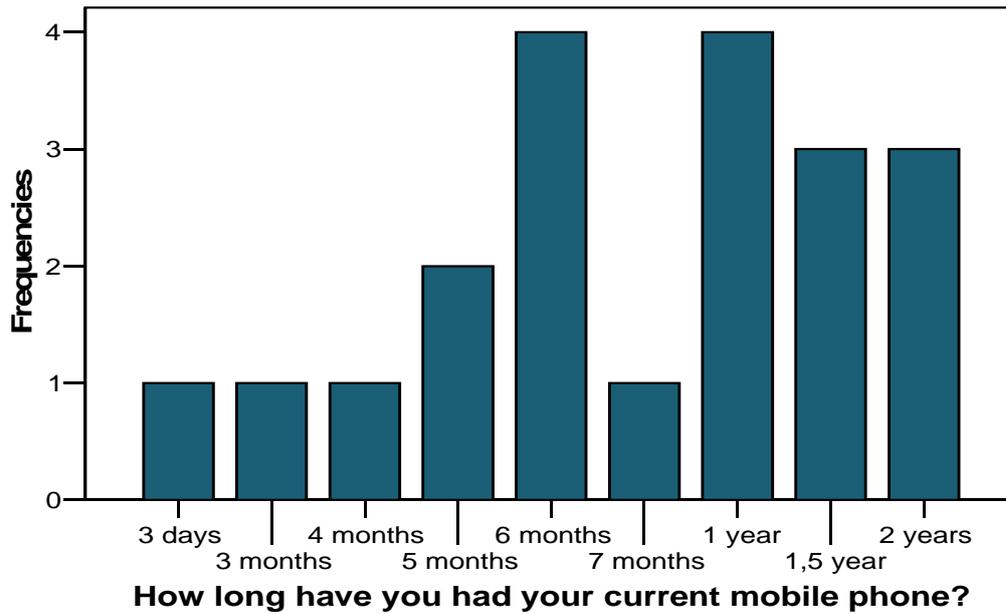


Figure 6.4: How long have you had your current mobile phone?

Figure 6.4 shows the results of the question “How long have you had your current mobile phone?” One of the participants had her mobile phone for only 3 days while the rest have had their phones from 3 months – 2 years. This participant said directly from the beginning “I don’t know that much about this phone because if have had it for only three days and therefore I’m not used to it yet”. This user was slightly nervous and hesitant while carrying out the given tasks.

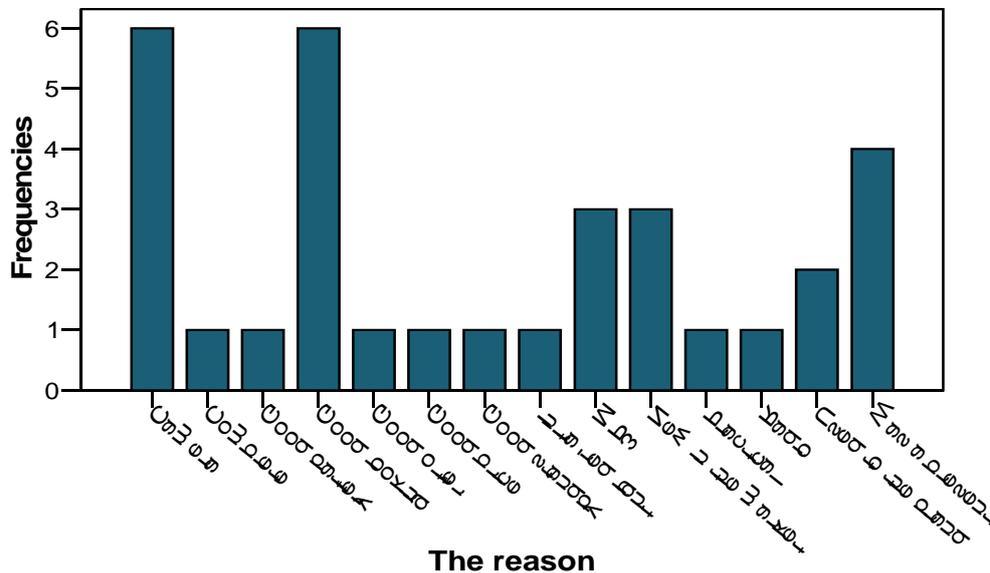


Figure 6.5: What was the reason behind purchasing the current phone?

Figure 6.5 shows the results of the question: “What was the reason behind you purchasing the current phone?” Most of the participants mentioned more than one reason. Camera and good looking feature got the highest frequencies.

When asking the participants about which function they use most respective least we got the result that are presented in the figure below.

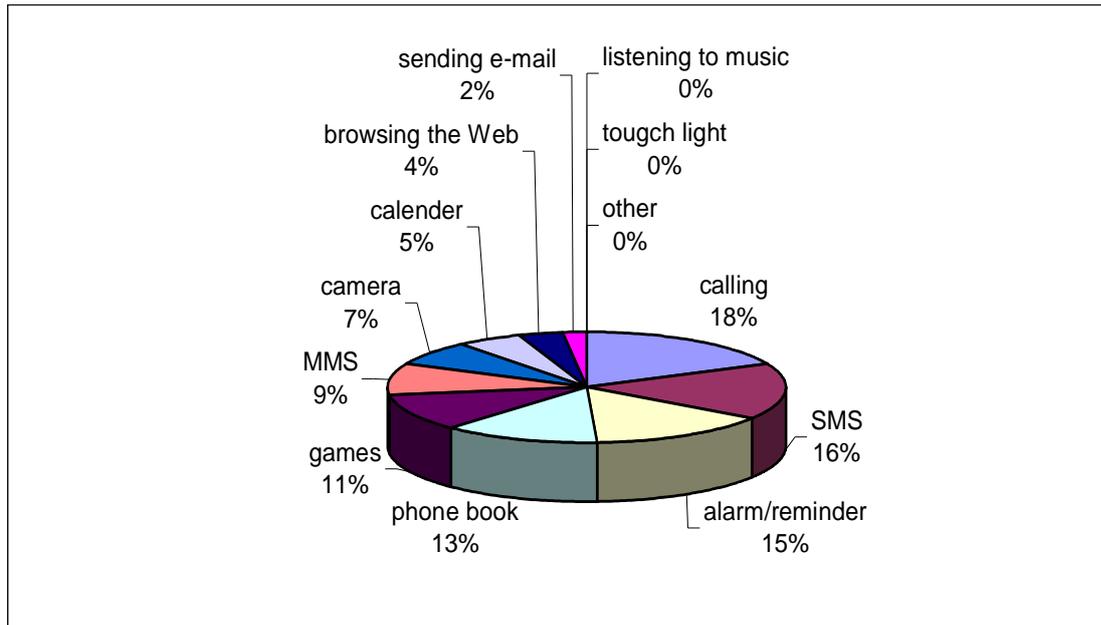


Figure 6.6: which function do you use mostly in your mobile phone?

From the figure we can see that making a phone call is the most used function then the SMS function. Sending e-mails and browsing the Web are on the other hand the least used functions.

To make a phone call was experienced to be the easiest tasks by all the users. This was due to the fact that the user's use this function always and therefore they are used to it (noticed figure 6.6). Another reason was that this function does not require many steps (see figure 11.6 in the appendix). Then comes writing and sending a SMS which was also due to the fact of usage. One of the users mentioned the camera to be the easiest function because he uses it often. Meanwhile all of the users chose one of the last three tasks to be the most complicated ones. Some of the reasons where that it requires many steps to perform the desired task, it was difficult using the function, not used to use the functions and the bad internet connection when using the WAP function (see the figures in the appendix).

When asking the users how they wish their new mobile would look like or contain the answers where as follow:

- Better internet connection
- Be able to listen to music
- To have less functions that are unnecessary
- Better and powerful camera with better and sharp colours and pictures
- Better sound
- Bigger screen
- Larger memory for SMS and pictures
- More advanced functions
- A GPS "navigation system"
- Smaller size
- Be able to have programs e.g. msn, games, hacker
- Modern look
- Easier to use
- Be able to control the phone with voice
- Be able to download music

- Wish to have a Windows similar interface that people are used to from using PC's
- More ring tones
- The screen is dark and there is no way to read the time or look at the screen without needing to open the phone or press on the keyboard buttons.

6.2. The user test tasks

Here we are going to present the results of the six tasks that were given to the 20 participants in our user tests. (See appendix 5)

6.2.1. Task 1, 2 and 3: Calling, SMS & Phone book

Almost all the participants didn't have any problem performing the first three tasks; making a phone call, writing and sending a SMS and adding a new contact to the phone book. Those three tasks were carried out easily and quickly. All the participants had the ability to make a phone call in more than one way. They could either use the menu - go to the phone book - chose the person they wish to call then make a call or go directly to the phone book and make the call. Regarding the SMS function, one participant had the opportunity to write the SMS message and chose the sender directly from the same page without browsing the phone back and forth to insert the senders' number. There was one user on the other hand who didn't use the SMS function saying: "I hate writing SMS because I don't have the patience to write a SMS and therefore I prefer calling instead". The same person had experienced some complication when trying to add a new telephone number. The user mentioned that it is difficult to add the number without manually writing a note about what kind of number that is being added, e.g. home number or mobile number. 16 of the participants, though, had the opportunity to add all information needed when adding a new contact even the e-mail address of the added person was possible. One participant could directly add the number of the person that has just called him because his mobile had saved the number of the received call in the corner of the main screen and thereby the participant added the number with the caller's information directly in the phone book after finishing the phone call. The same participant added that he is able to do the same thing with a missed call because the phone saves the note of a missed call on the main page of the phone.

6.2.2. Task 4: MMS

The MMS function was the forth function that we studied. Only eight of the users thought that it was easy to use this function. Most of the users mentioned that they either never used the MMS function or have used it few times. Most of them had to activate the function before using it. Some had to have an Internet connection in order to be able to use the function. 13 participants believed that this function has no worth of using. One of the users got an error message saying that there is no network, when trying to carry out this task. Another participant has used the function before but due to some reason she wasn't aware of that the function doesn't work anymore and the user has given up using it. One user thought that it was not a necessary function

to use therefore never uses it. Another user mentioned that he always uses Bluetooth when wanted to send pictures to friends or other people. Most of the users also believed that it is complicated to use the MMS function. There was a user who mentioned that she has tried once to send an MMS but it didn't work then. However, this function worked in the end, when carrying out this task, but with some difficulties when going through all the steps in order to send the MMS which, in spite of those difficulties, made this user surprised. One user commented "I have never liked this function and never had the need to use it therefore I have never used it"

6.2.3. Task 5: Camera

Taking a picture, giving it a name and then sending the picture to a contact on the phone book was the fifth task that was given to the users. All phones gave the participants more than one way to use the camera function not only by using the menu. Only 12 of the users could carry out the whole task. One of those participants mentioned that he never uses this function. There were some who couldn't give the taken photo a name. Five participants didn't know how to give a name to the taken photo. 11 participants couldn't give a name to the photo directly and needed to go out of the camera function, in to the photo map, search for the taken photo and then give it a name. Only one user had the possibility to give the taken photo a name directly after taking the photo without needing to exit the camera function. While the others didn't have the possibility to give a taken photo a name in their phones. One of the users thought that this function, the camera, was difficult to use but necessary at the same time.

6.2.4. Task 6: WAP

The last task was to connect to a homepage and download a picture from that homepage. This task was the most complicated and was not easy to perform by all users. Most of the users could not carry out this task due to the lack of internet connection in their mobile phones. Neither one of the users uses this function to download pictures from the internet nor know how to use it. All the users stated that if they wished so they would use the internet installed into the computers to download pictures to the computer and then transmit the picture/ pictures to their mobiles instead. Almost every user wanted to skip this task because they believed that it was time consuming and will cost them money. The participants tried at first to perform the task but stopped everything after a while of waiting and going back and forth without knowing what do to or were to go. They also thought that using WAP was very complicated and needed prior installation and there was no need of using it. Some of the common comments we got when asking the users about their attitude towards this function were;

- "I have never found any reason with using this function therefore I have never used it"
- "I have always access to the Internet using the computer so why should I use it on my phone "
- "I have tried using it before but never managed to do anything with it, I don't really know what one should do and where one should go, which home page."
- "why should I use it when I always have access to the Internet and it costs a lot also and you have to wait a while and the page is small and don't look or work like the Internet on the computer "

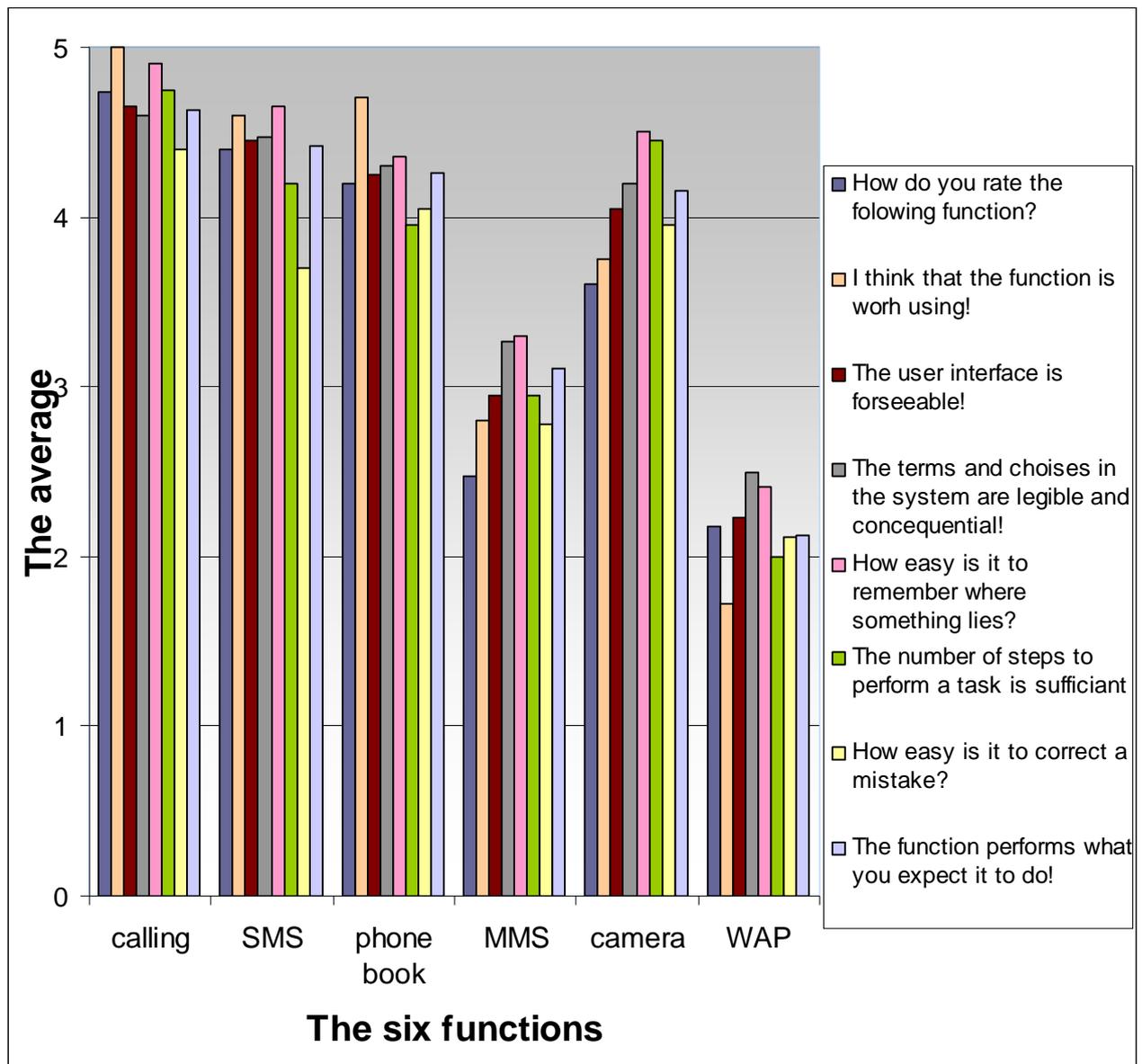


Figure 6.7: The average of the participant's attitude towards the six functions

The above figure represents the participant's attitude towards the six studied functions. We can see here that the "calling" function is the most liked and is experienced to be easy, worth to be used, have sufficient terms and number of steps needed to perform a task using it and foreseeable function by the users. Then comes the SMS respective phone book and the camera functions. Meanwhile the MMS and WAP functions were the most disliked and difficult to use. More detail can be seen in the appendix.

Chapter 7: Empirical Study, Second interview with the experts

In this chapter we will present our second interviews with the experts. As mentioned previously these interviews were conducted after carrying out the user tests and surveys and are based on them.

7.1. Second interview with Peter Waller

According to Peter Waller the properties of the functions we studied should be as following;

Calling: there are no specific properties that can be mentioned here. In general it's important to know for whom the mobile phone is designed in order to know how the design should look like or work e.g. there are some people who need to have a mobile phone with big text or there are other people that want to have a mobile phone with big buttons. It is important to have similar and consistent mobile phones. It will help the users to use any mobile phone easily and without having any troubles. Concerning this function it should look alike in varies phones; *“the red and green buttons should be alike, I should recognize where they are located and how they work no matter what phone I’m using”* adds Peter.

SMS: It should be simple to write readable message and send it to other mobile phones, and it should be possible to send long SMS message.

Phone book: It should be simple to use, *“you should be able to store many numbers for the same person in your phone book and if you get a call, it should be possible to save the number in your phone book directly”*, states Peter.

MMS: It should be easy to initiate the MMS function because, as Peter mentions, users today have to initiate the MMS function before they can use it. Although the users have the MMS function in their mobile phones they don't use it because they think that it's difficult to initiate the function and that they don't know how to use the function. The initiating process makes it difficult to discover the MMS service by chance. It is important to have a good screen that both the sender and the receiver can clearly see the message.

Camera: It should have good photo quality, and it has to be the possible to delete, save, rename, edit a picture if one wanted to and to easily transfer it to the computer.

WAP: It should have many functions that the http-browsers of the Internet has, it should be feasible to close the page, the user is at, immediately and easily, it should be possible to go back and forward easily without any need to download the page again every time one moves back and forth and that it doesn't require the user to go back through many menu steps.

In addition Peter thinks that the difficulty in using WAP and MMS functions in the mobile phone could be depending on that these functions don't fulfil what people expect it to do and wants to use it for and at the same time it's difficult to use. It could be that people avoid using WAP and MMS because they are not experienced as "worth the effort". WAP also has bad interface and is difficult to initiate because it requires installation. It's important to have similar icons, symbols and interface in the mobile phone as it is in the computer. It's also important to use a function directly when you first use the phone without needing to initiate or install anything. *"For me there has been only one time when I felt that it was useful using WAP and it was when I was on the train and it was delayed, then I wanted to know why and I sat there and used the WAP function to know about the reason"*, adds Peter.

Peter explains further that it hasn't gone long time since mobile phones have been developed. Mobile phones is a branch where it happens very much and there are always new functions that are added to the mobile phones, perhaps without thinking about to whom and which target group the phones are designed for. Moreover all the companies have their own way to develop and design mobile phones and its functions e.g. some companies have even patents which limits other companies' design. By this other companies can't develop or design the functions in a similar way. This fact makes it difficult and confusing for users to use different mobile phone because different mobile phones have different designs. *"If designers have in mind which experience user's have with using computer and designing some functions like WAP accordingly, will help users to use mobile phones with less difficulties"*, mentions Peter. With that he means that users know many symbols from using the computer that will make it easier for them to use a mobile phone if they recognize those icons and symbols and their functionality and prosperities. User's attitude and experiences in using mobile phones will make it easier to use a mobile phone but it doesn't really mean that a mobile phone design should not be more simply designed.

Finally Peter mentions the contradiction that mobile phones size should be small with big buttons and big screens. He adds that the recommended size of a mobile phone depends on which target group the mobile phone is designed for and if they want to have a big or small mobile phone, big or small display, etc.

7.2. Second interview with Anna Schömer

According to Anna Schömer the properties of the functions we investigated should be:

Calling it is important that the process of making a phone call is easy and quick. The user should be able to cancel all other ongoing activities with the mobile phone when wanting to make a phone call. There has to be good speech and audio quality.

SMS: there should be a possibility to directly write a message without any need to select using the SMS or MMS function. The only thing the user has to do is to write a message and the mobile phone should be smart enough to choose which function, SMS or MMS, is most suitable for that message. In addition the information flow shall be correctly for SMS and you shall just need to write a message and send it away without any trouble.

Phone book: As for this function and like the other functions it has to be easy and quick to use.

MMS: quick and easy is also important here. It has to be fast to send a MMS and the information flow shall be flexible. In addition the target group has an important roll in developing and designing a product. For example, if a mobile phone is designed for young people that send many MMS and SMS it has to be clear and easy to use. Meanwhile if a mobile phone is designed for businessmen, that don't send SMS and MMS in the same extend as the young people may do, these functions may not be as important for this user group as they maybe for the younger ones.

Camera: it has to be easy to use the camera in the mobile phone. She explains that many mobile phones have just one button for camera and you can take picture very easily and simple. In addition she says that the quality of camera depends on the target group the product is designed for and how they are going to use this function.

WAP: it has to be flexible to use. It is important that the user is well informed about how much using this function costs.

In order to improve MMS and WAP functions Anna mentions that generally difficulties with those functions can depend on that diverse mobile phones work in varies ways. One mobile phone works in a way and another mobile phone works in another way. Anna adds that the difficulties with using MMS and WAP can depend on that they are difficult and complicated to use, partly because of the difficulty of how to install the functions on the mobile phone and partly maybe it can depend on how much using these functions costs. "The users' maybe think that it's expensive to use WAP and MMS functions but they are maybe not so expensive as users think", says Anna.

Anna mentions further that the difficulty in using different functions in the mobile phone can depend on that it is difficult to install programs on the mobile phone and the lack of information about the costs. She explains that why should users use their mobile phones that is expensive and don't have big screens as computers have when they can use their computers that have bigger screen, better pictures and faster internet connection. "It is easier and cheaper to use the computer and maybe users have access to free internet connection", explains Anna. When its comes to WAP she thinks that the operators have to be more clear about how much it costs to use the functions. The manufactures and developers also have to make the functions easier to use. According to Anna maybe a function is god designed but it is not worth to be use because the users are not motivated to use the function or the function is expensive to use and adds "you can think that MMS is well designed but you still won't send a picture because it costs very much to send a picture".

Further Anna says that the reason behind having problems with different function could be that there are different conventions on how things should work. All mobile phones work in their own way. It makes it complicated and difficult for users to use different functions because every mobile phone has its own way of use. Different functions in different mobile phones are not consistent, Anna adds. Anna explains in addition that user's attitudes and experiences in using a mobile phone can play a roll in adapting and using a function.

In the end Anna explains that although the current mobile phones are relatively big in size now they still have small screens and small keyboards. The size of the mobile phone has a significant roll in the user's experiences of using a function according to Anna who prefers the mobile phone size to be small with bigger screen and bigger keyboard.

7.3. Second interview with Anette Sandegård

According to Anette Sandegård the properties of the functions we studied should be as following;

Calling: It is important to have easy access to the phone book. Users should be able to call directly without having any problem and it has to be obvious how one can begin and end a call. It is also important to have a good speed dialling.

SMS: It is important to have quick access to the SMS function, it is important to be able to write and send a SMS quickly and easily, it has to be easy to add up words to the phones dictionary, those word that one wants to add, it has to be possible to write long SMS messages, it has be the feasible to save many SMS in the memory and it should be easy to transfer SMS messages to the computer. Moreover it is important to have the possibility to use icons and animations to send more fun and live SMS messages.

Phone book: It should be possible to save several numbers and e-mail addresses to the same person. Phone book should ask if users want to organize their numbers in a special way and categories their contact persons as wished, instead of adding the contact person in an alphabetically order. When the user has selected the person in the phone book it has to be easy and fast to call that person. In addition it has to be the possible to use phone book for other functions than just calling, like sending SMS or e-mail. The user has also to be sure where the added information in phone book is being saved, if it's in the telephone memory or on the SIM card.

MMS: It has to be easy to configure this function. *"The operator should arrange it for you, optimally it should be on the SIM card and it has to work as soon as you want to use your mobile phone"*, comments Anette. It's the same case with WAP.

Camera: one should to be able to take a picture quickly and save it even if the mobile phone is locked. One has to be able to transfer the pictures that you have taken to the computer directly from phone camera. It also has to be the possible to delete a picture and take several pictures in sequences. Moreover the phones photo and display quality has to be high.

WAP: It has to be easy to configure the function. It's important that users know exactly what it costs to use WAP and MMS. Writing a required address when using the internet in the phone differs from using the internet on a computer. This is a big hindrance when using this function because the users may get confused and don't know how to write the internet address when using WAP.

Further Anette thinks that the difficulty in using WAP and MMS functions could be due to the difficulties in configuring the functions and the lack of const control of using them. Mobile phone operators should improve the configuration and information about how much using these function will cost. These reasons are likely to be behind the users not willing to use WAP and MMS. Anette believes that MMS could be used more if the configuration of the function wasn't a big problem for the users and if it doesn't cost more. She adds that it actually shouldn't be any differences in using MMS and SMS. It's important to motivate users to use WAP by for instance Blogging.

Annette explain more that having different design in different mobile phone could be because of the fact that there are not any standard design that designer could use when he/she is designing an artefact. Designers get their design by varies ways like for instance asking users or performing different usability evaluation methods. This makes different mobile phone brands to have different designs from mobile to. But there are de facto standards also for design.

When asking Anette about how important is the users experience in their attitude towards the functions and how much of this experience is in the designers mind when designing, Annette answered with “*balance*”. Annette further explains that it is important to have the users experience in mind when designing an artefact but there should also be an importance in trying to make the users first time use experience an enjoyable one. According to Annette when the user is used to using a certain function and is more capable of using it he/she tends to move to trying to use and learn using a new function. Therefore the users experience and attitude after the first time of using this new function should be satisfying in order to make the user go back to using that function again and again. Annette adds here that the functions attractiveness is not everything it also has to meet the users need and requirements. However those functions that do not fulfil the goal they are intended to and do not meet the users requirements should be removed from the mobile phones and instead one has to improve those functions that users like using most.

Finally Annette states that there are none universal size for mobile phone, it’s entirely different depending on the needs and contexts of use and there are different hand sizes. Mobile phones buttons should be suited for older and younger users. There are different target group and the manufacturers develop many telephones in order to reach different groups.

7.4. Summary of the Second Interviews with the Expert

Table 7.1: Summary of the second interviews with the expert about the properties the studied functions should have to be usable

Interview persons	Calling	SMS	Phone book	MMS	Camera	WAP
Peter Waller	The function, buttons, terms and choices should be alike and consistent in both their functionality and location not matter which phone the user uses	Simple to write readable message	Simple to use Store many numbers of a person to a phone book	Easy to initiate Good screen	Good photo quality Possibilities to delete, save, change a name or edit a picture Easily transfer picture to the computer	It should have many functions that the http-browsers of the Internet has Close a page immediately and easily Go back and forward easily It has to be easy to initiate WAP from the beginning

Anna Schömer	<p>Good speech and audio quality</p> <p>The caller has to be able to make a phone call very easily and fast</p>	<p>Writing and sending a message without any need of choosing between SMS or MMS functions</p>	<p>Simple and fast</p>	<p>Simple and fast</p> <p>The target group has an important roll in developing and designing a product</p>	<p>Easy to use</p> <p>Simple</p> <p>The quality of camera depends on the target group</p>	<p>Lithe to use</p> <p>Clear about how much it costs</p> <p>It has to be easy to install and initiate this function from the beginning</p> <p>WAP and MMS have to be easier, faster and free to use</p>
Anette Sandegård	<p>Easy access to the phone book</p> <p>Call directly</p> <p>Affordance in how to make and cancel a call</p> <p>Good speed dialling</p>	<p>Sending quick and easy SMS messages</p> <p>Easy to add up words to the dictionary</p> <p>The possibility of sending long SMS messages</p> <p>Easy to transfer SMS messages to the computer</p> <p>Icons and animations</p>	<p>Saving several numbers and e-mail addresses to the one person</p> <p>Easy and fast to call the person with help of the phone book</p>	<p>Easy to configure MMS</p> <p>The operator should arrange configuration for the users</p> <p>optimally configuration shall be in the SIM card</p>	<p>Take a picture quickly and save it even if the mobile phone is locked</p> <p>Transferring the taken photos to the computer easily</p> <p>Possibility to delete a picture and take several pictures in sequences</p> <p>Good display quality</p>	<p>It has to be easy to configure WAP.</p> <p>It's important that the users know exactly how much using WAP & MMS functions costs</p>

Table 7.2: Summary of the second interviews with the expert about the reason in having problem in using some function in mobile phone like MMS and WAP

Interview persons	Why is it difficult to use WAP and MMS	Why is there different and not consistent function designs	What do you think about using and having in mind users experience when designing	What do you think about the current size of mobile phones
Peter Waller	<p>These functions don't fulfil what people expect it to do and wants to use it for and at the same time it's difficult to use</p> <p>These functions are not worth using</p> <p>WAP has bad interface and it's difficult to initiate WAP from the beginning</p> <p>Having similar icon, symbol and interface in the mobile phone as it is</p>	<p>It hasn't gone long time since mobile phone has been developed</p> <p>There are different target group</p> <p>All the company have their own way to develop and design mobile phone and its functions</p> <p>Patent</p>	<p>If designers use user's experiences in using computer it will help users to use mobile phone without having any difficulties</p>	<p>Mobile phone should be small with big button and big screen</p> <p>It depends on to which target group mobile phone is designed</p>

	in the computer can be a suggestion to solve this problem			
Anna Schömer	<p>Different mobile phone work on different way</p> <p>They are difficult and complicated to use, partly because of difficulty of how to install the functions on the mobile phone and partly maybe it can depends on how much it costing</p> <p>Mobil phone has Small Screen</p> <p>Users are not motivated to use these functions</p> <p>Designing worth to use function</p>	There are different conventions on how things should work	User's attitudes and experiences in using a mobile phone can play a roll in adapting and using a function	Mobile phone size has to be small with bigger screen and bigger keyboard
Anette Sandegård	<p>It could be depending on difficulties in doing configuration and const control of them</p> <p>Operator should improve configuration and information about how much using these function will cost</p>	There are not any standard design that designer could use when he/she is designing an artefact	There should be a balance between having the users experience in mind and making the first time experience a good one	<p>There are none universal size for mobile phone, its entirely different needs with different using contexts</p> <p>There are different target group</p>

Chapter 8: Analysis and Discussion

This chapter discusses the results of our interviews with expert, synthesizes user tests and surveys, and relates our findings to the literature. Here we are going to discuss the factors that were presented in figure 4.1.

8.1. Usability definitions

All the interviewed experts in our study believed that the current usability definitions that are mentioned by literatures, such as Allwood (1998), Nilsson (1993) and Preece et al. (2002) could be used and work together for designing mobile phones. There is a need for adjustment in those definitions when it comes to designing mobile phones. Here the designers have to take consideration to the context of use and the target group the phone is designed for. Peter believed that the universal design rules are diffuse rules and very general. He means that these rules could be adapted to every situation. From the interviews, user tests, and literature review we agree that the traditional definitions are neither enough nor totally suitable to mobile phone usability. No experts considered that any standard definition for usability exists and neither any definition for usability of mobile phones. We think that a reason to this is that the current definitions are too narrow and don't take into consideration that mobile phones can be used in various consistency. The traditional definitions have a strong focus on effectivity and that the system should help the users perform a task in a suitable way, but place less importance on how the user experience the usage of the system. We believe that reason behind this variation of usability is mostly because the mobile phone can be used in a more different way than the use of stationary computer.

8.2. Design and usability principles

We were motivated by the challenge of grasping the most important usability criteria of mobile phone. According to the literature in this field we found out different descriptions and principles that are important in designing usable artefacts such as; the product has to be easy to use, easy to remember, effective to use etc. (see chapter 3 and 4). According to Peter it is important to know for which target group you are designing a mobile phone. The target group does not only consist of the people that are going to use the product but also in which context the product is going to be used as well as to which errands the product is going to be used in. This goes hand in hand with the ISO 9241 definition of which factors should be considered in order to come up with

usable artefacts (see section 3.1). Anna mentioned that an interactive product has to be effective to use, flexible and at the same time satisfies the user, e.g. the end user has to be able to reach their intended goals with the artefact in a satisfying way. Meanwhile, Anette explains that it is important to design an easy to use, intelligibly and attractive product. Anette points out the fact that the designer has to take consideration to both “out of the box experience” and the long term of use experience.

All the interviewed persons pointed out some of the criteria that the studied literature mentions such as it has to be easy to use as artefact, effective etc. However, as Anette mentioned in her first interview we also wonder what the concept “easy to use” and the other similar terms, that different litterateur mention, really mean because the meaning of terms could be interpreted in different ways depending on who is designing and who is participated in the design work.

Moreover both Peter and Anette believed that usability goals for mobile phone could not be to design usable functions but also functions that are worth using. Anna pointed out, as Preece et al. (2002) also mention that the interaction between the phone and the user has to be flexible and that the end-user must be provided with sufficient feedback on what is happening at every stage of the interaction process. She also thought that it is good to have a good convention for interaction between mobile phones and people. User competence has also been stressed by Allwood (1998) as a critical factor in the usability area (see section 3.5). All the interviewed experts mentioned that if the designer uses the user’s experiences of using other artefacts such as computers and have that in mind while designing will help the users to use the mobile phone without having any difficulties. As Peter mentioned using familiar interface for WAP, as the one in the Internet, will help the users to use this function in a wider extent and have less difficulty in using it.

8.3. Mobility, Mobile system context and Multitasking

Most factors that were mentioned in the literature, such as Dix et al. (2002), ISO 9241 and Wickens and Hollands (1999) were the same which the experts pointed out. All three interviewed experts mention that due to the fact that mobile phones are used in different context there are some extra difficulties in designing mobile phones, so it is important to take consideration to the different mobile contexts when designing a new function. Authors such Dix et al. (2000) as have stressed the importance of context and different environments that play a huge roll in how the mobile is used and integrated in the user’s everyday life. Further all the interview persons said that usability quality in the current mobile phone is depending on which target group the mobile phones are design for. Anna believed that a function should be worth using, flexible, and in the same time it has to be fun to use it and all these three criterions should work together. These factors have also been emphasised by varies researchers which Allwood (1998), Normans (1988) and Preece et al. (2002) are among (see chapters 3 & 4). However, what surprised us was that none of the expert mentioned mobility to be an important factor that, in our opinion, is an important factor that makes the factors context and multitasking come up and be possible. From these we draw a conclusion that target group and context in use have significant roll in designing an artefact. However, we consider those factors that have been brought up by both the experts and the literature are all of importance and comprehensive factors. Meanwhile there are other factors that a more detailed study may be successful to discover.

8.4. Categorization of mobile-service users

Constantiou et al. (2005) presented a mobile-service user categorization to; talkers, writers, photographers and surfers. In our user tests we asked the participants to grade how much they use different functions in their mobile phones, how long they have had their current mobile phone, which given task did they find to be the easiest respective the most difficult one and why. The reason behind that we wished to gain a picture of the user's experience of using their mobile phone was that we considered the mobile phones habit to be an important factor to gain knowledge about. This was due to the fact that we think that users who are not familiar with the mobile phones functionality would eventually have difficulties using the phone's functions well. We considered that not knowing the user's experience level in using a mobile phone might be a problem in conclusion whether the reason behind the user's having problems carrying out a task was due to the functions been used or to the limited experience the users had. All the participants have had their phone for a while, mostly 3 months to 2 years (see figure 6.4), and were familiar with their current mobile phone in spite of one participant who has had her phone for the three days only (see figure 6.4 in section 6.1). This user was nervous and hesitated while carrying out all the tasks. The other participants, on the other hand, carried out the common tasks easily. All the participants pointed out that the tasks concerning calling, SMS, and phone book were easy. This is due to the fact that they were used to use these functions. This is also supported in figure 6.6 there calling, SMS and the phone book were among the most used functions (see chapter 6). Almost the same results were found in another study carried out by Britta Nilsson (2005). In Brittas (2005, p 48) study the three most used functions in a row were; calling, SMS and alarm. Meanwhile the less used function was using the net. From this we think that the reason behind having problems in using WAP and MMS could be that the users are not used to using these functions and that these functions don't have the same properties that similar functions have on other artefacts, e.g. WAP applications are not like the Internet applications on a computer. From the results we got from our user tests we can state that the participants in our study all belong to the photographer's category. This is due to the fact that all of the participants mainly use the voice and SMS services. However, most of them use the camera service and to a lesser extent they use the MMS service (see figure 6.6).

8.5. The Mobile phone functions

Most of the test persons in our user tests performed calling, adding a number in their phone book, sending SMS and taking a picture without having any problems. Almost most of the test persons considered that calling, adding a number in their phone book, sending SMS and taking a picture in the telephone were clear. When it comes to using WAP and MMS functions most of test persons mentioned that these functions weren't clear to use. All the three experts that participated in our study described, as our test persons also mentioned, that the reason behind having difficulties in using WAP and MMS could be that it is difficult to configure these functions partly because of the difficulty the users meet while installing the functions on the mobile phone and partly could be due to the lack of knowledge about how much using these functions costs. Almost all the user test participants believed that the functions calling, SMS,

phone book and camera were worth using. In addition they thought that WAP and MMS functions weren't worth using (see figure 11.2). We think that in order to make this technology, not just useful but also worth using, the designers need to know the existing requirements and how important they are for the end user. The importance of a system that covers the needs of the user is important in designing mobile phones. Therefore the designer of mobile phones should strive for a reduced amount of options instead of quantity. The quality of the existing function, option etc. is much more important.

Peter believes that having similar icons, symbols and their functionality in the WAP function, as is used in the computer, will help the users to use and recognise using the function in a similar way as they are familiar with when using the Internet. As we described before according to Preece et al. (2002), brought up in section 4.1.5, it is important to have consistence and affordance in the user interface in an artefact. We also think that these two factors should be taken into consideration while designing a mobile phone. Having these two factors in the phone could, according to Peter and Anna, help the users in recognizing the functions in the mobile phone. According to Anna different mobile phones work in different ways. This fact makes it difficult for the users to use other mobile phones than their own. Having similar and consistence interfaces in mobile phones according to our three interview persons could be achieved if we have same conventions and standard design on how things should work. Most of the test persons thought that the usages of terms in the functions calling, SMS, phone book and camera were consistent, but they weren't consistent when it comes to the WAP and MMS functions (see figure 11.4).

Another reason behind not using WAP and MMS functions, according to Anna, is that mobile phones have small screens and the users are not motivated to use these functions because they are costly and not worth the effort. So according to all the three interviewed experts it is important that the phone operators give clear information about how much it cost to use WAP and MMS and improve the configuration of these functions. We think that providing clear information about how does it costs using WAP and MMS and the procedure for initiating these functions may help and motivate the users in using mobile phones functions like MMS and WAP in more extent than it is today.

Further when its comes for the functions WAP and MMS, almost all our test participants thought that it wasn't easy to remember where things lie in these functions, the number of steps to perform a task weren't sufficient, it wasn't easy to correct a mistake and the functions in the system didn't performed what they expect them to do. On the other hand the participants didn't have any problem with the above issues when it concerns the functions calling, SMS, phone book, and camera (see figure 6.7). We also think that one solution could be to have a consistent mobile phone interface as in the computers and other familiar interfaces. In this way designers can limit the learning time of using a function and users can directly use mobile phones functions without having any trouble. In addition we think that it's important to develop mobile phones with WAP services that provide direct and simple access to the internet without any need for pre-usage configuration. Cheaper, usable and useful WAP services on mobile phones will be ones the give the user key, summarised information.

When it comes to the size of mobile phones all the three interview persons believed that the size of mobile phone is dependent on which target group the mobile phone is designed for. Anna believed that mobile phone size has to be small with bigger screen and bigger keyboard. There are entirely different needs with different using contexts according to Anette and Peter. From that we draw conclusion that designing mobile phone are most depend on target groups and theirs need.

8.5.1. Calling

According to the all three interviewed experts, the user has to be able to make a phone call very easily and fast. Peter and Anette on one hand believed that understanding and designing mobile phones for target group is an important factor in designing a function or an artefact. According to Peter it is important to have similar and consistent mobile phones. Anna and Anette on the other hand believed that the function “calling” has to have good speech and audio quality. All participants in the user tests in our study didn’t have any difficulty performing the task “making a phone call”. They carried out this function easily and quickly. The participants pointed out that making a phone call doesn’t require too many steps to go through neither does it take a long time in order to accomplish the task together with it being easy to learn. Authors such as Allwood (1998), Löwgren (2005) and Preece et al. (2002) stressed the ease of use, speed of performance and learnability among the critical factors an artefact should have in order to be considered as usable artefact (see chapter 3). As we mentioned before in a study by Klockar et al. (2003) they did find that test participants in common, were able to do frequent functions, such as calling or sending an SMS message, in near optimal fashion without problems. We have again in our study got the same result. We can draw conclusion that the test persons were able to make a call that we think, as mentioned earlier, is due to the fact that making a phone call is considered to be a frequent used function.

8.5.2. SMS

We reached the same result as Klockar et al. (2003) got concerning SMS usage. All the test participants could perform the task sending a SMS. There was on the other hand one user that didn’t like SMS function because he didn’t have the patience to write a SMS and prefers to call instead. As we mentioned before from Groot & Welie, (2002, p.1) many experienced users of SMS are “willing to invest time in a poor user interface” because of the fact that this function has high level of utility. Further according to our interview persons SMS function and also other functions in a mobile phone has to be simple and fast. Anna and Anette mentioned that user had to be able to write and send a SMS message without any needs of choosing between SMS or MMS functions. Peter adds that sending SMS is popular in spite of all the difficulties because users find this function worth using. We draw the conclusion that users like sending SMS because they find it worth using.

8.5.3. Phone book

All the test participants could easily and quickly perform adding a person’s number to their phone book. There was just one test user that had difficulties when trying to add a new telephone number. The user mentioned that it is difficult to add the number without manually writing a note about what kind of number that is being added, e.g. home number or mobile number.

According to the three interviewed experts it has to be easy and simple to add a number to phone book. In addition there should be a possibility to save more than one number of the same person in the phone book. We think that adding a number in the phone book is easy but not always quick enough because some users have to write manually if the number is home, work or mobile number. On the other hand we agree with Anette that this function could be improved if it gives the user the opportunity to categorize the contact persons and not only save the names in an alphabetical order as it are today.

8.5.4. MMS

Most of the test participants mentioned that they have either never used the MMS function or have used it few times before. Most of the users also believed that it is complicated to use the MMS function (see chapter 6). All our interviewed experts also believed that it has to be easy to initiate and configuration the MMS function. Anna explained that the MMS function has to be easier, faster and free to use. She added that a function may be well designed but it's not worth using because the users are not motivated to use the function or it's expensive to use it. So we draw the conclusion that a good design is not always the answer to use a function. There are other factors like users motivation in using a function or cost or maybe that a function is not worth the effort.

8.5.5. Camera

Taking a picture, giving it a name and then sending the picture to a contact on the contact list was also a task that was given to the users (see chapter 6). Some of users were able to carry out the whole task. One user mentioned that he has never used this function. There were some who couldn't give the taken picture a name. Some of them didn't know how to give a taken picture a name while the others didn't have this possibility in their phones. One of the users thought that this function was difficult to use but necessary at the same time. According to our interviewed experts the camera in mobile phones has to have good photo quality. They believe that the camera has to be easy and simple to use. Peter and Anette mentioned that it has to be easy to transfer pictures to the computer. Anna added that the quality of camera depends on the target group e.g. if they take many photos or not. We think that being able to take a picture is not enough in deciding that the camera is usable but it is also important to have good photo quality and that the camera is easy and fast in use.

8.5.6. WAP

As we mentioned before this function was the most difficult one. Almost all the test participants couldn't or wouldn't perform the task because it was difficult to use. They mentioned that WAP wasn't worth to use in comparison with what you get from it. They haven't installed it or they thought that it was expensive to use. In addition they mentioned that they had access to internet

in other places with better quality and cheaper prices and they didn't see any value in using WAP because they didn't have any need to use a mobile phone with a small screen. Some of test users tried to use this function but they stopped after a while because they thought that it was difficult to use WAP and you don't know where you end up.

According to our three interviewed experts users have to know how much it costs when using WAP. They all mentioned that it has to be easy to configure WAP from the beginning. Peter believed that WAP has to have many functions that the Internet have. Anette also mentioned that writing a required address when using the Internet in the phone differs from using the internet on a computer. Anette also added that this is a big obstacle when using this function because the users may get confused and don't know how to write the internet address when using WAP. The input aspect was also stressed by Buchanan et al. (2001) together with the small screen size that was also pointed out by the three experts. Therefore we will emphasize the importance of having similar interface in mobile phone as in the Internet. In this way users won't be confused about how to use this function. In addition Peter mentioned that it has to be easy and fast to exit a page immediately. Therefore we draw a conclusion that users are not familiar with the WAP interface and therefore not enough motivated to use it.

Chapter 9: Result and Conclusion

In this chapter we conclude our findings and we propose some suggestions to the future research work that we believe will be a natural continuation of our work.

9.1. Result and conclusion

We tried in our study to explore available usability criterions. We wanted to see if they can be used for mobile phones. In order to accomplish this, we encountered few questions at issue; How do users interpret usability in their phones and how do experts work with usability criterions when designing a mobile phone? Is there any difference or similarity of those two parties point of view?

9.1.1. How do users interpret usability in their phones and how do experts work with usability criterions when designing a mobile phone?

In order to answer this question we studied the functions calling, SMS, phone book, MMS, Camera, and WAP to see how mobile phones end users experiences these functions and which criterions are important from usability experts of mobile phones points of view. Due to the fact that both studied groups had the same perspective about usability of mobile phones we will answer the above question according to the results we got from both parties.

After conducting user tests, surveys with the mobile phones end users and interviews with the experts we found that our user test participants carried out the functions calling, sending SMS, adding a number in their telephone book, and taking a photo very easily and quickly without having any problem. Almost all of the test participants on one hand thought that the functions calling, adding a number in their telephone book, sending SMS and taking a picture in the mobile telephone were clear and they didn't have any problem in performing these tasks. On the other hand most of test participants believed that WAP and MMS functions weren't legible to use. Most of the test participants stated that they had never used the WAP and MMS functions or had used it few times before. Most of them thought also that it is difficult to use the WAP and MMS functions and they couldn't or wouldn't use WAP because of that. We found that the reason behind having difficulties in using WAP and MMS could be that it is difficult to configure these functions partly because it is difficult to install the functions in the mobile phone and partly it may depend on how much it costs to use them. In addition we found that users are not

motivated to use WAP and MMS functions due to the fact that mobile phone have small screen and these functions are not worthy using in comparison with their cost and not worth the effort. Due to the fact that the users had access to the Internet in other places with better quality and cheaper prices they didn't see any value in using WAP because they didn't have any need to use that in a mobile phone with such a small screen. We believe that providing more information to the users about how much is the cost of using WAP and MMS and how to initiate these functions might help motivate the users to use these functions more. We found that it's important to develop mobile phone with WAP services that provide direct and easy access to the Internet without any need of pre-use configuration. More cheap, usable and useful WAP services on mobile phones will be ones that give the user key, summarized information.

Further we found that the functions WAP and MMS weren't easy to use, weren't easy to remember, the number of steps to perform a task weren't sufficient, it wasn't easy to correct a mistake and the functions in the system didn't performed what they expected them to do. On the other hand we found that the functions calling, SMS, phone book, and camera didn't have any of the above issues.

We also found that it is important to know what the user really needs and not just add new functions that are not worth using in comparison with what you get from them. In order to make technology, not just useful but also worth using there is a need that the designers identify and prioritise the users needs and requirements.

Although the current diverse in mobile phone design can be an advantage by making the phones more attractive so that it can match different user's life style and taste. However, we found out that mobile phone users may find difficulties switching between phones if the phones continued to have different designs and structures. Therefore we think that a balance in having a some what similar and consistence interfaces in mobile phones is preferred. This could be achieved if designers use same conventions and standard design on how things should work. If designer use user's experiences and competences in using other artefact like computer it will help the users to use mobile phones without having any difficulties e.g. using similar interface for WAP as internet has will help the users to use this function more often. In this way the learning time of using a function can be reduced and the user can directly without having any trouble use mobile phone functions.

Moreover we found that the size of the mobile phone depends on which target group it is designed for. There are entirely different needs with different using contexts. Optimal mobile phone's size has to be small with bigger screen and bigger keyboard.

Finally we noticed that the usability of an application is independent of the mobile phones model and brand because almost all the participants in our user tests had the same experience about the difficulty in using different functions though using different mobile phones.

9.1.2. Is there any difference or similarity of those two parties' points of view?

In our study we didn't find any difference between mobile phones end users point of view and the usability expert of mobile phones. Both studied groups pointed out the same problems in using mobile phones and its functions. The most interesting thing was that both groups had the same experiences about the reason behind the difficulties with some functions like WAP and

MMS. Both parties believed that a function should to be easy, and users should not need to spend a lot of time learning and installing a program in their mobile phones to initiate a function.

Further we found that it is important to make mobile phones more usable. It is important to critically evaluate new functions that are being added to the mobile phone to see if they are usable and worth using. It is also important to identify what users really want and if a function is needed in the mobile phone. User may avoid using WAP and MMS because they are not experienced as “worth the effort”. Therefore it is much more important to improve the quality of existed functions in the mobile phone instead of just adding new functions. In addition we found that interaction designers have to work very close to the end users in order to understand what they really need and how a function should look like.

We also found that when designing the interaction group work with different stakeholders in mind e.g. it could be the company’s internal product planners, the suppliers or the end users. This means that interaction designer can’t all the time make all of the mentioned above satisfied but with a bit of balance every one would be happy in the end.

9.1.2. Usability criteria for mobile phones

As mentioned in our research objectivity, the primary aim of this research was to come up with suitable usability criteria that can be utilised when evaluating usability of mobile phones. Table 9.1 contains the current usability criteria that have been mentioned by the reviewed literature together with other usability criteria that we have compiled with the help of expert interviews as well as user tests. We would like to point out that these criteria are additional to those that have been mentioned in the reviewed usability literature.

Table 9.1: The current and additional usability criteria of mobile phones of this study

Current usability criteria	Additional Usability criteria
Context of use	Worth of use
User's goal	Quality of use
User	Portability
Efficiency	Have a smooth work flow
Learnability	logical
Effectiveness	Availability
Satisfaction	Flexibility
Relevance	Adaptability
Attitude	Ease of use
Safety	Easy to initiate
Adjusting	Quick access to its functions
Errors	Consistency
Functionality	Well advanced
Memorability	Familiar to current used technologies
Trustworthiness	Browsing possibility
User acceptance	Necessity in its functions
User-competence	Attractiveness
User-friendly	Clear structure
Utility	Give a good experience
	Give a good feeling
	Feedback
	Intelligible
	Good integration between the functions
	Consequential
	Foreseeable interface
	Fulfil expectation

The elements that have mentioned in the table are not sorted after their priority. This is due to the fact that we think that there are even more criteria that still need to be revealed that can be used to evaluate usability of mobile phones. In other words they are not the only principles concerning usability of mobile phones. Therefore table (9.1) is not a standard check list. They are all important and need to be taken into consideration when designing a mobile phone. Together with the current usability principles, these additional usability criteria can improve the usability of mobile phones when taken into consideration. Meanwhile, which of the criteria is on the top of the list and which is less important depends on the context of use and the target group the phone is designed for.

In the end we want to say that the main purpose of the usability requirements specification is to serve as a dynamic and redefinable tool for the succeeding development phases, with two complementary objectives: (i) guarantee that the usability requirements are being considered in the software development, in the conceptual design and in design of the user interfaces activities and (ii) help verify whether the usability goals are achieved during the evaluation. In this paper we pointed out some aspects that a user centred design process needs to take into account when dealing with usability requirements specification for mobile context. We suggest a holistic approach that looks at the context of use in a broader perspective, than the one of the three traditional usability categories of effectiveness, efficiency and satisfaction. To this respect (Preece

et al., 2002) claim how “the emergence of new technologies offering increasing opportunities for supporting people in their everyday lives in a diversity of application areas (e.g. education, entertainment, home, public area) has brought about a much wider set of concerns”: these, identifiable as “experience goals”, such as engagement and motivation, are not so clearly defined and imply for new analysis approaches. The elicitation of requirements on the one hand, and the way in which requirements can be formalized and assessed on the other, are therefore activities that deserve to be looked at with particular concern and are likely to require innovative methods and frameworks. In this sense the involvement of users in the process, for an understanding of new aspects that were traditionally not addressed in the usability analysis can support the creative design of these emerging mobile scenarios, and promises to offer a better foresight of their future acceptance.

9.2. Thinkable improvement

When we look back on the work we've carried out, we can see it from another point of view. We've in the theoretical and the empirical part of our study tried to give a somewhat justified picture of the subject in issue. The purpose with this has been to give a wide picture about the chosen subject.

Further in our study we tried to combine a qualitative and a quantitative study with each other in order to get a wider perspective about the studied subject. We are aware that a qualitative study could be affected by our subjective interpretations, but we have tried to be as objective as possible through combining interview with expert with user tests and surveys (Backman, 1998).

Further we think that we could interview more usability experts in order to get a yet wider image and deeper understanding about our thesis subject. We think also that interviewing the mobile phones end user combining with user test instead of using survey could help us to get deeper understanding about their experience and point of view concerning usability of mobile phone.

Last but not least we want to point out that the results we have come up with are probably unique for us. We should not forget that there would be a high probability that someone else can come up with other results and conclusions than ours. The reason behind this is that we as “scientist” are in the end human beings. We are coloured by our earlier experiences, own knowledge and our individual life view. This has reflected inevitably in the results we have presented, but this is in itself not negative. We see instead this as strength for qualitative study, because we think in the real world there is not only one truth without many. Therefore we have combined our qualitative interviews with the user tests and survey with the mobile phones end users to get better information about the studied subject.

9.3. Suggestion to future work

We think that there are many subjects in the usability and mobile phone area that can be studied. One suggestion could be to study other functions in the mobile phone than those that we have studied. Another suggestion could be to study usability of mobile phones and its functions for other target group than our target group to get a wider picture about our studied functions. One

could possibly do just a qualitative study by interviewing mobile phones end user to get deeper understanding about usability of mobile phones. It could also be interesting to develop a standard design and usability definition for mobile phone and its functions. Another possibility could be to change the questions used in our survey and see if one get the same result as ours, or use the same survey with the same functions for the same target group and see if the same conclusions would be reached.

Chapter 10: Appendix

Appendix 1. The first interview question

- 1) Can you tell a little about yourself and your background?
- 2) How usually examines usability aspects for mobile telephones?
- 3) Which usability criteria are important to take into consideration when designing design of mobile telephones?
- 4) Which usability properties exist in design of today's mobile phones and what is it that would be needed to be added, changed or taken away?
- 5) Which usability goal exists now for mobile phones and which problems meet designer when designing mobile phones in order to reach these goal?
- 6) Which future goal have designer in order to improve usefulness of today's mobile phones?
- 7) Which functions do you think are important for us to examine when it goes for usefulness of mobile phones?

Appendix 2. The first interview with Peter Waller

1) Kan du berätta lite om dig själv och din bakgrund?

Jag är civilingenjör i tekniskt fysik. Jag har forskat inom mobile telefon med inriktning på antennteknik, sedan har jobbat lite med läkare utan gränser, humanitär hjälpverksamhet för utvecklingsländer. Nu arbetar jag med teknik i nära samarbete med människor, Genom att vara doktorand på Certec kan jag kombinera jobba med människor och tillämpad teknik. Min kunskap om gränssnitt problematiken är mest erfarenhetsbaserad under några studier som jag har under några år, och eftersom jag har arbetat med antennteknik, så har jag den djupaste erfarenheten i detta.

2) Hur undersöker man usability aspekter för mobile telefoner?

Jag vet hur man gör i lund, när det gäller usability testing vet jag att vissa företag gör detta, också här i huset gör dem detta i användbarhetslabbet, t.ex. Sony Ericsson gör detta i stan och jag tror detta är något bättre eftersom man för bättre upptäcker programs buggar, Sony Ericsson har test telefoner så om det hänger sig så rapportera man detta. Jag tycker inte usability i en kontrollerad labb är bra och tror också att Sony Ericsson också har märkt det, eftersom det är viktigt att komma i såna konstiga scenarier som programmerare inte har tänkt på. Användbarhet som jag ser det passar och ingår i en design fas och om man vill gå inom en labb så måste man veta vilken målgrupp man har. Även om designer inte vet vilken målgrupp det är så kan det vara att dem har det är huvudet, användbarhetslabbet fångar inte up vardagsituationen på samma sätt som vardag gör.

3) Vilka usability kriterier är viktiga att ta hänsyn till när man designar mobile telefoner?

Usability kriterier: det beror väldigt mycket på vilken group man vänder sig till om man vill tillverka en mobile telefon för äldre, mobile telefon blir mycket Ospecifik, Så får man fråga vad en mobil telefon är, ska man bara ringa eller ska man göra andra saker till. Jag tror att det finns universell design; hur man designar något så att många har nytta av den, jag tycker att det är diffus mening. Jag pratade om universell design och jag tycker att det beror på vem man vänder sig till, jag tror att man i mobile telefon branschen jobbar med scenario eller persona, man definierar en specifik användare och man designar mobile telefoner till just denne. Jag tror inte att den här metoden är riktigt bra, jag tror att det är ett företags metod som har kommit till universitet världen, jag har upplevd att det finns en del problem med den, t.ex. antar att man intervjuar 100 personer och man ska värva en specifik personas har hyfsad lika men ändå olika, så detta leder till att det ställs olika krav på gränssnittet.

4) Vilka Usability egenskaper finns det i dagens mobiler och vad är det som behövs tilläggas, ändras eller tas bort?

Det beror på vem man riktar sig till. Jag tycker att mobile telefoner ska vara oöm, vattentät, väldig bra att den har ficklampa, surfa på nätet, Camera jätte bra, det ska gå att koppla till dator, det ska gå att svara med en knapp tryckning, tala om vad andra användare vill ha, att förstå hela menyn systemet. Meny system har blivit designat så att det är komplicerat t.ex. äldre människor har haft mycket stort tekniskt revolution. Här jag har en mobile telefon som finns samma knappar för tre olika saker, det här är något som många har problem med.

Usability ramverket är väldigt generellt ramverk, Det låter så generellt så att det kan passa till vad som helst, något som jag tycker att är väldigt viktigt är det ska vara situerade, vara i situationen oss människan är då upptäcker man saker och ting.

5) Vilka Usability mål har man och vilka problem träffar man på vid design av mobiler? Jag vet inte om man har det men jag tror att usability mål kan vara att t.ex. 90 procent att personer ska kunna utföra jobbet i 5 sekunder, klarar jag att ta fram och skriva en meddelande samtidigt som jag går. Ett annat kan vara klarar jag att sätta på lampa i mörkret samtidigt som gör andra grejer, usability mål är bra rent tekniskt, men jag tycker att det iterative växer. Det är absolut viktigt att så tidigt som möjligt komma ut till dem som berörs, man måste vara i situationen.

6) Vilka framtida mål har man för att förbättra användbarhet av dagens mobiler? Framtida mål: Jag tycker att användbarhet är jätte viktigt, man kan inte bortse från sammanhanget man är i, SMS, har fortfarande fullständigt urusel gränssnitt, det innebär att folk har det svårt att använda den men ändå använder den eftersom det är värd att användas, nånstans när du pratar om usability så pratar om labbverksamheten, är det nåt som jag ser som mål är det användbarhet, vad är värd för en person att använda t.ex. en bok kan vara läsbar men inte läsvärt, en mobil telefon kan vara användbar men inte användvärd, det viktiga måste vara att det är värd att använda, och i det ingår också att det användvärd, kontra enkel att använda, man vill helst uppnå användbar och användvärd och du får bara få veta i situationer hos personer och man kan inte veta bara i labb, vi går mot att tänka på människor i sammanhanget, det gör också mobile företaget.

7) Vilka funktioner tycker du är viktiga att undersöka när det gäller användbarhet av mobiler?

Viktiga Funktioner: SMS, telefoni är viktigt funktion,

Intressanta funktioner: Videotelefoni, det är lite oklart, det är teckenspråkliga och early adapters som använder den för att ta reda på vad som är det viktigt för att det ska fungera bra.

Att knyta Camera till (intressant), att ta en bild med kamera och få den bli publicerat och skicka den till nätet. (finns olika Nokia life Blogg) spännande funktion att titta på.

Snabbt nummer eller adress bok är också en viktig sak att titta på.

Appendix 3. The first interview with Anna Schömer

1) Kan du berätta lite om dig själv och din bakgrund?

Jag är beteendevetare från början. Jag har jobbat med användbarhet i början av 94 genom en student projekt. Jag gjorde en student projekt tillsammans med några studenter på KTH, jag läste på Stockholm och blev intresserad av det och gjorden såna interchip på Apple. Och så har jag jobbat som konsult med användbarhet. After det har jobbat i 2,5 med andra saker.

2) Hur undersöker man Usability aspekter för mobile telefoner?

Man kan göra på hur många sätt som helst, dels kan man titta på färdiga produkter och göra användbarhet tester och se vad användarna vill, titta vad finns på behov. Man kan även jobba på skolan och det beror på vad man vill få svar till, Man tittar på hur man använder teknik. Vi gör mycket expert utvärderingar och har börjat nu göra usability tester.

3) Vilka usability kriterier är viktiga att ta hänsyn till när vid designar mobile telefoner?

Att man ska titta på de vanliga användarna ska göra vad dem vill och på ett effektivt, smidigt och tillfredsställande sätt så har man kommit jätte långt. Kanske det behöver inte gå jätte fort men det ska vara smidigt. Användbarhet finns det bara i sitt sammanhang. Vi har ingen mall det är svårt att sätta en eftersom om man har en ny produkt så är det svårt att använda en gammal mall för ny produkt. Det finns vissa må för utvärdering av produkter t.ex. att användare ska kunna utföra en uppgift t.ex. alla användare ska t.ex. skicka mail.

4) Vilka Usability egenskaper finns det i dagens mobiler och vad är det som behövs tilläggas, ändras eller tas bort?

Use Kvalitet, Att det ska finnas brukskvalité, ska man ha musik i sin mobiltelefon så ska det vara bra och det ska finna plats med tillräckligt mycket utrymme, Det ska fungera, bra och på ett tillfredsställande sätt.

5) Vilka Usability mål har man och vilka problem träffar man på vid design av mobiler?

En jätte stort grej är formatet, Allt som har med hur man sparar filer, finns det nått struktur, att känna igen sig, var filen ligger och strukturen för att få en överblick och upplevelse, smidighet och den känsla att man är säker på vad man gör, man styr interaktionen och inte tvärtom.

6) Vilka framtida mål har man för att förbättra användbarhet av dagens mobiler?

Hitta en bra konvention för interaktion folk börjar känna igen sig, eftersom nu Nokia har en modell, Ericsson har en modell, LG har en annan modell och ... Det är bra att hitta ett sätt att interagerar med programvara i mobile telefoner.

7) Vilka funktioner tycker du är viktiga att undersöka när det gäller användbarhet av mobiler?

Informations hantering, spara ner filer, flytta filer mellan olika mappar och skicka filer, nåt om hur man hanterar information i mobiltelefoner och mellan mobiler. Hur Hämta bilder på nätet och ladda ner den. Usability Faktorer: Alla de ska fungera tillsammans. För att det ska vara värd att använda så måste man kunna göra det man vill göra, och på ett smidigt sätt, och man ska tänka att det är kul att göra det och de tre saker ska hänga ihop: Jag tycker att definitionen för usability gäller för maskiner: Man kan använda av dem också men det finns extra svårigheter just för mobiltelefoner för att göra att dem sakerna blir bra pga. Formatet t.ex. det är svårare att veta hur olika applikationen fungerar tillsammans, Det är mycket svårare att ta up på en bra nivå eftersom man har en format som är svårt att jobba med.

Appendix 4. The first interview with Annette Sandegård

1) Kan du berätta lite om dig själv och din bakgrund?

Jag är Interaktionsdesigner på Sony Ericsson. Jag har läst påbyggnadsutbildningen interaktionsdesign på K3, Konst, kultur och kommunikation, vid Malmö högskola. Jag har en konstnärlig bakgrund och är utbildad skulptör. Jag har studerat Interaktionsdesign från 1998 till 2000. Jag arbetar idag på Sony Ericsson i Lund på sektionen Usability & Interaction design sedan år 2000. Idag är jag team ledare på Sony Ericsson. Jag har designat WAP, Camera, Camara album, Walkman, musik spelare, video, browser. Jag ansvarar idag för mobile phone Camera och videotelefoni, videosamtal, dvs ljud och bild tillsammans.

2) Hur undersöker man Usability aspekter för mobile telefoner?

Vi har huvudkontoret i Lund och utvecklingen i Kista, Tokyo, USA. Det är viktigt att mobile telefoner fungerar globalt eftersom vår marknad är globalt. Därför testar vi våra mobile telefoner globalt. På Sony Ericssons har vi Team User Experience, labb tester och gör även fältstudier. Dessutom använder vi oss av fokus team, användartester för att testa våra mobile telefoner. Vår fokus grupper brukar ibland skriva dagbok om deras användning av mobile telefoner. Vi brukar även ge våra mobile telefoner till familj medlemmar och be dem jobba med dem. På Sony Ericsson brukar vi jobba med olika projekt. Vi brukar jobba med 3 telefon projekt samtidigt. Exempelvis brukar vi jobba med Camera applikationer, minst tre generationer av Camera design och olika plattformar som vi jobbar samtidigt med.

3) Vilka usability kriterier är viktiga att ta hänsyn till när man designar mobile telefoner?

Jag tycker att två aspekter är viktiga. Den första är den första användarupplevelse av mobile telefonen när användaren vill använda en funktion. Det är något som vi jobbar väldigt mycket med på Sony Ericsson. Den andra är andra gångs användning av mobile telefonen och funktioner under en längre period. T.e.x. Om användare vill jobba med mobile telefons Camera är det viktigt att första gången som denne vill använda den funktionen kan han/hon jobba med den enkelt så att den fungerar och användaren är nöjd med den, det ska vara tillräckligt lätt, begripligt, och attraktivt. Samtidigt är det också viktigt att när användare vill jobba under en längre period med t.ex. Camera att det ska fungera på ett tillfredsställande sätt. T.ex. har jag många Camera foto i min mobile är det viktigt att veta hur jag kan hantera dem, kanske spara dem på dator eller enkel navigera i dem. Så det är också viktigt med långsiktiga användningar.

4) Vilka Usability egenskaper finns det i dagens mobiler och vad är det som behövs tilläggas, ändras eller tas bort?

Ease of use, men hur man mäter den och vad den innebär är det någon annan sak. Ease of use hur man mäter den och vad den innebär kan skilja sig med tanke på vem man frågar. Ease of use och många funktioner går inte alltid hand i hand med varandra. Vi måste faktiskt se till att mobile telefoner och dess funktioner går det att använda. Det är också viktigt med integrations mellan olika funktioner t.ex. på Sony Ericsson olika grupper jobbar med olika funktioner men till slut mobilen är en enhet så det ska upplevas att det är samma group som har designat och utvecklat den. Det är mycket viktigt att olika funktionen hänger ihop fast det är olika grupper som har utvecklat den. Det är viktigt med integration mellan olika applikation design och funktionalitet av olika funktioner. Det ska vara samma och en upplevelse. Dessutom är vissa användarscenarier viktiga och önskvärda och vad vill man göra enkelt, snabbt och tydligt t.ex. jag vill ta en bild och snabbt bli av med den eller jag vill ta en bild och snabbt spara den eller skicka den till någon

annan. Det är viktigt med att en bra integration eftersom alla användarsmål inte kan vara högst prioriteringar t.ex. att ringa ett samtal ska fungera på varje pris.

5) Vilka Usability mål har man och vilka problem träffar man på vid design av mobiler?

Vi interaktions designer står användarens närmast, vi har en produkt beskrivning av den här målgruppen. Vi har kontakt med tre olika målgruppen, det är vår interna produkts avdelnings chefer, det är våra mobile telefoner leverantörer och det är slutanvändarna. Vi måste göra alla tre grupper nöjda. Vår uppgift är att vara diplomati och envisa och våga sticka ut. Dels vi måste tänka på den första upplevelsen av mobile telefoner, det ska inte finnas något hinder, och det ska fungera på ett längre perspektiv, om vi vet vad våra slutanvändare vill ha kanske ska vi testa på dem som är första gången mobile användare och också på dem som har använt mobil telefonen under en längre period.

6) Vilka framtida mål har man för att förbättra användbarhet av dagens mobiler?

Vi drar på samma motiv, och göra det mer användbart. Det är viktigt att kritiskt granska nya funktionerna som ska läggas till mobile telefoner och se till att är viktiga användbara.

7) Vilka funktioner tycker du är viktiga att undersöka när det gäller användbarhet av mobiler?

Telefoni, kontakt bok med olika nummer, olika kontakt information, hur ska den vara utformat, kontakt bok på andra språk, text input, SMS. Det är viktigt att effektivisera text input, man kan både skriva på olika språk och växla mellan olika språk när man vill t.ex. skriva någon SMS. Camera, långsiktiga mål, bildhantering, vad man vill göra med sina bilder, eller skicka bilder om man lagrar bilder hur man vill navigera dem, vill man lägga dem på dator eller inte, bloggning över mobile telefon. Idag lagrar vi bilder i våra mobiler, är det så som folk använder sina mobiler? Hur ser man på en mobile telefon, kontakts bok kopplas nät foto till den. Är det nät intressant?

Usability definitioner:

När det gäller mobiltelefoner den används i olika kontexter, sammanhang hu sitter inte i soffan, då måste utvärderas i olika sammanhang på strand, ljus, ljud, på bussen t.ex. mobilen är mobil skiljer sig från datorer vilket glöms bort när man designar och testar ljud omkring, te.x. skiljer sig i olika sammanhang. Learnability är svårt när man testa ny funktion första gången för att man måste ha lång återkommande kontext med slutanvändare vilket inte görs ofta.

Appendix 5. User test and survey

Institutionen för informatik



Investigating the usability of mobile phones

Background

Mobile phones develop quickly and we use them in our every day life as tools and for entertainment regardless of our gender, or our age. Today more and more functions like camera, mp3, radio calendar, voice recording etc, are added to mobile phones and it makes it possible for the users to use it for more than just making calls (Ketola, 2002). Therefore it is important that mobile phone user-interface is designed in a way that facilitates and helps the users to get information and do a specific task easily.

The study investigates the factors that influence the usability of mobile phones.

Your participation is of a great value for us!

Best Regards

Rana Alsafi & Armita Daniari

Pre Questions

1. Are you a Man or Woman
 2. How old are you? _____
 3. Which mobile brand do you own? _____
 4. What was the reason behind purchasing your current phone? _____
-
5. How long hav you had your current phone? _____
 6. For which errands do you use the phone? _____

User test tasks

1. Call someone who is in your phone book
2. Write a massege and then send it to someone who is in your phone book
3. Add a person and his/her number in your phone book
4. Send a picture to someone by using the MMS function in your mobile phone
5. Take a photo with your camera in your phone, give it a name and then send the photo to someone in your phone book
6. Use the WAP function in your mobile phoe to go to a web page and download a pitcture from that web page.

Survey

1: Which functions do you use mostly in your mobile phone? (rate 1-10 where 1 = use less, 10 = use most)

Calling	
SMS	
MMS	
Calendern	
Browsing the Web	
Alarm och reminder	
Games	
Sending e-mail	
Listening to music	
Cameran	
Phone book	
Torch light	
Other	

2: Attitud

A: overall and general impression towards the System

How do you rate these functions?

1=bad 2=somewhat good 3=ok 4=good 5=very good

	1=bad	2=somewhat good	3=ok	4=good	5=very good
Calling					
SMS					
Phone book					
MMS					
Camera					
WAP					

I beleive that the different functions are worth using!

1= don't agree, 5= totally agree

1 2 3 4 5

	1	2	3	4	5
Calling					
SMS					
Phone book					
MMS					
Camera					
WAP					

B: Interface

How do you agree on the following statements?

The user interface is foreseeable, 1= don't agree, 5= totally agree

	1	2	3	4	5
Calling					
SMS					
Phone book					
MMS					
Camera					
WAP					

C: Terminology and system information

The usage of the terms and choices in the system is suitable and consequential: 1= don't agree, 5 = totally agree

	1	2	3	4	5
Calling					
SMS					
Phone book					
MMS					
Camera					
WAP					

D: Learnability

To remember where something lies is: 1= very difficult, 5 = very easy

	1=very difficult	2=difficult	3=ok	4=easy	5=very easy
Calling					
SMS					
Phone book					
MMS					
Camera					
WAP					

The number of steps needed to perform a task is suitable: 1=don't agree, 5= totally agree

	1	2	3	4	5
Calling					
SMS					
Phone book					
MMS					
Camera					
WAP					

E: The functions

To correct a mistake is: 1= very difficult, 5= very easy

1=very difficult 2=difficult 3=ok 4=easy 5=very easy

Calling					
SMS					
Phone book					
MMS					
Camera					
WAP					

The functions in the system perform what you expect them to do! 1= never, 5= always

1=never 2 3= sometimes 4 5= always

Calling					
SMS					
Phone book					
MMS					
Camera					
WAP					

3. How do you want your new mobile phone to be/have/look like?

Post Questions

1. How did it feel carrying out the given tasks?
2. Which function did you experience to be the easiest to carry out? Why?
3. Which function did you experience to be the hardest to carry out? Why?
4. What do you think about your mobile phone now?

Thank you very much for your time!

Appendix 6. Surveys material

The figures, 11.1 – 11.8, below show the results of the surveys. Each staple in each function represents a participant.

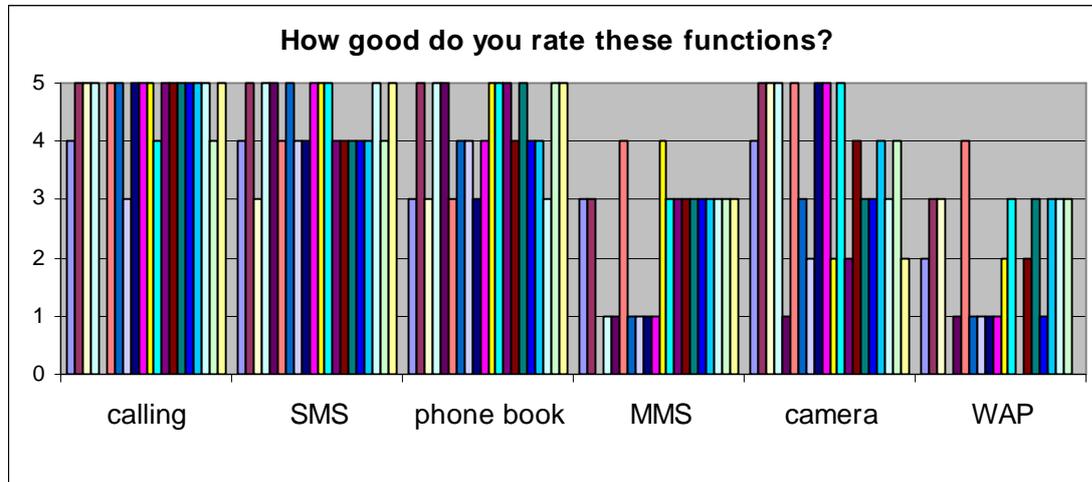


Figure 11.1: How good do you rate these functions? 1= bad, 5 = very good.

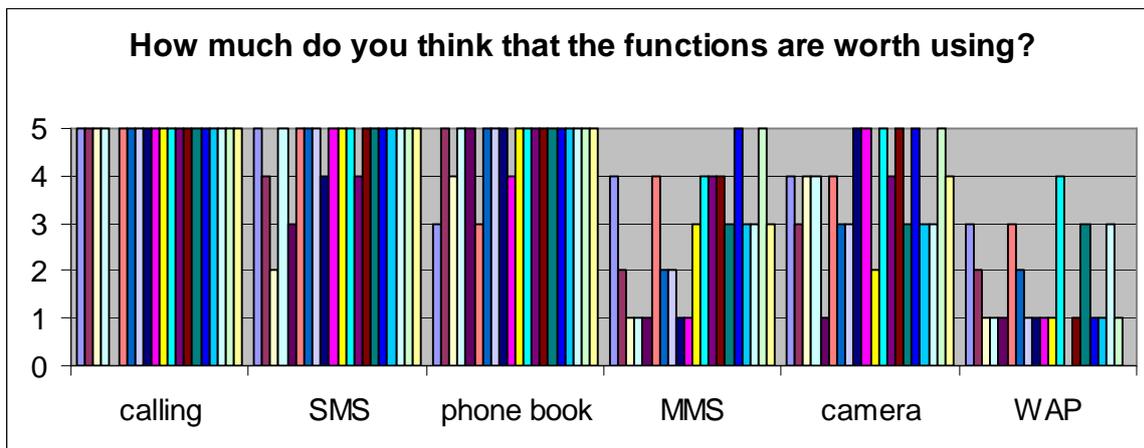


Figure 11.2: I believe that the different functions in the phone are worth using! 1=don't agree, 5= totally agree.

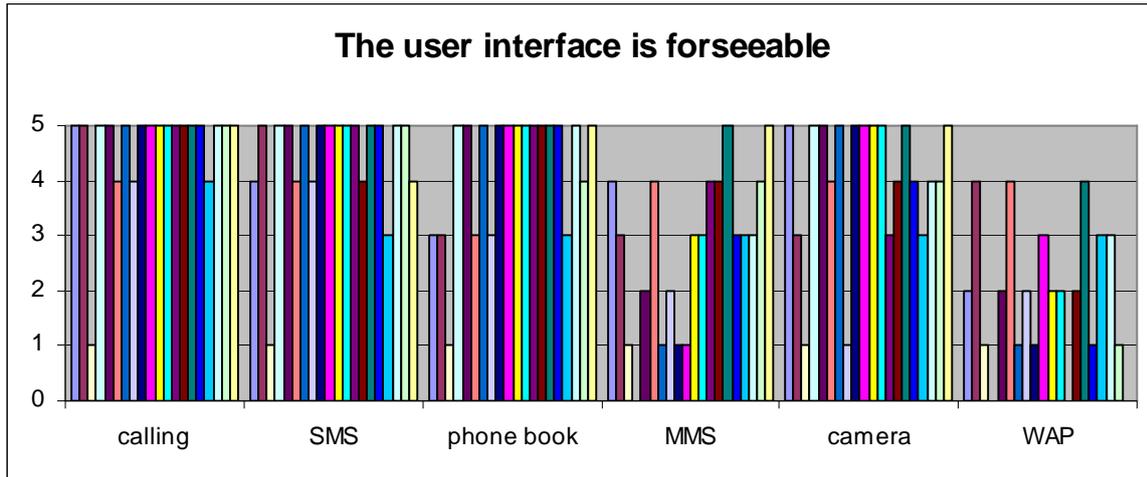


Figure 11.3: The user interface is foreseeable! 1= don't agree, 5= totally agree.

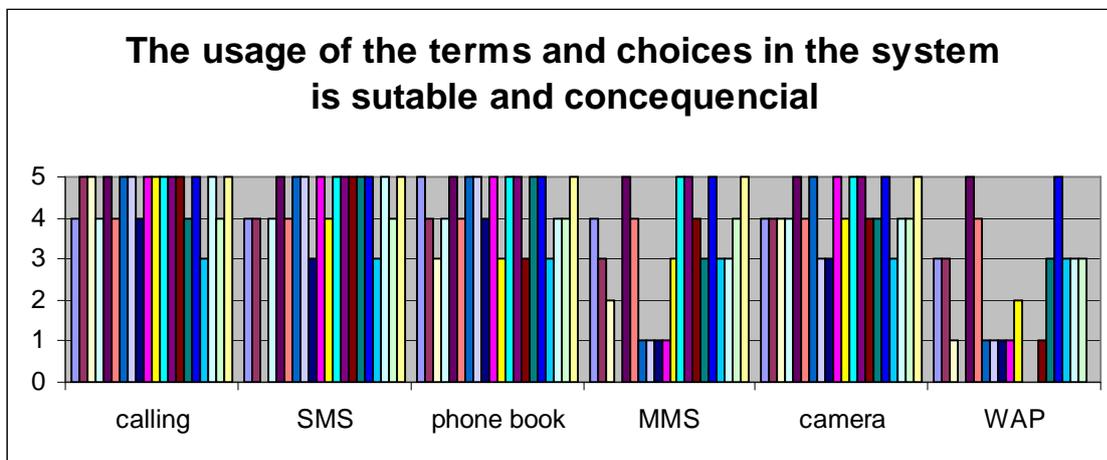


Figure 11.4: the use of terms and choices in the system is suitable and consequential! 1=don't agree, 5=totally agree.

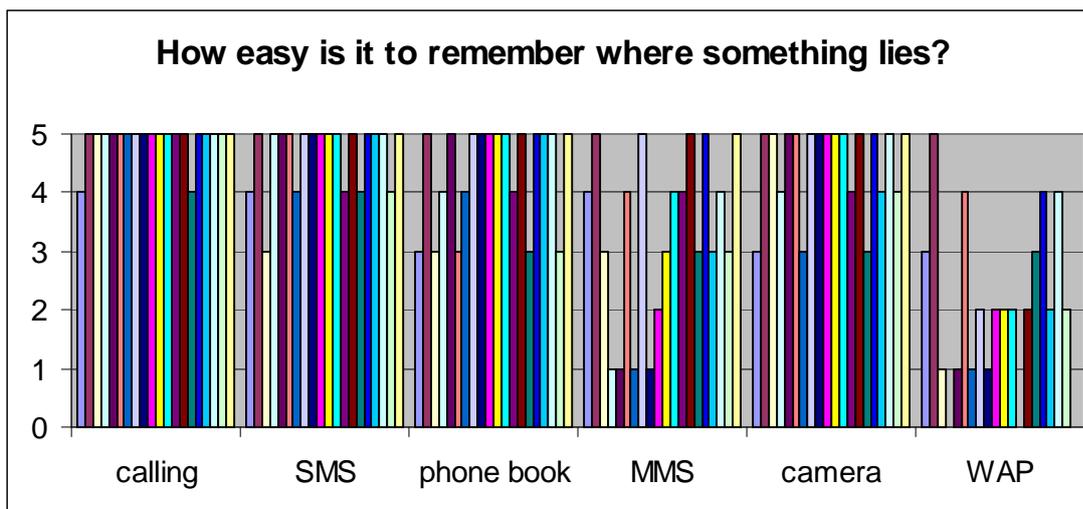


Figure 11.5: To remember where something lies is? 1= very difficult, 5=very easy.

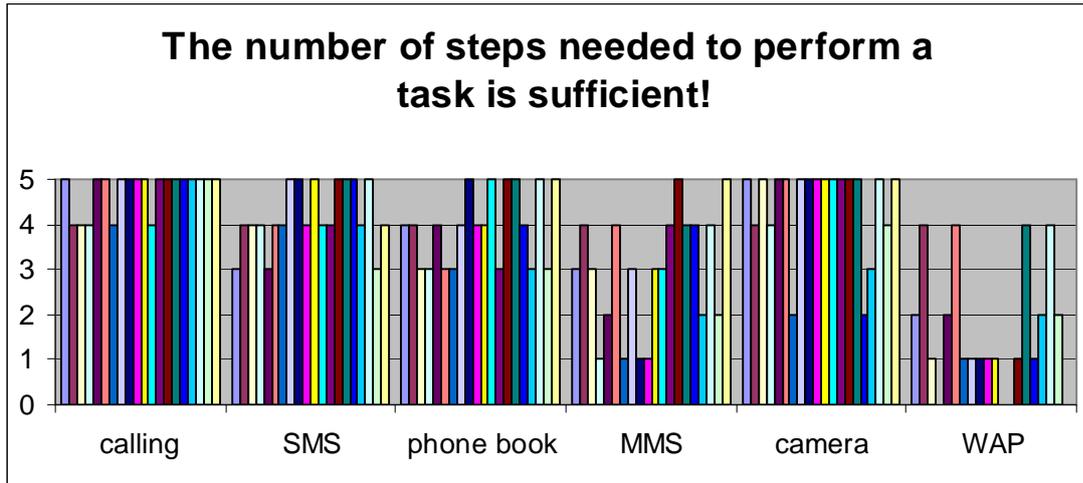


Figure 11.6: the number of steps needed to perform a task is sufficient! 1=don't agree, 5=totally agree.

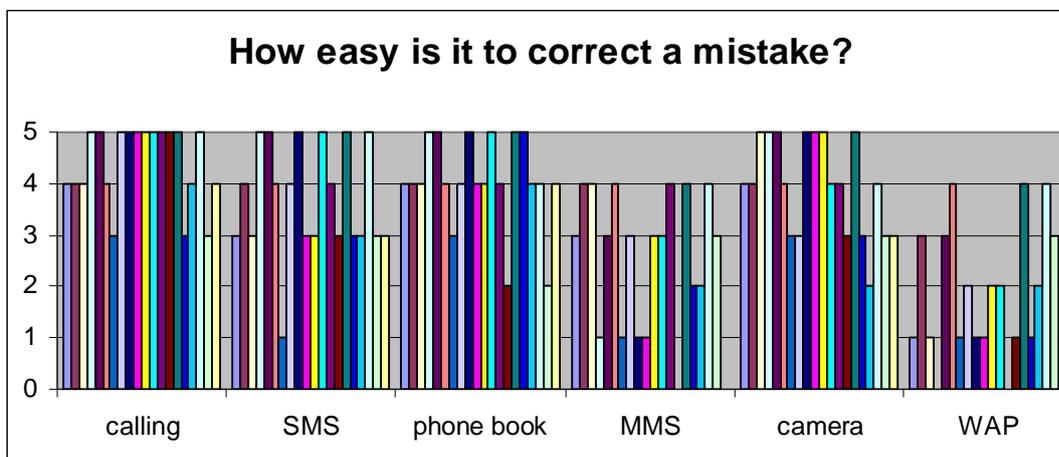


Figure 11.7: To correct a mistake is? 1= very difficult, 5= very easy.

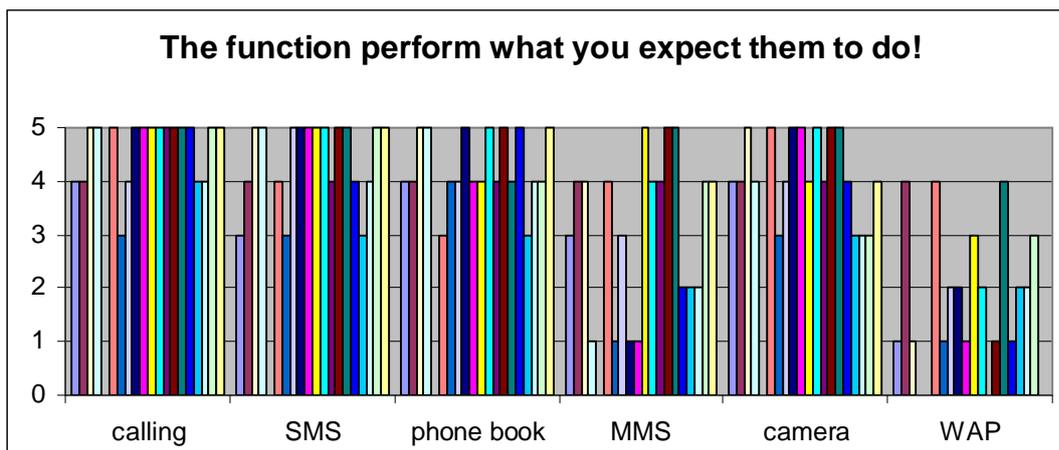


Figure 11.8: The functions in the system perform what you expect them to do! 1= never, 5= always.

Appendix 7. Second interview questions

1) Which properties should the following functions have?

Calling:

SMS:

Phone book:

MMS:

Camera:

WAP:

2) What do you think can be done in order to improve MMS and WAP functions?

3) Why do you think users use some functions like Calling and sending SMS more than the other functions like WAP and MMS? Why do you think users have problems in using WAP and MMS?

4) There are certain functions that differ between different brand e.g. when it goes for Camera different mobile phones have different design, why do you think such simple functions have different design?

5) Do you think that peoples' attitudes differ if they use a mobile phone or its functions for the first time with when they use a function under a longer time?

6) What do you think about the size of current mobile phones?

Appendix 8. Second interview with Peter Waller

1) Vilka egenskaper ska var och en följande funktioner ha?

Calling: Det är viktigt att veta för vem är mobiltelefoner är design för, det finns dem som är det viktigt med stort text eller det finns för dem som är det viktigt med en knapp, det finns dem som behövs för ett steg. Att det är likadant i alla telefoner, att inte ett märke hitta på en kostighet att man kommer från en annan telefon och man inte kan använda den, att jag kan komma till vilken telefon som helst och känna mig hemma och kan använda dem och att man kan använda den det ska vara enkelt att använda den, allt ska funka likadant, t.ex. den röda och gröna knappen ska vara likadant, att jag ska känna igen mig, på vilken sida ska knapparna sitta, Det ska allt ska funka likadant i alla mobiltelefoner, jag ska känna igen mig hur det finkar.

SMS: Det ska vara enkelt att skriva en text om man vill, det ska gå att skicka långa SMS meddelande, det ska gå förstås läsa bra det man skriver.

Phone Book: Det ska vara enkelt att komma åt, jag ska kunna lagra många nummer på en person, jag ska kunna ta ett nummer om jag få ett samtal eller SMS och lägga den i telefon bok,

MMS: De problem jag känner till är att man måste initiera MMS hos sin operator, det gör att folk som har den inte använder den eftersom det är svår att använda den, och folk vet inte hur dem kan initiera den. Det kan bli väldigt enkel om man kan använda den att skicka MMS om man kan det. Viktigt med en bra skärm att andra kan se vad man har skickat.

Camera: Det ska vara bra foto kvalitét, den ska gå att summa med, redigera bilder i telefonen, enkelt skicka den, spara den, byta namn, enkelt att överföra den till dator.

WAP: Många funktioner som vanlig Internet har, det ska ha Cash, det ska gå att stänga av omedelbart och lätt, att kunna gå fram och tillbaka, man ska ladda sidan på nytt om man bakar, det ska ha Cash, extera funktioner för att stänga av sidan snabbt, så jag inte behöver backa och backa i många meny träden.

2) Vad tycker du man kan göra för att förbättra MMS och WAP funktioner? Varför tycker du de flesta i vår user test hade problem med WAP och MMS?

3) Vad tycker du kan vara orsaken till att användare använder vissa funktioner t.ex. Calling och skicka SMS mer än andra funktioner t.ex. WAP and MMS?

Jag tror att på något sätt att det inte har passat in i vad dem ville göra och det har varit försvårat. Och inte användbart, det här är försvårat i jämförelse med vad man få från den. Dåligt gränssnitt jag tycker dem flesta WAP har. Det är svårt att initiera från början. Det speglar kanske inte bara vad är svårt utan vad folk tycker är värt att använda.

WAP tror jag att är på väg ut eftersom http, det är viktigt att det som man har i mobiltelefoner likadana det som finns på dator, MMS tycker jag att det har större potential, MMS: För det första det ska funka direkt när man har mobiltelefoner, jag känner att jag själv inte orkar använda den, man vet inte vilken potential den har. De gånger som jag tyckte var bra att använda WAP var när jag satt i tåg förseningar och ville veta vad händer.

4) Det finns vissa funktioner som skiljer sig mellan olika märken, tex. när det gäller Camera varför skiljer såna enkla funktioner?

En sak är att det inte har gått lång tid att vi använder mobiler, det är en bransch som händer mycket, det kommer hela tider nya funktioner det hela tider kommer nåt nytt, skillnad i vem mobiltelefoner är designat för, det är olika företag med olika märke. Det kan t.ex. vara med patent att göra. Att vissa företag har patent på kanske en funktion och låter inte andra använda den. Kanske inte har gått lång tid, olika målgruppen, patent.

5) Tycker du att folks attityd skiljer sig om de använder en mobile för första gången med när de använder en funktion under en längre tid?

Man ska känna igen sig och ska kunna använda den bara för att man känner igen sig, till jag tycker att man kan använda sig av många symboler som finns i datorer och vi bär med oss även om vi inte är medvetna av dem att man använder av dem, att man i varje läge vet vad man ska göra, på den här skärmen har vi dem här möjligheterna och vet hur jag ska använda den, jag tror att man ska använda vana med det utesluta inte det att det ska vara enkel, man kan använda den

6) Vad tycker du om nuvarande storleken på mobiltelefonerna?

Det ska vara små mobile med stor skärm och stor knappar. Storleken har ingen betydelse eftersom mobiltelefonerna är diversifierat mot olika målgrupp.

Appendix 9. Second interview with Anna Schömer

1) Vilka egenskaper ska var och en följande funktioner ha?

Ringa samtal: Det ska gå snabbt, ringaren ska kunna avbryta allt annat. Det ska inte behövas att användaren backa ur med nåt annat. Det ska gå att avbrytas. Det ska vara bra tal och ljud kvalitet, det ska vara så att man bara trycker in ett telefonnummer och man kan ringa direkt och snabbt.

SMS: Flödet ska bara fungera, man ska bara behöva skriva, man ska inte behöva välja ett SMS eller MMS, det ska man kunna skriva och det går iväg som det är billigaste.

Kontakt lista, phone book: Jag tycker att Nokia t.ex. har en bra kontaktlista. I Nokia mobiltelefoner man kan dels se senaste ring samtal så man kan antigen gå in genom loggen och sen gå in i kontakt lista eller genom själva mobiltelefonen. Dessutom har de lagt till en sök funktion som man kan skriva in en bokstav och hitta den en telefonnummer snabbt. Det ska gå snabbt och enkelt.

MMS: Man lägga en bild på SMS och det blir det MMS

Det ska vara snabbt, flödes ska vara smidigt, det ska vara tillgängligt men det ska vara för alla andra funktioner, men exakt var och hur det ska vara beror det på målgruppen, om det är ungdomar som skickar många MMS och SMS så ska det vara jätte tydligt och enkelt för dem att använda dem funktionerna. Men om målgruppen är business man så är de funktionerna kanske inte lika viktiga och kanske andra funktioner är mer viktiga.

Camera: Många mobiltelefoner har bara en knapp för Camera och man tar en bild och det är integrerat med andra funktioner, i en kamera mobile är det enkelt att det har bara en knapp, egenskapen beror på målgruppen om dem tar många bilder eller inte. Egenskaper beror på vilken målgrupp produkten blir utvecklat för.

WAP: Det ska vara smidigt att använda och tydligt om hur mycket det kostar för användaren.

2) Vad tycker du man kan göra för att förbättra MMS och WAP funktioner? Varför tycker du de flesta i vår user test hade problem med WAP och MMS?

Allmänt svårigheter med att använda MMS och WAP kan det bero på att olika mobiltelefoner fungerar på olika sätt, det ena fungerar på det sättet och det andra fungerar på det andra sättet. Det kan bero på att dem är Krångliga, komplicerande, och dels hur man installerar på sin mobile, och kanske det kan beror på hur mycket det kostar, kanske WAP och MMS är inte så dyrt att använda men folk vet inte hur mycket det kostar.

3) Vad tycker du kan vara orsaken till att användare använder vissa funktioner t.ex. Calling och skicka SMS mer än andra funktioner t.ex. WAP and MMS?

Det kan bero på att det har mycket att göra med att det är svårt att installera och det kostar pengar. Varför ska man använda sin mobiltelefon som är dyrt och inte har lika stort skärm som dator och är lättare, snabbare och kanske till och med gratis Internet koppling. När det gäller MMS det är operatörerna som har gjort så att det är otydligt. Ansvaret ska ligga hos operatörerna att hur mycket det kostar och utvecklarna ska göra att det blir enklare att använda. Det är operatörerna som har gjort så här det är många faktorer som har gjort att folk inte använder det. Det är lättare, snabbare, gratis att använda dator än att använda mobiltelefoner. Just idag den

målgruppen som ni intervjuade inte reser så mycket men om det är någon som reser 5 dagar i veckan och inte har Internet koppling så har det annat behov.

Jag tror att många tycker att WAPning är enkel att göra men det kostar mycket pengar att göra det. Just idag den målgruppen som ni intervjuade reser formodligen inte så mycket men den målgruppen som reser för mycket och inte har Internet koppling så har de ett annat behov, målgruppen och motivationen skiljer sig mellan olika målgruppen.

Det oftast är det krångligt att installera och man ska betala abonnemang avgift och kanske man inte vet att om man kommer att använda och sen det eller inte. Det är inte lika bra syn upplevelse på en mobiltelefon som det är på en dator

Att en funktion är bra utformad men det är inte värd att använda för att jag inte är motiverat att använda den det kan t.ex. bero på att det är dyrt att använda, jag kan tänka en dyr bil är bra med jag kommer inte att köpa den. Det kan bero på att det kan vara att folk tycker att MMS är bra utformat men jag kommer inte använda den pga att den är dyrt. Jag kan tycka att det är bra utan att vilja ha den. Det kan vara att man tycker att MMS är bra utformat men jag kommer inte att skicka en bild eftersom det kostar för mycket att skicka en bild.

4) Det finns vissa funktioner som skiljer sig mellan olika märken, tex. när det gäller Camera varför skiljer såna enkla funktioner?

Det finns inga konversioner, alla jobba på sitt eget sätt och har sina egna konventioner på hur saker och ting fungerar. Det är ingen har bestämt att det ska på fungera på det här sättet, det krävs att en jätte dominant spelare kommer och säga att vi gör på det här sättet och alla följer dem, det blir komplicerat för användare. Det är så olika det ena fungerar på ett sätt och det andra fungerar på det andra sättet olika mobiltelefoner är inte konsekvenserna. Var och en har sin egen konversion och därför blir komplicerat.

5) Tycker du att folks attityd skiljer sig om de använder en mobile för första gången med när dem använder en funktion under en längre tid?

Det finns dem som köper den pryl och som läser manualer och gör allt sen och det finns dem som bara ringer och kastar mobiltelefoner sen, Attityd en som köper mobiltelefoner nu förmodligen. Attityd och vana spelar stort roll i användning av. Det är attityden till tekniken, tycker att det är spännande.

6) Vad tycker du om nuvarande storleken på mobiltelefonerna?

Skärmen är för små nu men mobiltelefonen är stor. Det ska vara en mobiltelefon med stor Storleken på mobiltelefoner: Man ska ha en liten mobiltelefon, med stort skärm och stort tangentbord.

Appendix 10. Second interview with Annette Sandegård

1) Vilka egenskaper ska var och en av följande funktioner ha?

Ringa samtal: Det ska finnas lätt åtkomst åt telefon bok/kontakt lista, lätt åtkomst åt call lista, måste kunna knappa in siffror direkt, det ska vara tydligt hur jag slår och avslutar ett samtal, fungerande speech dial., röd/grön knappen.

SMS: Snabb åtkomst, input metoder prediktive input fungerar olika, lätt att addera ord till ordlista (de ord som jag använder), spara maximalt många SMS i minnet inte bara i SMS minne utan i minnet, Det ska vara lätt att överföra SMS till dator, skriva SMS förstärkas med ikoner, animationer gör det roligare, Det ska vara snabbt och enkelt att skicka SMS.

Kontakt lista/Phone book: Användare ska kunna knyta flera nummer till en kontakt även e-mail, fråga om jag själv vill gruppera mina kontakter och inte lägga de i alfabetiskt ordning, när jag har valt enkelt kan jag göra flera saker är att bara ringa, att skicka SMS t.ex. eller skicka kontakt info till ngn annan, vara säker var kontakt info sparas i telefonen eller simkortet.

MMS: Konfigureringen måste vara buss enkelt, operatören skall ordna det åt dig, optimalt skall det ligga på simkort eller den ska komma till dig så fort du använder mobilen, samma sak med WAP, att skriva adress när man använder Internet är ett stort hinder för man vet inte hur och var man skriver adressen.

Camera: Ta en bild med det samma när jag drar kameran är det säker att den sparas när jag tar den från kameran kan se bilderna jag taget att kunna koppla till album direkt från kamera, kan ta bort en bild, ta flera bilder i följd, även om telefonen är stängd kan jag snabbt få igång kameran i bild kvalité och display kvalité i telefonen.

WAP: Konfigurering, Vad kostar, kostnadskontroll även på MMS ska veta exakt vad det kostar.

2) Vad tycker du man kan göra för att förbättra MMS och WAP funktioner? Varför tycker du de flesta i vår user test hade problem med WAP och MMS? 3) Vad tycker du kan vara orsaken till att användare använder vissa funktioner t.ex. Calling och skicka SMS mer än andra funktioner t.ex. WAP and MMS?

Konfigurering och kostnadskontroll i MMS + WAP. Är det operatör som måste förbättra sig (Vi har den kontroll men även operatörerna), som gör att folk inte utnyttjar den. Camera: Drar ner antal inställning, ska kunna automatisera inställningar beroende på kontexten.

Konfigurering + kostnadskontroll, många sidor i nätet MMS inte är byggda för mobilen. När du har MMS så måste du ha mottagare, motiverat att starta och browsa.

MMS ska användas mer om konfigureringen inte är ett hinder och om det inte kostar mer. Den skulle inte finnas skillnad mellan MMS och SMS. Motivera folk att använda WAP t.ex. blogging.

4) Det finns vissa funktioner som skiljer sig mellan olika märken, tex. när det gäller Camera varför skiljer såna enkla funktioner?

Det finns standardiserings organ där utvecklare tillhör utveckla man standard design utifrån markering, usability data vi får från slut användare som mobile märke skilje sig.

5) Tycker du att folks attityd skiljer sig om de använder en mobile för första gången med när de använder en funktion under en längre tid?

Balans vilket är svårt, ofta är det olika saker som man göra med en applikation, man måste först hur man använder en funktion. Prioritera funktionen ingång skall vara snabbt attraktivt som inte mötta dig men efter att du har vänjs dig ska du gå till andra funktionen. Vissa funktioner bör kanske tas bort och inte finnas och vara argumentera detta.

6) Vad tycker du om nuvarande storleken på mobiltelefonerna?

Det finns ingen universal storlek, helt olika behov, olika användnings kontexter, olika stora händer, knappar ska vara passande, äldre och yngre plus rätt säkerhet och läsbarhet, tydligare kontrast om det är färgad skärm, olika målgrupper olika behov, mobile tillverkare äger många telefoner för att de ska passa olika grupper.

Chapter 11: References

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11.2. Interviews

- Interview with Peter Waller, Licentiate in Engineering, 2006-04-10, 10:00 am and 2006-05-09, 10:00 am at the Design Centre in Lund.
- Interview with Anna Schömer, Interaction designer, 2006-04-11, 12:00 am, and 2006-05-04, 12:00 am at IDEON in Lund.
- Interview with Anette Sandegård, Staff Interaction Designer, Usability & interaction designer at Sony Ericsson Mobile Communication AB in Lund, 2006-04-20, 11:00 am and 2006-05-11, 10:30 am at IDEON in Lund.