



Blekinge Institute of Technology
School of Engineering
Bachelor Thesis
2004-05-24

Think big - for small

infusing confidence, security and trustworthiness for
mobile services

Authors:

Roger Antonsson, roaa01@student.bth.se
Lena Petterson, lepe01@student.bth.se

Supervisors:

Christina Hansson, School of Engineering
Mårten Pettersson, School of Engineering

Acknowledgements

We would especially like to thank a few persons who have influenced and helped us during this work:

Our supervisors Christina Hansson and Mårten Pettersson for as well their support as their constructive and guidance feedback throughout this thesis.

Annika Antonsson, Magnus Johansson and Viktor Santesson for their linguistic comments.

Ericsson AB for letting us be a part in a larger student project.

Our fellow project members for their participation in the work with the Mock-ups and their patience with our redesigns.

Our participators in the think-aloud technique for their time and valuable comments.

Finally a special thank to our families for putting up with us during this time.

Foreword

“There’s an old story about the person who wished his computer were as easy to use as his telephone. That wish has come true, since I no longer know how to use my telephone.”

(Bjarne Stroustrup, inventor of C++)

This quotation has been most appropriate for us during this semester. We are two students attending the third year at the Human Work Science programme at Blekinge Institute of Technology. (In this thesis we will use the Swedish name Människor Datateknik Arbetsliv (MDA)). MDA is an interdisciplinary programme which combines work science with computer science. This semester we have had the opportunity to be a part of a larger student project at Ericsson AB. During our work in this project we have been focusing on graphical user interface design.

Abstract

The use of mobile telephony has over the past years increased and consequently has the development of services over the mobile phone also increased. This semester we have taken part in a large system development project, our contributions have been designing the graphical user interfaces. In doing that we found the problem with how to mediate trust to a user through a graphical user interface interesting. In this thesis we are focusing on how to develop graphical user interfaces for a mobile phone service that radiate and infuse *confidence*, *security* and *trustworthiness*. In order to attain the purpose, we have used the combination of literature studies and to some extent user involvement with Mock-ups and a Think-aloud technique. We are also describing the importance of taking as well usability and usability goals as the needs for the end users into consideration.

We have found that more research on how to radiate and infuse trust through a graphical user interface is needed. This thesis is concluded with some aspects on that subject that we think is important to have in mind. It is of great importance to never leave the user in a state of uncertainty and therefore is clear, sincere and informative feedback necessary throughout the service. Also central in designing graphical user interfaces is to make sure that there is no mismatch in the security of the system and the radiated security.

Keywords: GUI, usability, confidence, security, trustworthiness, mobile phone, small interface

Sammanfattning

Användningen av mobiltelefoner har de senaste åren ökat, det har även utvecklingen av tjänsterna till mobiltelefoner. Under denna termin har vi deltagit i ett större systemutvecklingsprojekt och vår del har varit att designa det grafiska användargränssnittet. Under projektets gång har vi intresserat oss för problemet, hur tillit kan förmedlas till användaren genom det grafiska användargränssnittet. I den här rapporten fokuserar vi på hur man utvecklar grafiska användargränssnitt för en mobiltelefonservice som utstrålar och ingjuter *förtroende*, *säkerhet* och *trovärdighet*. För att uppnå vårt syfte har vi använt en kombination av litteraturstudier och till viss utsträckning användarmedverkan med Mock-uper och en Tänka-högt teknik. Vi beskriver även vikten av tänka på såväl användbarhet som användbarhetsmål som användarnas behov.

Vi har funnit att det behövs mer forskning om hur man utstrålar och ingjuter tillit genom ett grafiskt användargränssnitt. Uppsatsen avslutas med några av våra synpunkter på vad som är viktiga att ha i åtanke. Det är av stor betydelse att aldrig låta en användare sväva i ovisshet och därför är det nödvändigt med tydlig, korrekt och informativ återkoppling genom hela tjänsten. Centralt vid design av grafiska användargränssnitt är också att förvissa sig om att det inte är någon skillnad mellan säkerheten i systemet och säkerheten som utstrålas.

Table of contents

Introduction	1
Our fictitious design case.....	3
Important words.....	3
The outline of the thesis.....	4
Methods	5
Scenarios.....	5
Mock-up.....	5
Think-aloud technique	7
Usability design	7
Reflection of the methods	8
Theoretical background.....	9
Human Computer Interaction.....	9
Interaction design	9
Conceptual model	10
Interface metaphors	10
Usability	11
Usability goals.....	11
Interface design	12
Eight golden rules of interface design	12
Guidelines for input	14
Psychological aspects	15
Design	17
Technical boundaries	17
Usability through the user interface	19
Conceptualizing the design field	19
Understanding the user.....	19
Usability	21

Think big – for small

Trust through the user interface.....	22
Confidence.....	22
Security.....	26
Trustworthiness.....	28
Design reflections.....	32
Discussion.....	33
Conclusion.....	35
References.....	37
Electronic sources.....	38
Unpublished reports.....	39
Appendix	

Introduction

The use of mobile telephones is more and more common in the modern society. According to SIKA (Swedish Institute for Transport and Communications Analysis) the mobile telephony has increased rapidly the last few years and the trend is continuing. We seldom leave home without keys, wallet and the mobile phone. For that reason is the development of services over the mobile phone increasing. It is now possible in Sweden to fill the income-tax return form over the mobile phone. Other examples of services for mobile phones in the future could be; ticket booking, paying alternatives, key and access card solutions. Actually all the services provided at Internet may in future be conceivable in the mobile phone. In just a small number of years the mobile phone has become a lot more than just a phone to use for calls. Many of the mobile phones that come out on the market today have cameras and there are also a lot of other extra functions.

There are several reasons for the fast development in the mobile telephone business. One reason is yet another step in the technical development – from information technology to wireless information technology. The technique for mobile phones has also improved the last few years regarding capacity and performance. They have better processors, memories and displays with higher resolution and better colours.

This semester we have participated in a project along with master students from Department of Telecommunications and Signal Processing at Blekinge Institute of Technology, Sweden. The task on hand for the project has been to develop a demo for a mobile service. It is connected to as well a mobile phone as a website. The mobile service was at the beginning intended to be as well a (Wireless Application Protocol) WAP service as a JAVA application running at the mobile phone, but the service ended up like a WAP service. The students working in the project have various technical backgrounds, but they have in common a Bachelor's Degree in Electrical or Computer Engineering (or equivalent) and have basic knowledge of telecommunications and signal processing. The students in this project have different nationalities and come from all over the world.

Our first and primary part in the project has been to design usable graphical user interfaces for the demo, as well for the mobile phones as the web site. The graphical user interface allows access to the functionality of an application. From the user's point of view, the graphical user interface is the application displayed on the screen. In the continuation of this thesis we will be name it user interface. During the remainder of the project we have been responsible for the development of the demo. The project was carried out at Ericsson AB. We did not have the possibility to meet end users, so we have

used our project members to get user involvement for our design. We have also studied literature to get an idea of the research area.

To illustrate the design decisions more clearly, regarding this thesis question of issue, they are shown in a fictitious design case.

Partly we decided to use this kind of work procedure because of the fact that the work with the demo was not finished when submitting this thesis. The main reason is however to strengthen and clarify our design solutions in regard of our question of issue. This also gave us the opportunity to involve end users that did not have any association to system development.

Central for the MDA programme has been to take both the technology and the people using it into consideration. We consider ourselves as the link between the developers and the users of the technology. Gulliksen and Göransson (2002) portrait usability designers and we recognize ourselves in the description they make. One of the most important tasks for a usability designer is to consider the interests of the end-users and work as their advocate. In our work as usability designers for the demo, this has been our assignment. Gulliksen & Göransson (2002) argue that the role of a usability designer is important. For this project we have been taking an active part in the development of the demo, we have also been represented in the project management. We would like to point out that we for this thesis has chosen not to discuss the demo design. Mainly because this work will not finish before our thesis is completed but also to restrict the extent of this thesis. Still, we were able to use some experiences from this part in the work with this thesis.

As the project went along, applying trust to the user interface became gradually more interesting to us. We found the topic, how to develop graphical user interfaces for mobile phones that radiate and infuse confidence, trustworthiness and security, interesting and are in this thesis focusing on that.

For MDA students is having the end user in mind important. Norman (1986) argues that the design of the interface should be dominated by the needs of the user and that the rest of the system should be dominated by the needs of the interface. In a design process it is therefore important to think about the user interface. For the user the usability of the system is very important. A system that has an excellent technical solution but lacks a good user interface may never be used. On the other hand, a user interface that is well designed cannot hide a bad system. In order to design a desirable user interface it is valuable to involve end-users in the design process. As MDA students we are trained in and experienced in involving end-users in the design process. In this project we got the opportunity to gain knowledge

about how to design a system using a different approach. It is important to bear in mind that end-users are central to software design and their perspective should always be the starting point.

During this project we have come across a suitable expression when designing for a specific device with a few tasks, information appliance. To define information appliance we are adopting the description from Sharpe & Stenton (Jacko & Sears, 2002). Their description is; a consumer device that performs only a few targeted tasks and is controlled by a simple touch-screen interface or push buttons on the device's enclosure.

Our fictitious design case

As previously written we have designed a fictitious case to strengthen and clarify our question of issue. We decided to design a bank service for the mobile phone. The fictitious mobile phone service is named MobileBank. The mobile service is associated with a website and there are user interfaces designed for as well for the mobile phone as the website. On the mobile phone the user should perform the intended service with a few operations. At the website, continuously termed User Administration, the user should be able to adjust the intended service and have possibility to view a larger amount of information, at the same time. In order to motivate to exploit an application the user interface ought to radiate an ease of use and usability. Designing for a mobile phone puts even higher demands on the user interface since the display is comparatively small.

Important words

A number of keywords have been important for this thesis; usability, confidence, security and trustworthiness. The words have been defined by others and here we are going to give a short review of what others have said and also give our own interpretations of the words. One of the words, usability, is discussed in more detail in the theoretical background p 11.

Confidence - In the Oxford English Dictionary confidence is defined as the mental attitude of trusting in or relying on a person or thing; firm trust, reliance, faith and the feeling sure or certain of a fact or issue; assurance, certitude; assured expectation. Stevrin (1998) points out that confidence is a multifaceted concept that is hard to define. He means that the significance of the concept is a result of our previous experiences, expectations, conceptions – a result of our thoughts. The meaning of the word depends on what perspective and scientific discipline it is about. Stevrin (1998) argues as a result that confidence can be seen as an “open concept”, that is to say there

is no definitive determination of the meaning. Confidence can have different meanings depending on the context. For the context we are designing for, we define confidence as attaining ones expectations.

Security – Security is a wide concept and we are in this thesis narrowing it to computer security. To define computer security we are adopting a definition from Turn (1999). His definition is “*protection of the system and the data stored therein against unauthorized access, modification, destruction or use and against actions and situations that deny authorized access or use of the system*”. (Turn, 1999, p 1106) Focus for us has been how security is perceived by users in the user interface.

Trustworthiness - Keen et al (2000) point out that trust is a topic that is widely studied in a number of research fields and that there many ways of defining it. From their point of view trust focuses on reliability. To balance collaboration and control is the key to trust. Trustworthiness means, to us in this project, that a system is accountable and can generate reliable and authentic information.

The outline of the thesis

The thesis opens with a presentation of our methods. The next section contains a theoretical background. It is followed by a section where we present our design solutions. After that comes a discussion where we bring up some, for the thesis, relevant topics. The thesis ends with a conclusion and we present the outline of our work.

Methods

The methods for designing the user interfaces have been literature studies and to create scenarios. Additional methods have been work with Mock-ups and think-aloud technique. For the Mock-ups the user representation was with the project's members. The think-aloud technique was used only for the fictitious design case with the purpose to get feedback of the ideas on that. Creating scenarios were partly used to show the design decisions. An additional part in the project has been to act as usability designers for the demo and that has also given inputs for the design of the MobileBank.

In this section there is first given a short description of scenarios, followed by a description of Mock-up. Next comes an idea of think-aloud experiments. After that there is a short review of usability designers. At the end of this section there are reflections on methods.

Scenarios

Scenarios are described by Erickson (1995) as scripts that are abstract. He points out that unlike stories that are personal, scenarios are described with a greater distance. There is a small chance for identification in scenarios, if one exists. Scenarios are often made-up though the intention is to present hypothetical user situations, which not yet exist. Scenarios are also described by Gulliksen and Göransson (2002) as a technique to explore and visualize different design solutions.

Mock-up

Greenbaum and Kyng (1991) point out that at the beginning of a design process it is important to get an understanding about the future design and the use situation. It is necessary to accomplish a general understanding about the future product. A Mock-up can be seen as a prototype of a future product and it is usually made of simple material such as paper or Styrofoam with the aim to be a realistic substitute for a real product.

Using Mock-ups is a way to gain an overview of the future design, a method for both designers and users to achieve a common understanding of the graphical design and the functionality of the product. Mock-ups are also useful for designers and other members of the development team to achieve a common understanding of the future product. Mock-ups provide the users and the designers with an easy, fun and innovative way to elaborate with

design proposals. Together they can shape their different views about the end product, into something concrete, which will serve as a first attempt to prototyping. A Mock-up is easy to change and refine in the design process. Another advantage using Mock-ups is that the users easily have the ability to change functions and they do not have to be technically skilled to make these changes. The users sometimes have a resistance towards technology and therefore they feel more comfortable with a Mock-up that is more physical and easier to understand. When future users have opportunity to influence the product and its design, the possibility for the product to end up useful and successful is enhanced. Users and designers also get the opportunity to understand each others competencies and find a common language.

“Mock-up: cardboard designs that serve in the game of envisioning future work, enabling users to experience and modify potential design-solutions”.
(Crabtree, 1998, p 94)

For the design, Mock-ups were partly used to formulate and visualize a mutual understanding about the system in the project and partly to get ideas for the design. There were Mock-ups for both the mobile phones and the website User Administration. See Figure 1 and Figure 2. In the work with the Mock-ups our users had the possibility to see the different steps in a sequence of the intended service, by moving a paper slip through a Mock-up mobile phone. In doing that they had the ability to follow the different display steps in an easy way. There were comments on how gainful the use of Mock-up was.

Since the users of the mock-up also are developers they found benefits in the use of the Mock-up for the developing process. They thought it was a good way to visualize and change the design. It was not hard to get them to use the mock-ups and they came up with many valuable opinions of what they wanted to be changed. Apart from the Mock-up work with mobile phones and the website, there were documents attached at a wall with design suggestions. The members of the project were asked to comment them in writing. After updating the design the documents were continuously exchanged. This gave additional feedback to the design.

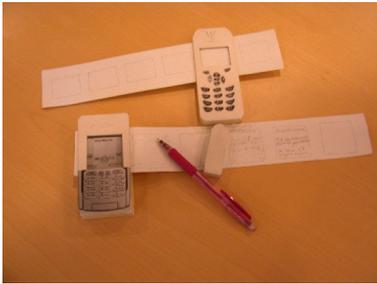


Figure 1 our Mock-ups of the mobile phones



Figure 2 Mock-up of User Administration

Think-aloud technique

To get feedback on the fictitious design case, MobileBank, we have tried out our ideas by using think-aloud technique with a couple of persons. The technique is described by Preece et al (2002), among others. When conducting the think-aloud technique the participants were asked to make loud comments as they saw the different design solutions. As they made comments notes were taken. They had been told about the scenarios and some more background about MobileBank. To clarify some of the comments and gaining a better understanding, the participants were asked concrete questions. The group of persons that participated, apart from one person, has some computer experience and use the mobile phone to make calls and send Short Message Service (SMS).

Usability design

Gulliksen and Göransson (2002) define a usability designer as a usability spokesman and the users advocate. It is important that system development is user driven instead of being technical driven. This is accessible when focusing at the solution instead of the different technical parts. The usability designer is responsible to keep the development user-centred and have an

overview of all the parts that creates a usable system. Gulliksen and Göransson (2002) argue that a usability designer should keep focus on the usability of the system or the product that is under development.

Reflection of the methods

The methods of choice have been relevant and suitable to the design work. A more thorough user involvement would have been preferable in the design work. The lack of end users that do not know the technical circumstances for this system has sometimes been hard to overcome. There have been occasions when the project members knew too much about the technical solution to have the ability to help us in the design process.

The think-aloud technique, used for the fictitious design case, appeared to be a useful method. This technique would have been valuable as a complement to the Mock-ups. Preece et al (2002) point out that a problem with using a think-aloud technique could be that the participator turns silent. One solution to come around that is to let participators work in pair and discuss with each other. This was not a problem for this session, partly because the participators were familiar with us.

Theoretical background

For the theoretical part most of the facts are received from the studies at the MDA-programme and partly from literature studies during this project. First there is an explanation of the main ideas about Human Computer Interaction (HCI). After this follows a part that shortly explains Interaction Design including the notions conceptual models and interface metaphors. In the middle of this section there is a description of the idea of usability and elucidate its importance. In the part Interface design Shneidermans (1997) eight golden rules of interface design are introduced along with five guidelines for input that he presents. Finally two psychological aspects are presented, cognitive and perception psychology, which have been acting as guidance throughout the design decisions and the whole design process.

Human Computer Interaction

Among the many authors that discuss HCI, Gulliksen and Göransson (2002), Lif (1998) and Preece et al (2002) have been the most influential in the preparation of this thesis. HCI is a research field that aims at designing software that effectively supports the user during decision-making processes. The central goal is to understand how the user interacts with the computer. The spread of information technology has resulted in that people with the most varied backgrounds, cultures and knowledge uses computers and technical devices.

It is not a viable strategy to only focus on a single demographic group when trying to get acceptance for this kind of technology. Consequently user interfaces need to be easy to use for all users, disregarding their previous knowledge. Without a well planned interface design the technique behind the interface may be working well but the use of it would not be efficient and easy to use. This research field is multidisciplinary and knowledge is gained from several disciplines such as computer science, psychology, ergonomics, design and social science.

Interaction design

The following quotations are a definition and a description of the intention of interaction design given by Preece et al (2002).

*“designing interactive products to support people
in their everyday and working lives”*
(Preece et al, 2002, p 6)

“The aim of interaction design is to redress this concern by bringing usability into the design process. In essence, it is about developing interactive products that are easy, effective, and enjoyable to use—from the users’ perspective.”
(Preece et al, 2002, p 1, 2)

In their book they also discuss what to think about when employing interaction design. During the design process their definition and goals are used as a starting-point.

There are two issues that are essential to take into consideration when designing usable interactive products.

- who is going to use them and in what context
- understand the kind of activities people are doing when interacting with the products

Conceptual model

The purpose of a conceptual model is mainly to support the process of system development. Based on users’ needs and other requirements a conceptual model is created to envision a proposed product.

“a description of the proposed system in terms of a set of integrated ideas and concepts about what it should do, behave and look like, that will be understandable by the users in the manner intended.”
(Preece et al, 2002, p 40)

All systems have some kind of activity that the user will be involved in. Preece et al (2002) state that the four most common types of activities are instructing, conversing, manipulating and navigation and finally exploring and browsing.

There are different techniques to design an appropriate conceptual model and here are we going to present the technique we used in our design.

Interface metaphors

Preece et al (2002) argue that interface metaphors have proven to be highly successful. Interface metaphors are descriptions of similarities to a known phenomenon and they give more evident information when using them in the design of user interfaces. Interface metaphors can make it easier for the interface designers to create a good and understandable interface design. When using metaphors the users have the possibility to recognise

themselves from other similar situations in their life. Since the interface metaphors are providing users with for them well-known representations of activities, it can help them understand and learn how to use a system. A good way to start designing user interfaces is therefore finding metaphors related to the future product or system.

Usability

“The 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”

(ISO 9241-11 Guidance of usability)

This is the international standardization for usability and the focus is that the specified users' needs are provided for. Ottersten and Berndtsson (2002) describe usability as a quality characteristic (kvalitetsegenskap) on behalf of interactive products. The usability of a product becomes visible in the interplay between the product and its user during the usage. Allwood (1998) discusses the importance of adding usability to a system or a product to improve the use of it. Preece et al (2002) point out that usability must not be mixed up with functionality that is about the products function and feature and does not concern whether users are able to use them or not. Greater functionality does not mean improved usability.

Preece et al (2002) argue how important it is to consider who is going to use the system and where the system is going to be used in order to design usable interactive products. Also important is to understand what kind of activity users are doing when interacting with the products.

Usability goals

Preece et al (2002) discuss how an important part of the interactive system design process, is to be clear about the needs of the user. There are as well usability goals as user experience goals to take into consideration. User experience goals focus on how users from their perspective experience an interactive product. The usability goals are central to interaction design and are concerned with meeting specific usability criteria. Examples of criteria that have to be thought about are the time it takes to complete a task, the efficiency and time to learn how to use a system, learnability. Both the usability goals and the user experience goals are illustrated below. See Figure 3.

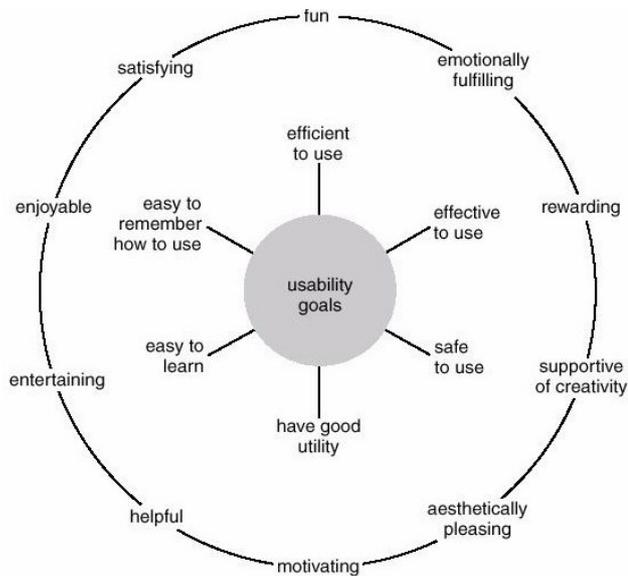


Figure 3, picture from Preece et al (2002, p 19) showing usability goals and user experience goals

Interface design

Most computer systems are used by people with various knowledge and experience of computers. Bearing this in mind the interface design is an important part of system development. Sundgren (1992) points out that an interface design has a significant part in whether the user will accept a system or not. The interface design also affects how the user will appreciate the system.

Eight golden rules of interface design

Shneiderman (1997) has presented eight rules of thumb for developing interface design and they have principles that can serve as the starting point for designing usable interfaces for most interactive systems. Nielsen (1993) has also worked out principles that are similar to Shneiderman's. These fundamental principles of interface design should be adjusted, refined and increased to suit each individual design. Here follows an outline of Shneidermans eight rules.

1. Strive for consistency

Striving for consistency is one of the most essential principles and refers to that the user should feel familiar with the system and never be left with questions. To always consequently present information in the same way is therefore necessary. Words, icons etcetera should always be presented in the same manner and at the same place throughout a sequence with different

user interface steps. Shneiderman (1997) points out that it is also one of the hardest to follow since there are so many kinds of information.

2. Enable frequent users to use short cuts

Experienced users want to have the possibility to use short cuts to reduce the number of interactions and to increase the pace when interacting with a system. Fast display rates and short response times attracts knowledgeable frequent users.

3. Offer informative feedback

It is important that a system offers feedback of what is going on. There should be a system feedback for every user action. Feedback prevents the user from feeling unwitting and frustrated. The user should have the feeling of being in control over the situation, not wondering what is happening or if there is something unknown going on in the system.

4. Design dialogs to yield closure

Central when designing user interfaces for each sequence of a system is to give informative feedback from the start to the end of the sequence. The user must know that the task is done and this gives the user a sense of relief and satisfaction. When the task is completed the users mind is ready for another action.

5. Offer error prevention and simple error handling

Preferably, the system should be designed so that the users cannot make a serious error. In case users make an error the system should discover the error and offer a simple, constructive and specific instruction for recovery.

Nielsen (1993) argues that error messages should follow four basic principles. Error messages should be written in the users own language and codes should be avoided. The message should specify what is wrong and not just tell that something is wrong. The message should tell the user how to solve the problem, and should also be pleasantly presented and not degrade or insult the user.

6. Permit easy reversal of actions

This means making the user feel comfortable knowing how to correct mistakes and not being afraid of using the system. It is of importance to have the possibility to easy step backward in the system.

7. Support internal locus of control

For experienced users it is of importance that they are in charge of the system and not being ruled by the system and the system should respond to the user's actions. There should not be any surprising system actions or

repetitive sequences of data entries. The possibility to produce the undesired actions should also be avoided.

8. Reduce short-term memory load

The displays should be kept simple and spreading the information over various numbers of pages should be avoided because of the limitation of human short-term memory.

Guidelines for input

In order to increase usability there should be a minimum of actions that has to be performed by the user. A user is sensitive towards the number of operations and is less likely to use a time consuming and demanding system. The designer should therefore consider if each input really is necessary. Moreover, inputs stop the flow and add the risk of making mistakes. Shneiderman (1997) presents in his book five high-level objectives. Below is an outline of these proposals.

The first proposal is *Consistency of data-entry transactions*. It means that under all circumstances similar sequences should be used; the same delimiters, abbreviations etcetera.

The next suggestion is *Minimal input actions by user*. Fewer input actions mean a larger productivity for the user and also less risk for errors. Rather than to type a long string of characters, it is better to do a selection with a single keystroke. To eliminate the need for memorizing, to structure the decision making assignment and reduce chances of typographic errors, a list to select from is to prefer. Also redundant data entering should be avoided. If the same information is asked for in two fields the system should be able to copy the first one, but still give the user the opportunity to change the data. If the user would have to enter the same data twice the risk of making a mistake would increase. This double entry would also be annoying for the user since it would be seen as time-consuming.

The following proposition is *Minimal memory load on users*. It states that the users, while entering data, should not have to remember lengthy lists of codes and syntactic command strings that are complicated and hard to remember.

The fourth suggestion is *Compatibility of data entry with data display*. This means when entering data, the format of the data-entry information should be linked closely to the format of displayed information.

Flexibility for user control of data entry is the last proposal. This proposal suggests that skilled users might prefer input fields that appear in a certain

order, an order which they themselves can decide. It can for example in one situation be more convenient to a user that a certain field is shown on top of the screen, while in another situation it might be more convenient that another field is shown on top of the screen. However, this kind of flexibility should be used with a great deal of caution since it conflicts with the principle of consistence. In the menu it is important to think about the order of the different options. The option that the user is most likely to use should be placed on top and the one least likely to use in the bottom.

Psychological aspects

Crucial for designing interfaces is to take into consideration how people think, how they perceive information and how they take in knowledge and information. During the design psychological theories have been taken into a major consideration to get a good understanding of human behaviour and to get an overview of how users in general interact in their use with artifacts. The books of Lif (1998) and Allwood (1998) have mainly been used.

Allwood (1998) argues that any programme or system will be more productive if they are adjusted to the psychological qualities of human beings. A user interface should therefore be designed so that it activates already existing knowledge in the user's memory. Consideration should also be taken to the analogical thinking. Humans often do knowledge transferring when there is a new problem to solve, knowledge from one area is transmitted to another. The analogical thinking should be made use of consciously and clever. Inconsistency and violation against natural analogies can make a system difficult to use.

Cognitive psychology can be described as studies of human mental processes and their part in thinking, perception and behaviour. By using cognitive psychology is it possible to minimize the user's cognitive load, meaning the user should not have to imagine how the system should look like or work. It is important that the user can interpret the information correctly, since the user should not have to predict how the system works. A user interface can be improved by predicting what users for example can and cannot do and what they can be expected to do. Cognitive psychology also identifies and explains what causes the problems that arise for users in the interaction with the system.

“The user interface should be designed so that the user can handle the interface automatically (i.e., on a lower cognitive level), leaving the higher cognitive level for solving work-related problems.”

(Lif, 1998, p 5)

Perception psychology is described by Preece et al (2002) how humans use their senses, like eyes, ears and sense of feeling. How they gather information and how patterns, colours and sounds affect us. Humans strive to find structures and patterns to make it easier to understand and remember what they perceive. Humans often use a combination of their different senses to get an easier and better perception. There are many things that affect our ability to percept, for example fear, darkness, stress, concentration and tiredness.

Design

In this section there will be a presentation of the thoughts and decisions taken during the design process with the stipulation of radiating and infusing confidence, security and trustworthiness. There will be examples of interfaces from the fictitious design case, MobileBank. It is necessary to point out that the solutions for that case are not tested in a technical environment, they are mainly intended to visualize the decisions. The design developed in the project for Ericsson AB is on the other hand used in a technical environment though it ends up in a demo.

In order to get usable interfaces for the real and the fictitious design are parts of both Shneiderman's and Nielsen's principles applied to the design, also the described guidelines are used. All described in the theoretical background, pp 12-14. They are adjusted to suit the design of the user interfaces, foremost for the design of the mobile phone.

Creating scenarios were partly used to show the design decisions. Each scenario will show how the system responds when the user solves a task. Some of the design proposals have been sketched and they will be demonstrated as simple display interfaces. The design for the demo has been done in an iterative process. There were not as much re-iteration as wanted in the fictitious design case, MobileBank.

The section opens with a description of the mobile phones that is designed for. When using these mobile phones there are technical boundaries to consider. After that follows a part that discusses usability through the user interface. This includes the conceptual model and the interface metaphor used for the design along with usability. Finally there is a part about trust through the user interface and there is a presentation of the design proposals, having confidence, security and trustworthiness in mind.

Technical boundaries

The interface design will be shown on devices with various kinds of screens, it is therefore important to design an interface that very much looks the same through the different devices. The user should not have to learn a new system because he/she changes mobile phone, the interface as well as the functions should remain the same. Though the service is intended to be used worldwide there will be a lot of different mobile devices in use while using the service. Of course the system has to work properly on different devices and within various contexts.

When designing for baby interfaces like the ones on mobile phones there are restrictions to take into consideration. Like Ewert (2000) describes there are things to consider during the design process. The mobile phone has a limited display with a small interface, and the limited space restricts the amount of information that can be displayed. The space differs in different mobile phones, but there is still a small area in comparison with a computer screen. There are also limits for the processing capacity and for the speed of transferring. For the design there have been restrictions like the speed, the transferring data and the processing capacity into consideration, but the main focus have been on the restriction of the display.

For the design there were three different mobile phones to develop the service at; one with a small display, the Nokia 6310, another with a mid-size display, the Sony Ericsson T610, and the Sony Ericsson P900 with a large display. See Table 1. These mobile phones were used partly because they were appointed to the project and partly because they have different sizes and prerequisites.

Mobile telephone	Nokia 6310	Sony Ericsson T610	Sony Ericsson P900
			
Screen size	37 x 28 mm	32 x 38 mm	40x40 mm (closed) 40x61 mm(open)
Characters per row	17	17	25
Numbers of rows (excl. menu & option field)	4	6	13
Colour screen	No	Yes	Yes
Internal memory	4MB	2MB	48MB

Table 1 The mobile telephones

On all the mobile phones there is a possibility to use a scrollbar. It is also possible to manipulate the amount of rows by increasing or decreasing the size of the text format.

The system designed for in the project is intended to be used all over the world, so the aim became to design an interface that works on different mobile phones. The design in the fictitious MobileBank is built upon the same

conditions. It is important that the system not only is designed to support a high-end telephone, like Sony Ericsson P900 because that would block a large amount of people to use the system. It is easier to apply an interface designed for a low-end telephone like Nokia 6310 at a more advanced device, than vice versa.

Usability through the user interface

In order to design usable user interfaces it is important to understand as well the design field as how the presumptive users will use the supposed system. For the systems, as well as the real as the fictitious, the design is aimed towards mobile users in general, which means users with various knowledge and background are supposed to use the service.

First in this part we will describe our thoughts about the design field. Next we will talk about the intended users and their needs. We finish with a part about usability and its necessity.

Conceptualizing the design field

The conceptual model is based on conversing, which means that the system works as a dialog partner. In order to apprehend the system as a solid partner it is essential that the user interfaces radiates usability confidence, security and trustworthiness. During the design in the project interface metaphors were used. Interface metaphors are used to transmit conceptions and ideas from one field to another. The metaphors in the design were used to help the user generate an apprehensive conceptual model of the system. For the system MobileBank the metaphor were used to conduct bank services at banks. The idea was to think of as well the Internet bank as the mobile bank (telefonbanken) and the traditional bank.

Understanding the user

In order to develop user interfaces it is important to understand how users will interact with the contemplated product. This increases the possibility to bring a product into line with consumer needs. Since the service is intended to be used worldwide the prerequisite will differ, not only between countries and continents there will also be differences of use between genders, groups of ages and people with various economic statuses. Bearing this in mind the interface design has to be as apt and clear as possible to suit all users. All different users should have the possibility to use a system without being confused about the meaning of symbols and words or what is going to happen next.

To achieve a usable system the user should not be distracted by the device. The MobileBank gives users the possibility to perform money transactions. For both the fictitious and the real case the focus mainly have been on envisioning, but for some functions also the auditory and feeling perception. For the MobileBank the user may be focused on something else beside the bank service at the mobile phone that may cause a distraction. The users focus when using the system is then to perform a task regarding the mobile banking and not use the mobile phone to make phone calls. Sharpe and Stenton (2002) discuss how focus should be put through the tool (here the mobile phone, our remark) onto the task. This means for us that the mobile phone should just be an artifact to carry out that task, like a pencil is an artifact when writing.

Essential for many systems is that the system is fast. The user will be wearied of a too slow system and not use it at all. It also has to work properly otherwise will the trust for the system immediately disappear. Equally important for the system is that the user feels that he/she is gaining something from using the system.

In an early phase of the project it was obvious that the users wanted to have a lot of information displayed on the screen of the mobile phone. During the use of the Mock-ups the users had problems with envisioning and comprehending the actual view of the mobile phone. Apart from the difficulty of taking the small interface into consideration, they also found it hard to grasp the minor processing capacity. Many of them wanted to have the interface that a web site has and functions that is possible at a website that require a larger screen. By using Mock-ups with accurate proportion the users were able to see the user interface as a concrete representation.

The need for flexibility of the system became apparent during the Mock-up process. By using the Mock-ups we as well as our users, experienced how many interface steps there were to go through to reach the end of the intended task. We discovered that the user group wanted to have different adjustments for the mobile service. The system is intended to reach users in general and it is therefore necessary for the users to customize the service.

During the work with the Mock-ups there were similarities to what Ehn (1989) describes in his book *“Work-Oriented Design of Computer Artifacts”* the UTOPIA project. He discusses how the users (graphic workers) in the beginning of that project were not able to fully participate in the design process. The developers at first tried to use scenarios and work flow but the tasks were too abstract. It was when they started to use Mock-ups they could simulate the future use.

The comments received when using the think-aloud technique were useful in this thesis. It gave further inputs of what to think about when designing user interfaces that has to radiate and infuse confidence, security and trustworthiness. The logo of the supplier of the service increased the confidence. They expressed a general insecurity and caution about wireless technology. The login was a must and they associated the displayed padlock with security. They had comments about the displayed information and wanted it sometimes to be clearer. Some of the proposals were about having more text displayed on the screen. Although, when they added more text to the design slips they perceived it confusing.

Usability

It is of great importance that an interactive system is easy to learn and effective to use with a satisfied result for the user. In other words; permeating the system with usability. To keep that in mind has been a matter of course during the design.

To get an easy and understandable system the text information displayed has to be short, informative and precise in a logical way. Also important in reference to usability is that the system is similar in any of the mobile phones. A user should not have to learn a new system when changing mobile phone. Too much information at the same time makes it hard for the user to perceive and understand the information.

Apart from the interface there are issues that also affect the usability and the user's willingness to use a system or product. From a user point of view the system or product is no more than an artifact and because of that the system should be easy to learn. The effort should have to be performing the task not using the system.

It is important to think about what kind of data that actually is needed. Another thing is to minimize the keyboard input, as it is difficult to handle with its small sized keys. The keyboards on mobile phones are not only small sized they are limited in numbers and each key has more than one letter, numbers and special signs. Special signs are not physical visible on the keys, they are just visible on the screen, when pressing the right key. An ordinary user does not know where the special signs are placed without checking on the different keys. Compared to a computer keyboard the input on a mobile phone is more tedious. The user gets interrupted in the flow and the operation may feel time-consuming. When user type in information there may be mistakes typing in the required information. The smallest amount of information should be typed in to the mobile phone. If the user has to type in information it should be numbers not letters and definitely not numbers and letters mixed. If there has

to be some information from the user it would be preferable that the user can choose information from a list. The interaction between the user and the mobile phone should be short, efficient and the concentration should not be at the device. For the design the number of places where the user has to enter data has been minimized, but it was sometimes inevitable. See Figure 4.

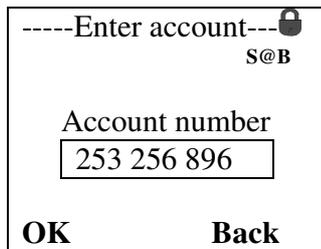


Figure 4, example of a view with an input

Trust through the user interface

It is important for the system to radiate and infuse confidence, security and trustworthiness. Providing trust through the user interface is the key to success in system developing of several mobile phone services. There are a number of matters to consider, in doing that. For the user interface taken as a whole a clean and spartan interface radiates seriousness and creates a feeling of trust and confidence. Dunning and Ramakrishnan (2002) argue of the importance that the screen ought to supply the user the necessary assurance at a glimpse.

Confidence, security and trustworthiness are three characteristics that are quite similar. They have related traits and are in some cases dependent and based on each other. Still, they are not synonymous and they have their differences. In order to understand them and obtain a suitable interface design their unique features have been crystallized. In this part there are design proposals for each of them. First confidence, continuing with security and finally trustworthiness.

Confidence

Earlier in history we closed deals with eye contact, a handshake and a nip. This can be characterized as an act of confidence. The development has made the contact between people less physical and less personal. In this day and age it is more common that the contact is electronically and confidence has to be characterized in other ways. Nevertheless, radiating and infusing confidence is essential when people interact.

This part illustrates thoughts about how to mediate confidence for a system

that handles bank services over mobile phones. By putting a user in charge of a system, it will increase the perception of confidence and there will be a description of ways in doing that. It opens with a scenario and follows up with examples of how to put the user in charge of the system we have designed for. Additionally to infuse confidence it is important to offer appropriate feedback and some design proposals will be presented to show the ideas. Finally the importance of showing all correlated information at the same time is pointed out to.

Scenario 1

Trevor has recently started to use his banks mobile phone service, MobileBank. He knows that the service offers a user administration where he has the possibility to customize his personal settings. He enters the home page of his bank, Svenska@Banken (S@B), and logs in to the User Administration at MobileBank. Since it is the first time he visits the site, he examines his options. He changes his password and then he customizes the service in the mobile phone to suit his needs.

In this scenario the logotype of the bank is displayed on the screen. This is an example of how to infuse confidence to the user. The user's recognition of the logotype creates a feeling of confidence.

It is important that this systems offer flexibility, because it turns toward mobile users in general and therefore there are a lot of user profiles with different needs. These different user profiles have to be customized to suit every user. From the work with the Mock-ups in the project it was early on obvious that the users wanted various settings. Because they are skilled users, they are used to shortcuts and possibilities to adjust services. The participants for the think-aloud technique are not that skilled and did not think about such possibilities.

It is hard to do adjustments on mobile phones hence the limited screen size of them and the limited keypad. Due to the limitations of the mobile phone the personal settings would be easier to do in another part of the system. Sharpe and Stenton (2002) point out that for information appliance designs more complex tasks should be performed at other parts of the system. In order to comply with that, the solution is to customize the personal settings at a website on a personal computer with a bigger screen. This would make it easier to read and get an overview of the information displayed on a larger screen, than on a smaller display on the mobile phone. See Appendix 1. In this "User Administration" the user should have the possibility to change the personal settings and make the system suit their own needs. See Picture 1.

Info	Transferring limit		
Default settings	Set a personal limit for the money you transfer, per day/s or per transfer or both read more		
FAQ	Limit per transfer between my own accounts		
Terms & conditions	<input type="text"/> sek		
PUL	Limit per transfer between other accounts		
Cookies	<input type="text"/> sek		
Contact	Transfer limit per <input type="text"/> days <input type="text"/> sek		
	<input type="button" value="Modify"/> <input type="button" value="Cancel"/> <input type="button" value="Clear"/>		

Picture 1, example of User Administration

An example of what the users should be able to do is to adjust their own security level to feel comfortable with the system. Another possibility to make the user confident is to allow the user to affect the flow of actions. To cut down on the different steps in the mobile phone, the user can shorten the action/process. It is hard to use shortcuts on a terminal like mobile phones, therefore it is of great importance that skilled users are allowed to customize their mobile service in some way, to satisfy them. When allowing the user to customize their service the system feels more useable. The user gets the feeling that they themselves have control of the system when they have to log in. Regarding how much feedback the user wants should be optional in User Administration, so the users themselves have the possibility to decide the individual amount of feedback they want. After using a system for a time the user will be more skilled and trained on what is happening and will therefore not need all the feedback offered.

Bringing feedback to the user throughout a system is essential on behalf of feeling confident. A visual feedback is easier to the user to perceive and therefore does not distract the user in the same way that a text based feedback does. To handle error messages is another type of feedback. The feedback has to be constructive and offer help to the user to continue his task. See Figure 5. Lack of feedback, while the system is processing, can easily engender uncertainty. It is frustrating not knowing what is happening when performing an action in a system. To avoid these situations the design proposal is to include an indicator in the interface that shows the user that the

system is processing. See Figure 6. The indicator would be a help to the users, so they know that the system is working and they have to wait.

<p>-----MobileBank----- S@B</p> <p>Login</p> <p>XXXX</p> <p>OK Back</p>	<p>-----Incorrect login----- S@B</p> <p>Try again</p> <p>Login</p> <p>XXXX</p> <p>OK Back</p>
--	--

Figure 5, example of error handling

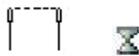


Figure 6, examples of indicators

The menu also has to facilitate for the user and offer proper feedback. In the menu it is important to think about the order of the options. The option that the user is most likely to use should be placed on top and the one least likely to use in the bottom, so it is easy to reach the most common alternative. In the MobileBank system the account balance is probably the most wanted option to reach. The user only has to log into the MobileBank and press “OK” to watch his/hers different accounts balance. See Figure 7. In this case the users do not have to choose any option in the menu, because the “Account balance” in the menu is pre selected. This will shorten down the needed action from the user, but only when the user wants to check the status of his/hers account and not when choosing any other option.

<p>--MobileBank menu-- S@B</p> <p>1. Account balance</p> <p>2. Transfer</p> <p>3. Transaction logs</p> <p>OK Logout</p>	<p>-----Balance----- S@B</p> <p>754 235 865 10000:25</p> <p>754 658 249 535:42</p> <p>754 698 245 99447:23</p> <p>Menu Logout</p>	<p>--MobileBank menu-- S@B</p> <p>1. Account balance</p> <p>2. Transfer</p> <p>3. Transaction logs</p> <p>OK Logout</p>
---	--	---

Figure 7, example of a user interface with pre-selected menu alternative

In this project there has also been an SMS solution to design for. In the fictitious case, MobileBank, there is no possibility to use SMS. There are some things that are important to think about when offering a SMS solution. When using SMS it is important with feedback, as it is in all our design solutions. To get an idea of how existing SMS solutions work, a logo was

ordered to a mobile phone. The instruction, found on a web site, was to send a SMS with a code for the chosen logo to the merchant. The cost for the logo and the SMS was 10 SEK and it took 40 minutes to get the delivery. However, no receipt or indication if the SMS was sent properly before the logo was received. Especially inexperienced users accidentally could send an additional SMS and then having to pay for that one as well.

Key findings:

- Offer feedback
- Recognition of brands
- Putting the user in charge of the system
- Offer flexibility

Security

Security is essential in many aspects for a system. It has as well to be secured as it has to radiate and infuse security. Thinking about how to mediate security through an interface has had a low priority in system developing. The focus on security for this thesis has exclusively been on the graphical user interface and not the security within the system.

For usability designers it is important to think about the user interface and how it is perceived. This part describes how to mediate security through the user interface. It opens with a scenario to exemplify some security aspects. It continues with showing features of a secured access into the system. Eventually there will be an explanation of the effect of using symbols that radiates security.

Scenario 2

Oscar is visiting a pub with a couple of his friends to watch a game of football at big screen television. The pub is crowded, so the sound level is high. Oscar decides to get something to eat. He logs in to MobileBank and checks his balance. He realizes that he needs to transfer some money. While using the MobileBank he also keeps track of the game. He accidentally enters 200 EUR instead of the intended 20 EUR. Oscar has customized his bank service at MobileBank's website regarding his transferring limits. So now when he entered 200, the mobile phone emits a sound, vibrates and displays a text message. Since the volume in the pub is noisy and Oscar's focus is on the game he only perceives the vibration. He checks the text message and realizes his mistake. He transfers the right amount of money. After the transaction Oscar forgets to log out. The system will automatically log him out after three minutes.

The security for a user is to be thought of as the perceived security, an emotional issue. Not as for an issuer that has to calculate on risks. It is important that a user psychologically and emotionally feels that it is secure to use a service. Of course the actual security is essential, but for a user the appearance of the view is as important as the actual security is.

The phenomenon with being able to log in with a pin code and log out from a system gives users a sense of security. Hence, this system is handling money it is of even greater importance that it infuses security. As an extra precaution that the system would benefit from, is an automatic logout. That allows the user to forget to log out and will as well increase the security for the system. Since it is important to put the user in charge of the system, the time limit should be possible to change or decline in User Administration.

Since the mobile phone has such a small screen it is important to think of how the pin code is displayed. There were three different options to display the pin code. Usually when there is a pin code the digits are misrepresented as stars to perceive privacy. Since the display of mobile phones is small the chance for someone else to see the pin code is very limited. One solution is to show the pin code rightfully or just for a few seconds. That would decrease the risk of incorrect input. When presenting these ideas to the users (i.e. project members) they turned them down. A contributory cause to their opinion was that in similar contexts the pin code is not exposed. They also felt it more secure not having the pin code exposed.

When designing an interface that has to infuse confidence, security and trustworthiness, there has to be a high security level when the user starts to use the service. As a starting-point the user should have to log in to access the service, i.e. MobileBank. To further enhance the security into the system is to give the user the opportunity to confirm money transfers with the pin code. See Figure 8. This is not to be mixed up with login.

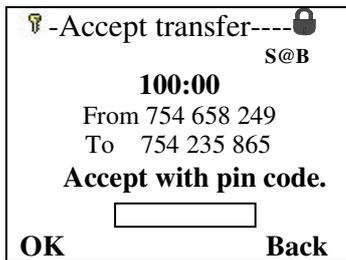


Figure 8, example of a view that shows enhanced security

Dunning and Ramakrishnan (2002) discuss that there is a lack of any real understanding of user perception of security. Like they argue there is a point in displaying a padlock that radiates security to a system through the user interface. This can be useful in the design of user interfaces in services that ought to radiate security. Also a key is a symbol that can radiate security. See Figure 9. In this design there is a padlock displayed in the upper right corner to indicate that it is a secured system. When a user is logged in there is a good idea to indicate that somehow. To indicate that state in this design there is a key displayed.



Figure 9, examples of symbols for security

Key findings:

- Emotional and psychologically security for users
- Login and logout functions
- Concealing pin codes
- Use symbols for security

Trustworthiness

A user must never be in a state of uncertainty when handling money. In systems managing money one must be able to trust displayed information. A system whose user interfaces radiates and infuses trustworthiness extends the ability to be used.

This part starts with a scenario that shows different features of displayed information. After that come aspects of how information should be displayed on the subject of visibility and feedback, with trustworthiness in mind. It finishes up with describing the value of branding.

Scenario 3

Megan is out shopping. She fancies a pair of pants, but they are quite expensive. To afford them she decides to transfer some money from her saving account to her spending account. She picks up her mobile phone, logs in to MobileBank and starts to transfer some money. The transfer fails and she gets an error message saying there are not enough money and the current balance. Megan is confused about the balance, she thought that she had more money. She decides to check the transaction log. When she views the log, she remembers the pair of shoes she bought last week. Megan realizes that she has to wait until Friday when she gets her salary.

To obtain user interfaces that radiate trustworthiness it is important to think about all the text displayed. There are different purposes of the displayed text, but common for them are that they have to be informative. To achieve visibility the interface design should be spartan without too much information and text displayed at the same time. An overload of information on the screen can be a source of distraction and lead to that important information is overlooked. The information displayed has to be limited and only the most important and relevant information should be displayed. Another thing to consider is that the words and expressions are clear and precise.

When it comes to the headline it is important to think about that it clearly has to show where in the system the user is. Also central is to let the user know what to do. See Figure 10. Also the alternatives to confirm a choice should be clear and informative. Too much text on the display makes it harder for the user to read and understand. If the information is clear and informative the user gets a good overview of what to do and what the information means. See Figure 11.

<p>-----MobileBank----- S@B Login <input type="text" value="XXXX"/> OK Back</p>	<p>🔑 -----Menu -----🔒 S@B 1. Account balance 2. Transfer 3. Transaction logs OK Logout</p>	<p>🔑 --Account balance--🔒 S@B 754 235 865 10000:25 754 658 249 535:42 754 698 245 99447:23 Menu Logout</p>
--	--	--

Figure 10, example of headlines



Figure 11, example of displayed information

If a money transaction fails it is essential that the user receives feedback of what has happened. The user must never be in doubt whether the money has been transferred or not. If the transaction fails due to lack of money the feedback should tell the user that he/she did not have enough money as well as the current balance. See Figure 12. There can be others reasons to a transaction failure, for example no mobile coverage or no charge at the battery. Regardless of the reason for the failure, it is important to receive feedback about the state at the account. See Figure 13.

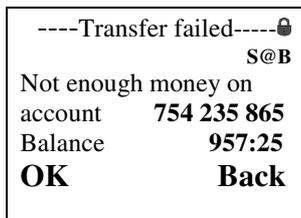


Figure 12, example of a message when a transfer fails due to lack of money

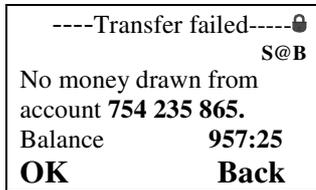


Figure 13, example of a message when a transfer fails

To avoid that the user fail to notice information it would be preferable to avoid scrollbar. It could be hard to catch sight of information that not is displayed on the screen without scrolling. The most desirable case is when all the text can be shown in the window without having to scroll. In the case where a scrollbar is necessary, it is good if it is shown in some way with an indicator that it is more information when scrolling the page. There is a risk that many inexperienced users will overlook the information further down in the display. Therefore should important information never be in the area that has to be scrolled down to. For the MobileBank system it is desirable if only the view with the transaction log is the one that is scrollable. See Figure 14.

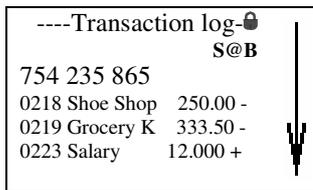


Figure 14, example of an interface that needs a scrollbar

For an issuer, in this case S@B, can a trademark of the system or something to identify it be valuable to display to increase the trustworthiness of a system. In this design the trademark have been placed at all the screen displays. They are to keep the consistency positioned at the same spot and look the same regarding size, form and colours.

Key findings:

- Short, informative and precise text displayed
- Proper feedback
- Visualize information
- Display trademarks

Design reflections

This design is not to be considered conclusive. In order to achieve a good graphical user interface design there has to be more iterations. Even more important is to have user participation that is more extensive and thorough. All graphical user interfaces require being well-considered, but for a small user interface the demands is even higher. Since it is such a small interface every icon, word and even letter has to be measured.

As mentioned before, during this design there was not so much access to end users as the MDA programme teach out and influence to. This has been an interesting experience, but unusual and to some point frustrating. However looking back, it feels like the design is on the right track and the steps taken are in the right direction.

Discussion

Think big – for small, this expression has characterized these 20 weeks in the project. In spite of being inferior in numbers in the project the part of usability designers played an important role in the project. There is a lot to consider for the small screen. Furthermore the work with juggling the big banking metaphor into the small mobile telephone. In this discussion the focus will be on the question of issue *how to develop graphical user interfaces for mobile phones that radiate and infuse confidence, trustworthiness and security*. We will reflect on some of the issues we have come across and found to be most relevant in the design work. The discussion opens with some aspects of usability. It continues with discussing the need of flexibility on behalf of confidence. After that arguments of the importance of thinking about security as a whole. It is followed by a discussion about different kinds of feedback to increase trustworthiness. Finally we point out the significance of thinking about branding.

Usability issues are highly topical and have been that for the last few years. Many authors have been written about the subject, among others Gulliksen and Göransson (2002), Lif (1998), Nielsen (1993), Norman (1986), Preece et al (2002). Allwood (1998) discusses the importance of adding usability to a system or a product to improve the use of it. In that we agree with him. Throughout the studies at the MDA programme, emphasis has been put on usability matters. We have during the work with as well the design as the thesis not found as much as we expected about usability for the small interface. We think that depends on that we are just in the beginning of the development of services for small interfaces. Applying usability was still an important part for us, even though our main focus has been trust issues. On behalf of usability we have especially focused on that the system should be easy to learn and effective to use.

For a system to be easy to learn we are of the opinion that the text displayed has to be understandable and logical. In order to be effective to use, the number of operations ought to be cut down to a minimum. Bearing usability in mind, the input should be put into a minimum. In the design the user has to type when transferring money to someone else account. As we have seen it, this input has been unavoidable.

One of the most important issues, with confidence in mind, is to put the user in charge of the system by letting him/her customize their service. Since this service is mainly designed for a device that Sharpe and Stenton (2002) characterize as information appliance, it would be most inconvenient to make

changes on that. Like they suggest, this systems complex tasks is put to another part of the system.

To make a secure system, it takes more than a secure looking interface to reach that. Dunning and Ramakrishnan (2002) point out that there is a problem when there is a mismatch between user's perception of security and what the system actually is providing. Neither the interface designer, nor the ones who perform the implementation of the system, are able to manage this task on their own. It is not enough that a system radiates and infuses security to get a secured system, as a whole. Nevertheless a secure system that has a user interface that does not radiate and infuse security will run a lesser chance of reaching user acceptance. Security and usability sometimes oppose to each other, because a higher security level can demand more actions from the user.

We find, like Dunning and Ramakrishnan (2002), that the lack of understanding for user's perception of security is inferior. When using the think-aloud technique we experienced that a locked padlock radiates security. Like the participants we correlate a padlock with security. We are not claiming that this survey is generally prevailing, but we believe that there is a point. Furthermore, we believe that the lack of thorough user participation as a whole has been a disadvantage in our user interface design. Still, in system developing it is central to start from the end users needs regardless of user participation or not.

Important to mediate trustworthiness is to offer informative feedback. Shneiderman (1997) points out that in one of his eight golden principles. We agree and would like to add that it is important to not leave the user in the state of uncertainty. To avoid that, we have for the sake of clarity tried to refine the displayed information. In the headlines we put an effort to make them clear and informative. It was important to us that the user knows, by just at a glance of the headlines, where in system he/she is, what is going to happen next and what action is required from the user. The other displayed text is also required to be brief and to the point. There is more than one reason to keep the information down. Foremost because the display will be perceived as cluttered with text and therefore difficult to read. Many of the mobile phones of today do not have the option to display a scrollbar, so a user could easily overlook important information. Although, there is a danger when reducing text. The displayed information runs a risk to be insufficient.

To gain trustworthiness for systems, Stevrin (1998) argues that users have a tendency to have more trust to a known brand than to an unknown. Also branded companies are gaining more trust from users than companies that are unknown.

Conclusion

From the perspective as MDA students this has been a challenging and interesting semester. Taking part in this large student project at Ericsson AB along with students from Department of Telecommunications and Signal Processing at Blekinge Institute of Technology has been stimulating. It has been evolving and enabled us to use acquired knowledge from previous studies at the MDA programme.

During the work with this thesis the lack of research with focus on how to radiate and infuse confidence, security and trustworthiness through a graphical user interface became obvious. Especially in relation to the small interface, that was the main interest. The key issue on behalf of the development of different services is to be able to mediate trust. It is really important that the users feel and experience that trust. Since the technical development of faster transferring rate and the more advanced mobile phones, it will increase the need for well designed graphical user interfaces in the future.

Though, from the studies there are a couple of things that feels essential to point out. It is of great importance to never leave the user in a state of uncertainty and therefore is clear, sincere and informative feedback necessary throughout the service. Also central in designing user interfaces is to make sure that there is no mismatch in the security of the system and the radiated security. They have to be in accordance.

References

Allwood, Carl Martin (1998). *Människa-datorinteraktion – Ett psykologiskt perspektiv*. Studentlitteratur, Lund

Crabtree, Andy (1998). Ethnography in Participatory Design, (pp. 93-105) Proceedings of the 1998 Participatory Design Conference, Seattle, Washington.

Dunning Larry A. & Ramakrishnan Sub (2002). Security Status Display and Browser Interframe Communication (pp 237-241) Proceedings of the 2002 ACM Symposium on Applied Computing, ACM Press, New York

Ehn, Pelle (1989). *Work-oriented design of computer artifacts*. Almqvist & Wiksell International, Stockholm

Erickson, Thomas (1995). Notes on Design Practice: Stories and Prototypes as Catalysts for Communication. In Carroll, J. M., *Scenario-Based Design. Envisioning Work and Technology in system Design*. John Wiley and Sons, New York

Ewert, Magnus (2000). *WAP: ett steg mot framtiden*. Studentlitteratur, Lund

Greenbaum, Joan & Kyng, Morten (1991). *Design at work*, Hillsdale, New Jersey

Gulliksen, Johan & Göransson, Bengt (2002). *Användarcentrerad systemdesign: en process med fokus på användare och användbarhet*. Studentlitteratur, Lund

Keen, Peter & Balance Craigg & Chan Sally & Schrupp Steve (2000) *Electronic commerce relationships: trust by design*. Prentice-Hall, Inc. Up Saddle River, New Jersey

Lif, Magnus (1998). *Adding usability, Methods for modelling, User interface Design and Evaluation*. Eklunds Grafiska, Uppsala.

Nielsen, Jacob (1993). *Usability Engineering*. Academic Press Inc, London.

Norman, Donald A (1986). Cognitive Engineering. In Norman D.A. & Draper S.W. (eds.) *User Centered System Design* (pp 31-61). Lawrence Erlbaum Associates, Inc. Hillsdale, New Jersey

Norman, Donald A (1988). *The Psychology of Everyday Thing*. Basic Books, New York

Ottersten, Ingrid & Berndtsson Johan (2002). *Användbarhet i praktiken*. Studentlitteratur, Lund

Preece, Jenny & Rogers, Yvonne & Sharp, Helen. (2002). *Interaction design: beyond human-computer Interaction*. John Wiley & Sons, Inc., New York

Sharpe W. P. & Stenton S.P. Information Appliances. (2002) In Jacko, J. A. & Sears A. (ed.) *Handbook of Human Computer Interaction*. Erlbaum, New Jersey

Shneiderman, Ben (1997). *Designing the User Interface*. Addison-Wesley, New York

Stevrin, Peter (1998). *Tillitskrisen*. University of Karlskrona/Ronneby, Lund

Sundgren, Bo (1992). *Databasorienterad systemutveckling*. Studentlitteratur, Lund.

Turn, Rein (1999). Security and privacy requirements in computing. (pp 1106-1114) IEEE Computer Society Press, Los Alamitos, California

Electronic sources

GSM World

www.gsmworld.com 040518

Oxford English Dictionary

<http://dictionary.oed.com> 040518

Swedish Institute For Transport and Communications Analysis (SIKA)

http://www.sika-institute.se/utgivning/ss2003_4.pdf 040518

<http://www.usability.serco.com/trump/resources/standards.htm> 040518

Unpublished reports

Anastasiadis, Kleanthis & Ohlsson, Carolina & Rydin, Stefan (2003).
Connybanken Department of Human Work Science, Media Technology and
Humanities, Blekinge Institute of Technology, Ronneby

Appendix

User Administration

Info Default settings FAQ Terms & conditions PUL Cookies Contact 	View transactions Balance 167.58 sek Last Transactions <table border="1"><tr><td>040412</td><td>23.37</td><td>PrimaVera</td><td>-20.07</td></tr><tr><td>040412</td><td>23.39</td><td>GroceryStore</td><td>-40.00</td></tr><tr><td>040413</td><td>00.08</td><td>EllaModo</td><td>-54.09</td></tr><tr><td>040414</td><td>21.25</td><td>GasBody</td><td>-8.07</td></tr><tr><td>040415</td><td>21.47</td><td>ValletinStore</td><td>-42.35</td></tr><tr><td>040415</td><td>21.47</td><td>SpaMeet</td><td>-36.35</td></tr><tr><td>040415</td><td>21.47</td><td>SpiceHouce</td><td>-12.35</td></tr></table> <p style="text-align: center;">view more</p>	040412	23.37	PrimaVera	-20.07	040412	23.39	GroceryStore	-40.00	040413	00.08	EllaModo	-54.09	040414	21.25	GasBody	-8.07	040415	21.47	ValletinStore	-42.35	040415	21.47	SpaMeet	-36.35	040415	21.47	SpiceHouce	-12.35	 
040412	23.37	PrimaVera	-20.07																											
040412	23.39	GroceryStore	-40.00																											
040413	00.08	EllaModo	-54.09																											
040414	21.25	GasBody	-8.07																											
040415	21.47	ValletinStore	-42.35																											
040415	21.47	SpaMeet	-36.35																											
040415	21.47	SpiceHouce	-12.35																											

Appendix 1, example of a view in User Administration