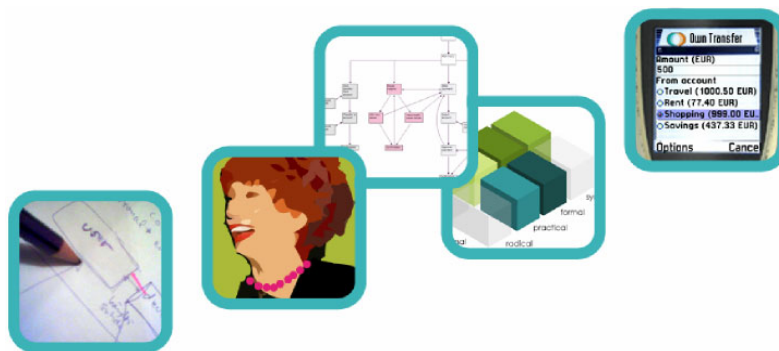# Bank in a pocket

Approaches to design problems of a mobile banking service

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1   Introduction

Most people in Finland carry with them a multipurpose tool of information and communication called a mobile phone. Great future potential is seen in mobile Internet services, which are accessed via Internet enabled mobile phones. Be it a service specialised for news, ring-tone downloads or banking, the fundamental design problems posed by mobile phones remain the same. The basic concept of accessing Internet with mobile device is not a new issue, since WAP technology was introduced already in the late 90's. The catch of the new mobile Internet technologies is in the access to the same web pages from the desktop computer and the mobile phone. For the user interface designer it means a possibility to design more sophisticated layouts for mobile Internet services. However, that is only a small advantage when being faced with the new technology and design problems it causes. There is something old and something new in the situation. There is an understanding of the browsing concept and web design in general, but the browsing device and usage habits related to it are radically different from the desktop terminals.

Given this situation, the first-hand assumption tempts one to believe that the significant design problem lies in the mobile phone device, its' small display, clumsy input mechanisms and mobile nature. However, technology of the tool is only a starting point in the chain of design problems, which accumulates to the larger context of the design work. In order to design appropriate, usable interface and system beneath it, the content of the mobile Internet service should be carefully customized to fit the device and -more importantly- to meet the needs of people. The mobile phone carried with enables the access to mobile Internet services from any location at any time, thus the designer cannot know for sure when, where and how that happens, not to mention the current desires and tasks of the person. The new set of design approaches, methods and principles are needed besides traditional usability design methods, because the new technology creates new research areas for a designer, and mobility raises new issues regarding usability problems as well as use and perception of services. There is a need to extend the perception of the user from the cognitive and physical operator to a holistic entity, which is part of the society.

1.1   Background

The topic of this thesis came out as a side effect of several years' work as a user interface designer within the field of IT. The design work in a software (or service) development project is generally based on action instead of research, and the aim is usually in rapid

product deliveries. Seldom there are opportunities to examine the frame of work as a whole, and to question whether the current design methods and approaches are valid at all. These doubtful thoughts evolved, when I got an assignment for a design of a mobile banking service, which was going to be used over the Internet. My professional background is mainly in the web and software design, thus a mobile phone as a target platform seemed doable. In the beginning I assumed, that the mobile phone as a physical object would make the strongest impact on the end result, because of its' size and input mechanisms compared to the desktop terminal. Soon it became clear, that there is a whole new range of issues related to mobile browsing, devices and use habits. That finding gave a nervous feeling, that my design work is based on mere assumptions instead of real knowledge. It was important to find a way to categorize constraints of the design assignment, because the requirements for the service appeared to exclude each other. After finding an abstract model for addressing different parties and their constraints it became possible to examine their specific requirements further. Design problems as abstract entities have given me a wide perspective to the product development culture in general. With this thesis I have had an opportunity to clarify things that are not in the scope of my work for wages. Though clear solutions for the specific design problems will not be given, the most significant contribution of this thesis is the recognition of the aspects that form the design process of the mobile banking service.

1.2   The aim and structure of the thesis

In this thesis I will examine design constraints of the mobile banking service. The goal of this thesis is to recognize different constraints and motivations that are brought to the project by different parties, and to understand how they contribute to the overall design process. After all, designer is a member of a team and an employee of a company, without much control over the whole production process. In order to suggest new, improved design practices there should be an understanding of the current ones. Also it is beneficial to take a wide perspective to the design assignment, because it is very easy to dwell deep into the details, while the big picture remains unclear. One goal of this thesis is to find an appropriate concept and vocabulary, which would communicate the essence of the design problems to other parties, who are involved in the same productions. Lawson's model of design problems [Lawson 1997, 107] acts as a tool for recognizing the different generators of design constraints.

The second chapter is an introduction to the history and development of electronic banking in Finland, giving background for the topic of mobile banking services. In the third chapter a design framework of the mobile banking service will be introduced with the help of

Lawson's [1997] model of design problems. In the fourth chapter I discuss users' various roles as a customer, consumer and user, as they are perceived from different domains of interests. Design challenges of mobile phones will be discussed from the designer's point of view in the fifth chapter. The sixth chapter briefly introduces usability as one quality of the service, and how that quality can be established.

1.3 Terminology

Generally I discuss in this thesis about the design work, which is conducted in the product development environment. From the technical point of view 'design' means the act of planning the technical performance of the system, how the required functionalities are established in the code, how databases are utilised and such issues. From the visual crafts' point of view 'design' means the visual and structural organisation of specific information that will be provided to a particular audience, and to meet specific objectives. The fact, that there are dozens of naming conventions for the professionals of design, does not make the use of that word easier. I have chosen to use both 'user interface designer' and 'designer', when referring to the person, who concentrates both on the visual and structural organisation of the information. In my vocabulary 'user interface designer' is also a user advocate who evaluates the content and features of the interactive system. Personally I do not see much difference in the objectives of 'user interface designer', 'user experience designer', 'interaction designer' or 'information designer', thus the chosen title is purely based on my own preferences.

When discussing about the mobile Internet services and their production, it is unavoidable to talk about the field of Information Technology. Productions that are conducted within that field can be labelled in different ways. I use words 'software development', 'service development' and possibly other variations parallel to each other, for describing the organisation and methods of developing interactive systems. In some cases I have especially emphasized the purpose of development processes with a term 'product development process', since the electronic service or a piece of software are products as any other material objects are.

2   Electronic banking in Finland

2.1   What is a bank?

Bank is *a "business establishment, in which money is kept for saving or commercial purposes or is invested, supplied for loans, or exchanged"* [The American Heritage® Dictionary of English Language[1]]. Banking is *"the business of operating a bank"* [Cambridge Dictionary[2]].

A financial institution is a facilitator between the payer and the payee, a provider of credit and an intermediary between the investor and markets. The role of financial institutions is to transfer information and risk: they invest (transfer, buy and sell) wealth that they govern, from which they gain profit. Banking is mainly transference of money in electronic form, which is one reason why banking services are suitable for Internet.

In general level electronic banking service is the service provided by a bank or financial institution, which enables the management of banking transactions and other banking services via networks. [Syrjänen 2000, 3] In more detail, electronic banking means *"the adoption of information or services by a bank to its customers, via a computer, television or mobile phone"* [Mattila 2001, 81] or complicatedly *"an electronic connection between bank and customer in order to prepare, manage and control financial transactions"* [Mattila, 2001, 81]. Also terms such as "Internet banking", "e-banking" and "telebanking" are used as synonyms for electronic banking. For regular consumers the term "Internet banking" means banking services that are accessed over the Internet with various terminals, such as personal computer, mobile phone or TV.

2.2   Evolution

The evolution of Finnish electronic banking systems began with the banks' investments on extensive giro ATM[3] network, which enabled credit transactions. The pricing of giro ATM transfers was adjusted to be cheaper than credit transfers at the bank counter, and thus ATM services tempted customers. [Jyrkönen & Paunonen 2003, 7] Since the Internet technology

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[1] Dictionary.com, http://dictionary.reference.com/search?q=banking [Retrieved 2.11.2003]

[2] Cambridge Dictionaries, http://dictionary.cambridge.org/define.asp?key=5854&dict=CALD&desc=bank [Retrieved 2.11.2003]

[3] There are two different types of Automatic Teller Machines: cash-dispenser ATMs for cash withdrawals and giro ATMs for credit transfers.

evolved towards the end of the 90's, and most of the Finnish population became familiar with it, Finnish banks saw an opportunity to expand their retail banking services to the Internet. It is clear, that availability and utilization of electronic banking is parallel to the sophistication of IT and development of Internet. Also people's opportunities to access Internet is a factor in the use of electronic banking channels: when in 1999 only 33,5% of the Finns had an opportunity to access Internet, in 2002 the corresponding percentage was approximately 62%, containing people of ages 15 - 74. [Statistics Finland 2001[4], 2002[5]] Especially the pricing has been effective mechanism for controlling customers' banking behaviour towards self-service. Nowadays giro ATM transfers are more expensive than transfers via Internet banking services, encouraging customers to employ those services for all sorts of banking activities. [Jyrkönen & Paunonen 2003, 7]

Banks' motivation for vigorous development of IT-services was not purely in the will to offer better services for their customers or in bypassing the competitors with technology, but in the costs. In order to survive aggressive competition, banks had to reduce their costs. Practically costs meant the personnel, branch offices and internal services. [Syrjänen 2000, Mattila 2001, Karjaluoto 2002] The statistics of The Finnish Bankers' association [2003] show clearly, how the popularity of Internet-based self-service (figure 2.1) correlates with the number of branch offices (figure 2.2) and employees of banks (figure 2.3).

Figure 2.1 Telebanking customers and transactions conducted Finland in 1993 – 2002. Source: The Finnish Bankers' Association [2003]
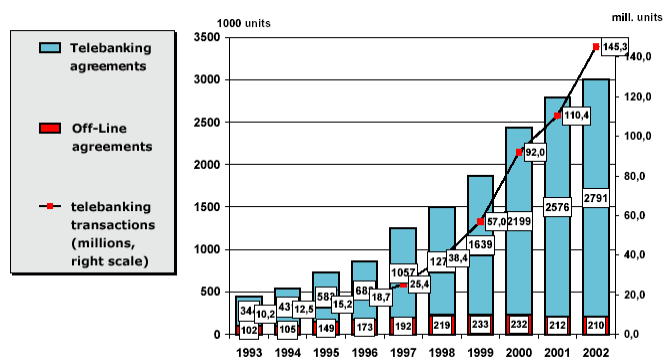
[4] Statistics Finland, http://www.stat.fi/tk/yr/tietoyhteiskunta/tietokoneenkautto_kaytto_taulukko.html [Retrieved 2.11.2003]

[5] Statistics Finland, http://www.stat.fi/tk/yr/tietoyhteiskunta/tietokone_onverkkoyhteysjsskin_kuvataulu.html [Retrieved 2.11.2003]

Figure 2.2 Bank branches in Finland 1993 – 2002.
Source: The Finnish Bankers' Association [2003]
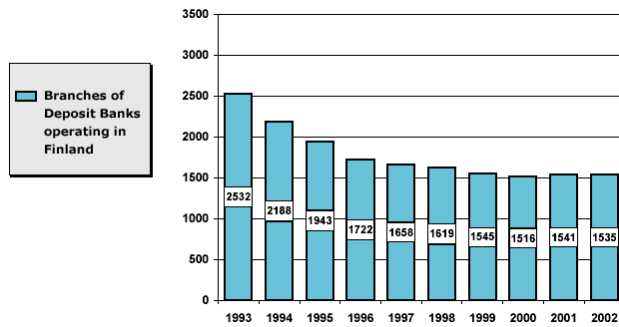
Figure 2.3 Bank employees in Finland 1993 – 2002.
Source: The Finnish Bankers' Association [2003]
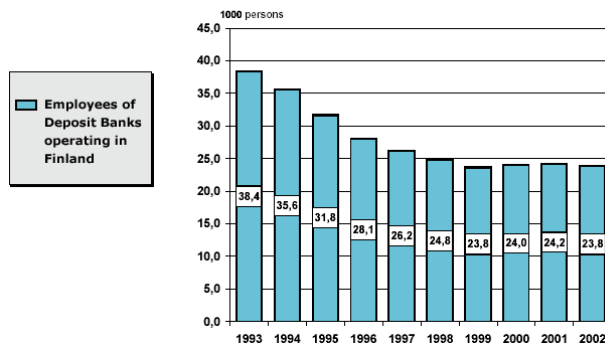
The development of IT was not the only change of Finnish banking industry during the decade, as also the whole approach shifted from the product-centric services to customer-centric services: nowadays banks try to offer more personalized services through all banking channels. The change in bias can be seen for instance in the identification of a customer: back then customers were identified by products, which meant that if a customer went to a bank attempting to withdraw some money, it was necessary to have a bankbook. Or if the customer wanted to withdraw a loan, again he was identified based on a loan's ID. Nowadays a bank customer is recognized as an individual, who has various agreements, liabilities and services with the bank. Also the purpose of branch offices has changed from conducting routine operations towards consulting, for instance customers get private consultation regarding their investments.

It is said, that in Finland electronic banking services are the most advanced in the world. [Castells & Himanen 2001, 23] One reason for the rapid evolution of Finnish electronic banking services could be the small amount of banks and financial institutions operating in

same markets: the fewer negotiators, the easier it is to agree on and develop common standards for co-operation. For instance in United States the development of compatible electronic banking system is much more complicated, since there are hundreds of negotiators with radically different systems, and naturally no-one wants to make more significant admissions regarding their own banking systems than any other involved party.

2.3 Electronic banking channels

Electronic banking services are perceived convenient for the customer: they are flexible, mobile, individual and independent of place and time. [Mattila 2001, 11] The electronic banking is divided into different delivery channels: to PC banking, Internet banking, managed networks, TV-based banking and telephone-based banking. [Mattila 2001, 15-16] The newcomer among these channels is the mobile phone banking, which means that banking activities can be carried through with a mobile phone, whether through Internet or with an application that is installed to the phone's memory. Mobile phone with Internet access goes technically under the Internet banking category, but practically for the user it is different, since the banking terminal is distinguishable. Mobile banking is a combination of telephone banking and Internet banking, and it could be considered as an own category, since in the future also different other types of payment systems may become available through mobile phone.

PC BANKING

A system, where the proprietary software distributed by bank is installed to the computer is called PC banking. With banking software customer accesses services via modem, which is linked directly to the bank. [Mattila 2001, 15] PC banking software gives very good opportunity for developing pleasant user experience for the service, because the technical possibilities of graphic user interface are least limited among electronic banking channels. The drawback of this delivery platform is that the user is tied to one location and device. PC banking was introduced in Finland already in the mid-80s, but it seems that Internet banking services have bypassed PC banking in the popularity already a long time ago.

INTERNET BANKING

Internet banking offers access to the customers' bank and accounts through a web portal by a computer or a mobile phone. Customer accesses his/her services from any location where the

Internet network is available, e.g. from home, work or school, or from any location within the wireless network.

TELEPHONE BANKING

By telephone banking customers access their banking services via fixed phones: calling to Contact Center[6] (which basically means the customer service of a bank) or using push-button telephone for conducting banking activities, such as paying bills. In Finland in 2000 approximately 3% of banking customers used mobile phone for banking, and only 25% of those used banking services via WAP. Most often mobile phone was used for calling straight to Contact Center, which happened in 64% of the cases, and the rest 11% of mobile banking was conducted via SMS. [Mattila 2001, 70]

MANAGED NETWORKS AND TV-BANKING

Managed networks are not very well known in Finland. They are online services provided by another parties, used by banks to deliver their services. As poorly known in Finland is TV-based banking, which uses satellite or cable to deliver banking services to customer's TV screen. Interactive digital television banking services have been piloted in Finland for several years, and by 2003 at least one bank offered services through digital television.

MOBILE BANKING

The newcomer among older banking techniques offers access to banking services with a device, which is familiar to most of the Finns. Mobile banking services are accessed with SMS, Internet connection (WAP, TCP/IP) or in future through high speed 3rd generation Internet connections. [Karjaluoto 2002, 26] There are two methods for managing the personal finances with mobile phone: via online Internet service, or with banking application installed to phone. Internet-enabled mobile phones with browser let customers to access exactly the same Internet, that was previously accessible only via desktop terminals. However, constraints of different sorts (e.g. the physical size of the device and bandwidth) alter the user experience significantly. The possibility of using XHTML-based banking services with mobile phone or other wireless devices (e.g. PDA) could be considered as a big leap forward, if comparing to the previous stages of mobile banking services through WAP and SMS. On the other hand, in the future the mobile banking will get much more

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[6] Previously Contact Centers were labelled as Call Centers, but as the increasing amount of customer contacts arrive by e-mail, the contemporary name was changed to match the usage.

sophisticated, when banking software can be installed to the mobile phone, enabling both online and offline banking. Through mobile Internet service customer could conduct basic banking tasks such as creating payments, viewing account transactions or applying for a credit card, but as the device is small and has it's own technical capabilities, it is not reasonable to offer all possible features through it. For instance, theoretically it would be possible to apply for mortgage via mobile phone, but practically there are obstacles which would make the task highly complicated: restricted text input-methods of the device, bandwidth, the slow and detailed nature of the task and possibly some legal issues related to handling of agreements. Along with mobile phone, customers may use also their other portable devices, such as PDA's (Portable Digital Assistant) for mobile connections. The trend in banking is shifting towards wireless mobile technologies. [Karjaluoto 2002, 25]

3   Design framework of a mobile banking service

In this chapter the design work will be studied from different angles. This chapter mainly focuses on different aspects related to design of mobile Internet banking service. In order to understand how design process is established, it is important to consider design work as a problem solving process, which consists of design problems. Design problem, on its behalf, consists of design constraints, which will be discussed in detail by recognizing their origin and nature. Exploration of constraints is reasonable, because in the beginning of the process designer faces requirements of different sorts, which are difficult to classify – especially if the design assignment is of a new kind for the designer. Design constraints of the mobile banking service will be explored with Lawson's [1997] model of design problems, and the needs for extending the model will be recognized. Since the model of design problems was originally developed for the purposes of architecture, its' utilization in the field of IT (and specifically in the design of digital mobile banking service) requires subjective interpretation. Some extensions to the model of design constraints will be proposed, regarding characteristics of the service development organisation and technology of assignment. Also the end result of design process, concept of design solution, will be introduced briefly.

3.1   Once upon a time there was an assignment

When outlining the requirements for a mobile Internet service, it becomes clear that there are more aspects involved, than the platform for which the service will be developed, or a user for whom the service is intended. The straightforward assumption is that the technology of a mobile Internet service is very close to same of a desktop Internet service, and thus the biggest difference between them is the device used for accessing the Internet. This assumption is not completely incorrect, as indeed, mobile Internet and desktop Internet are alike from technical point of view[7]. However, mobile phone is not a miniature computer. There are two possible approaches for designing mobile banking service. Whether an existing Internet banking service (originally designed for desktop terminals) is modified to

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[7] Some Internet enabled mobile phones with XHTML browser support the same TCP/IP protocol than personal computers, which means that the user can access the same Internet pages via mobile phone and computer. TCP/IP (Transmission Control Protocol/Internet Protocol) is *a protocol for communication between computers, used as a standard for transmitting data over networks and as the basis for standard Internet protocols.* [The American Heritage® Dictionary of the English Language, Fourth Edition 2002, http://dictionary.reference.com/search?q=tcp/ip&r=67, retrieved 17.10.2003]

fit the mobile phone, or the banking service is reconstructed from the very beginning to meet the needs of mobile use. Whatever the approach, device's size remains the same. Mobile phone's interface is compact and gets easily packed: it requires more effort to establish a proper service than by squeezing all possible features to mobile phone's display. [Keinonen & Lindholm 2003, 268] The look should be taken to the initial process of the product development. Many questions have to be answered: why the service is developed, for which purposes, for whom and where it will be used and how is it going to be built. Based on that information, all necessary features –the backbone of the system- should be reorganised and restructured.

Since design is considered rather as a process than the result, attention should be paid to the element creating the process – to the design problems and their substance. Design constraints of mobile banking service can be outlined with Lawson's [1997] model of design problems, which is based on observations and research in the field of architecture. Nevertheless, the generators of constraints (e.g. user, client) and their domains (e.g. formal, practical) in his model are generic enough for the purposes of other design disciplines as well.

Interestingly enough, often the comparison is drawn between architecture and design of digital interactive systems. [Borchers 2001; Kapor 1990; Kim, Lee, Han & Lee 2002; Kim & Hong 2003-03; Tognazzini 1998, 2003] Pattern approach of architecture has been modified and reused for managing the interaction design of software products. [Borchers 2001] Computer's user interfaces have been experimented and researched as metaphors for buildings and physical spaces, e.g. a picture of a branch office's interior as an interface for electronic banking system.[8] [Kim & Moon 1998] A designer of interactive systems has often been compared to an architect, as a person who has a holistic approach to his/her work, who is "*specifying the user experience in every aspect of the construction*" [Tognazzini 2003], and whose task is to create "*attractive, inviting spaces for the people*" [Tognazzini 1998]. One possible reason for these comparisons may be in the short history of interactive digital systems, as well as the lack of tradition in their design.

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[8] Web interfaces of late 1990's seem to have been under influence of multimedia CD-ROM design, since plenty of graphics were used and the low data transfer capacity of networks ignored. Research that dealt with the concept of reliable *cyber banking* interfaces came to conclusion that in order to evoke feelings of trustworthiness and reliability, the banking interface has to be "*designed using three dimensional, dynamic clipart that covers ½ of the total screen size*" [Kim & Moon, 1998, 16]. The result of the study can be seen as a curiosity of it's own time, reflecting the trends of the user interfaces back then.

3.2 Design as a process

'Design' as a word has several meanings: as a verb it means the action of designing something, and as a noun the end result of that process: the plan of a product or the actual end product. When the design project is about the service development, plans do not materialize to touchable products, but to constructions of digital systems that can be seen as software or web service interfaces. Those services can be utilized with devices of different sorts, e.g. desktop computer, PDA or mobile phone. Generally in the field of software design the process of designing interfaces is perceived as straightforward action beginning from the moment when the requirements are handed to the designer[9]. The designer is supposed to produce a plan that meets the requirements by following some design principles, and then hands the plan forward to the next person in the software assembly line. As it is clear for designers considering humane aspects in their profession, usability or customer satisfaction are not qualities that can be added to the product independently from other structures of the product. Design is diversified activity of various tasks and stages, having diverse parties and individual preferences involved, as shown in figure 3.1. In addition several inanimate aspects should be taken into account. A design action resembles diplomacy, as it basically involves negotiation to establish a suitable solution for all parties involved, leading to practical decisions about the product's objectives. Practically design work is problem finding and solving under certain constraints. [Lawson 1997]

Figure 3.1 Involved parties of a mobile banking service
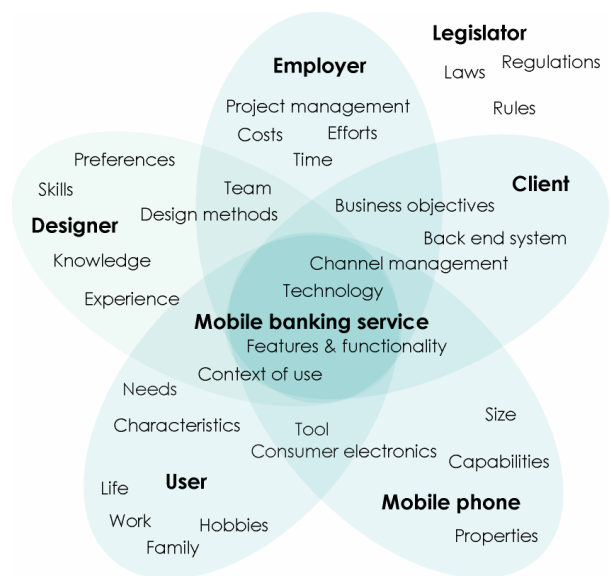
'Design' is not free from reputation within the technically oriented field of software industry. It seems that often it is considered from the engineering point as synonym for complicated, time and effort consuming, artistic and irrational creative action. The reason for the different views lies within the different domains of interests and tasks. An engineer has the interest in the technology, performance and functionality of the system and the processes within, perhaps also in 'the art of coding' in the form of building a compact and economical system

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[9] The designer can be called with several different names, e.g. interaction architect, interaction designer, user experience designer or user interface designer, all meaning basically the same.

with minimum lines of code. Meanwhile the user interface designer has the interest in user, for whom the technology is supposed to be a helper or a tool for making life pleasant (if not easier). Systems that are easily learned and adapted by users may be complicated and time-consuming to build. With efficient and proper communication within product development projects, systems can be built in a good spirit and co-operation.

For the designer the design process itself is important, sometimes more important than the end result. Especially new technologies require a lot of experimenting before they can be utilized in the field of business. For instance it is important to experiment with the mobile phones' technologies, when developing a game, service or product etc. for specific devices. The more failures are faced during the experimentation, the better quality it (usually) means for the product, as the technology's possibilities are properly researched and the optimal features utilized. It is said that the purpose of the design phase is fundamentally "*to make both, the user and the service-providing organization, happy*" [Hiltunen, Luomala & Laukka 2002, 87]. Though the satisfaction of an end-user and a client organisation, (as well as the profits from the successful production), are appreciated, they are not the only motivations for people to engage into the design process. Through the assignment the designer gathers and processes masses of information related to the service, user's tasks, technologies and design methods. The designer will sway between equally good and bad options before making the decisions, which at the end increases his/her knowledge, and develops professional insight to the assignment. From this point of view design can be considered as an action-based method of research, aiming at advancing knowledge. [Lawson 1997, 183]

Sometimes design action (including experimentation) is the only reasonable way of gathering information on special areas of interest, if documentation does not exist or it is difficult to find. For instance it may be difficult to find thorough documentation on the CSS support of mobile phones' XHTML-browsers in the dawn of those devices. Because of that, styles should be found through experimentation: by creating HTML-pages using all sorts of styles with Cascading Style Sheet (CSS), uploading them to the web server and reviewing pages through the mobile device. If the result does not satisfy, pages are modified, uploaded and reviewed again until everything is in its right place. This loop can be repeated dozens of times before the right combinations of useful CSS attributes are found. From designer's point of view this action seems somewhat pointless and frustrating,, since the key is in the access to the information and documentation. When the design process is established with microscopic but significant obstacles, designing fancy user interface for mobile Internet service may be surprisingly long and laborious process. There is also a risk, that significant amount of time and effort is allocated for humble issues covering the serious ones. For

instance the attention is paid to representational problems, while the functionalities and features of the service are not altered enough to meet the requirements of mobile use.

3.3   Design problems

Design problems are pointed to some extent already in the assignment. Whether the task is to design a house on a rocky slope or an interface of mobile banking service, the challenge for the designer is to provide a suitable environment and conditions for a user to fulfil his/her needs. Design problems are based on the constraints, whose purpose is to "*ensure that the designed system or object performs the functions demanded of it as adequately as possible*" [Lawson 1997, 100]. Constraints are brought to project by various parties: There are humane constraints besides environmental and technological ones, and they vary from rigid and mandatory to flexible. For instance laws must be followed, but designers' favourite colours can be discarded. The organisation of the model addresses the flexibility of the constraints in such manners, that the constraints shift from flexible to strict when proceeding from the top to bottom. Lawson's [1997] model of the design problems (figure 3.2) can be considered as a tool for the analysis of design problems, as well as a checklist of things that should be considered during the design process. However, recognising different aspects of design problems with the help of the model does not provide solution automatically, but it "*only indirectly assists in establishing a design process*" [Lawson 1997, 106].

Figure 3.2 The model of design problems (Reproduced with permission from Bryan Lawson)
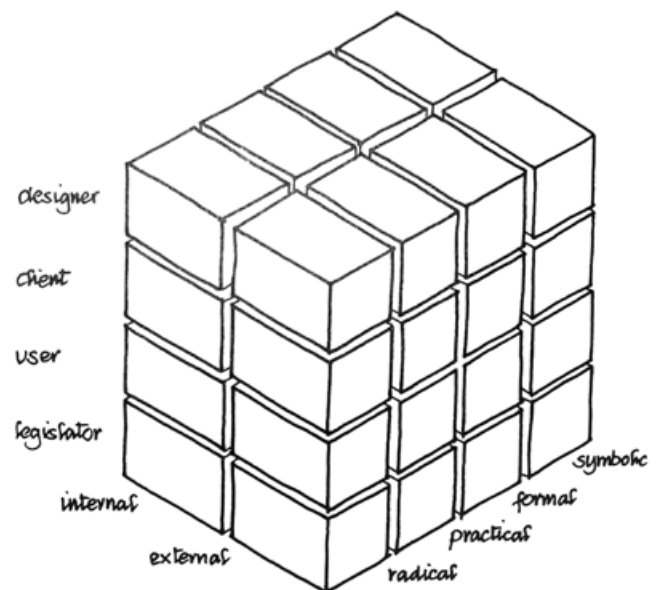
For the designer it is difficult, or even impossible, to address all problems related to the design task, since no one individually can master the subject of production as a whole. [Keinonen 2003, 6-7] For instance, design of mobile banking interfaces requires understanding of banking business logic, mobile technologies, human-centered design principles, and also insight to engineering practices. Thus sometimes the final piece of design may be rather a result of intuition than reason, based on previous experiences and abilities to adapt existing knowledge for new purposes. [Lawson 1997, 121; Keinonen 2003,

6] Especially in the productions based on new technologies, the designer's (or any other team member's) experience does not necessarily provide advantage when tackling new types of problems. For instance the experience in designing web pages for desktop computer gives some advantage for a designer, when beginning to design user interface of mobile Internet service, since there is already an understanding of HTML (which is the basis for XHTML), and limitations of it.

Designers learn about design problems basically by trying to solve them. [Lawson 1997, 53] Since the design problems tend to be complex and appear hierarchically, the first impression of the design task is not very reliable. Designers tend to underestimate the difficulty, time and effort consumed in the design process. [Lawson 1997, 53-54] This is one of the paradoxes of the creative design process being part of the commercial production. The production schedules are partially based on first hand estimations, before a full understanding of underlying design problems is achieved. Also, in the beginning of the process designer does not necessarily know which design problems and which information is relevant to the task, until the solution is attempted. [Lawson 1997, 54] The advantage of iterative product development process lies in the designer's ability to attempt a solution, test it and fix the design accordingly, by finding problematic parts before it is too expensive or late to make corrections.[10] Appendix 2 gives an insight to the evolution of user interface and to specific UI problems that are found and solved during iterative design process.

Quick reactions to the changing (or evolving) markets put all participants of service development projects in the field of IT between a rock and a hard place, since there are often contradictory demands for both quality and rapid delivery of a product.

CONSTRAINTS OF THE MOBILE BANKING SERVICE

When engaging to the work assignment and the intention is to design a service for the mobile Internet, different sorts of aspects should be considered. The user and his needs should be served with appropriate features, though the context and conditions of use remain unknown. Features of a product should meet the needs of users and the business objectives of banks. Technology of the banking device may be novel and thus unknown for all parties. Many of

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[10] This kind of situation is very likely to appear in certain types of production processes (e.g. waterfall process), if plans are not tested with users properly before they are accomplished to actual code. Perhaps the most difficult product development method from designer's point of view is the abovementioned waterfall process, since the actual result can be seen in the end of the whole process. In the end, when the product is about to be launched, it is extremely difficult to alter the UI or task flows, unless clear errors are recognised.

the design constraints are invisible kind, such as those that formulate the routines, methods and resources of the designer.

Some design constraints are very practical ones, for instance the technical performance of the device or the input methods of it. The use context changes, as the device is carried with, altering the noise, lighting conditions and social situation. Also the banking functionalities should be optimised for the mobile phone by finding the core banking functionalities, which fulfil needs of users. Design may be practical form of research, but in addition it is also diplomacy in practice.

Client

Usually a client introduces the design assignment. There is a problem, but the client is unable or unwilling to produce a solution within own organisation. Sometimes clients are also unable to map the problem entirely themselves, in which case they need the help of a specialist. [Lawson 1997, 84]

In the case of mobile banking services, the client is a financial institution or a bank. Client's problem originates from the tight competition on the banking sector, where the reduction of costs is a matter of survival. Savings are gained as the banking services are transferred to Internet and customers are taught to serve themselves via Internet; the branch offices are closed and the personnel dismissed. The assignment is given to subcontractor, consultancy or similar company, because it is economical to externalise IT services instead of building the online banking systems within the own organisation. After banking services have been shifted online, the basic need of the client is fulfilled. However there is an increasing demand for individualised services. The satisfaction of customers should be guaranteed for instance by enabling wider selection of banking tools e.g. interactive digital television and mobile phone. The banks and their customers have firm relationship, because of mutual benefit. Banks play a role that can be seen especially in significant stages of people's lives.

Financial institutions and banks most likely know their needs regarding the content of the online service, or rather, they have an understanding of what kind of functionalities can be provided to their customers, by utilising their own back-end systems containing all relevant information related to the banking tasks. Back-end systems are accessed through online banking service, thus the clients are obviously aware of possibilities and processes within. As well as technical solutions, banks have their own business objectives, policies, internal rules and guidelines that may reflect to the end design.

User

Users are those people, who finally utilize the designed system. Users have their personal, physical, psychological, social and cultural characteristics, which may have an affect for instance on the interaction with the device and the adaptation and conception of the service. Without understanding the user's needs and requirements designer is not able to specify and design a suitable system for the user - though the client or designers' employer might be satisfied with the result. Designer should be able to define who the users are, and what their characteristics are, the tasks the users carry out, under what circumstances they do it and the success criteria of it. [Macaulay 1995, 180] Besides cognitive task-centered usability approaches to a user, there is a demand for developing a holistic perception to an individual person, considering also non-measurable aspects such as individual tastes, motivations, emotions, social and cultural characteristics. [Jordan 2000, Lindholm, Keinonen & Kiljander 2003]

One thing that can be known for sure about the customers of mobile banking services, is that they own Internet enabled mobile phones. Otherwise it is quite difficult to foretell who they are, from where they access the service, under which circumstances and at what time of the day. This note suggests, that the early adopters of mobile banking services could be identified through mapping the current customers of banks and segmenting the result with the target audience of Internet enabled phones. Or the other way around: people who own mobile phone capable for Internet connections may seek for services that let them get the best use out of the worthy device. Most likely the future customers of mobile Internet banking services will be already familiar with the desktop Internet banking, and they demand more flexibility from banking activities. On the other hand, WAP banking has been available for several years already (and increasingly people own WAP phones), but with lame success - indicating that the ability to conduct banking tasks "anytime, anywhere" is not a sufficient reason for people to use mobile banking services. Technology might have something to do with this: people who have possibility to choose between desktop terminal with fixed Internet connection and WAP may choose desktop Internet service, because it enables more banking features and has more pleasant Interface.

Internet service, that is supposed to be used with mobile phone, should be designed with the end user in mind, both in the level of the content and the surface. However it is more complicated task than it sounds, since banking needs may differ radically according to the life situations. The life and needs of a single female student in her twenties are different from a 40-year old mother of two, or from 70-year old pensioner. The target groups of services can be mapped out by customer and consumer researches, the design process itself can be

conducted in user-centered design methods, e.g. by participatory methods, where users are involved in the design process as members of multidisciplinary team. The user requirements can be studied from different aspects, for instance social and human sciences, ergonomics and psychology. When considering this variety of approaches, it is ironic that often in product development companies the target users and features of product are defined by marketing and business strategies, before actually conducting any field studies. [Hiltunen et al. 2002, 67]

It is often reminded that clients are not users; vice presidents of companies are not users; designers of the system are not users. [Lawson 1997, Nielsen 1993] All parties involved in the development of mobile banking service may consider themselves as typical users - as definitely they use online banking services. However, their insight is filtered through knowledge and experience around the topic, and thus their judgements are biased.

Design has much to do with politics: the communication between designers and end users is not necessarily direct and it may be filtered by organisational politics. If the user feedback is directed through (or blocked by) the client organisation, the designer will have a great trouble of understanding users' fundamental problems and concerns. [Lawson 1997, 85] On the macro-level of communication the management of software company communicates with the client bank about what, how, when and in which budget the work will be done. On the micro-level the designer should communicate straight -or indirectly through client organisation- with the users about how the service would serve their lives, needs and tasks. However, there may not be an access to the real end-users at all. [Lawson 1997, 87] Because of politics, designer should sometimes question himself which client has more importance formulating the end result: the paying client or the user client. [Lawson 1997, 87-88] Ignoring these conflicting objectives of different parties and producing "*something that appears to them to be workable*" may bring some short-term gains, but most likely create problems in the long run [Macaulay 1995, 4]. Designer should be very convincing in his/her arguments for the design solutions, because the client pays for the design but the user has to live with it.[11]

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[11] It is also possible, that if the service is perceived too difficult to use by the customer, it will be dismissed. Unlikely the customer changes the bank because of finding online services displeasing, but the risk exists since most of the customers manage their basic banking tasks online, and branch offices' profile is changing towards other types of services, e.g. investment consulting.

Designer

Knowledge and information are abstract concepts, as they do not have a natural form. User interface designer transforms that invisible information into surfaces that can be used. [Norman 1994, 81] Designers are between two worlds of different values, where on the one side there are the technologists working for technology's sake and on the another side there are the individuals/consumers/users who "*want convenience and value, they just want to get on with their life, and their life is their family, entertainment, education and their work* " [Bergman & Norman 2000, 18]. In a sense, the designers profession is somewhere between these two domains, acting as an interface between the technologist and the user (given that ones' guiding principles of design are rather human-centered than technology-centered).

The public considers design often as form of art. However, creative process behind a piece of art is different from a design process - even similar types of talent may be needed for both. Artists are free to explore topics and design problems of their personal interest, unlike designers. [Lawson 1997] Designers may also be considered artistic by the clients, employer and team members: instead of producing a chair, house or the graphics of a web site, they are expected to consider form, space, colour, human factors etc. during the design process. The result is expected to be a carefully pondered piece of 'design' instead of a plain piece of engineering. [Lawson 1997, 87] Sometimes the aura of art is a disadvantage for the designer in the software development environment, as it is traditionally very technology-oriented world where the mutual prejudice between 'hard' engineers and 'soft' designers has existed. [Kapor, 1990; Tognazzini, 2003] However, designer's involvement in a product development process does not create any added value itself, if the conflicting constraints prevent designers' input, for instance quality of product is desired but no funds nor time allocated for reaching it. Designers contribute to design problems also with their personal interests: to some extent they desire freedom when defining the design problems, because engaging to a process requires some personal interest. On the other hand designers need the wages and reputation gained from successful works. [Lawson 1997, 88]

Designers' work is negotiation and diplomacy from two points of views. Firstly, designer must negotiate a satisfactory solution from the basis of often implicit and incompatible requirements, and secondly, designer should negotiate with his/her team members to establish a fluent process aiming at the same target. [Lawson 1997, 111] In order to meet the former, designer should have the ability to recognise and analyse the nature of the design problem and finally respond to it with appropriate design process. [Lawson 1997, 109-110] For this to happen, the designer should be technically competent to understand and react to the demands of technology, and at the same time possess some artistic qualities and well-

developed aesthetic appreciation. [Lawson 1997, 10] In addition designer should have some understanding of the theories of sociology and psychology in order to understand the users and their needs. [Norman 1994, 81] Latter has to do with social and communication skills. Products are developed in multidisciplinary teams, which consist of people from different fields, backgrounds and cultures. Every team member -not only the designer- brings into the project his/her *intellectual baggage*: personal motivations, strong sets of beliefs, views, values and attitudes about the practices of their fields. [Lawson 1997, 185] The professional jargon that each team member uses may be confusing and incomprehensible to others, especially to the end users participating productions as representatives of end users. On the other hand some empathy and skills in interpreting are required from team members as well, since professionals may have difficulties in understanding users, who do not possess similar backgrounds and knowledge of application, concepts or methodologies. [Borchers 2001, 4] For instance, if testing an application and being faced with error, user most likely would not be able to recognize the difference between errors originating from faulty test data or the flaw in application.

Legislator

Legislators create the most rigid and mandatory constraints for design, possibly being the most remote from designer. Constraints created by legislators are those, within which designers must work. Designers may consider legislators overly controlling and inflexible, while legislators may find the designer irresponsible and wild. [Lawson 1997, 89]

Financial sector is supervised and regulated thoroughly by different parties, both nationally and internationally. There are standards, codes and rules, guidelines, agreements and recommendations of how banking is practiced, which do not leave designer much to argue about. For instance in Finland the financial sector is under supervision of The Financial Supervision Authority, FSA[12]. The FSA supervises financial markets and participants in order to promote stability of the financial markets and enhance the public confidence in supervision and market behaviour. The FSA operates independently, but is in connection with Bank of Finland[13], which is the central bank of Finland. The Bank of Finland is under supervision of Finnish Parliament. The Bank of Finland is a member of European System of Central Banks (ESCB, Eurosystem)[14], which operates in the level of EU. The objectives of The Bank of Finland are the same as those of Eurosystem: to promote price stability and to

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[12] The Financial Supervision Authority FSA, http://www.rahoitustarkastus.fi/english/

[13] The Bank of Finland: http://www.bof.fi/eng/1_suomen_pankki/index.stm

[14] European System of Central Banks, ESCB: http://www.ecb.int/

support other economic policy objectives, without prejudice to the objective of price stability. The Bank of Finland is also a member of Organisation for Economic Co-operation and Development (OECD)[15], which is the producer of internationally agreed instruments, decisions and recommendations promoting global economy. As one may imagine, there are plenty of other international operators in the financial domain connected to each other.

Rules, recommendations and standards have an effect on the design in several levels: they may be present statically in user interface or effect in the level of interaction (e.g. navigation or screen flow), depending on the importance of topic. For instance if there is a rule that the customer has to be informed on terms and conditions before submitting the application[16], there are different ways of meeting the requirement: on the level of UI there could be simply a checkbox with a text "I have read the terms and conditions" and in order to proceed, user has to tick the box as an indicator of conscious action. This does not mean that the user has indeed read the information – but by this act the banks responsibility to note customer about available information is accomplished. If the case is more serious and the bank wants to make sure the user has actually visited the page of terms and conditions or downloaded the related documents, the user can be lead by screen flow irrevocably through the page before the submitting the application.

Internal and external constraints

Clients, users, designers and legislators, they all create both internal and external constraints. These types of constraints describe the freedom that is available for the designer. Internal constraints allow more freedom to designer than external constraints, since "*they only govern factors which are under the designer's control*" [Lawson 1997, 98]. As mentioned, legislators are the most rigid in their requirements. Clients, employers and users create both rigid and flexible constraints. Constraints of designer are the most flexible of all. [Lawson 1997, 97] Internal constraints traditionally form the basis of the design problem, and clients tend to express it in the beginning of the process [Lawson 1997, 84]. For user interface

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[15] Organisation for Economic Co-operation and Development, OECD: http://www.oecd.org

[16] For instance European Commission has a recommendation on pre-contractual information that is given to consumers by lenders offering home loans. In this voluntary Code mortgage lenders commit themselves for giving two types of information to prospective borrowers, before signing a contract. 1) General information about the different types of products offered, including the types of interest rate and all additional costs associated with taking up a mortgage credit.
2) Personalized information for the specific product the consumer is interested in, indicating for example the exact amounts to be paid over the full time span of the loan, as well as any possibility and conditions for early repayment. [European Commission, Voluntary Code of Home Loan, http://europa.eu.int/comm/internal_market/en/finances/consumer/homeloans.htm]

designer internal constraint could be the layout of UI elements: navigation menus, headers, icons, body text, images, forms etc.

External constraints are those factors that are not under the control of designer, and sometimes these factors influence so much that the form of design is almost determined by them. For an architect external constraints are e.g. the landscape, climate, movements of the sun and moon; for a fashion designer the production methods of a cloth or the shape of the body. [Lawson 1997, 94] For a user interface designer external constraints are for instance the platform of a product, e.g. personal computer, PDA or mobile phone. External constraints created by employer are e.g. issues related to schedules and working methods. External technological constraints of different sorts also originate from other companies developing their own products, like the mobile device manufacturers improving their platforms and products. As the development of technology is fast and the big hits of the future are difficult to predict, often designers aim at 'a moving target'. Especially if the technology is so new that similar products do not exist on markets, the design process has to begin with an emulation of the target platform. For instance if the task of the designer is to create a mobile Internet service at a time when the Internet-enabled mobile phones are not yet available on markets, the design process is established based on practical external constraint.

Radical constraints

By radical constraints Lawson [1997] means the fundamental reasons for the system or the object being designed. [Lawson1997, 103] The need for school buildings originates from the educational system and in the same manner the mobile banking service is based on contemporary financial system where banks are an important factor of managing finances. As already told, banking is all about transfer - whether it is money, information or risk. The financial institution acts as a facilitator between a payer and a payee, it is a depositor of wealth and provides credit at it's own discretion. In addition it is an intermediary between investors and markets. The radical constraint of mobile banking system is for instance the concept of money as an instrument of trade: it began with squirrel skins, spices and other valuables, then came metal coins, notes and finally it all was transformed to bits of the digital systems. One cannot pay with grains of salt even if trying to do so.

Practical constraints

The practical constraints deal with technical things, in making, producing or building the design. Practical constraints are not limited only to actual production of the design, but they

also cover "*the technical performance of the object during its working life*" [Lawson 1997, 104].

Internet service operated with a mobile phone includes already four technological variables: Internet, mobile phone, browser software and transmission method of data. The technology of Internet in this context means for instance the protocol (WAP, TCP/IP) and the constraints it poses to the services' content, navigation, layout and interaction in general. The transmission method of data (data call[17], GPRS[18]) affects on the speed of connection and the charges it poses to user in form of phone bill. The technology of the mobile phone means the platform and operating system, going very down-to-earth questions such as duration of battery, size of the memory, size and colours of the display. The last but not least variable is the software used for browsing the Internet. There are default browsers in mobile phones and in addition browsers developed by third parties. Practically the same page may look different when viewed with different phones and browsers.

One very fundamental trouble for a designer is the availability of tools. If a certain mobile phone is not on markets yet when the services' design has begun, designer has to rely on the emulator ran on a computer. As a starting point for a piece of design this is a very unstable arrangement, since the designer cannot imagine the experience of actually using the device: holding it, pushing the keys, peeking the display and figuring out the UI logic and mechanisms of the phone. Designer's assumptions about the tool may turn out to be wrong. Especially the input-mechanisms of mobile phones are very limited, and by using the emulator on a computer the designer may deceive herself/himself to underestimate the problems related to handling of the device.

Especially in the field of IT the UI designer works under expectations of change: it is not possible to foretell how platforms, devices or politics within technology will change in period of years. The change is rapid: today's novelties will be history in few years. The lifespan of a service is fairly tied to the technology it is implemented with, which is the technology that is available for the customers. For instance, if the customer does not own an Internet enabled mobile phone, he is very unlike to use mobile Internet banking services either. The User Interface does not wear out as physical objects do, but the underlying

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[17] The data call is based on charges of time (per minute).

[18] GPRS, General Packet Radio Service: "*A GSM data transmission technique that does not set up a continuous channel from a portable terminal for the transmission and reception of data, but transmits and receives data in packets. It makes very efficient use of available radio spectrum, and users pay only for the volume of data sent and received.*" [The Free On-line Dictionary of Computing, http://www.dictionary.com, retrieved 19.9.2003]

system may become obsolete thorough time. Practices and possibilities for interaction change as new tools and devices are invented. Also the social significance of technology changes as the technology blends in everyday life in form of smart devices. Customers' attitudes change and so should those who provide services: user does not want to operate mobile phone in order to access mobile banking service, nor accomplish banking tasks with help of mobile phone; rather user lives her/his life where the personal finances are just one aspect among others, and mobile phone is one available method of managing finances.

Formal constraints

The formal constraints of architecture differ significantly from those of a digital service. Formal constraints may include some rules about proportion, form, colour, texture and material. [Lawson 1997, 104] These qualities can be found easily e.g. from architecture and costume design as through history several genres and styles have been introduced. Jugend castle can be differentiated from modern functional building, the dresses of Italian Renaissance from those of La Belle Epoque.

Since banking services are digital constructions without touchable surfaces, information is building material for that construction. The proportion in this context could mean the proportion of information or the proportion of features, e.g. the service can be aimed at professional investors or average customers interested in investing on stocks. The style of textual communication could be considered as the texture of that information: how customer is addressed for example in error messages and help files, with imperatives or suggestions.

As the history of digital services is short, clear genres in visuals are difficult to address. Technology though gives clear directions regarding the form and organisation of UI: XHTML provides different sort of visual form than Java (J2ME). The formal constraints of mobile banking service could have also something to do with the domain and purpose of visual design in relation to the services' content. If presenting this matter in a pointed view, the designer may follow the ideas of usability or graphic design; the size of the font is chosen in order to be readable or good looking for the purpose. In the case of usability design the service is optimised for communication and transference of information, in graphic design the design is optimised for emotions and evocative visual presentation: both are important aspects which promote different values. These differences might be addressed if comparing e.g. entertaining services with informative ones. Brands and graphical guidelines provide formal constraints, which could be considered equal to construction styles: Nokia's products can be distinguished from Sony Ericsson's just by style and shape of the device and style of user interface, which on the other hand reflects to the whole spectrum of related materials,

e.g. marketing materials, packages and so on. [Kiljander & Järnström 2003, 17] However, there is also history and evolution behind devices and their visuals, which means, that there are different styles within the same product family. In the case of the mobile phone product families, the common nominator for all devices can be the structure of the system, for instance the logic of the User Interface and hierarchical menu that is operated with softkeys. [Helle, Järnström & Koskinen 2003, 56-57]

Symbolic constraints

Symbolic aspects are seldom considered relevant by designers, when it comes to buildings or fashion. Rather it is the critics and journalists who interpret meanings of the piece of design. [Lawson 1997, 106] Seldom the building is initially designed to be a symbol of an abstract thing (except perhaps in totalitarian societies), and as distant idea it is to design a mobile banking service to become a symbol of convenience or global economy. On the other hand, bank may have some values that they try to deliver through their brand: for instance reliability, trustworthiness, care, friendliness and so on. Those symbolic aspects may be mediated through advertisements, marketing materials and all company-related materials from pens to business cards, through uniforms of bank counters to web services. Also customers' expectations towards service could be considered as symbolic constraints, though very flexible ones.

There are several points related to symbolic constraints that require awareness when designing the User Interfaces: the culture and conventions of target audience, colour codes of the society and possible taboos. Icons in the user interfaces are a good example of graphics that may deliver wrong or confusing messages, for instance Finnish post boxes might not be recognized as such in USA. Colours may carry some messages that the designer coming from different culture does not intend to. Some colours are linked to religions and to certain holidays. For instance black, white, red, purple, blue, green and yellow convey some meanings in every continent, but the meaning varies: red in Christianity has a hint of evil, dishonour and paganism; in Catholic culture carmine red is respected colour of priests; in Buddhism it is connected to creativity, life and activity; in Hinduism red represents bloodshed, death and military.[19] When designing a mobile banking service, with current low bandwidth there is no need to consider the symbolic meanings of graphics, since they are anyway kept in minimum. Colours may be picked from client's graphical guidelines, or possibly brought to project by client's trusted advertising agency.

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[19] Coloria, http://www.coloria.net/kulttuurit/uskonnot.htm [Retrieved 24.10.2003]

ADDITIONAL CONSTRAINTS

Lawson's model [Lawson 1997, 107] should be extended in order to map thoroughly the design problems of the mobile banking service. Additions handle mostly the combination of mobile phone, the user and the use context, but also the designer's position in the service development project. The first addition to the model of design problems is the employer. Designer works in a company, that has it's own business objectives. Designer's employer is the party, who sets the production schedules and provides the resources for designer. Designer as an employee cannot make decisions independently from the employer, and that is the reason why employer should be considered as a party creating design constraints. The second addition is the mobile phone. In this case of mobile banking services, the mobile phone as a banking tool poses various design constraints, which are too multi-layered and significant to be only categorised as practical constraints in Lawson's model. If comparing the design objectives of architecture, a building, house or other construction is the end product. In the case of mobile banking service, the service is the end result, and the mobile phone is the tool through which it is utilised. It has been recognized, that the mobile phone is for users more than a tool of communication. Instead of operator and technical device there is a question of person's relationship with technology. [Lindholm, Keinonen & Kiljander 2003, 94] The use of mobile phone also involves social and cultural issues, which are difficult to place anywhere else in the model of design problems, if a mobile phone is not recognised as an entity creating design constraints.

Employer

In the model of design constraints Lawson [1997] considers designer as an independent actor, who negotiates directly with the customer about the work appointment and who is the natural leader controlling the project. However, most designers involved in software development are employees of companies, organisations or other organs that set the framework for their work. Employer has principles, production methods and processes on how the work is organized in the level of the whole company. In addition they have methodologies and product development processes that aim at delivering competitive products, while balancing time and efforts spent in production. (Figure 3.3) In that sort of set, instead of considering *what* to do, the designer mainly concentrates on the question *how*.

As an employee of a company, the designer has to adjust oneself to the organisation, adapting the design methods to the available resources. Designers' impact on the end product may be significant or minimal, depending on the values and the product development culture of the

Figure 3.3 The project management context [Rajala 2002]
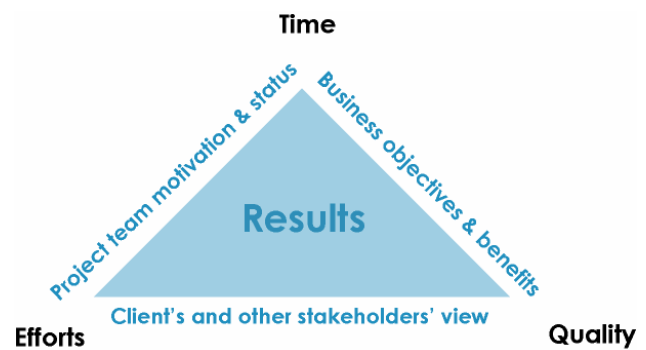
employer. Values of the company in this context mean the practical choices when balancing between cost-effectiveness, time consumption and the quality of a product, as they form the allocation of resources for the designer. The bureaucracy of an organisation can be seen on the flexibility of the design process and the conciliation methods between the members of the multidisciplinary team or departments. The timetables are set in co-operation with customers, but also partners and investors have a say on schedules and business objectives. If the organisation is technically oriented and values rapid deliverables with low costs, a designer might have work in a position of low importance, possibly being overruled in the deadline pressures and thus having also low impact on the end product. In the opposite case the company's production culture might aim at focused products and to the satisfaction of the end user, thus considering the user advocates as key professionals of production to practice user- or task-centered design methods thorough the whole production process, beginning from the market researches and ending to the follow-up of products.

Companies specialized in software development consist of different types of professionals. Projects are always conducted as teamwork, since various skills are needed to design and build a product. In order to understand the tasks, that the end product is intended to serve and the users of it, team should contain *"expertise in human cognition, in social interaction, in the task that is to be supported, and in the technologies that will be used"* [Norman 1994, 105]. Teams consist of different parties having different tasks: there are people responsible for the e.g. management, software engineering, business analysts, user interface design, application domain, marketing, technical writing and graphic design.

Everyone involved in the production process has their own visions of what the final product is and what it could become, if only the criteria would be adjusted. UI designers wish more flexibility, time and resources for testing the plans before they are actualised, proper user research and iteration to bring in quality; software developers wish straightforward solutions in order to meet the schedules with reasonable effort, also technically elegant solutions for

challenge; management wishes efficient results in cost-saving methods to keep the budget in balance. Trade-offs are difficult decisions, which should be treated in diplomatic manners: parties 'losing' in the trade-offs will may feel both neglected and being kept from doing qualified work.

Device

The device is the tool with which software products or online services are accessed. The mobile phone as a device is a physical object, a sophisticated piece of consumer electronics that may contain several different types of software products along with the original purpose of placing calls to other people. The mobile phone, as a tool for accessing mobile banking system over Internet, has much significance for user and for designer. For the users mobile phones are part of life, on the other hand enabling straight communication with other people but also being part of their social self-image. Mobile phones have a significant impact on the society and culture. For a designer a mobile phone poses very practical limitations regarding the design of the service, for instance page layout is affected by the size of screen where HTML elements for certain banking tasks have to be fit. The device can be considered as a practical constraint in Lawson's model [Lawson 1997, 107] but on the other hand it is the platform, physical object placing very special requirements to the service's design. Mobile phone places especially practical and formal constraints, and it is considered to be in the interests of the client, the user, the designer and the employer, perhaps also the legislators. Most likely the client is interested in the device through business objectives, as an extension in their banking services, and as a piece of technology that should communicate with the existing banking systems. The user owns the device and carries it with as 'a garment', tool, entertainment or whatever the user finds from it. The designer is interested in the technology of the device and the things it affords regarding user interfaces. The employer considers what sort of expertise is required for developing desired systems for mobile phone, and finds those resources for the production. Legislators are interested in the laws, rules and regulations related to the use of the device, or the users of device: for instance SMS-advertisements are allowed in one country and forbidden in another.

Though there are varying types of mobile phones with Internet browsers on the markets, manufactured by different companies, they have at least something in common: methods for scrolling the web page and clicking the hyperlink. For the text-input there are several options: keypads in different layouts and touch screens that enable writing straight to the phone's display with a pen-like stick. The standard mobile phone keypad is called ITU-T, which contains 12 keys. In this keypad characters from A to Z are accessible through number keys from 2 to 9. Some phones have the keys in standard QWERTY -layout, in which the

keys are in the same order as in computers or typing machines. Also other systems exist, but these two are the most common in phone's keypads, at least in cultures where Latin character systems are in use. In addition there are different methods for text input with keypad: with *multi-tap input* user taps each key as many times as is required for finding desired character under specific key. *T9* and other *disambiguation methods* require only one tap to each key for inserting a character, because they use the dictionary for finding the closest match to the typing. [Silfverberg 2003, 159]

3.4   Design constraints of each generator

Following tables present the constraints of each generator. Some constraints may stay unnoticed or otherwise they are difficult to categorize unambiguously with this model. Also some constraints overlap each other, depending on the party's bias: for instance legislator provides laws, rules and recommendations, which are possible to accomplish in several ways. Client organisation on its behalf may have internal policies how those laws are taken into account in their services. This categorisation of mobile banking service's constraints does not come out totally smoothly, since matching practice of actual design and abstraction of the model requires indeed some interpretation: for instance it is sometimes difficult to make a division between technical and representational constraints, since they go very much hand in hand. Some constraints require further inspection, since these summaries present the absolute minimum of constraints for the establishment of the banking service, which does not -however- guarantee that the service has some quality.

DESIGNER

Designer brings to the project only flexible constraints, since the designer is the one responsible for finding a solution for design problems. (Table 3.1) It is always easiest to compromise from the self-created constraints. Practically only designer's skills and knowledge of the technology are those constraints, which affect on the end result. On the other hand, part of the designer's work is to learn and increase the professional knowledge of novel things.

Designer may have some attitudes and ideologies towards global economy and business in general, which could be considered as radical constraints. Those attitudes determine, if the work assignment is meaningful for designer or not. Seldom designers are free to choose their assignments themselves, though wages and reputation from successful work may compensate the trouble. From the practical domain the designer is free to construct the user

interface with given technology and resources. The employer determines how much and what sort of resources are given to the designer, and once those are available, designers usually may decide themselves how the work is organised in given situation e.g. which interfaces and which features will be tested.

The designer may suggest from her/his part which features and information are important for the user, given that the designer knows who will be the users of the developed system. Personal tastes may be involved when designing the user interfaces, e.g. the colours and the style may be characteristics of a particular designers work. On the other hand, if the client has a strong brand and graphical guidelines, the designer's taste preferences does not really matter.

Table 3.1 Distribution of designer's design constraints

	Internal / Flexible	External / Strict
Symbolic	N/A	N/A
Formal	• Skills, knowledge and professionalism. Ability to adapt old information to new context and to learn more. Ability to visualise service that will be accomplished in novel technology. • Validation of information: spotting important and unnecessary features. • Insight to user and her/his tasks and context of use. • Understanding and perception of the users' tasks will guide the creation of UI. • Taste regarding UI style and graphics.	N/A
Practical	• Practical skills, knowledge and professionalism related to preparing the product. Understanding of technology's properties. • Construction and organisation of UI, with given technology and resources. • Organisation of the design work. Professional insight to design methods and practices, e.g. user-centered design methods, participatory design etc.	N/A
Radical	• Designer's attitude towards banking business, ideologies. • Wages and reputation from work.	N/A

As mentioned earlier, designer is the most flexible party that is involved in the production. Figure 3.4 illustrates the domain of designer's constraints. This division to flexible and strict constraints is based on the idea of properly functional product. The external (strict) constraints are those, which must be taken into account, if 'good enough' design is desired. Internal (flexible) constraints are handled as background aspects that increase the overall

quality, work, environment or the design process in general. The significance of each area is marked with such a colour scheme, that the lightest colours point the most flexible and negotiable areas and darkest colours the most significant requirements.

Figure 3.4 The distribution of designer's constraints
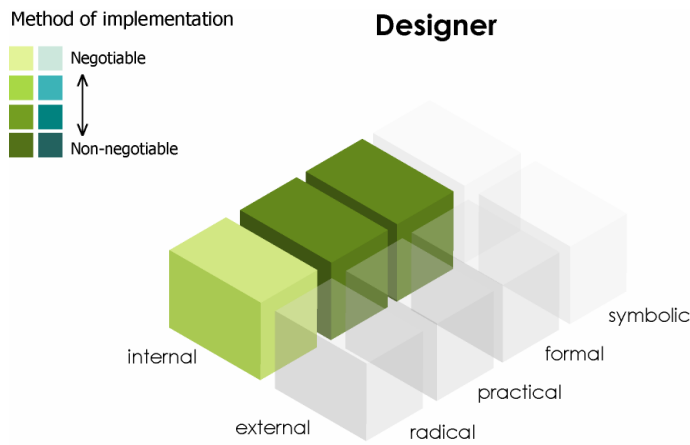
EMPLOYER

Employer generates mostly strict design constraints, as presented in table 3.2. The fundamental reason for an employer to be involved in the service development business is clearly the expectation of profit from successful deliveries. Good reputation brings more clients and resources, e.g. employees and investments.

The employer is responsible for managing the whole project: the integration, scope, time, costs, quality, human resources, communications, risks and procurements. All of these are strict constraints for the designer, which cannot be ignored. The only flexible constraint from the party of the employer could be the team's micro-management: when tasks are appointed to teams, they may have the freedom to manage among themselves how the work is practically conducted, and in which order the tasks are done.

Table 3.2 The distribution of employee's design constraints

	Internal / Flexible	External / Strict
Symbolic	N/A	N/A
Formal	N/A	N/A

(continues)

Table 3.2 (continues)

Practical	• Employer may give freedom for teams to organize their part of the work assignment individually within certain frame of time - as long as other teams are kept informed and the end result appropriate: something that works in the real life.	• The project management context: Quality vs. efforts vs. time • Project integration management • Project scope management • Project time management • Project cost management • Project quality management • Project human resources management • Project communications management • Project risk management • Project procurement management
Radical	N/A	• Money: profit from successful delivery of a product and fulfilled contracts • Reputation from successful work; amount and scope of contracts with clients. • Business strategy, e.g. expanding the scope of services. Partners and stakeholders may have a say about the directions.

Figure 3.5 shows that the employer does not intervene in the representational issues. Employer guards the technical production and the actual work process in the level of the whole company. All sorts of management in the company naturally influences on the designer's work as well, but it may depend on the production methods and company values, how strong the effect is. Chosen product development method of the company may be challenging or uncomplicated for the designer.

Figure 3.5 The distribution of employer's constraints
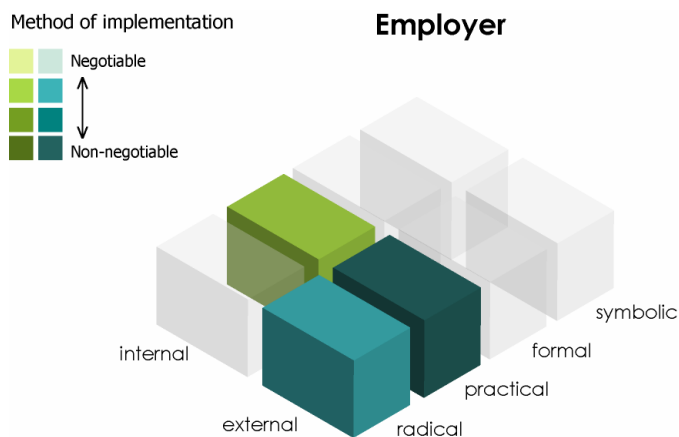
CLIENT

Design constraints of a client are shown in table 3.3. The fundamental purpose of a bank is to facilitate transactions, provide credit on it's own discretion and to intermediate wealth between investors and markets. Introducing new channels of self-service will reduce the costs of banking, which is the fundamental reason for the client to involve into the production. Money is essential part of survival in our society, and banks are the key institution for handling wealth. The role of financial institution may vary though, for instance client may be specialised in certain type of banking or serve only specific customers.

Table 3.3 The distribution of client's design constraints

	Internal / Flexible	External / Strict
Symbolic	N/A	• Company values. E.g. how feelings of reliability and trustworthiness are evoked in customer.
Formal	• Bank's approach to user, how she/he is addressed. • Preferences in the visual organisation of the system. E.g. order of the input fields. • Professionals of the bank revise design and suggest changes.	• Features and information of the service, their construction and proportion. • Brand guidelines, visual practices. • Clients' guidelines of banking practices, e.g. at which point user must authorize transactions.
Practical	• Bank's strategy of implementing the service: may affect on the schedules or the order in which design work is done since revisions of design should be done by client's system professionals.	• Back end system of bank. Possibly some new piece of code should be built in between mobile web portal and back end- • The technology, in which mobile banking service will be built. E.g. XHTML or WAP- Delivery schedule and the scope of work.

(continues)

Table 3.3 (continues)

Radical	• Bias of the role. E.g. an expert in the investments and wealth consultation, or a retail bank-	• The way finances are handled in general. Clients' role as facilitator, provider, intermediary; risk and information transference. • Aggressive competition in banking brings in the need of reducing costs. Self-service equals cost effective banking. • Money as the prerequisite for staying alive in our society. Bank is essential for handling personal wealth, since no one could survive without a bank account. Salaries, grants, everything is paid straight to the account. E.g. it is decreasingly possible to pay bills with cash straight to companies' customer service.

Figure 3.6 shows the variety of the client's constraints. In general level banks are very thorough in their requirements, because their line of business is very serious. They govern wealth of other parties, thus they have to be 100% sure that all new systems will work together with the existing systems.

Figure 3.6 The distribution of client's constraints
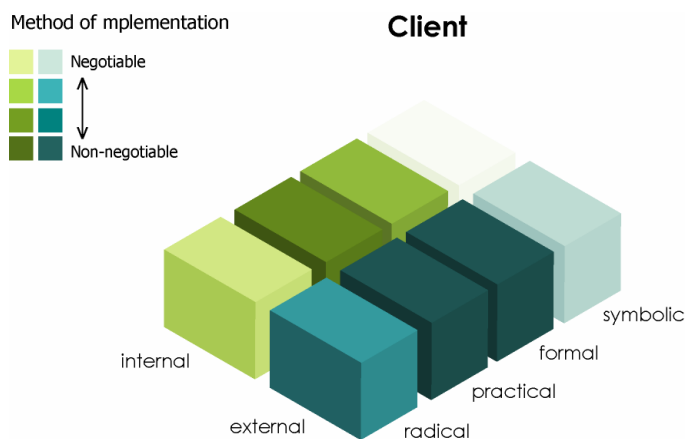
The client bank may have some values and objectives that they try to intermediate to their customers, such as trustworthiness and reliability. The form and 'texture' of the information may be determined by company's politics, marketing and brand. Some practices can be seen in the structure of the designed system, for instance the fixed practices of when and how users are authenticated. The demands for the technical system are very strict, because banks have a great variety of software, operating systems, servers, databases and all other sorts of

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systems to integrate and control. The integration of the technical systems is a long process in general, because all new additions to the systems are thoroughly tested before launching the product for the use of their customers.

DEVICE

The design constraints of a device are presented in table 3.4. From the practical domain it should be made sure, that all phone models with the XHTML-browser will show the user interface of the service as intended. Technically designed system should be such that functions in the real world and in a real use. All security-related issues must be taken care of, as well as the overall technical performance of the system. Banking features should be produced into the design with the given technology, in a way or another.

Table 3.4 The distribution of the device's design constraints

	Internal / Flexible	External / Strict
Symbolic	N/A	N/A
Formal	• Functionalities & tools that aid the use. E.g. payee registers, possibility to save incomplete payments. • UI style, colours, images. • The structure and organisation of information on UI. • Task & screen flows.	• Banking functionalities must be suitable for the mobile phone. Features that conflict with the mobile use should be avoided, e.g. time-consuming functionalities. • Content should fit the device. Information should be retrenched to absolute minimum, still to offer enough features and functionalities. Information in reasonable chunks: prioritised and presented compactly. E.g. error messages are kept short and informative.
Practical	N/A	• Mobile phone: size of the device, type of keypad, interaction methods, UI hierarchy of device, type of screen (Colour screen or monochrome). Browser software. • Security of the system, safety measures in level of mobile phone and service. E.g. if mobile phone is stolen, none should be able to take an advantage of password lists. Or additional security measures in the domain of service, if the passwords and user ID are stolen. • Stability, automatic recovery of information if connection fails.

(continues)

Table 3.4 (continues)

		• Chosen technology of the service and the capabilities of it, e.g. XHTML, WAP, Java. • UI of the service should be compatible with all phone models with XHTML-browser.
Radical	N/A	N/A

The purpose of strict formal constraints is to ensure, that the banking functionalities are selected considering the nature of mobile phone and it's use. Also the features of the service -and how they are presented in the user interface- should be taken to a bare minimum. The dilemma in this case is the proportion of simplicity vs. functionality. The product should offer enough information and functionality for the users, but at the same time keep them in minimum for preventing clusters on screen. In flexible formal domain lies a suggestion of the aiding tools, which would help the user in his/her tasks. Such tools are especially beneficial, if tasks are time consuming and complicated, requiring a lot of typing and memorising. Information should be organised on user interfaces both on the level of the one screen and task flows, i.e. task divided to sequence of screens.

Mobile phone poses mainly practical and formal constraints, as seen in figure 3.7. Mobile phone is a very challenging device for the device, since its constraints are various and their nature tends to be strict. Also the combination of the user and the device brings other challenges apart from representational and technical constraints. User's relation to the device is handled further in the chapter 4. Characteristics of the device and its use are examined in chapter 5.

Figure 3.7 The distribution of device's constraints
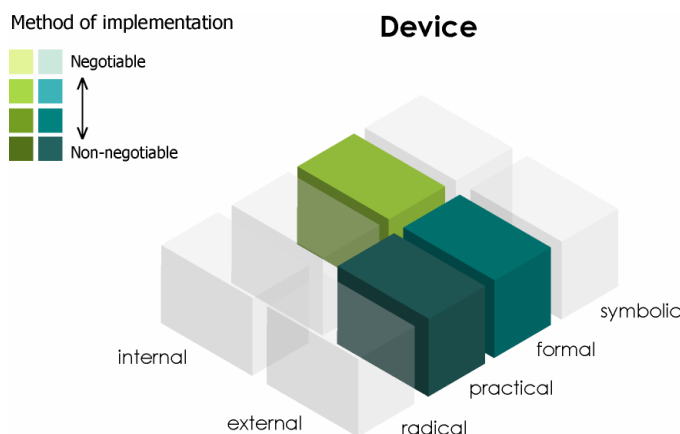
USER

The user poses both strict and flexible constraints to the design, as shown in table 3.5. The strictest demands are those that affect on the actual use of the system. For instance colour-blind users should be able to use the banking service despite their physio-characteristics, thus enough contrast should be provided in the UI elements. From the technical point of view the service should be such that functions in user's phone. This is very demanding requirement, since there are all sorts of phones with an XHTML-browser on markets, and they all differ from each other technically. This means trouble for both designers and engineers, since it is technically very difficult to build universally compatible services.

It might be good to consider the amount of information on page also from the economical point of view. User pays for the connection to service, whether in the form of transferred data (as in GPRS), or based on time (as in data call). The less time is spent on the service, and less unnecessary information is packed on the service, the cheaper it is to use and thus perhaps more appealing for customers of the bank. As a prerequisite for the design work there should be an understanding of the varying use contexts and their significance, since users may perceive the features and quality of the service differently in different contexts.

It is essential that the features of the service meet the needs of the users. The technical functionality of the service should be correct, otherwise it is difficult to establish usability in it. It should be also taken care of by basic usability design practices, that people are able to use the service independent of anthropometrics and with different physical and cognitive abilities. It is beneficiary to understand users holistically, but practically it may be difficult to process those ideas to the design of the banking system. Users' values towards Internet services could be considered as flexible symbolic constraints, which suggests that taking users values into account and producing them into the design, the service brings an aspect of quality to user's every day management of finances. User's expectation towards quality of the service is important to recognize as well, since they partially determine if the service will be used on a regular basis.

Table 3.5 The distribution of user's design constraints

	Internal / Flexible	External / Strict
Symbolic	• Values related to Internet services: convenience, transparency, guaranteed fulfilment, security, personalization, proactivity, timeliness, choice and interaction. • Expectations of quality: reliability, responsiveness, competence, accessibility, courteousness, communication, credibility, security, understanding and tangibility.	N/A
Formal	• Pleasure-based approach to design: anthropometrics, physical and cognitive abilities, taste preferences and identity issues of user.	• Usability approach to users: anthropometrics, physical and cognitive abilities of user. • Usability of service: easy to learn, efficient to use, supports memorising, brings up few if none errors, is satisfactory. • Banking needs and tasks of the user: appropriate features on demand.
Practical	• Costs of using service with mobile phone, connection type (GPRS/data call). • Factors that appear in the use context. Emotions, time of the use, movement while using, social context and physical context.	• Service should be such that works technically in various mobile phones. E.g. members of the family access services with different devices.
Radical	N/A	N/A

User's requirements for the mobile banking system are very traditional kind. (Figure 3.8) It must be assured that user's can use the service –at least to some extent- regardless of their physical and cognitive abilities. By flexible-formal constraints it is acknowledged that different approaches to users and their characteristics, values and expectations are demanded. Users will be handled further in following chapter 4. Users' expectations towards the service will be handled partially in chapter 6.

Figure 3.8 The distribution of user's constraints
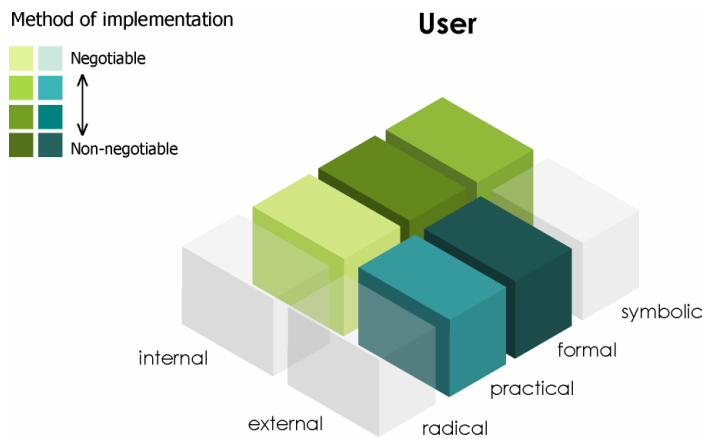
LEGISLATOR

It is impossible to map all possible constraints of legislators, since they are very thorough, versatile and plentiful. It is impossible to present exact constraints, since legislators regulate all sorts of imaginable and unimaginable things. Examples of legislators' design constraints are presented in table 3.6.

There are several instances controlling the financial markets and banking business. Electronic banking services are regulated as any other services, but because they involve money (which is in interests of many, both in good and bad), all possible security measures etc. are legislated. The designer will meet these constraints in both flexible and strict form, since all constraints of legislator are not mandatory. Rather, some constraints are 'recommendations', which will be converted into rules, if they are not generally implemented to banking services.[20] Some information is strictly legislated, for instance the fee of the service must be clearly available when such features liable to charges are utilized. Legislators may not be interested in detail, how the laws are actualised in a product or service - as long as they serve the purpose.

Table 3.6 Examples of legislator's design constraints

	Internal / Flexible	External / Strict
Symbol	N/A	N/A

(continues)

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[20] For example The Voluntary Code of Home Loan by European Commission,

http://europa.eu.int/comm/internal_market/en/finances/consumer/homeloans.htm

Table 3.6 (continues)

Formal	• The way regulated information is made available for user, as long as it happens. E.g. the task flow leads user through pages with required information, or in the UI as additional information.	• Laws regarding content, features of the service. The information that must be available to user.
Practical	• The way laws are actualised within the product, as long as they serve the purpose.	• Laws related to actualisation of the service, the technical system: How authentication, authorization, security, digital signatures etc. are regulated.
Radical	• Recommendations of banking practices, which however may be made into laws if they are not accepted voluntarily	• Laws, rules and regulations of economy, the way how banking is legislated. Both national and international institutions, organisations and other organs control those practices.

Legislators govern all sorts of design constraints, which are difficult to specify without a proper case study. Also without brief cases it is difficult to explore how legislators effect on the design process (or to the end result), because every case is different – and such are laws. However, constraints of the legislators are presented in the figure 3.9.

Figure 3.9 The distribution of legislator's constraints
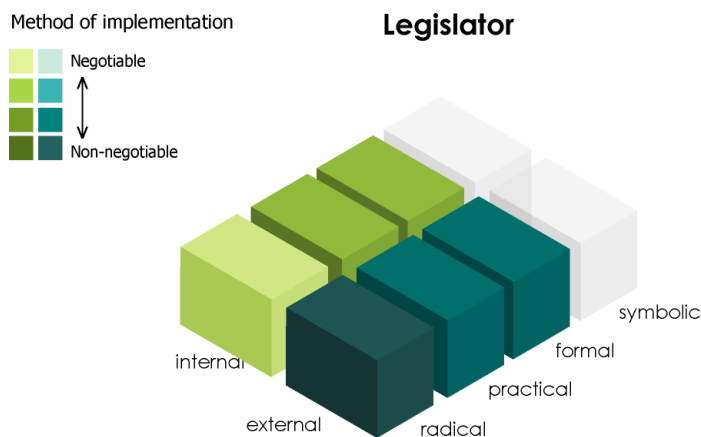
3.5   Design solution

Design problems cannot be solved independent from each other. For instance laws and legal issues cannot be applied to a mobile banking service without altering the screen layout, screen flow or organisation of tasks. Since the piece of design is holistic response to the design problems, there is an infinite amount of possible design solutions to design problems. [Lawson 1997, 123] Seldom –if ever- optimal solution is captured in a piece of design, as it is a result of negotiation, diplomacy and compromising. As Lawson [1997] notes, design process ends when whether running out of time or money – or coming to a conclusion after approaching the topic from different angles, that any significant improvement will not be gained by continuing the pursuit of a perfect solution. [Lawson 1997, 53] After months (or perhaps years) of sweating with The Plan, the outcome should be something that can be actually built. The design work should be also conducted within the budget and the result should be competitive in the real world.

Since design is a practical method of research, which ultimately aims at solution, there is also a risk of being mistaken. All design decisions are based on current knowledge, technology and perception of what is suitable response for current problems. Sometimes product gets life of it's own after the launch, when being used in different way than it originally was meant. It is sometimes a mystery how the piece of design/product finally effects the society or culture. For instance the mobile phone as a consumer product of masses has changed the way we communicate with other people, how we behave and socialise. It is also ironic, that today's design solutions will make contributions to the design problems of the future. [Lawson 1997, 122-124] For instance operating systems of computers (such as Windows or Mac OS) present example of software engineering, which caused some trouble 30 years later. Programmers back then possibly could not imagine, that their piece of software would be in use for over 30 years, since they decided to drop few first digits from the information describing the year in the system. That would cause panic and headaches for administrators worldwide, when expecting the turn of the century 1999-2000. The trade-off between completeness of information and space consumption created the 'Y2K'[21] problem (which finally turned out to be harmless).

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[21] Many software programs that were written years ago represented the information of a year in two digits instead of four. The problem with this approach was the turn of the century, when the year 1999 turned into 2000. The programmed computer logic assumes that those numbers get larger. It was widely speculated that after year "99" the year "00" would confuse and break computing systems that were not prepared for the millennium. [Whatis.com, http://searchwin2000.techtarget.com/sDefinition/0,,sid1_gci211494,00.html]

3.6   Summary

In this chapter the design process was introduced as a problem solving process. The design process can be also considered as an action based method of research. The design process is established with a design problem, which contains more aspects than are perceived in the beginning of the work assignment. Lawson's model of design problems [Lawson 1997, 107] can be used as a tool for mapping and categorising holistically design constraints of mobile banking service that is developed in the field of software/service development industry. The terminology of Lawson's model can be perceived as valuable knowledge for designer, because without fixed terms it is difficult to communicate design problems comprehensively to other people, who are participating on the multidisciplinary team of service development. There is a need for comprehending holistically the production and the motivations involved, because design work is basically negotiation and diplomacy, aiming at a solution that is suitable for all parties involved.

Design constraints of the mobile banking service are generated both by human and inanimate parties. Users, clients, designers, employers and legislators are recognised as humane generators of constraints. Mobile phone is suggested to be a generator of it's own, since it has a significant role as a platform for the service. Mobile phones also have a role in user's life, not only as a gadget but also as a means for socialising with other people. All of those parties generate both flexible and rigid requirements for the design, which may be from the practical, fundamental, formal, or symbolic domain. The design constraints of mobile banking services seem to be much of the strict kind: device, client, employer and legislator create mainly strict constraints. The users create mainly flexible constraints, but the strict ones are extremely important to be established in the piece of design. The designer brings to the project basically flexible constraints, since it is designer's role to negotiate a design solution with all parties involved.

It can be seen that the practical constraints concern each party, when these constraints of each generator are put together in figure 3.10. Symbolic constraints, on their behalf are those least demanded aspects of the mobile banking service. The service itself may symbolize comfort, convenience and choice - or at least such aspects are brought to potential users in marketing letters. In addition bank may want to promote some abstract values with their brand, e.g. reliability, responsibility and security.

Figure 3.10 Design constraints of the mobile banking service. Lawson's model of design problems is reconstructed.
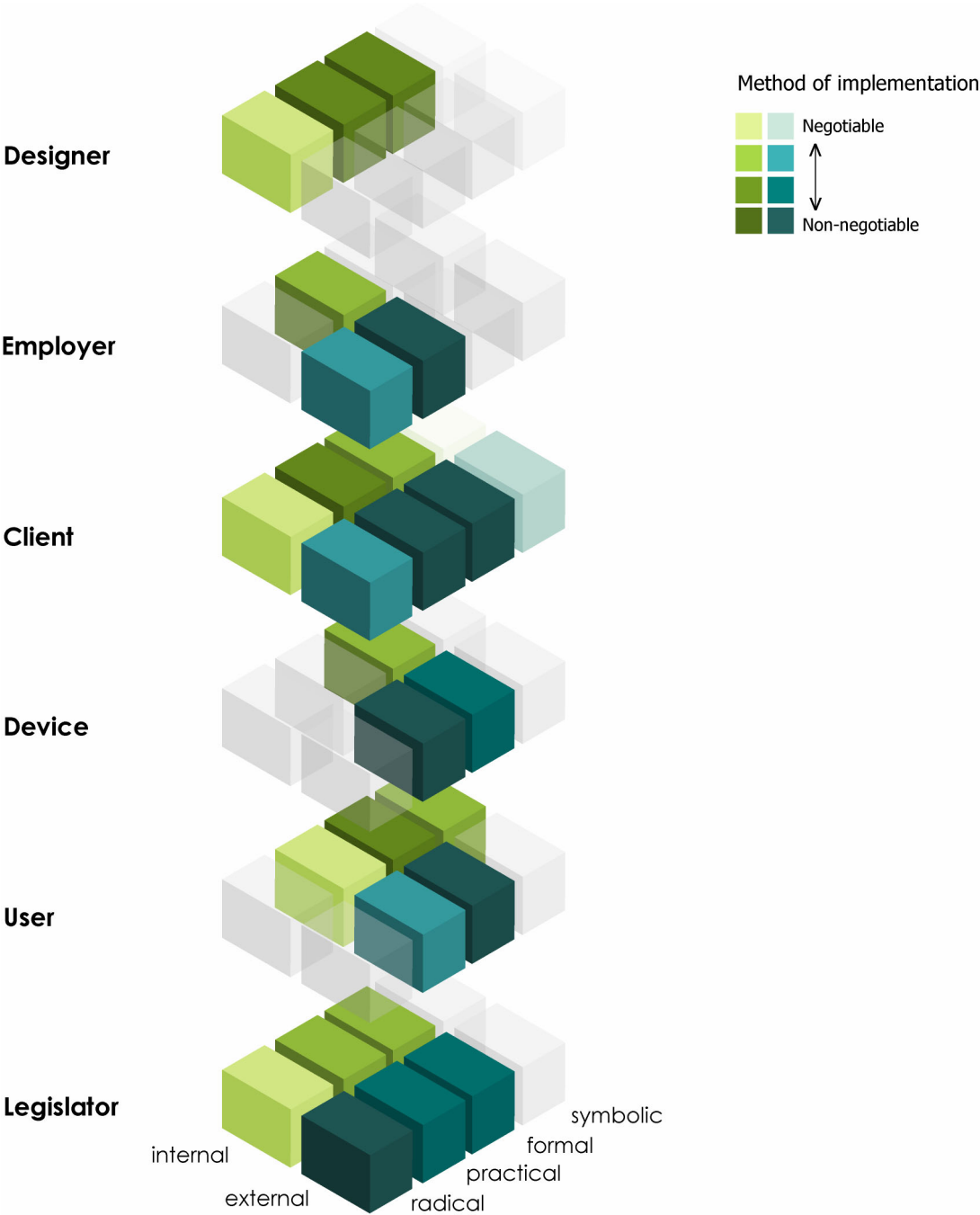
4   Knowing the audience

In this chapter the various roles of the end user will be discussed. An individual, who finally utilises the mobile banking system, is at the same time a customer of a bank, a consumer of electronics and the user, depending on the perspective. A person is a customer to a bank, which often plays an important part in people's lives. Banks try to keep their customers happy and at the same time seek profits from doing that. An individual is considered as a consumer of gadgets and technologies, when it comes to the person's relationship to mobile phones. From a usability designer's point of view, a person utilising the design or product is a user. The need for widening the perception towards users will be discussed, and examples for holistic approach to users are sought from the field of industrial design.

4.1   Customer

A customer is someone that buys goods or services: "*One who regularly or repeatedly makes purchases of a trader; a purchaser; a buyer*" [Webster's Revised Unabridged Dictionary 1998[22]]. The customer of a bank purchases services: the bank facilitates transactions, provides credit and intermediates wealth. Bank's relationship to its customer is tight, as it is involved in the customer's important phases of life, when significant decisions are made regarding the short or long term commitments. For instance a family applies for a mortgage, when a child is born to the family and there is an urge for larger apartment.

Before producing a single sketch of a product, there should be an idea of the target audience. If the market research and the competitor analysis have been done properly and the target groups are classified and segmented from the population, then there should be available profiles of different customers. Most likely the bank has well-defined profiles of their potential mobile banking customers, to be given to the company that will develop the mobile banking service. Target groups can be classified to the different categories for instance by the geographical region, socio-economic state, age and gender. [Routio 1996-2003[23]] It is not enough to know who the customers are: their expectations are equally important, because they "*form a criterion against which the performance and pleasantness of service is measured*" [Hiltunen et al. 2002, 11].

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[22] Dictionary.com, http://dictionary.reference.com/search?q=customer [Retrieved 26.10.2003]

[23] Routio 1996-2003, Arteology or the Science of the Artifacts: Analysis in Product development
http://www2.uiah.fi/projects/metodi/13a.htm

The target groups of Internet banking services are *the sovereigns*, *the cools* and the *insouciants*. All these mentioned groups show a great interest in the electronic banking and they search carefully information about the services. The sovereigns are mainly interested in saving money by lower transaction costs, the cools adopt the technical innovations and the insouciants expect more comfort, though they are worried about the security issues. [Locarek-Junge et al. 1998, according to Mattila 2001, 36] Before the year 2001 there was an image of the typical Internet banking customer being young, relatively wealthy and highly educated person with a good knowledge of computers and Internet, who belonged to the conservative or liberal-intellectual upper class or partially to the career-orientated upper-middle class. [Mattila 2001, 36] The typical Internet banking user of the 2000 was found to be a middle aged, married male: the age or the gender did not correlate to the use of Internet banking services as much as the marital status did. [Mattila 2001, 62] The usage of mobile phone as a banking tool was very rare in the 2000, and *"almost nobody"* used them for the banking activities [Mattila 2001, 63]. Only 3.1 percent of all bills payments were accomplished via SMS or WAP. [Karjaluoto 2002, 90] Naturally customers are not a homogenous group, but rather there are different approaches, attitudes and individual needs that form the groups of the users. For instance the customer may have a certain level of the Internet banking experience, being a beginner, an intermediate or an expert. [Mattila 2001, 36]

The customers of the Internet services value 1) *convenience*, 2) *transparency*, 3) *guaranteed fulfilment*, 4) *security*, 5) *education*, 6) *personalization*, 7) *proactivity*, 8) *timeliness*, 9) *choice* and 10) *interaction*. [Cascoyne 1997, according to Mattila 2001, 39] These values are also common among the customers of the Internet banking services: convenience is important, since people are stressed by work and they have decreasingly free time; people need comfortable and intuitive interfaces, they do not want to tackle with the complicated terminology and complex hierarchies; they definitely demand guaranteed fulfilment, not to mention security; most people value personalized services with a timely response as well as updated and immediate information; they demand various features and diverse products. [Mattila 2001, 39 - 40] People may not expect education from the banking services, but banks are very eager to educate their customers about available products and services. After all, it is a question of a profit, as in any other field of the business. Also an interaction with the banks personnel is decreasing when using Internet banking services, though the online banking services have often an in-built messaging system, which enables the communication between the user and the personnel. Also every now and then there is a need to consult an office clerk face-to-face.

Though customers consider price as a very important criteria when adopting the service, also the speed of the service and the reputation of the bank are important. Accessibility, functionality and low price are essential, but the most important aspect of all is the customer's attitude towards the technology itself. [Mattila 2001, 41 - 42] In 2000 the biggest barriers for the use of the Internet banking services were e.g. the belief, that one cannot get personal service from the Internet banking services, and the customer's lack of experience with computers and Internet. [Mattila 2001, 74]

4.2   Consumer

A consumer is someone who consumes, "*especially one that acquires goods or services for direct use or ownership rather than for resale or use in production and manufacturing"* [The American Heritage® Dictionary of the English Language[24]]. Sociologists and other behavioural scientists have also the interest in consumption. The consumption is part of our society: we have a system in which work contributions are exchanged to wages, which again are exchanged to goods. The needs related to consumption vary from the very basic physiological needs to the needs of social and cultural level.

Maslow's hierarchy of needs in figure 4.1 presents the basic needs in the five stages. [Boeree 1997] The hierarchy of needs is based on the idea, that the needs that are situated lower in the hierarchy must be fulfilled, before the needs higher in hierarchy will become relevant.

There is a constant strive to fulfil new needs, when the previous ones are taken care of. On the first level there are the very basic needs related to *physiological needs*. They are all those biological aspects that are required to keep people physically well being and alive. Once the physiological needs are fulfilled, there

Figure 4.1 Hierarchy of needs by Maslow

is strive for the second level: people become interested in finding safe circumstances, security, stability and protection. *Safety needs* may be for modern people equal to the safe neighbourhood, permanent job or insurances. When people feel safe, the next level in the hierarchy may emerge: *the love and belonging needs*, which are the needs for friends, relationships and so on. These needs may be fulfilled in getting married, having a family or

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[24] Dictionary.com, http://dictionary.reference.com/search?q=consumer&r=67 The American Heritage® Dictionary of the English Language, Fourth Edition [Retrieved 26.10.2003]

perhaps in a form of dedicated career. When *esteem needs* will become relevant, there is the need for respect from others and the need of self-respect. For instance the status, fame, attention or appreciation from the party of other people fulfil the esteem needs, while a person wants to get some feelings of competence, confidence, independence and freedom through the self-respect. The final stage, which is unreachable for most of the people in the world[25], is the level of *self-actualisation* needs. Such needs as beauty, uniqueness, perfection, playfulness, richness or effortlessness are not relevant for the people tackling with the daily challenges of life, though these qualities of life are appreciated by most of us. [Boeree 1997]

Mobile phones are information appliances[26] sharing the essence of the consumer products. Though the mobile phones are appliances specialized in information, they are also expected to be easily operable and their interfaces to be self-evident. [Mohageg & Wagner 2000, 30] Mobile phones are in use of people, who are not necessarily virtues in computers or technology: placing a call without consulting a manual should be doable. Beginners do not want to spend time learning the new products, rather they learn while actually using the device for the real tasks. [Sinkkonen, Kuoppala, Parkkinen & Vastamäki 2002, 260-261] Various device manufacturers have noticed the modern customers' low tolerance for learning, because it seems that compact instructions are provided with the purchased item (and a thorough manual), explaining briefly how to begin using the device. Instruction books and manuals are consulted most often in the problematic situations, when there are not expected cues in the interface.

In our society technology and gadgets have immersed into the everyday life. People are surrounded by technology, but not only because the technology is handy for certain tasks. In addition there are values, tastes, social image, preferences of lifestyle and other personal matters involved. There are different values involved to the black and white TV of the 70's than to the latest hi-tech wide and flat TV screen hanging on the wall; as a piece of a consumer electronics it may also be a message of a lifestyle. The users or their tasks cannot be researched independent from the technology, because technology is ubiquitous. Instead of the disjunction, attention should be paid to the people's relation with the technology. "*The*

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[25] Maslow at some point supposed that only 2% of world's population is self-actualising. [Boeree 1997]

[26] Information appliance is "*an appliance specializing in information: knowledge, facts, graphics, images, video or sound. An information appliance is designed to perform a specific activity, such as music, photography, or writing. A distinguishing feature of information appliances is the ability to share information among themselves*" [Bergman 2000, 3-4]. Also term 'smart product' is in use, which refers to "*a product that contains embedded information technology integrated with a 3D physical product*" [Keinonen 1998, 12]

user needs to be seen as a subject consuming technologies" [Lindholm et al. 2003, 92]. From this point of view it might be important to know the user's relation, values and expectations towards the mobile Internet, since indirectly they could affect to the perception of the services that are available in the mobile Internet.

Presumably all of the contemporary design practices recognize the satisfaction of an end-user as one of the important design considerations. The satisfaction is one of the main reasons, why people stay loyal to the brands or services. The usability of a product tends to be a marketing argument among others, though nowadays consumers expect products to be usable by default. If their assumption turns out to be wrong, it is an unpleasant surprise. [Jordan 2000, 3] This shift in attitudes connotes, that the usability design does not increase the marketing value of a product. Rather the usability design should be as self-evident part of the product development process as the expectations of it are for the consumers. [Jordan 2000, 4] The marketing value can be increased e.g. by addressing the product for a precisely targeted audience[27], and by producing a piece of design that meets both their functional and emotional needs, if the product is expected to be usable by default. Figure 4.2 illustrates the hierarchy of consumer needs. A product should have appropriate functions to perform the tasks for which it is intended. A proper functionality is a prerequisite for a product to be usable, but it does not yet guarantee usability. Usability should be established to a product by following appropriate design disciplines and principles. The pleasure-based approach to product design aims at emotional benefits in addition to the functional ones. [Jordan 2000, 4]

Figure 4.2 Hierarchy of consumer needs (Jordan 2000, 4)
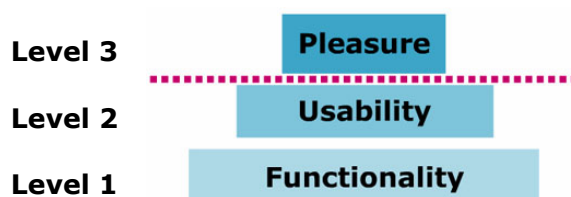
An exposure, past experiences and future promises formulate consumers' expectations towards mobile communication technologies. [Lindholm et al. 2003, 92] It is important to pay attention to consumer's expectations, as they also determine whether mobile Internet

[27] The 'design for all' often turns out to be 'design for no one especially'. Definition of a target audience is supposedly a common dilemma for product managers: whether to pursue wide and variable audience with lower price or carefully targeted audience with higher price. Expectations of profit play a big role in this matter.

services are adopted for the regular use or not. [Kim, Kim, Lee & Lee. 2003-04] It is difficult to see a future for new technologies, if consumers do not find any value in them. [Keinonen & Lindholm 2003, 270] On the contrary, too high expectations may play a part in the lame success of technologies. Kim et al. [2003-04] found out that people who discontinued using mobile Internet services had high expectations towards them.[28] Possible mismatches between expectations and first cumbersome experiences with the service may lead to a frustration, and later those dissatisfied persons may have an influence on other peoples' opinions about the service. [Kim et al. 2003-04, 10-25]

So, people should find value in technologies, and services should meet the expectations of the consumers. This brings few curious thoughts into one's mind, concerning the possible reception of the mobile banking service: through mobile banking service people may manage their financial businesses wherever they happen to be. In Finland approximately 98% of the population between ages 15-29 own a mobile phone, which makes them the most mobile phone-saturated group. [Statistics Finland 2002[29]] Teenagers and young adults do not have much wealth, due to studies or short working careers. The most frequent banking functionalities (such as balance check or simple payments) are in favour of 'the poor' people, who constantly struggle to keep their consumption in the balance with an income. Probably the mobile banking service would not make their lives easier or more comfortable, rather making them painfully aware of the poor financial state that they happen to be in. Who would like to get rid of money anytime, anywhere? Also, wealthy people would not necessarily have to know the balances exactly, since they know that there is more than enough anyway. (And credit cards do exist.)

4.3   User

Users are those who use. Person is not a user without a task or a tool to operate, thus the idea of a function is involved. Also, without the user the tool is only a combination of materials without any purpose. A mobile phone alone is just an expensive combination of the metal and plastic, but when it is utilized, it becomes a tool for various purposes. In the same manners there is no reason for having an access to the mobile banking service without a mobile phone.

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[28] In that research *perceived value* was constructed by the expectations of usability, usefulness, system quality, compatibility, instant connectivity, perceived sacrifice of money and effort and by social influence. Especially social influence was found important as a determinant for discontinuing, indicating that people trust in recommendations of friends and known people. [Kim et al. 2003-04, 10]

[29] Statistics Finland, http://www.stat.fi/tk/yr/tietoyhteiskunta/matkapuhelin_oma_kuvasivu.html

During the history of interactive systems the role of the user has been evolving from the simple operator to a life-experiencing individual. Back then users adapted to machines with the goal of *operating the machine*, such as producing the punch cards or paper tape in order to program them. By the time the attention shifted to the tools and applications of the computer, and the users began *using the software*, e.g. using the word-processor. After that, people began *accomplishing tasks*, such as writing an essay or creating a timetable. Nowadays the user is considered as a person *experiencing the world and life* with all aspects involved, e.g. learning, living, working, playing and so on. [Rettig 2003] Good systems go beyond the task-oriented design by supporting the life and experiences of the user. There are demands for the invisible technology that would support the pursuits of the users. [Norman 1994, 1998]

In Finland the future users of the mobile Internet banking services will be most likely the existing customers of banks, who are familiar with the desktop Internet banking and who own an Internet enabled mobile phone. If examining the Finnish customers of the electronic banking services, it becomes clear that they are a particularly diversified group of people. [See: Karjaluoto 2002, 82-87; Mattila 2001, 35-37] Ages, incomes, education levels and social statuses vary much, which indicates that the design of the electronic banking service cannot be targeted for any group especially, but it should be suitable for most of the people. Producing 'mostly suitable' design for the web channel seems easier than designing the same for the mobile Internet service. In the desktop web the size of the screen allows the placement of all sorts of features to the screen layout[30], and the customers just use those, which are most relevant to them. For instance the menus may be available on the desktop web page all the time, but the mobile web page should be designed in manners that the elements on the screen consume as little space as possible.

Users are usually divided to the different categories by their attitudes towards the technology and habits of adapting it, e.g. innovators, early adopters, early majority, late majority and laggards. [Rogers 1983, 246] Innovators and early adopters are the minority of the consumers that are very fond of the new technology. The ability to meet the needs of early and late majorities matters, if the service is valued by rates of the users. The early and late majority are about 68% of the population, while the early adopters are approximately 13,5% of the population. [Rogers 1983, 246-247] The most significant issue regarding the abovementioned groups is to notice the different needs and expectations, and especially majorities' need for stability, as majorities are the key to the wide success of a service or

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[30] Layout in this context means the combination and placement of elements that structure the screen, e.g. the menu area, logo of service, content area etc.

technology. People "*want a very slow evolution toward improved devices, slow enough that they can grow with them, learn them, and feel comfortable with them*" [Bergman & Norman 2000, 18].

What the designer should know about the users, when beginning to design a service or a product? The usability-based approaches consider people as physical and cognitive beings, paying attention to the humane features, such as the physical and cognitive capabilities to perform tasks. The basic usability design methods stress the knowledge of the users' physical and cognitive abilities related to their tasks, circumstances and the success criteria of the performed tasks. The task-centered design approach is criticized for being narrow in the interpretation of the user through his tasks. According to this approach the product or service is considered usable, if the person manages to perform his tasks quickly and without errors. [Jordan 2000, Lindholm et al. 2003] However, without the basic understanding of the target audience it is difficult to produce a service or product that would be usable for the customers. For instance in the case of the Internet banking service the target group is very diverse, thus the user interface cannot be customized for any specific group of users. Some general aspects should be taken into consideration and processed into the user interface, such as the differences in cognitive abilities, the experience in using Internet and the perception of the banking activities[31]. The interface cannot be 'perfect' for anyone, because of the users' differences from each other. Rather it might be 'suitable' for most of the people. Elder people with a poor sight might require different interface than teenagers: coming up with the universal interface that satisfies all of the target groups seems quite exceptional.

However, if the usability is the only objective of the design, the outcome may be painfully dull. The interface of the web banking service cannot be too experimental or exiting, because it is supposed to be informative, functional and utile in order to serve the purpose. Especially with the mobile Internet it is better to begin with such a layout design that the users cannot miss the point of the service. After all, browsing with mobile phone is basically hunting of the desired information and the cues from the interface. All additional trouble of finding the desired information decreases the patience of the user.

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[31] System designers, who have an insight to the banking activities, may have a totally different kind of understanding of the concepts and their hierarchies in the banking system, not to mention the functionalities, which are the very basics when building a banking system. The users on their behalf may not find the conceptual difference between *a payment* and *a transaction*, and it might be unclear to them when the money actually 'disappears' from the bank account.

4.4 Holistic view to users

The perception of a user should be widened from the usability perspective to include also the social, cultural and personal issues, in order to design better services. The potential context of use, and its effect on the use practices should be recognized. Users' interpretations of the world, cultural context, personal characteristics, skills and interaction techniques as well as demographics are also sometimes important factors in the design. Designing tools for communication brings designers close to the basic functions of the society and culture, because the communication is a prerequisite for them. If the users are considered as a part of the society, *"understanding users means understanding how they change as the society around them changes in general, and specifically how they change through interaction with the products that we introduce"* [Lindholm et al. 2003, 94]. In Finland of the 2002, approximately 94% of the males and 85% of the females aged between 15 and 74 had a mobile phone in their own use. [Statistics Finland 2003[32]] Lindholm et al. [2003, 94] consider the mobile phone user as

- *An information processing unit accomplishing tasks*
- *An actor varying physical and social contexts*
- *A consumer with a lifestyle*
- *An interpreter of socially constructed meanings*
- *A locus of different motivations*
- *A member of a culture*
- *An object and an initiator of continuous change*

Four different categories are proposed for mapping people's characteristics and for finding out holistically their requirements for the products. [Jordan 2000] First, *the physio-characteristics* map user's physiological features, such as the musculo-skeletal system, special disadvantages and size of the body; second, *the socio-characteristics* describe the user's relationships to other people; third, *the psycho-characteristics* categorize the cognitive and emotional characteristics; and fourth, *the ideo-characteristics* map for instance the values, tastes and aspirations of the people. [Jordan 2000, 62-82] Examples of the characteristics and their categories can be seen in the appendix A.

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[32] Statistics Finland, http://www.stat.fi/tk/yr/tietoyhteiskunta/matkapuhelin.html [Retrieved 3.10. 2003]

Users' emotions, values and ideologies are ignored to the some extent in the software product development.[33] It may be considered as a task of graphic designers and marketing professionals to create an appealing 'package' for the product, in the same manners than the usability is thought to be applicable to the product, after the technical design is finished. Software products are seldom considered pleasurable, though the technology itself can be a source of pleasure by giving a feeling of control, or indicating the high level of user's skills. Also product's aesthetic appearance and positive associations can evoke the feelings of pleasure. [Konkka 2003. 97] It is easier to understand the pleasure as the product's quality, when considering cultivated industrial designs such as a toothbrush, sneakers or mobile phones as physical objects. It is argued that the human factors literature considers users as cognitive and physical processors, ignoring aspects that make us human. People have emotions, values, hopes, fears, aspirations, principles and tastes in addition to physical and cognitive characteristics. [Jordan 2000, 58] In table 4.1 the interests of the usability-based approach and the pleasure-based approach are compared. Traditionally users are mainly considered to be a part of the system consisting of a product, a user, a task and a context of use. [Jordan 2000, 58] The pleasure-based approach to the product design can be considered taking into account all of the potential benefits the product can deliver – which is evidently a nice idea, but the benefits are terribly difficult to explain for managers of software development companies. [Jordan 2000, 12]

Table 4.1 Usability- and pleasure-based approaches to user [Jordan 2000, 60-61]

User characteristics	Usability-based approach	Pleasure-based approach
Anthropometrics	X	X
Physical abilities	X	X
Taste preferences		X
Cognitive abilities	X	X
Context of use		X
Identity issues		X
Environmental issues		X

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[33] In the early years of computing such terms as 'abort', 'execute' and 'kill' were used as commands, but they were replaced with less offending terminology, when the hostility embedded to these commands were paid attention to.

Emotions play a big role when using banking services, especially if being on the move. Most people are careful with their wealth management, and particularly in the electronic banking environments the worries about the security, trustworthiness and self-created errors are very significant issues, which may tone the ways people use the services. For instance the user may avoid the tasks that he/she expects to be difficult to cancel, or refuses to learn new, improved ways for performing tasks if the old ways still do. [Sinkkonen et al. 2002, 260-260] If something is bothering users in the mobile banking services, they are likely to stop using that specific channel and carry on using same services in more familiar channels, e.g. desktop terminal. [Hiltunen et al. 2000, 184]

The social context of use evokes emotions as well, since the mobile phone is carried along and mobile banking can be practiced in the various circumstances. For instance the user may not want to access the mobile banking services at all in the social circumstances, if he feels the need for the privacy and discreetness while accessing his accounts. Or if the service is accessed, the user may cover or hide the display from others, or change his behaviour altogether by seeking a distant and quiet environment for the mobile banking.

4.5   Summary

In this chapter different roles of end-users were discussed. Person using a mobile banking service is at the same time a customer of a bank, a consumer of technology and a user of the designed system. It is necessary to consider customers' values towards Internet services, since meeting their expectations means satisfied customers, who will continue using those services. People, who consume technologies should perceive some value in the novel systems, otherwise new technologies will not be adapted. Person's exposure to technology, past experiences and future promises of the salesmen formulate consumers' expectations, which –again- should be fulfilled with the service. It is healthy to take a look to the user as an individual living his/her life and to refresh designer's traditional ideas about the user as a cognitive and physical processor. What makes the products and services appealing for the customers may lie above mere usability, which should be established to the piece of design by default. Holistic approach to the users takes into account all sorts characteristics related to the physical, social, psychological and ideological aspects in the person. Totally another case is if these wider ideas of the users can be brought into the software- or service productions of the IT-business, since it is already difficult to establish usability engineering practices into the field, not to mention the vague ideas of the holistic approach without the engineering sprit.

5   Small device - big challenge

In this chapter the mobile phone will be considered as a challenge for the designer, since there are several issues related to the device and it's use, which should be known in the beginning of the design process. The new technology is a challenge, since the designer may not have an insight to the capabilities and possibilities related to it, thus having difficulties optimising the use experience. Mobile phones are carried along wherever people go. The designer cannot foretell the ways people use mobile banking services, thus some approaches will be suggested. A mobile phone presents practical design challenges of different sorts. The mobile phone is small in the physical size, with the limited memory, storage, processing power and duration of the battery. The navigation and data input mechanisms require close investigating, in order to use device's features as economically as possible in the user interface design. The mobile context of use alters the environment in lighting, network coverage, social conditions and sound. User's attention is easily distracted and therefore the designer of mobile Internet service should be prepared to catch and preserve the state of the service when user's attention is engaged elsewhere.

5.1   It is mobile, but is it a phone?

Most of the Finnish citizens own a mobile phone: 93% of households have at least one. [Statistics Finland, 2003[34]] The mobile phone is nowadays perceived for instance as a tool for communication, the social bond between people, a part of the lifestyle and image, and as an entertainment unit. Originally mobile phones were mainly used for a voice communication and SMS-messaging, having additional features such as a calendar, a calculator and an alarm clock. Currently in 2003 mobile phones have a wide selection of features and additional gadgets, to the extent that they sometimes rather remind universal apparatuses –the Swiss army knives of the information appliances- than phones. Also mobile Internet technologies have evolved around the world introducing for instance WAP and I-mode. [Weiss 2002, 23] Also nowadays XHTML-browsing is an available technology. Mobile phones contain the variety of software applications such as the calculator, calendar, notebook, e-mail and games. Also the hardware has been merged to the phones, such as a digital camera enabling photographing, multimedia messaging (MMS) and video recording.

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[34] Statistics Finland, http://www.tilastokeskus.fi/tk/tp_tied/tiedotteet/v2003/221tuls.html [Retrieved 23.10.2003]

The mobile phone is a dilemma of a dedicated device that is at the same time anything but dedicated, as it has applications for dozens of purposes. On the other hand the mobile phone is a tool optimised for communication, but on the other hand the applications facilitate all sorts of activities from gaming to cooking. For instance the Nokia 5100 phone includes a flashlight, a calorie counter, a thermometer, a timer, a stopwatch and a stereo FM radio[35]. Nokia N-Gage is a combination of the phone and the game deck.[36] Running any given application gives very focused view to the topic or the task of the application, as it uses display's full area that is reserved for the content. Also the features of the applications naturally differ from each other. [Bergman & Haitani 2000, 99] The mobile phone presents the information in sequences, while the desktop computer can run several program windows at the same time, parallel to each other. [Keinonen 2003, 2-3]

5.2   Designer and novel technologies

Designers working with the new evolving technology deal constantly with the uncertainty: it is difficult to tell how the technology evolves, and how it changes the society and the behaviour of an individual. The future as an unpredictable factor causes problems for designers, whose work basically carries on living with the users, once the designer has finished working with it. [Lawson 1997, 113] The users may find alternative uses for the product, which did not originally even cross designer's mind.

Uncertainty during the design process may leave the designer into idling state: it is impossible to proceed with the work, if some essential parts – such as the technology of the product to be designed- is changing all the time. The development of technology itself is sometimes rapid, thus leading to the ever-accelerating production process: the target is moving and the tool transforming, but the satisfactory product should be in the markets the very next day, when the situation stabilizes. The situation is difficult, especially when being dependent on the information provided in white papers and technical specifications of the devices that are not launched yet. Presumably the mobile phone manufacturers wrestle with the same problems of meeting the scope and timetables as any other producer on the field, possibly leading to slight mismatches between the pre-release documentation and the end result.

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[35] Forum Nokia, Nokia 5100 technical specifications,
http://www.forum.nokia.com/main/1,,015_21,00.html [Retrieved 22.9.2003]

[36] Forum Nokia, Nokia N-Gage, http://www.forum.nokia.com/main/1,6566,015_98,00.html [Retrieved 30.10. 2003]

The designer reflects uncertainty by *procrastination*, *non-committal design* and *throw-away* design. *Procrastination* seldom provides any good solutions to a problem, since waiting does not make it disappear or to solve by itself. Rather vice versa: once the actual problem is identified, it is difficult to avoid the decision-making. [Lawson 1997, 15-16] *Non-committal design* aims at flexible and adaptable end result so that the structures can be changed later. It provides non-specific, bland, anonymous and neutral product, which may meet the function but not more. [Lawson 1997, 116-117] *Throw-away design* on its behalf is the design for the present only. There is an expectation of the replacement: the object of the design will be replaced with another up-to-date product in the short period of time. This sort of design approach is problematic, because it is waste of both material and intellectual resources. [Lawson 1997, 117] Especially mass-produced goods are throwaway design in its' exact meaning: the pressure of lowering the expenses leads to the reduced quality, which creates the need for the quick replacement.

5.3   Mobile context of use

A context of use includes the aspects of the social and geographical environment, personal state and technological infrastructure. The use context of the mobile Internet is "*any personal and environmental information that may influence the person when he or she is using mobile Internet services*" [Lee, Kim & Kim 2003, 6]. A conceptual framework of use contexts is introduced in table 5.1. The technical factors are excluded from the use contexts in this framework, though they are likely to affect significantly on the use, as is the case with low communication bandwidth and bad network coverage. [Väänänen-Vainio-Mattila & Ruuska 2000, 177] Technical factors e.g. errors will most likely affect also on the personal context by evoking feelings of frustration. Reports on the end-user frustration reveal, that especially Internet browsing causes significant degrees of the e-rage, which emerges when connections are dropped or refused, connections are timing out. Also long downloading times frustrate people, as well as web pages that are not found. [Bessiere, Ceaparu, Lazar, Robinson & Shneiderman 2003, 17] The designer cannot help failing connections or unfound pages, but the downloading time can be minimized in paying attention to the size of singular pages. Especially in the mobile Internet this is a significant issue, since people are used to the high bandwidth in the desktop web environment and they expect similar capacities from the mobile Internet. While waiting for the coming of the high-bandwidth mobile networks, the use of images should be kept in the bare minimum. Minimizing the size of the page is not

only because of users' convenience: some mobile devices simply refuse showing large files.[37]

Table 5.1 The conceptual framework of the use contexts of the mobile Internet [Lee et al. 2003, 7-10]

	Factor	Sub-factor
Personal context	**Emotion** May elicit certain behaviour, such as choosing specific mobile services	**Arousal** Intrinsic aspects of a user's mind, e.g. feeling stimulated or bored
		Pleasure Temporary physiological states and moods that user brings to any activity e.g. being joyful or depressed
	Time General factor	**Duty** On or off-duty: indicates whether a user is engaged in any kind of job or study on contrary being relatively unoccupied
		Time-on-hand Presence or absence of time for a person's activity, i.e. how much he/she is under time-pressure
	Movement Most important characteristics of the mobile Internet	**Static / moving** Whether user is moving or not through physical space
Environmental context	**Physical context** May encourage or discourage use of services	**Location** Geographical setting
		Crowding How crowded the user's immediate environments are, also users' perception of space
		Distraction Degree of visual or auditory disturbance people experience

(continues)

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[37] This claim is based on the subjective observations on different mobile phones during design and testing process. Without naming any specific brand, there are experiences of one mobile phone crashing when loading pages bigger than 10 KB.

Table 5.1 (continues)

	Social context	Interaction Degree of communication with other users
		Privacy Level of privacy provided by the place, public or private, in which the mobile Internet service is used

"Anywhere, anytime" is the mantra associated to the benefits of the mobile Internet services connoting the theoretical possibilities of the mobile Internet use. Instead it could be "sometimes, somewhere", because people tend to use mobile Internet services only in the few key contexts - regardless of the thousands of possible combinations of use contexts. [Kim, Kim & Lee 2003; Lee et al. 2003] Mobile Internet services are accessed only in few contexts according to a Korean study. Most of the times mobile Internet services were used in public place, while standing still, without interaction with other people and when being off-duty or under low time pressure. [Lee et al. 2003, 23-24] In the same study it was pointed out, that there is a clear relationship between use contexts and the type of services: hedonic mobile services (e.g. pages for ring tone downloads) were accessed in the different context than the utilitarian services, such as news, ticket reservations and e-mail. [Lee et al. 2003, 24] When participants used utilitarian-active[38] services, such as mobile banking services, they were most often on duty and reported unpleasant feelings. [Lee et al. 2003, 25] The physical context brings up also other varying aspects than only the audiovisual distraction or crowded environment: the lighting conditions vary from the direct sunlight to the darkness, and also the climate and weather conditions affect on use. Using mobile phone in the rain requires some protective activities, and in cold environment one may use phone while wearing gloves. [Väänänen-Vainio-Mattila & Ruuska 2000, 178] Moving in the environment poses organizing challenges for the user, whose concentration is divided between the activities related to moving, the activities related to communicating and the activities related to operating the device. [Väänänen-Vainio-Mattila & Ruuska 2000, 178]

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[38] Lee et al. [2003] classify mobile Internet services to two categories: hedonic and utilitarian, which are again divided to two domains: to passive and active. For instance hedonic-passive services can be humour, horoscope, cartoon etc. services. Hedonic-active services are for instance ring-tone or logo downloads, chat, games, text messages etc. Utilitarian-passive services are news, weather, lottery, e-mail, financial information etc. Utilitarian-active services provide ticket reservations, banking, stock trading, education, location reporting, transport ticket reservations, credit card information and other similar services. [Lee et al. 2003, 25]

It is impossible to guess how the environment and the context of use effects on user's interaction with the service. There could be some visible changes in behaviour e.g. covering the display of the phone when accessing the mobile banking service while being in social situation, or one may especially seek undisturbed place for conducting unavoidable banking activities. Because people experience different usability problems in different contexts, it is recommended to conduct low-fidelity usability tests in the key contexts of use before the design is taken further in the product development process, and again when the final product is ready. [Hiltunen et al. 104, Kim et al. 2003, 24] Interestingly enough, in Korean study the users experienced structural problems when using device with only one hand, representational problems when they were moving and problems with the content when they were standing alone in a remote place. [Kim et al. 2003, 22] Possibly the speed of banking system processes seem slow or fast depending on how stimulated the user is. Also surroundings may play a role in this case, e.g. the noise and the motion, thus the interaction paths and the communication sequences should be kept short. [Väänänen-Vainio-Mattila & Ruuska 2000, 178] However, there might be some troubles in recognizing the key contexts of use without proper researches, especially when bringing a new type of service to the mobile markets. Of course one could research the current use of WAP-banking services in Finland, since the banking features of the WAP services are simple and basic, such as checking the balance of the accounts and creating simple transactions. Most likely those features will become available in other sorts of mobile banking services as well.

One possibility for mapping the use contexts of mobile banking service could be in the pattern approach. The motivations and circumstances could be researched in order to find out when and where people need banking services. It could be a good start to know when and where for instance the balance of the account is consulted, the payments are made or money transferred from account to another. Also it would be interesting to conduct a survey of the motivations for using mobile banking services, because without motivation people will not see any value in the service. The essence of the mobile banking functions could be also investigated, since presumably one function fits better to the mobile use than another. This sort of pattern approach might be relevant as a preliminary phase for the design process, conducted for instance in the phase of gathering requirements for the service. Most likely there are certain behavioural patterns related to the use of money, use of banking services and to the contexts where those needs appear.

5.4 Use differences of mobile web vs. desktop Web

Mobile phone is an *information appliance*: a device specialized in information such as knowledge, facts, graphics, images, video or sound. [Bergman 2000, 3] It is designed to perform a specific activity like the interpersonal communication in the form of call, SMS, MMS or instant messaging. If compared to desktop computers, mobile phones are not easy to upgrade, they are perceived to be less expensive and less complicated to run and maintain, and they are also easy to learn and use. The user is not expected to be an expert handling the device. [Mohageg & Wagner 2000, 29] Phones have also less memory, smaller display, less powerful processors and dramatically different input devices than computers. [Mohageg & Wagner 2000, 30-32]

Representation of the information is *parallel* with the desktop computer, which lets the user to have several program windows open at the same time. One can do several tasks at the same time, or to utilize several programs for the same task by pointing and clicking the mouse on the desired object. The situation is different with the mobile phone. Only a small amount of information can be shown at a time, and if any application is run, it occupies the whole display. Information is represented *sequential* on the mobile phone. [Keinonen 2003, 2-4]

The differences in use of the desktop web and the mobile web are originating from the different sizes and input mechanisms of the devices. Most of the users of desktop Web use the Internet with the high-speed data connections and with fast processors in their computers, with a mouse for direct manipulation of objects, and with a keyboard to type using two hands. The surfing is entertaining and enjoyable, big chunks of information can be quickly skimmed through and the attention is easily distracted from the original purpose of browsing. With the mobile phone the situation is quite the opposite, 'surfing' is rather 'hunting' for the desired information. [Weiss 2002, 16] Processors of mobile phones are slow as well as their Internet connections. Typing web addresses with mobile phones' keypad is a time consuming task, thus the navigation from site to another would be practical through links. However, at the moment there are not many services or web pages available that are especially customized for the mobile devices with an XHTML browser, and thus the jump from topic to another is not easy with the current network of pages. Bookmarks are the essential part of accessing easily the web pages from mobile phones, because typing is clumsy. The small display also leaves most of the web pages' information invisible, and the user has to scroll through the whole page to find the information and links for navigating. [Weiss 2002, 16] The mobile web users go to the Internet with a purpose in their mind and with a little to non-existent risk of getting distracted.

Costs of the use are different for the mobile and the desktop web. Desktop Internet connections are usually paid on monthly basis and the use is unlimited. Though some households in Finland still use dial up modems, whose costs are charged in the phone bills based on the connection time. Mobile web connections are billed whether on the minute basis (data call), or by the amount of the transferred information (e.g. GPRS).

5.5 Designing the experience of mobile Internet service

Funnily enough, in 2003 the mobile browsing culture is nearly in the same level as with the desktop computers nearly ten years ago. Designers meet the same problems as in mid-90s: low bandwidth, poor resolution and worries about colour palettes. Through the desktop Internet users have learned the basic concepts of the browsing and also some conventions of visual organisation of web pages. For instance it is a very basic thing to interpret the object as link, pointing and clicking on it in order to move around. In the mobile Internet the basic concept remains the same, but instead 'pointing and clicking' user 'scrolls and clicks'.

As the size of the mobile phone is small, the web pages should be reasonable in the amount and size of the content. The XHTML browsers are showing basically the same HTML than in the desktop web. Designers should be careful with the fixed widths of the pages, as there are differences in sizes of the mobile phone devices. If it is possible, the pages could be designed in the manner, that the device may automatically adjust the page horizontally to the browsers' window. Scrolling the page vertically is easy, at least with devices that have a joystick-kind of tool for pointing the cursor to the desired object. However, the more information there is on the page, the bigger the file gets, which practically increases the downloading time.

The mobile nature of the device, small size, interaction methods, technical aspects and other design challenges of mobile phones bring the basic usability principles into the new position. It is more and more significant to provide consistency, feedback and to prevent errors, as the limitations of the device and the conditions of use inevitably affect on the use experience. In a vivid environment the attention span of users may appear shorter than in a static situation, as well as the focus will not be entirely on the device. Partially the form of phone already indicates the use intentions: whether the phone can be operated with one hand or does it require two, is it possible to use device while moving or should one stay still?

It is important to notice the properties of the technology, capabilities of it. Each technology has some *affordances*[39], which make some operations easier and some impossible. [Norman 1994, 106] Norman [1994, 243] recognizes in technologies a mindset, the way people think about technology and for which kind of activities it is relevant. For instance HTML is a display language, which is not interactive by nature: it is a publishing mechanism. The reason why it has proven to be successful is in the device-independent access to the information. [Bergman & Norman 2000, 22] One can connect to the Internet even with sewing machines, for updating the software of the device or for downloading patterns for embroidery.[40] Situation with Internet resembles the early electronic motor of General Motor, which was utilized for different purposes with accessories such as a hair dryer and a vacuum cleaner. [Norman 1998] Instead of connecting to Internet with different devices, the Internet along with the computer could be embedded anywhere, similar manners as it happened with the electronic motor. The properties of technology can be recognized in the shortage of the design solutions, if the task is to access information in Internet with a mobile phone. There are the properties of an XHTML and properties of the mobile phone: when matching these two, some features will be excluded from either of those. When working with XHTML, designer has very limited ways to organise the user interface elements, which means that some UI techniques (such as tabs), display area or soft key -menus of the mobile phone cannot be utilized optimally. Since browsing is one-way transmission, the information goes always to only one direction at the time, so the system responses to users actions with a delay. Conducting banking activities over mobile Internet means basically form filling, which is not the greatest pleasure either in the PC Internet environment, while using a proper keyboard. Mobile banking over Internet is the chain of events: user accesses through the mobile device's interface (UI of the mobile phone) the web banking Interface customized for mobile phone (Web Interface of the bank), through which the information is retrieved from the system of bank (back-end). The same steps are repeated backwards when the information is returned to user's phone. Each step can be seen as a filter. When submitting a form, something goes in and something comes out in return.

In mobile Internet it is difficult to establish an "*environment that is conductive to optimal experience*" [Norman 1994, 34]: web pages do not provide a high intensity of the interaction

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[39] Norman [1994] uses word 'affordance' both about properties of objects and technology: the perceived affordance of an object is "*what people perceive the object can do*". In the same manner it can be used for describing the perception of the technology: what people perceive the technology can do. [Norman 1994, 106]

[40] Sewing machine manufacturers such as Pfaff (www.pfaff.com) and Bernina (www.bernina.com) have computerized some of their models to include also the Internet connection.

and feedback; it is difficult to provide a feeling of direct engagement with the task, when task flows are divided to sequences in order to retrench the content on singular pages and to decrease loading times; motivation of the user is endogenous, not aided by the mobile banking service; the continual feeling of challenge may emerge from the input mechanism of the mobile phone rather than from the service itself; designer cannot prevent distractions and disruptions from the environment, that intervene and destroy the subjective experience, let it be a technical error (such as shortage of the power or the receiving area), or context dependent (such as noise and crowding on the bus). There should be definitely some aiding tools for helping user with the banking tasks. [Norman 1994, 34]

The humane feelings that are reflected from the environment grade the use of mobile Internet services as well. There might be some creators of the alert or negative feelings (e.g. uneasiness, fear, uncertainty) in the environment, which may be subconsciously associated to the quality of the service. The service should provide feelings of security and trustworthiness, because of the unpredictability of the use context. The pressures of the social context should not be underestimated when considering the mobile banking services, as especially the money handling involves attention both in good and bad.

THE PRIVACY AND THE SECURITY

Mobile phones are personal devices, as only one person is carrying and accessing it. This is the reason why the privacy and security of mobile phones are considered to be good. However, this aspect includes only the accessibility to the device and its' private contents. [Weiss 2002, 17-18] It is quite clear that the mobile phone is a private tool used by only one person, unlike computers at the home, in the offices or the public terminals. However, the security of the mobile phone is a wider issue. Security in one level means the security by identification. PIN (Personal Identification Number) codes, passwords and other identification methods are meant to assure that 1) the person using the device (or service through the device) is the one he claims to be and 2) he has rights to do what he is trying to do. On the other level the security includes the concept of the safe browsing, e-mailing and the software installation as of 'being safe from external hostility' when using the mobile phone. The security, safety and protection are potentially the future issues of increasing importance, when the mobile Internet connections will improve and the virus-writers will find a new playground. For instance the Symbian platform used in many phones[41] is open for

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[41] For instance mobile companies Motorola, Nokia, Sony Ericsson, Fujitsu, Samsung and Siemens have developed phones with Symbian platform. [Symbian.com, http://www.symbian.com/technology/symbos-phones.html, retrieved 27.9.2003]

software developers, so in some sense anyone is given the tools for constructive or -contrary-malicious action. On the other hand the history of computers has proven that the most popular, widespread (and closed) platforms attract more virus writers than the open source platforms, as is the case with for example Windows and Linux.

Security is a very important requirement of online banking services in general. Connections to servers are secured and the possibilities for breaking into the system are minimized. Identification systems are constructed in manners that the possibilities for the misuse by third parties are minimal. Usually the customer of Finnish online bank has to identify himself by giving the customer number, to authorize the current session by giving the varying password for accessing the service. If any money transfer from the account is done, the transaction authorization number is demanded as well.[42] With a system like this the customer of the mobile Internet bank has to always carry along the password lists and numbers, wherever he goes, even the banking terminal would be always available by nature. Some new reliable methods for the authorization should be developed, and the external password lists eliminated, but at the same time making sure that the new system cannot be taken advantage of in case the device is stolen or lost.

In the design of the mobile banking service the pre- and post-accident security should be considered. The user should have a confidence to his/her abilities to react properly in accordance with the possible security threats, before the accident happens or after it has happened. The user should be able to reduce the risk of accidents by acting in controlled ways in the service. On the other hand if an accident happens, he/she should have a possibility to minimize the scope of the accident. [Hiltunen et al. 2002, 41] For instance there are techniques used for 'impersonating' sites that are actually set up for gathering sensitive information from the unsuspecting customers, e.g. a fake login page of an online bank is set up for swindling the usernames and the passwords.[43] There should be a strategy how the user may inform the customer service as soon as possible about the accident and to revoke the passwords.

STABILITY

The design should include stability, as the users of the mobile phone devices are on the move. Connections may fail and unexpected things happen. The UI and the system of the

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[42] In USA the most important identifier of customer is the account number, which is well-kept secret from other people.

[43] For instance DNS and web site spoofing.

service (or application) should be stable in order to restore the state and the context of the user within the service, if the network connection drops suddenly. When coming back online, ideally the user should have the possibility to restart the interrupted process, with the entry fields pre-populated with the information of the restored state. [Weiss 2002, 68-69]

Ten to fifteen minutes is a short time for the banking activities, if considering the challenges of the task and the context of use. Because of security reasons, online banking services automatically disconnect users if they are inactive for certain period of time. Imagining the situation in a cafeteria, when filling the payment form for money transfer: suddenly an old friend bumps into the place. The 'timer' for the payment task is ticking from that moment on, when the web page with the payment form is loaded, giving e.g. 15 minutes time to fill the form and submit the payment. If the task demands extraordinary levels of carefulness in the means of double-checking the data before submittal, the five-minute chat meanwhile may be already too long. The outcome could be, that the user is disconnected from the service, as the task itself is time consuming. Or simply someone calls while the money-transfer is prepared. Few -if none- of the users will consciously keep the online session alive by navigating back and forth in the system, in case of external interruption. During a call it may be even impossible. Users should be provided an easy recovery from problematic and unexpected situations, for instance by storing the data that was inserted before the failure.

RESPONSE AND FEEDBACK

Continuous feedback should be provided to the users of mobile banking services, since users are definitely interested to know if their inputs are processed. Through the feedback users are being informed about the different stages of tasks, possible mistakes, or in general level about the normal, trouble-free functionality. Especially this is important, when money is involved. Users should be provided with the information or cues about the possible delays, for instance if the operation takes long to complete, like in cases when information is downloaded from the web server to the mobile phone. Internet browsers in general have some sort of indicators of the loading process. Usually it is an animation placed to whether upper left or right corner of the browser window. If the users are aware of this indicator, they know to wait patiently. Since the loading times with current data transfer systems are slow, people may panic or get frustrated while the data is sent to the back end and the response is delayed, letting the users assume that the system is faulty or it has crashed. At that point pushing the buttons would interrupt the process altogether, causing a real error instead of perceived one.

Feedback should be provided in two levels. On the level of UI structures, each page of the service should give hints about the location and the state of the user, how to navigate away from that page and naturally provide information what can be done on current page. [Weiss 2002, 69] When users become familiar with the conventions of the service, they find the necessary information by experience, spotting similar structures. For instance the navigational items should be clearly distinguishable from the informational content. On the level of the activities and processes the feedback is necessary, but especially in error-situations. User should be informed if his task was successfully accomplished by the system, such as the money transfer. Or if the transfer fails, user should be informed why the task failed and given a way to recover from the error-situation. [Sinkkonen et al. 73]

FORGIVENESS

Forgiveness is closely connected to the stability, as users make mistakes and the system and UI should be designed to support means for correction. For instance the payment form should be possible to clear by a single stroke of the link/key/button. Most Internet users have learned to rely on the 'Back' –button of web browser in desktop computer environment, if they have entered a difficult or dead-end situation while browsing. In the mobile phone environment the 'Back' or 'Undo' –functionality should be offered preferably in the multiple levels, meaning the possibility to back on the track through several pages in the navigation history.

There are two major types of errors: slips and mistakes. Slips are those that happen when the action is not intentional. Mistakes tend to be more serious kind, since they occur when the intended action is wrong. [Norman 1994, 131] The errors should be prevented in the design, and the recovery after an error should be supported. Through design some errors can be prevented altogether, or at least the impact of an error can be minimized. If a mistake happens despite of all precautionary measures, the design for forgiveness increases the chances of discovering committed errors. [Norman 1994, 131-138] Banking systems are very strictly controlled and designed to minimize slips. In Finnish banking system for instance it is nearly impossible to transfer money unintentionally to the wrong person's bank account, since both the account number and the name of the account holder has to match with the information in the bank's database, before the payment is taken to the further processing.

CONSISTENCY

The idea of consistency contains two levels: firstly, design should be consistent within the same application or service and secondly, it should be consistent between platforms. The

same terminology and interaction schema should be used within the same application and between the applications, e.g. between an online banking service and an installed banking software. Practically this means that the task flow remains the same even the banking tool changes. For instance, the user is asked to accept the payment when submitting a payment, before it actually proceeds to the back-end system, and he/she is given a confirmation message after the procedure is accomplished. In similar manners the authentication of user should be always carried through at the same point of the service. Between the platforms (e.g. digital television - web service - mobile service) the terminology and processes may remain the same, but only if they are appropriate for the mobile use. Otherwise the channel-specific service should be redesigned from the wireless user's perspective. Sometimes the small size of the device is also a fundamental obstacle for complicated, though precise banking terminology. The navigational items, the selection lists and the page titles should be presented compactly since the space is limited, but the basic terminology may be difficult to alter. For instance 'payment', 'transaction', 'exchange-traded security' and 'non-exchange-traded security' are fixed terms of the finance, which would be difficult to re-invent by the designer or anyone else.

It should be noted, that the consistency does not mean copying the same structure and content to the different banking channels, because different tools have their own properties, which should be respected. For instance when considering Internet as a banking channel, the tool for accessing Internet banking services may be a PC, a mobile phone or a digital television. These tools, they all have very different characteristics, and none seriously could consider showing the same layout and screen flow, hierarchies and structures on all of them. The mobile phone is not the PC, the PC is not the TV and the TV is not the Mobile phone, even though all of them may provide an access to the Internet. Users' expectations are different when handling each of these devices.

CONTROL

Users should be provided with the illusion of control. The real controlling entity is the system behind the interface, but the users should not feel like being trapped by the system, doing functions in those manners that the system demands. An access to different areas is an important point, as the user should have a possibility to move around the service by links between different areas of the service or the application, or entire applications. [Weiss 2002, 68] For all sorts of tasks there should be a clear beginning, the phase of doing the task and the end of the task. [Sinkkonen et al. 2002, 73] There should be also a clearly market points

where it is possible to log out from the system, which may sometimes happen in extreme hurry.

SCREEN DESIGN

The user interface is the main contact between the user and the system. Designer's first practical questions concern the size of the screen (the full canvas vs. the content area), the available colours (special palettes and the amount of colours), the browser requirements and the navigation methods (through hyperlinks, or is it possible to utilise the soft key –menus). Practical experimentation with the user interface of mobile phone is presented in the appendix B.

When preparing the UI of the mobile Internet service, the designer has to make decisions about the amount, layout and organisation of the information, general hierarchies and navigation within a screen, aesthetics, importance of the elements, perception and visibility of the information. [Sinkkonen et al. 2002, 126] In order to build comprehensible structures and menu hierarchies, the terms should be familiar to user, such that they are understood without doubt. This can be assured with several rounds of validations with the real end users. [Sinkkonen et al. 2002, 133] In some cases it might be necessary to shorten some long terms, but one should be careful with abbreviations unless they are conventional. For instance the currency codes are abbreviations, which are standardized by ISO, International Organization for Standardization. In some handbooks of UI design the use of abbreviations is encouraged, but some types of abbreviations do not suit the formal and exact characteristics of the banking service. Abbreviating words by eliminating vowels does not sound exact enough for the terminology of the mobile banking service. Also the use of acronyms is sometimes difficult, since some banking terns have unambiguous meanings that cannot be replaced. [Weiss 2002, 110]

As the size of the mobile phone is small, the web pages should be reasonable both in the amount and size of the content. The XHTML browsers are showing basically the same HTML than in the desktop web. Designers should be careful with the fixed widths of the pages, as there are differences in sizes of devices. If possible, the pages could be designed in the manner, that the device automatically adjusts the page horizontally to the browsers' window. Scrolling the page vertically is easy but horizontally cumbersome, since only small piece of information can be seen in a time and in that condition it might be difficult to find the searched information from the page. One can try reading a newspaper through a keyhole – the experience is somewhat the same.

Navigation and hierarchy

The basic problem with the menu structures is the hierarchical organisation of the information. Users should be able to recognize the link from the list, which they assume to be correct for their intentions. Information of web pages is organized based on perception of designers, who may find the structures and hierarchies differently from the users. Also there is usually more than one location in hierarchy for an item, like for the payment. The payment can be done for a person or a company that user does not know – in that case the payment is new for the user, since the payee does not exist in his personal banking space yet. Also the payment for a family member is the payment, but it feels different since it may be done very often and thus it is a familiar task, or even a routine for the user. The intention of use may affect on the perception of an item, and thus items cannot be placed to only one location in hierarchy. [Norman 1994, 178] Perhaps this is one reason for constant unawareness on scissors' location at home, because their essence changes depending on the use intention. Scissors that are used for cooking are placed in kitchen; scissors utilised for clothing crafts are placed among sewing equipment, scissors used for haircut are placed among beauty products, somewhere to the bathroom. Someone who seeks the scissors for cutting the parsley, will not look from the bathroom, because logically they should be somewhere in the kitchen.

The navigation from the page to another poses some challenges. The user should be informed of his location in the service, and he/she should be provided with paths to the other pages. Due to the technical limitations of the web banking systems, it is not always possible to use the back-button of a browser for backing in the page history. This feature is annoying when using desktop terminal, but an exponential trouble in mobile banking environment. Most likely the irrational back -button functionality will be the first serious generator of frustration among the mobile banking customers.

The recommended navigation structure of the mobile Internet site is wide and shallow as shown in figure 5.1. It means that the menu pages offer a wide selection of

Figure 5.1 Narrow and wide hierarchies
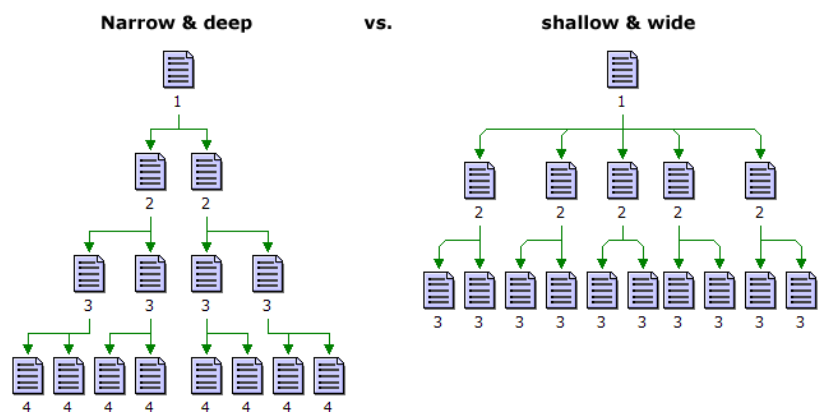
possible directions to go, and that there are only few layers of pages under the menu page. [Sinkkonen et al. 2002 259, Weiss 2002 107, Hiltunen et al. 2002 175] When a wide selection of links is visible on the same page, the user may skim through the available options and make his/her decisions of proceedings based on that. If the navigation structure is deep, the user should change a page for investigating the link structures behind the main layer of pages.

Since mobile phones represent the information in sequences, it is important to provide links on each page, for avoiding dead-end situations where the only option is to backtrack in the page history with the browser's back-button. That is why back –links could be placed on each page, in addition with the link to the main page of service. Also the placement of important links, such as 'log out', should be considered carefully: it should be easy to find without too much trouble clicking around, also it should be accessible fast, since the need for rapid logout may emerge on the go. If 'log out' is not placed on every page, it should be possible to end banking sessions at least from the menu pages. It would be interesting to test if people are able to log out from the mobile banking systems while running to the bus or chasing a handbag thief, in a shop while queuing to the cashier or on the local train when approaching the station.

Selection mechanisms

Typing with mobile phone is clumsy, and that is the reason why selection mechanisms should be offered instead of the typing. The exception in this matter is the situation where typing is faster than the search from the masses of choices. [Weiss 2002] The basic online banking functionalities require a lot of typing, such as forms of the payments or the trade orders. Mobile banking services and applications can be designed to support the selection mechanisms, e.g. by offering means for saving, storing and reusing the data, such as the information of payees and payments.

The key characteristic of mobile browsing is the use of bookmarks. Typing is inevitable at some phases of the browsing, for instance when pointing the browser to the web address for the first time. It might be a good idea to name the service to-be-launched meaningfully and provide an URL –address that is easy to type, like https://mobile.bank.fi, or similar, if the technology does not pose any restrictions to this issue. It would be even better, if a bookmark would be sent to user's phone, where it is easily accessible without typing and tinkering. Comprehensively titled services and addresses are easier to recall than a random sequence of characters and numbers. On the other hand, this book-marking task is supposedly done only once, unless the user forgets to save the bookmark to his phone.

Graphic elements

Since the mobile browsing is slow with contemporary connections, the use of graphical elements should be considered carefully. The user interface elements are for instance menus and links, text entry fields, check boxes, radio buttons, push buttons and text. Graphics are mainly images and icons. The size of the page increases the more graphics are included, leading to the longer downloading time. Ten seconds is said to be the 'pain limit' when waiting the page to load, but easily the limit can be less. Regular Internet surfers are used to the fast desktop Internet connections, thus they do not consider much the different nature of the mobile web. Internet is always Internet, whatever is the tool. [Hiltunen et al. 2002, 173] Graphics can be used without trouble in the mobile software applications though. If metaphors are used in graphics, they should be taken from the real world. Some metaphors of the computers are not suitable for the mobile phones, such as 'the desktop', since the concept does not really fit to the tiny mobile phone - the conceptual leap is too big. Also if graphics are used as hyperlinks, they should give a hint of their nature e.g. by borders or high contrast with the background colour. [Weiss 2002, 70]

5.6   Summary

This chapter discussed about designer's relationship to the novel mobile technologies, and described challenges that mobile phone as a platform brings to the design process. Mobile phone has various roles: it is a tool, the way of socialising with other people and an apparatus of various purposes, depending on the application that is ran at time. The phone is carried with in various contexts and used under unknown conditions; when being alone or in a group, at home or in the bus, while moving or standing still, in noisy surroundings or in absolute silence, at work or when having leisure time - just to name a few. Possibly mobile banking services will be used in the future only in the few main contexts. Regardless of the use context, the service has to fulfil some basic requirements in order to be utile: mobile banking service should be secure, stabile, responsive, forgiving, consistent and functional.

6   The quality of the service

In this chapter 'usability' will be discussed as a quality of the service. An insight will be taken to the difficulties of establishing the usability practices in software companies, despite of the long-term promotion of usability practices. It will be also acknowledged, that the type of overall production process functions as a supporting frame for the design work, thus the design methodology should be light and efficient enough to produce results fast.

6.1   Usability = quality?

Non-usable products frustrate, because their interfaces are blocking the functionalities and the technology that the product is supposed to offer. Usable products, on their behalf empower the users and give them a feeling of the control and the confidence. [Jordan 2000, 42] Usability is one of the qualities that customers expect, when they try mobile Internet services for the first time, or when they buy consumer electronics. [Jordan 2000, Kim et al. 2003-04] This means, that people expect to become familiar with the service quickly and that it can be utilized without the extravagant labour. It is also expected that the service lets them to do efficiently what they intend, and preferably without errors. In addition the users expect to like the service. [Nielsen 1993, 25] *Usability* is one quality of the acceptable system: it should be *socially acceptable* in order to be used by the customers and *practically acceptable* to be produced. [Nielsen 1993, 25] The practical acceptability means, that the production costs are reasonable (because the costs reflect to the purchase price) and that the product is both reliable and compatible. The designed service should be also useful – otherwise there may not be much demand for it. *Utility* of a product means, that it is practically useful, such that functions as intended. Usability concentrates on the matter how well users are able to use the available functionality. [Nielsen 1993, 25-26] Because of that sort of task orientation, usability-based approaches to design are criticised to be narrow in their understanding of user, considering them as a physical and cognitive operators that are part of the system consisting of a user, a device and a task. [Jordan 2000, Kim et al. 2003-04, Lindholm et al. 2003] Usability can be seen as a fundamental quality for the satisfactory services, which forms a basis for the other cultivated design principles, e.g. for the pleasure-based approach to the product design. [Jordan 2000, 3]

The qualities of the acceptable system could be compared with the customer's ideas about the quality of the service. It is important to meet the expectations of the users, and the designer may have a role in establishing those requirements (given that they have something

to do with designer's domain). In order to be the service of a good quality, it should be: [Parasuraman et al. 1985, according to Mattila 2001, 53]

1) *Reliable*, involving consistency of performance and dependability
2) *Responsive*, as willing to serve
3) *Competent*, as possessing required skills and knowledge
4) *Accessible*, as possible to access and ease of contact
5) *Courteous*, as polite, respectful, considerate, and friendly
6) *Communicative*: customers are informed in the language that they understand
7) *Credible*, meaning trustworthy, believable and honest
8) *Secure*, as free from danger, risk or doubt
9) *Understanding/knowing the customer*: understanding customers' needs
10) *Tangible*, as having the physical evidence of the service.

Most of these abstract qualities can be promoted in the design activities, though the frame (i.e. technology behind the façade) should be of a proper quality as well, because it forms the functional structure of the service. In the case of the Internet banking services some off-line aspects of the service provider affect on the ideas of the quality, such as the brand of the company or the offline contacts with the personnel.

The practice of designing usable systems is called in different terms, all meaning more or less the same. *Usability* can be seen equal with terms *CHI* (computer-human Interaction), *HCI* (human-computer interaction), *UCD* (user-centered design), *MMI* (man-machine interface), *HMI* (human-machine interaction), *OMI* (operator-machine interface), *UID* (user interface design), *HF* (human factors) and *ergonomics*. [Nielsen 1993, 23] Also terms like *interaction engineering*, *user experience design*, *interaction architecture* and other variations can be found meaning the same. It seems that the different terms are used according to personal preferences, since for the laymen there are not significant differences between them.

The principles of the usability design can be based on abstract guidelines, such as Nielsen's ten rules for heuristic evaluation [Nielsen 1993] or on concrete guidelines such as the company guidelines. [Borchers 2001, 6] The practice of the usability design may include for instance brainstorming, sketching, and prototyping, testing, evaluating and iterating the design. The emphasis of the design methods may vary depending on the preferences of a

person that is engaged in the design, but primarily the product development culture of the company has practically the main influence on those methods.

6.2   Design methods in dreams and real life

The full-featured usability engineering practice is "*a set of activities that ideally take place throughout the lifecycle of the product*" [Nielsen 1993, 71]. Usability design is not supposed to be an additional phase in the development process, happening somewhere between the planning and the system design. Rather it should be considered thorough the whole product development process, beginning from the early stages where the user interfaces are not even sketched yet. [Nielsen 1993, 74] Some of the usability engineering activities could be easily interspersed with the market research and product planning, such as the user research and the competitive analysis. It seems that the usability design activities are not generally part of the software development processes. The reasons for this could be searched from the production values of the companies (trade-offs between time, cost and efficiency) that conflict with the nature of the thorough usability design processes. Also the narrow comprehension of the usability design as a decorative –rather than a constructive- practice may influence on this matter. Usability engineering lifecycle consists of eleven steps: [Nielsen 1993, 72]

1. *User research*
2. *Competitive analysis*
3. *Setting usability goals*
4. *Parallel design*
5. *Participatory design*
6. *Coordinated design of the total interface*
7. *Apply guidelines and heuristic analysis*
8. *Prototyping*
9. *Empirical testing*
10. *Iterative design*
11. *Collect feedback from field use*

The thorough usability engineering design method has not settled to the software development industry, as it is generally considered as too slow and expensive for the IT industry. The traditional usability methods have a bias in the analysis, while the product development industry is based on action, i.e. delivering the products rapidly. Therefore cheaper, faster and effective usability design practices are easier to establish to the engineer-driven product development. Of course the usability practices in one company may be

established in different manners than in another, depending on the product development culture, the balance of the costs and profits, the overlapping organizational practices, the knowledge management and the capabilities of the technology. [Hiltunen et al. 2002, 50] Designer's resources may be very limited: there may not be enough time to do the usability studies, or they may be under funded. The management and engineers might not find usability important at all, if they lack an understanding of the topic, or they do not see any value in the increased usability of a product. [Hiltunen et al. 2002, 50] In opposite case the management may be very positive about the impact of the usability design practices. In these cases a systematic approach is required for promoting the idea further within an organisation, as well as resources are needed for supporting usability objectives. The systematic usability activities should be integrated to the development lifecycle, and in addition all user interfaces should be tested in a way or another. [Nielsen 1993, 21] This goal-oriented approach may be overly optimistic, since the need for the usability is often recognized too late, when the product is about to be released or when customers complain. In the real life the steps for establishing usability practices may range from the nonchalance to the miracle-expectations and through the panic towards the systematic use of usability methods. [Nielsen 1994]

Discount usability method is based on *scenarios*, *simplified thinking aloud* and *heuristic evaluation*. [Nielsen 1994] With this method the aim is not in the perfection, but in finding the most serious usability problems. In this method the idea is to produce design that is good enough. *The scenarios* are chosen among the features and the functionality of the planned system, taking the elements to the minimum for each simulated case. The scenarios can be implemented fast and cheaply with different sort of UI prototypes, e.g. the paper mock-ups or the façade prototypes. The advantage of small scenarios and cheap prototypes is in the possibility of changing interfaces frequently, reflecting the feedback from users. [Nielsen 1994] *The simplified thinking aloud* -user testing is done minimally instead of the full featured, videotaped user tests of 30 persons. Few representatives of the typical users are given some typical tasks of the product, and they are encouraged to think aloud while doing the tasks. [Nielsen 1994] Notes are taken during the session and conclusions implemented straight to the product. This sort of test does not require thorough training of interviewer or any complicated preparations, and at least the general usability problems will be found. *The heuristic evaluation* of the design is done based on the different rules and guidelines. There are hundreds of usability rules available, and it requires some time and effort (perhaps also experience) to filter the right set of the guidelines for the current purpose. For instance the design can be evaluated based on the natural dialogue, consistency, feedback, clearly marked exits, shortcuts, good error messages, help and documentation, non-redundancy,

supportiveness or flexibility. [Nielsen 1993, 20; Macaulay 1995, 57] Sometimes companies have their own brand guidelines that should be incorporated in the product as well. It is recommended to let several different persons to carry through the heuristic evaluation, as different people tend to recognize different types of problems. [Nielsen 1994]

## 6.3   Design process vs. product development process

The design process does not have a natural end, thus designers stop designing when they run out of time or when it is not worth of taking the topic further – from their subjective point of view. One skill of an independent designer is to know when to stop. [Lawson 1997, 124-127] Designers working within strict product development organisations do not often tackle with the problems of indecision, but the lack of time as the scope and the schedule of work are given from above. There are some conflicts in the nature of the design process and strictly controlled product development processes: there are an infinite amount of possible design solutions, and the design process does not have a natural end. The plans however should be created and delivered rapidly by the dead line. The result may be an inferior design in the quality, details, scope, depth of research and reason, as there may not be enough time to dig into the real problems but just to take care of the symptoms. The usual aim of the product development process is to prepare a product for the release and to eliminate the problems at hands. It is not the intention to find more problems towards the end of the production process. Of course the upcoming problems can be handled in the forthcoming versions of the same product, but that is another story.

The fact, that there is no such thing as a correct design process comforts the designers who are tackling with the conflicting requirements. [Lawson 1997] The design principles in the favour of the designer create the subjective ideas of the correct process and unfortunately often the design principles are too idealistic for the reality of the business world. After all, some usability in a product is better than none at all. [Nielsen 1993] Compromising in the cost of the professional values may feel uncomfortable, because designers contribute to the future by their work. Designed products will affect on the lives and daily activities of the people, whether in good or bad. There is a great stress for being successful in those professions that include design activities, since the designers are seldom forgiven the mistakes. [Lawson 1997, 127]

The conflict of the design process and the strict product development process can be seen for instance in the traditional waterfall method or in the variations of it. In the waterfall development process the product is developed in clearly defined series of steps, as shown in

figure 6.1. The fundamental idea of this method is that one step is finished when the next begins and so on until all steps are accomplished. [Lewis & Rieman, 1993-1994]

Figure 6.1 Phases of the waterfall development process
[Lewis & Rieman 1993-1994]
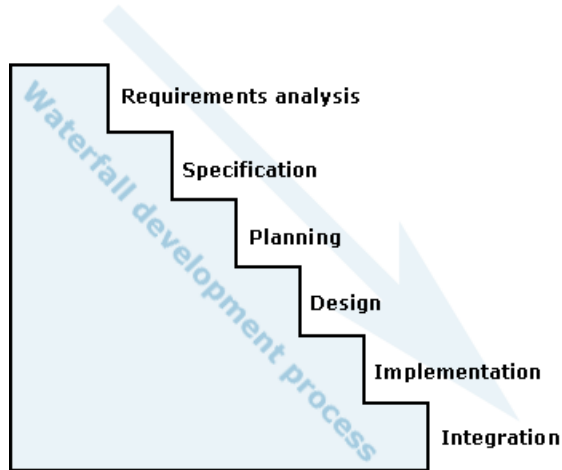
The waterfall method is problematic from the designer's point of view, because the design work is carried through in one step, and there is no way of improving plans after the production has reached the next phase. The result of the design work can be seen only in the end of the whole process, and thus the flaws in the design are both difficult and expensive to fix. The strictest form of the waterfall production prevents some widely promoted ideas of the design process, such as the iterative design. During iterative design cycles the plans are tested and evaluated in different ways, e.g. with the user interface mock-ups and the walkthroughs of different sorts. The design plans of the waterfall productions sometimes are delivered to the implementation without testing altogether, which sounds both hazardous and overly trusting. Since a delay in one phase means more pressure for the next, all phases are expected to follow the schedules. The final deadline (the delivery of the product) can be seldom reset after a contract is signed with a client.

6.4   Summary

In this chapter usability was discussed as a quality of the service. Customers' expectations of the quality could be taken into the consideration during the production process, because the designer is one of the key professionals who can improve the overall quality of the service. Appropriate resources are required for the proper design work, in order to produce plans above mere guessing. The mismatch between the creative design process and the goal-

oriented product development process is one of the biggest challenges when usability design practices are incorporated to the product development methodologies.

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Statistics Finland	http://www.stat.fi

Appendices

Appendix 1

Categorization of the people characteristics [Jordan 2000, 63-82]

Physio-characteristics	
Special advantages	Physical advantages e.g. skills (learned or inherent), strength, quick reflexes and exceptional dexterity
Special disadvantages	Injuries, diseases, allergies or illnesses; permanent conditions e.g. blindness, deafness or physical disability; temporary conditions e.g. pregnancy
Musculo-skeletal characteristics	Physical strength, flexibility/stiffness, mobility, motor control, sidedness (left, right or ambidextrous), athletism
External body characteristics	Height, weight and body shape, anthropometrical dimensions and facial features; hair, eye and skin colour; the condition of visible characteristics e.g. skin, teeth
Body personalization	Hairstyle, bodily and facial hair, piercing, tattooing, jewellery; glasses/contact lenses, plastic surgeries
Physical environment	Temperature and humidity of environment; environmental noise
Physical dependencies	Alcohol, tobacco, drugs (legal or illegal); eating disorders e.g. bulimia
Reaction to the physical environment	Adapting to heat or cold, smoke, dust, chemicals etc.

Socio-characteristics	
Sociological characteristics	Country and culture, values and customs; political considerations; characteristics of the neighbourhood and home
Status	A person's state in society, perception by others; cultural status e.g. being 'cool' to be seen with; social group; titles e.g. Sir, Lady, Doctor or Professor
Social self-image	Perception of own social identity and status
Social relations	Friends, family and loved ones; social preferences; living circumstances
Social labels	Characteristics that people may use to make assumptions about social attributes: e.g. person's visible characteristics like gender, age, ethnic origin; person's accent, name or nationality; clothing, hairstyle, outward signs of affiliation with a particular group
Social personality traits	The way that people relate to others socially: generosity, strong sense of community and social responsibility; particularly caring or loving; conformity vs. rebelliousness
Social lifestyles	Socially active, going out, meeting others vs. preference of spending time at home

Psycho-characteristics	
Special talents and difficulties	Intelligence, skill and creativity; ability to learn and memorize, perceptual abilities; mental disabilities
Psychological arousal	Temporary states of psychological arousal: feelings of being alert, stressed, tired, bored, etc.
Personality traits	Steady psychological attitudes: e.g. being extrovert, introvert, aggressive, passive, perceptive, intuitive etc.
Self-confidence	Level of a person's self belief: self-confident vs. uncertainty
Learned skills and knowledge	General skills: e.g. learning language. Specific skills: learning to use a particular product

Ideo-characteristics	
Personal ideologies	Personal lifestyle choices, goals and aspirations: traditional family values, work ethic, achievement orientation; hedonism: decadence, epicurism or matetrialism; 'purity': temperance or minimalism
Religious beliefs	Beliefs or lack of beliefs. Organized religions; moral codes; personal religions or moral codes
Social ideology	Beliefs about the way in which society should conduct itself and the way in which they should interact with others in society. E.g. respect for authority, environmentalism, political correctness; technophilia or technophobia; particular moral views about how the society should behave
Aesthetic values	What people will find aesthetically pleasing: judgement about what is beautiful or attractive; visual arts; attitudes towards styles e.g. fashion
Aspirations	Wish to see oneself in different ways. E.g. being a good father or mother, value of intellectual ability or sporting prowess; being modern or traditional; being a realist, a purist, a pragmatist, a cynic

Appendix 2

UI of the mobile banking application: payments –demo

Mobile phone manufacturer Nokia launched its' first Series 60 mobile phone, Nokia 7650 in June 2002. Along with that launch it became possible to explore suitability of a mobile phone for the banking activities. One characteristic of the Series 60 with the Symbian platform is that anyone has a possibility to develop software applications for it. During July 2002 a small scale demonstration was created in Meridea Financial Software by two persons, user interface designer Riikka Puustinen and technology specialist Erno Oxman, who programmed the application.

Since Meridea Financial Software had a great interest in the mobile banking technologies, it was found beneficial to carry out some experimentation of banking activities with the mobile phone. The project also aimed at increasing the knowledge of the Series 60 platform, Java applications (Java MIDP 1.0) and UI design for mobile banking software applications. The demonstration was considered also supportive for the marketing and sales department, since the actual piece of software in the mobile phone was perceived as the convincing evidence about the mobile phone's suitability for the banking activities.

The scope of the demonstration was kept relatively narrow, and the demonstrated banking features were chosen to be about the payments. The word 'relatively' is used here, because the final scope of the demonstration was basically determined with the UI designer and the programmer following opinions and the advices of the business analysts and the supervisors. The task of the project was to demonstrate as many banking features as it was reasonable/possible to accomplish during a one-month period, which was reserved for the project. The demonstration was chosen to be *horizontal*, which means that several features were implemented, but the depth of functionality was kept shallow. The other possible approach would have been the *vertical* approach, in which only few features are implemented, but all sorts of functionalities related to them are taken into account, from the error handling to the real context of use. In this horizontal demonstration for instance error handling and information verification was kept in the bare minimum. On the other hand, some aspects of the mobile use cannot be demonstrated easily, such as suddenly dropping connections or failing processes, as well as the recovery from those situations. The data transfer was simulated in some cases, when for instance a payment was accepted and the

money transfer was supposed to happen. In that sort of situation the user got an informative (but fake) message about the back-end activities.

In the overall level the project met its' purpose, and the understanding of the mobile phone's properties was gained. This report introduces briefly the Series 60 platform and Nokia 7650 phone as the platform for the demonstration. The design process of the user interfaces will be covered briefly. An insight will be taken to the evolution of UI during the project, with the help of the own transfer –task, in which money is transferred from the account to another.

The device

Nokia 7650 was the first phone model of Nokia that was based on the Series 60 platform, followed by Nokia 3650 and Nokia N-Gage Mobile Game Deck at 2003. Series 60 is built upon the Symbian OS technology, which is an open platform developed especially for the needs of the mobile phones.[44] Series 60 platform provides a range of technology standards, such as C++, Java API and since spring 2003 also an XHTML browsing environment. [Forum Nokia, Developer Platform for Series 60]

The Series 60 User Interface is designed for the one-hand operated high-end mobile phones, which have a large colour display, five-way navigation keys and two softkeys. For the text-input there is a standard ITU-T keypad of 12 keys. Other

Figure 1 Series 60 phone, Nokia 7650.

phone manufacturers can license the Series 60 platform as well, if their hardware meets the requirements. Keys and buttons of the Nokia 7650 mobile phone are pointed in figure 1.

[44] More information about Symbian OS and the specific needs of mobile phone operating systems are discussed in http://www.symbian.com/technology/why-diff-os.html

The resolution of the Series 60 display is 176 by 208 pixels. The pixels of the display are square (ratio 1:1), which helps the work of the user interface designer a lot. Nokia 7650 supports 12-bit images, which means that there are 4096 colours available for the use. The display is divided to different areas: [Nokia Series 60 UI Style Guide, 11]

- *Screen* is the topmost display component, corresponding to the entire pixel area of the physical screen.
- *Window* is a component that has no parent except the screen. Typically a window fills up the entire screen.
- *Pane* is a sub-component of a window. A window may contain many panes, which may contain further sub-panes etc.
- *Application window* is a principal window filling up the entire screen. It is usually not used directly for display, but as the parent for the various panes.
- *Element* is a bottom level component of display, that does not have any sub-components.

Application window is divided to three main areas as shown in figure 2. *Status pane* shows for instance the title of the application, signal and battery indicators and the application icon, *Main pane* is the principal area of the screen for the data and *Control pane* displays the labels that are associated with the two softkeys. [Nokia Series 60 UI Style Guide, 11 – 16] Each of these panes may contain further sub-panes.

Figure 2 Main areas of application window

→ Status pane

→ Main pane

→ Control pane
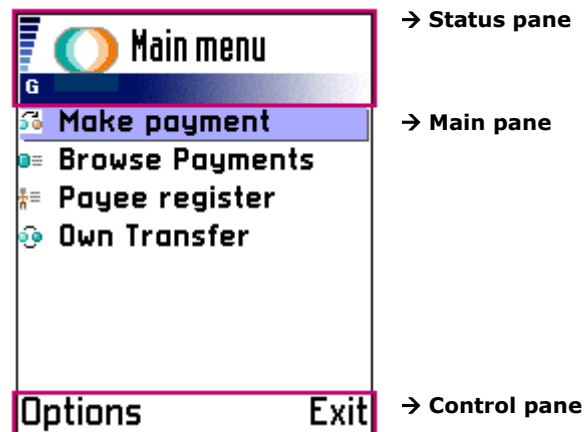
Design process

The work between the UI designer and the programmer was organised to support an iterative design process: first the scope of each feature was clarified with the business analysts. Then the preliminary navigation maps were sketched, as well as user interfaces based on the UI functional requirement documents. The preliminary sketches were first reviewed with the colleagues, then with the programmer who actualised the plans in Java Midlets. The

programmer reported potential problems to the UI designer, who then fixed the UI plans accordingly. That input was again brought to the application, until there was a perception of the workable application. At that point the first circle of user tests took place and the findings were incorporated to the design. After that the demonstration was tested for the second time with the different set of test users. Both of the times the demonstration was tested with 4-5 persons, who did not have previous experiences of using mobile banking applications. Basically each interface went through the iterative cycles 2-4 times. It was also agreed on, that the different sections of the demonstration were designed and programmed in sequences, in order to exploit all possible time that was available for the work. For instance when UI sketch of the new payment –section was under construction, the programmer investigated meanwhile the technology and system logic of that functionality. When the UI sketches were delivered to the programmer, the UI designer moved to the next section, e.g. own transfer, and so on until all sorts of features were accomplished.

Features

The demonstration follows the Finnish custom of making payments. Some basic payment tasks are introduced in it, as well as some aiding tools, such as the personal payee register for making payment tasks easier. The features of payments-demonstration are shown in table 1.

Table 1 Features of the Java MIDP –demonstration

Section	Task
Make payment	Make a new payment by filling necessary fields and accepting a payment
	Fetch payees' information from the payee register
	Fetch payees' information by typing a predefined nickname
	Save payees' banking information to the payee register
	Make the payment ready but postpone its transference (=save the payment for further use)
Browse payments	View both open and approved payments
	View details of the payment
	Edit information of the payment
	Edit status of the payment
	Approve all open payments
	Approve one open payment
	Delete the payment
Payee register	Add a new payee to the register
	Modify the existing payee information
	Delete the payee from the register
	Transfer payee's information from the register to the payment form
Own transfer	Transfer money from own account to another

Structure and navigation

A navigation method of the application was customized for the advanced users of Nokia Series 60 mobile phones. This design decision can be seen in the use of a select key. It is possible to enter and navigate the predefined paths between the sections just by clicking the select key. For instance bringing payee's information to the payment form with only one click of select-key. Those automated selections can be found also from the options menu, as the first option on the soft-key menu. This approach provides two different ways to navigate through the demonstration, but it has to be acknowledged that such custom is doubtful from the logical point of view. Now if user learned to use the select key as the main navigation method, he/she quickly noticed that in some parts of the navigation flow the use of options-key was unavoidable.

The overall navigation map in figure 3 shows the structure of the demonstration. The more detailed view to each section can be seen in the UI maps (figures 4-7), which show the content of the each state with the available commands in the soft key menus. The UI maps were made with the basic image editing software, thus the UI does not look exactly like the final outcome. In those maps graphics are basically placeholders, and fonts are just close approximates of the real fonts of the device.

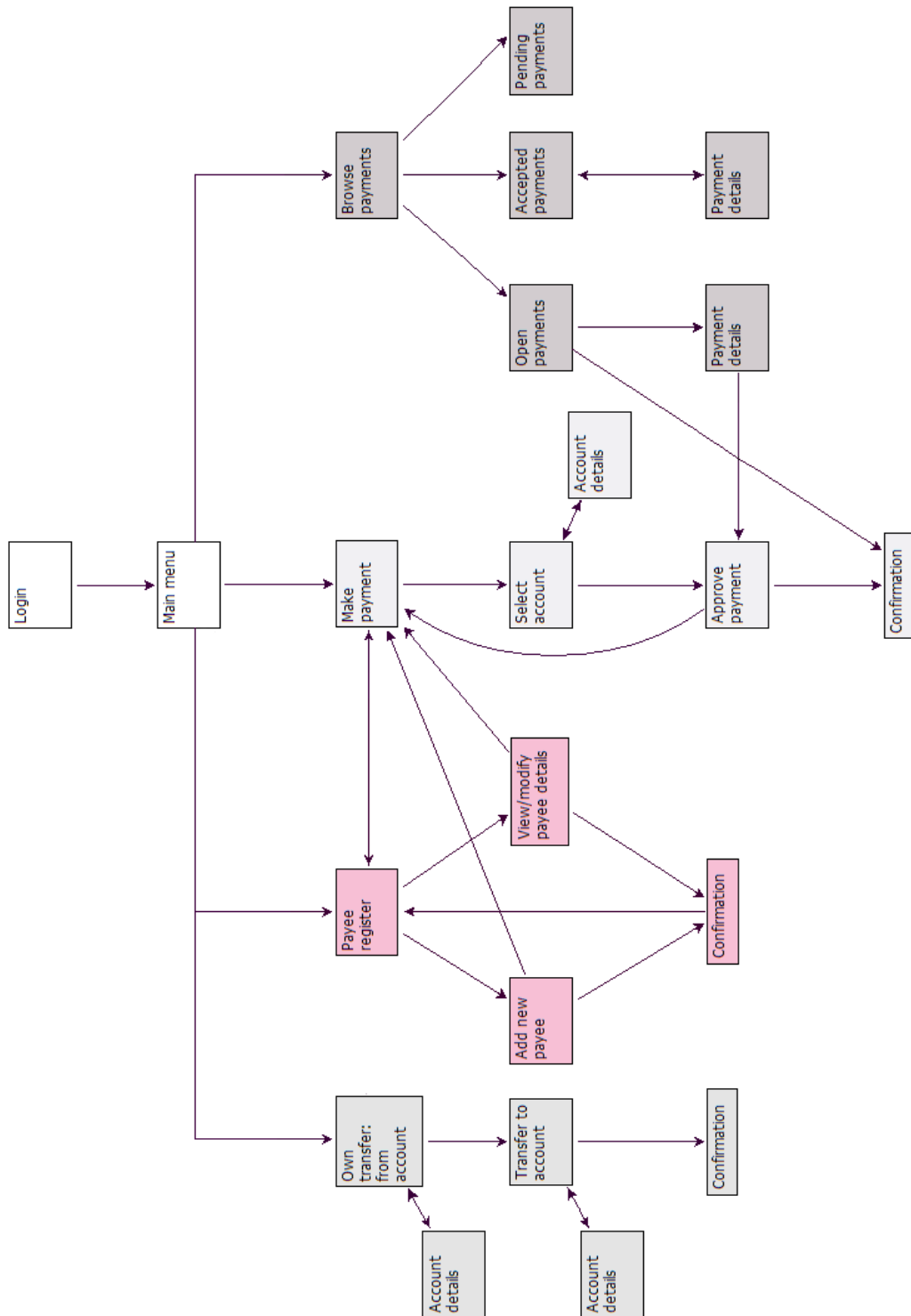**Figure 3** Navigation map of the payments–demonstration

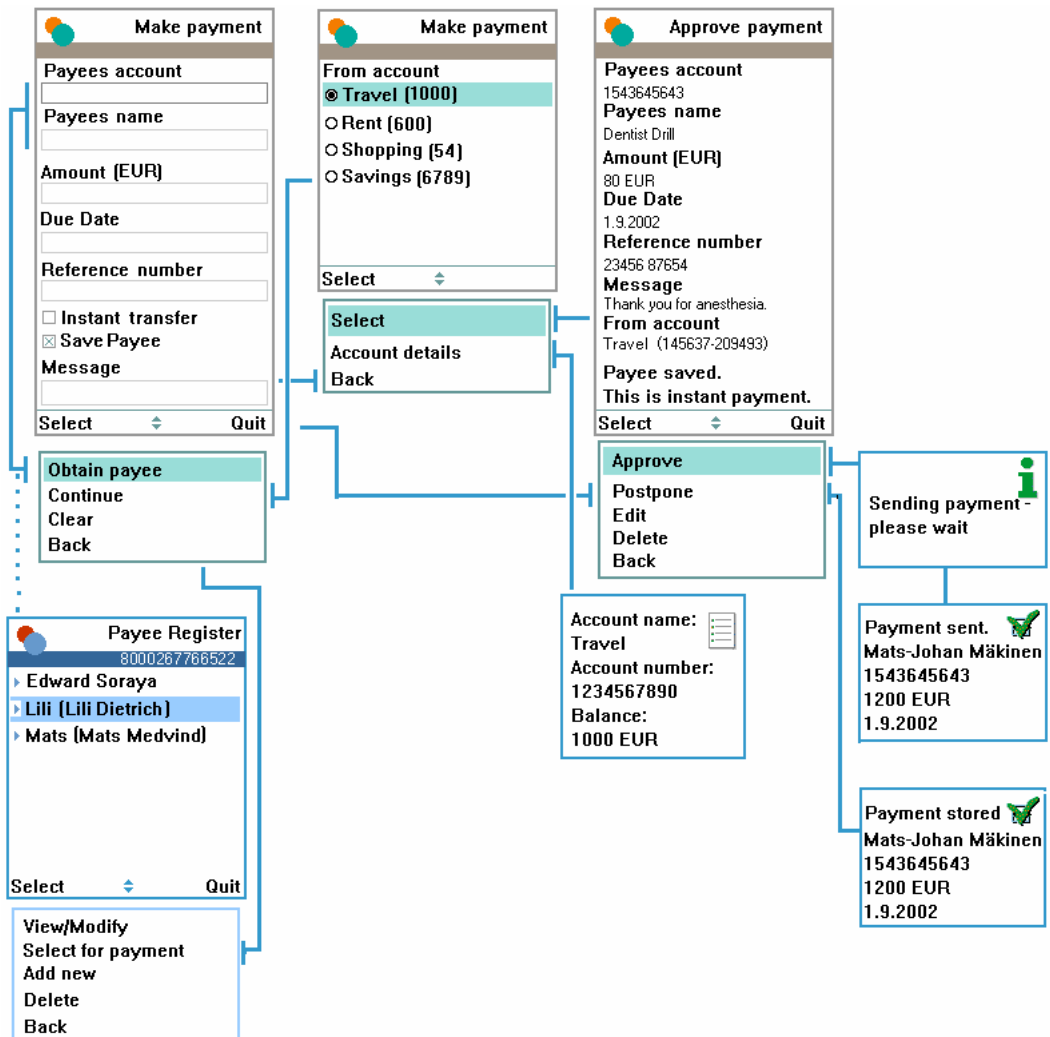**Figure 4** The UI map of the Make payment –section

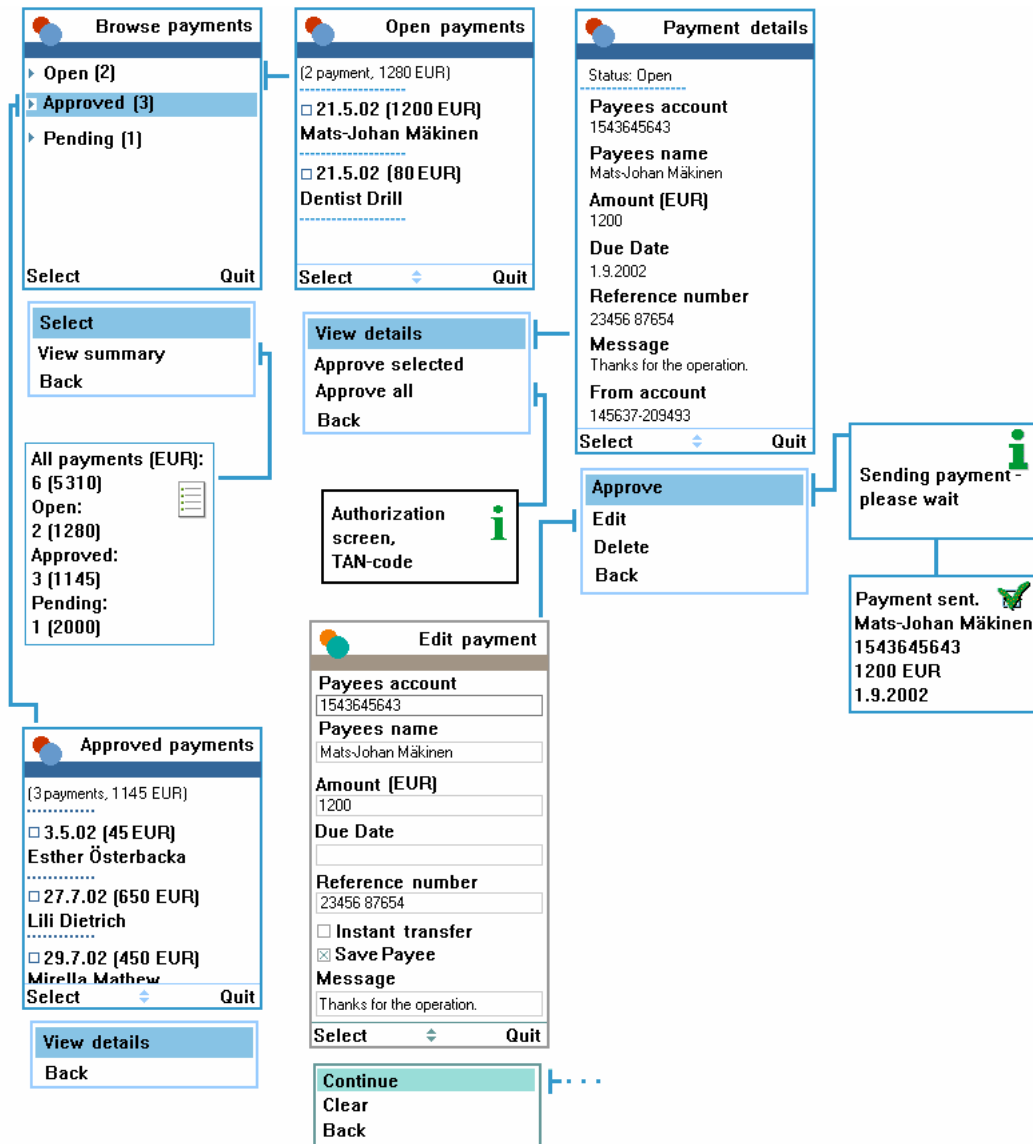**Figure 5.** The UI map of the Browse payments –section

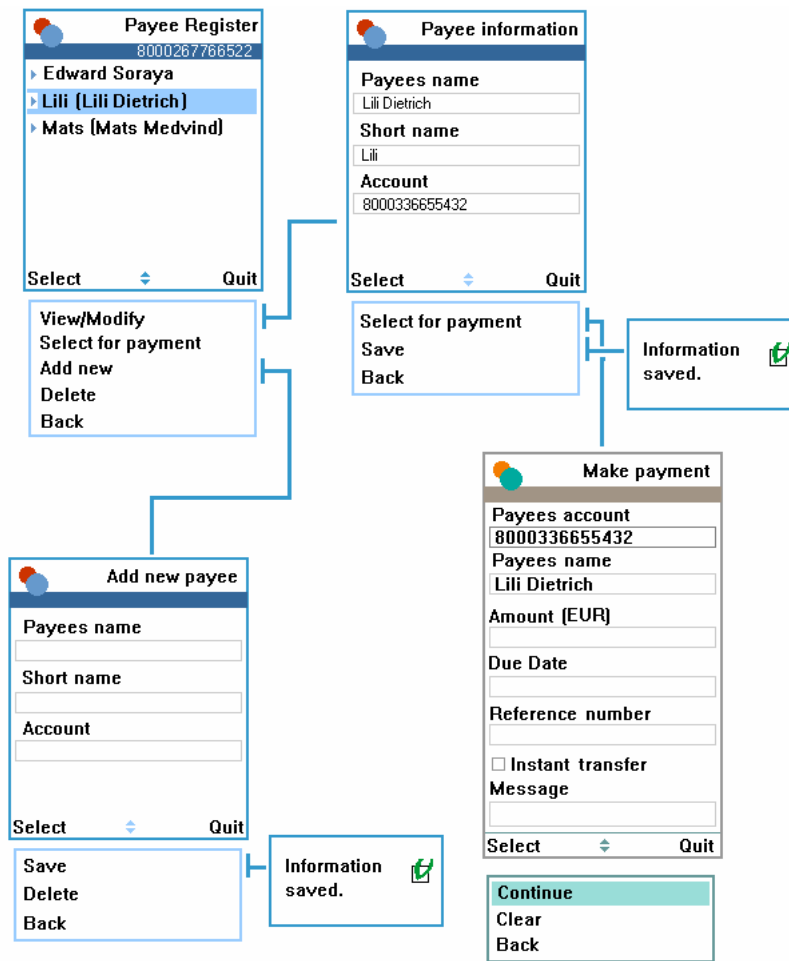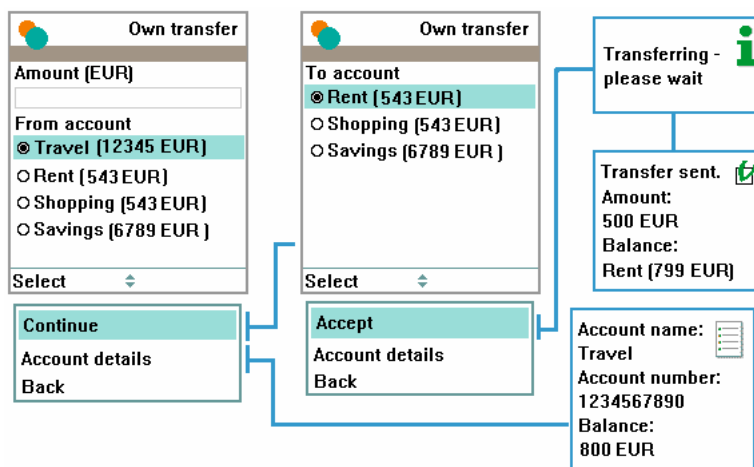**Figure 6** The UI map of the Payee register –section

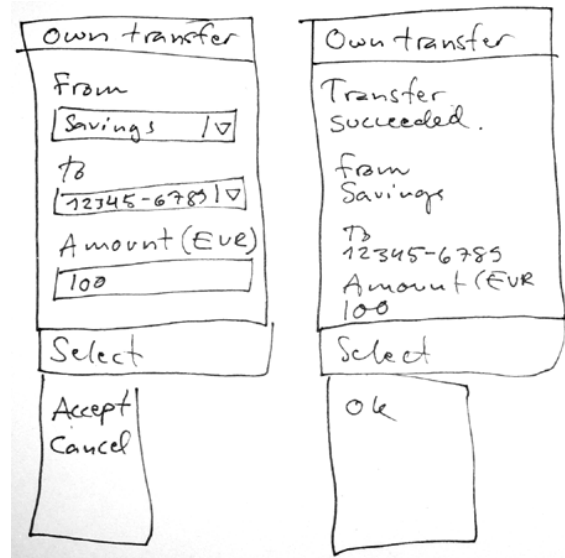**Figure 7** UI map of the Own transfer –section

Evolution of the UI

The evolution of user interfaces can be very dramatic, since unexpected things come up in different phases of the design process, sometimes thoroughly altering the UI. The section of own transfer is a brief and excellent example of the different sorts of design problems that formulate the user interface to the totally unexpected direction.

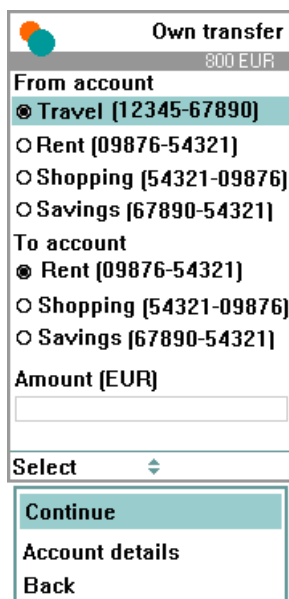**Figure 8** Hand-drawn sketch of the own transfer-screens

The first sketches of the own transfer - section present source and target accounts as the dropdown lists, and the money amount field is situated below them, as shown in figure 8. This organisation presents the logical order for the task, which is 1) to select the source account, since it can be seen how much money there is in the account, then 2) to select target account, and then 3) to define the amount to transfer. The confirmation is given when the transfer succeeds.

Since the programmer informed, that Java MIDP 1.0 did not support dropdown menus, the only choice for their replacement was the radio button list, as shown in figure 9. With this layout it was difficult to tell what was the balance of each account. The balance of the account was shown as a ticker, scrolling in the coloured bar below the screen's title. If the selection focus was changed from the account to another, the ticker appeared again from the rightmost side. It was very difficult to perceive this information, and thus the account number in brackets was replaced with the balance of account.

Figure 9 The second layout of the own transfer –screen

When user interfaces are designed only with paper, pen and image editing software, the main attention is in the layout and the logical order of the content. Actual behaviour of the interface elements will remain unknown, until the programmer develops the functionality of the application and the visual user interface based on the sketches. The first surprises come up in this phase, when actually trying out the functional user interface. The problem with the user interface shown in figure 10 was the cursor, which automatically focused to the amount –field. Users who entered this screen for the first time were confused, because scrolling down with the navigation keys did not give any response at all, even though the focus seemed to be on the first radio-button in the list. In reality the cursor was focused automatically to the bottom of the screen. In order to select an account, user should have scrolled upwards on the screen. Of course

**Figure 10** Lost focus of the own transfer -screen

users could not understand where the cursor was hiding, since they could see only a small part of the content at once. The visual cue of the first radio-button lured them to believe, that cursor was focused to the first item on the screen.
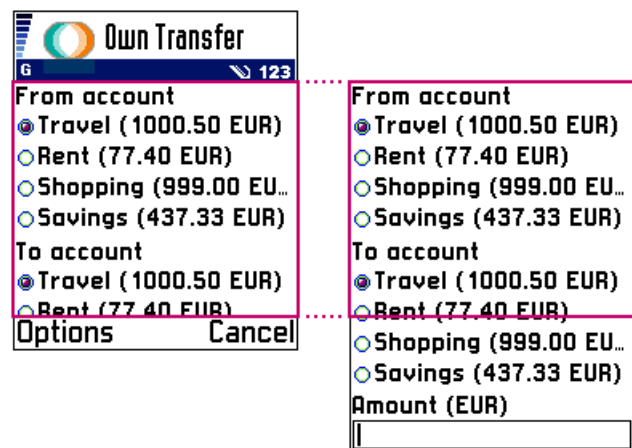
The cure for the lost cursor was to replace the amount -field to the top of the screen, as

**Figure 11** Third layout of the own transfer –screen.
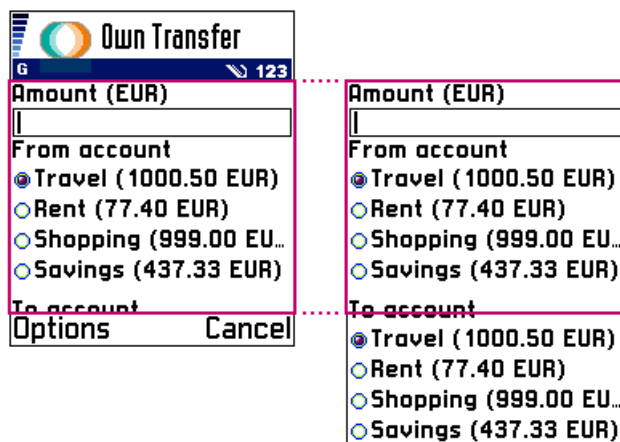
shown in figure 11. Now the focus behaved as it was supposed to: scrolling downwards was totally natural, though the logical order of the form felt a little bit peculiar. It is not exactly sensible to decide first how much money to transfer, before the source account is selected. Also it was possible to select the same account twice, because when the users scrolled the account lists back and forth, the previous selection disappeared from the sight.

account lists back and forth, the previous selection disappeared from the sight.

In the final stage the source and target accounts were separated to the different screens, as shown in figure 12. On the first screen the user inserts the amount to transfer and selects the source account. On the second screen the user selects the target account from the list. During the transition from screen to another the source

Figure 12 Fourth layout of the own transfer –screen.
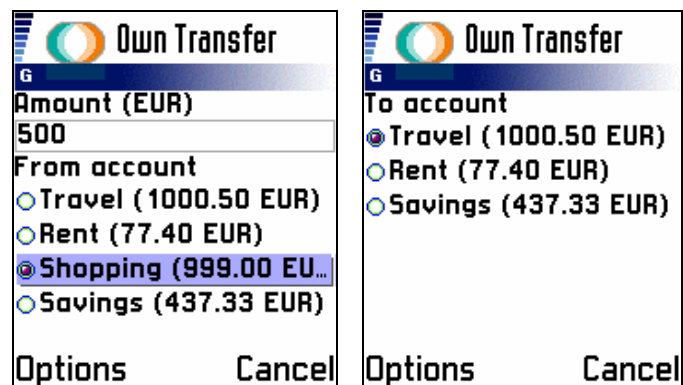
account is removed from the list of accounts. In this manner it is not possible to select same account twice. The logic of the money transfer task is lost in this layout. In user tests this task was generally found easy, but also confusing because the logical connection between the elements was broken in the transition from the screen to another. The users became worried when accomplishing this task, because they generally forgot the selection that they had done on the first screen. It was not noticeable, that the source account had been removed from the list of target accounts.

In general level the final screen flow and layout is by no means the best possible. In this case the design for error-prevention did not bring much advantage for the users, because the logic of the task became fuzzy when the source and target accounts were split to the separate screens. In this case it would be better to leave all elements on the same screen, and to wait for the Java MIDP 2.0, where the dropdown lists will become available.

Few known problems of the demonstration

Every here and there it can be noticed that the terminology and soft key options of the demonstration are not totally clear. For instance the term "Postpone payment" in the 'Make payment' –section [see figure 4] is quite technical, and does not necessary mediate the purpose of the functionality. Postponing the payment means basically saving it for the further use. Instead of "Postpone" there could be "Save", which makes more sense to the end-users.

The UI map of 'Browse payments' [see figure 5] presents the misunderstanding of the UI designer in quite concrete way. The purpose of the "Pending payments" category in 'Browse payments' -screen did not become clear at any point of the design process, and even though

programmer asked several times about the purpose of it, that category persistently stayed on the screen. Both the programmer and the UI designer were uncertain about its meaning. Later it was understood, that 'a pending payment' is a technical high-level category for those payments, that are not transferred yet, but waiting in the banking system for the transference. For instance the accepted payment is a pending payment, if it's due date is in the future.

A very small amount of graphics was used in the demonstration, and among those few graphics was found a very persistent problem with the application icon. The icon was supposed to be transparent in order to blend in, if the colour scheme of the mobile phone was changed. As the figure 14 shows, the problem could not be solved with a reasonable effort. It still remains as a mystery, how to create transparent PNG-images for applications, if it is possible at all. Despite of ten tries of different alpha-channels and transparency-settings, the logo remained the same. The conclusion is, that the application icon should be square, i.e. to use the whole area reserved for it, unless some clear instructions are found for solving this problem.

Figure 14 Transparency fraud uncovered

It is unavoidable to insert information with the keypad when making payments. It is nice to offer pre-filled fields with sensible information, for instance the due date on the payment form can be set to be the current date by default. It is also possible to set character restrictions to input fields. For instance the password fields can be set to numeric form, in order to type in numbers by default. However, the account numbers are usually presented in the two sets of numbers, which are separated with a dash. Customising the character restriction would have been very useful in this payment demonstration, because when numbers are inserted there is also a need for the special characters. For instance the money amount consists of the numbers and the punctuation mark separating the decimal. If one wants to insert that sort of set of characters (which is very likely), the default character restrictions cannot be used. During the user tests it was noticed, that most of the people did not know how to insert numbers easily, while being in the full character mode. Most of the test users tapped keys multiple times instead of using the long key press, which is the easier way of filling the numbers to the fields.