eye square

Mobile Usability

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Abstract

Concerning the classical, stationary internet it is by now widely accepted that factors like relevance, speed and reliability are not the only variables that determine a long-term customer-binding and a general success in the e-business. Usability and its relevance for successful e-business got more and more recognized.
With this study we transferred the usability-question to the mobile internet. What factors determine the acceptance of this medium? Is it comparable to the stationary internet?
Our aim was to provide a style guide full of recommendations especially for managers and developers who are engaged in the development of mobile data services and, moreover, to demonstrate in particular the importance of usability as a determining factor of success also in the mobile internet.
Based on this motivation, an extensive usability test with 36 representative users was carried out. We included four WAP (Wireless Application Protocol) portals of leading German mobile operators as well as 23 selected WAP services which were intensively investigated. The usability testing was based on three WAP-enabled mobile phones by Siemens, Nokia and Motorola.
Using task scenarios which represented a typical everyday use-situation, participants were asked to explore different WAP services.
The results are straight forward: Only user-friendly mobile services enjoy a high potential of user acceptance. The main factor of general acceptance is described by the experienced utility and usability of the WAP services. In other terms, successful services are especially characterized by limited functionality and a clear focus on the specific mobile situation of the user. This clearly demonstrates the users requests towards the mobile internet compared to the stationary internet.
Despite the underlying restrictions of the mobile internet, our data prove that consumers generally show interest in mobile services as they see the advantages of independence of time and space. On the other hand, our results demonstrate the necessity of a considerable improvement of the usability and the quality of information presentation.
The results will be specifically discussed to create usability recommendations for further developments.

1 Introduction

The central point of the mobile economy (m-commerce) is based on the mobility of the people. Mobility and fastness seem to define more than ever our modern society. Therefore, it is not surprising that also mobile communication becomes more and more important in our everyday life. The convergence of internet and mobile phones creates the mobile internet which in fact provides the user with extended possibilities in the mobile communication. The advantage in the wireless data communication is widely seen in the independence of time and location and therefore, in an increased flexibility and convenience for users concerning their mobility. Typical functions of the internet should be accessible at any time in any location.

In today's Germany already 50 million people see their mobile phone as an important and necessary tool in everyday life. Besides the conventional voice communication especially the text based communication, the Short Message Service (SMS), received an enormous acceptance and is widely used.

On the other side, the "mobile experience" of the most users is reduced only to these applications. Only a very few users practice an interactive data exchange via mobile phone in order to receive immediate information, send e-mails or order products.

Contemporary mobile internet applications rely on the WAP (Wireless Application Protocol), a standard which is widely used by developers of mobile, interactive data services for the GSM (Global System for Mobile Communication). This technological standard was developed in 1997 to overcome the limitations of the GSM-nets via intelligent data formats and data compression. More detailed documentation's about different versions of the WAP-standards can be found under: www.wapforum.org.
The WAP-technology describes the current standard of mobile internet in Europe. Therefore, in this study we investigated the usability of the mobile internet using the WAP-mobile phones as an representative example of it.

1.1 Stationary versus mobile internet – two main differences

In the following section we will briefly describe the main differences between stationary and mobile internet, which also might have implications and therefore, raise specific questions concerning the usability of the systems.

1.1.1 Restrictions of the mobile internet

As a general observation it can be stated that the mobile internet is highly limited and in many ways not comparable to the stationary internet. Even though, the power and performance of mobile technology will continuously increase, it most likely wont overcome some heavy restrictions. The main difference is due to the mobility aspect of the mobile internet. This mobility aspect requests small appliances including small (still two-colored) screens. We depend on in capacity and speed limited processors and we have no mouse or keyboard available. Taken together, this leads to a minimization of the "known" internet. A hypertext information structure in the way we are used to it from the big computer screen can´t be implemented. To explain this more illustratively, see figure 1 in which two user interfaces of the stationary and the mobile internet are presented.

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Figure 1: Left: Yahoo WWW-Homepage. Right: The according WAP-front-page.

Figure 1 clearly demonstrates the contrast: While the WebPages of Yahoo contains altogether 123 options and one banner (without scrolling), the WAP-front-page offers only 2 options! The most space on the little screen is taken by the logo. The quite logical consequence of this technical restriction can be summarized in: **Reduce to the Max!**
Therefore, developing a mobile data service means, to exactly know what the user wants and needs!
Another important restriction of the mobile internet is the very limited data transfer.
The mobile net has to provide wireless connections over long distances and thus the amount of transferable data is reduced and the costs raise. To add more to the list, the variety of colors and fun-generating animations still belong to the future.
All those factors are responsible for a reduced "user-experience" and seem to be not avoidable in the near future.

1.1.2 The universal device of the PC´s versus the device variety of the mobile internet

To use the classical stationary internet it doesn't need a very detailed understanding of the system itself. It is easy to handle by all users who have basic computer skills, i.e. working with the keyboard or the mouse. The needed equipment is pretty much the same throughout all kind of users, which enables the industry to offer standardized products and services accessible at any computer.
On the other side, the mobile internet is characterized by a highly diverse variety of appliances which seem to become even more specified and broad in the future (see also figure 2). Besides the mobile phone, other products with different technical specifications and usability concepts will offer the customer possibilities of using the mobile internet, PDA (Personal Digital Assistant) and so called Smartphones are just two examples.
In a first step of considering usability in the process of development it is important to fit the services to the customers and their specific needs and life situations. This is a quite known fact – the essential point concerning the mobile internet is to consider the enormous device variety. In other terms, not every service might work equally good on

every appliance. In terms of a fast text based communication an entire keyboard will be helpful, whereas simple time scheduling can be easily organized by holding a PDA in one hand and the according pen in the other. A keyboard is for this purpose not necessary.
That is, why we think the combination of the user-orientation approach (fit service to user) with the consideration of the immense device variety is essential. Taken together, this leads us to our proposed Mobile Economy Paradigm: **Fit Service to User to Device!**

Figure 2: Mobile Economy Paradigm - Fit Service to User to Device.

1.2 Usability as a determining factor of success in the mobile internet

In interactive systems, to which data services belong to as well, customer orientation becomes more and more a fundamental user orientation. The user interface is the most important representation of the company. That means, in the context of mobile services it is the mobile contact to the customer. If the usability of the interface is bad, customers will not be able to make proper use of the system, break contact or stop the running transaction and try to find alternative providers.
But what does usability mean?
We will now briefly give an introduction to three different approaches concerning the definition of usability (for more detailed information see also http://www.uiah.fi/projects/metodi/158.htm).

1.2.3 Shackel's approach (1991)

The outstanding approach to usability taken by Brian Shackel (1991) has been much used and modified (e.g. Chapanis 1991, Booth 1989), and was among the first to recognize the relativity of the concept in a number of respects. Shackel starts his presentation from a model of product perception, where acceptance is the highest level concept. The user or consumer is supposed to compare the properties of the product to the sacrifices needed to acquire it. In a purchase situation, utility, usability and likeability are balanced in a trade-off with the costs of the product. The best possible alternative is

selected, i.e. it is acceptable. Thus, acceptance is a function of perceived **utility, usability, likeability and costs.**
Utility refers to the match between user needs and product functionality, while usability refers to users' ability to utilize the functionality in practice. Likeability refers to affective evaluations, and costs include financial costs as well as social and organizational consequences. Having located usability in the context of acceptance, Shackel presents a descriptive definition: "Usability of a system or equipment is the capability to be used by humans easily and effectively." (Shackel 1991, 24) From the angle of consumers' product evaluation the short definition is adequate, because their own situation determines the context. 'Easily' refers to "a specified level of subjective assessment", and 'effectively' is equal to "a specified level of human performance".

1.2.4 Nielsen's approach (1993)

Nielsen suggests that usability and utility together form the usefulness of a system. He makes this explicit: "…utility is the question of whether the functionality of the system in principle can do what is needed, and usability is the question of how well users can use that functionality." This view is also supported by for example Grudin (1992). Grudin associates usability and utility with totally different disciplines, i.e. computer science and information system research. He takes the view that the differences also reflect on the design processes. Utility is defined first by the product managers, usability being subsequently optimized by the designers. Grudin heavily stresses a more integrated design process, but does not suggest that the concepts themselves should be merged.
The ability of the functions to help the user carry out a set of tasks is called utility. Usability is a concept that focuses on the problems of how users utilize these functions. Nielsen does not present any descriptive definitions of usability, but considers the operational criteria to define the concept clearly enough (1993, 26-37): **Learnability, Errors, Satisfaction and Memorability.**
Learnability refers to the novices' ability to reach a reasonable level of performance rapidly. Errors refer to the number of errors users make, to their ability to recover from errors, and to the existence of catastrophic errors, which destroy the user's work. Satisfaction refers to users' subjective assessment of the system concerning how pleasant it is to use. Memorability refers to the casual user's ability to remember how to use a system after a period of time.

1.2.5 ISO 9241 part 11 DIS

ISO 9241 DIS is a draft international standard for the ergonomic requirements for office work with visual display terminals (ISO 1994). Part 11 discusses usability for the purposes of product requirement specifications and product evaluation. In spite of the name, the definitions of part 11, "Guidance on usability", are also said to be applicable to other situations where a user is interacting with a product to achieve certain intended objectives. This extension makes usability a very general concept capable of wide application outside its conventional applications within the discipline of information technology. ISO 9241 defines usability as "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use." According to ISO 9241, the dimensions of usability are:

- Effectiveness: the accuracy and completeness with which users achieve specified goals.
- Efficiency: the resources expended in relation to the accuracy and completeness with which users achieve goals.
- Satisfaction: the comfort and acceptability of use.

Effectiveness measures usability from the point of view of the output of the interaction. The first component of effectiveness, accuracy, refers to the quality of the output and the second, completeness, refers to the quantity of the output in relation to a specified target level. Thus, including effectiveness means including the anticipated utility of the system in usability. Efficiency describes the interaction from the process point of view and relates effectiveness of interaction to resources expended. It may be measured in terms of mental or physical effort, time, materials or financial costs. Satisfaction has two components – comfort and acceptability. It refers to the user's point of view.

As we can see from these definitions it seems recommendable to the people who are involved in the developing process (project managers, conceptioners, interface designer and programming people) to take different perspectives within the developing process. Especially managers, technicians and software provider should imagine more often the perspective of the user to think of the possibilities and restrictions of the mobile economy of today and tomorrow.

2 Design

This study was conducted to answer the question: Why do WAP-based mobile services receive only little acceptance by users and what are the problems that users have in particular with this system?
The study was carried out in October / November 2000. We focused on B2C-WAP-services and excluded the B2B-WAP-applications intentionally in order to allow an unbiased comparison and to reduce complexity.
We investigated four WAP-portals of German mobile phone providers (D2, T-D1, E-Plus, VIAG Interkom) and altogether 23 WAP-based services of different branches (traffic services, bookshops, hotel services, cinema, news, stocks information services, search machines, night-guides and health information services). All in this study included content providers are listed in figure 3.

Deutsche Bahn Lufthansa ADAC		
service provider group A	service provider group B	service provider group C
▪ BOL ▪ Cinemaxx ▪ N-TV ▪ Comdirect ▪ Fireball ▪ Starwap ▪ Gscout	▪ Booxtra ▪ Hotelkatalog ▪ Cinema ▪ Süddeutsche Ztg. ▪ Consors ▪ Wapjag ▪ Max ▪ Gscout	▪ Amazon ▪ Hoteldirect ▪ Berlin030 ▪ ZDF ▪ Dresdner Bank ▪ Wapup ▪ Berlin030 ▪ Gscout

Figure 3: List of all content providers that were used in this study.

To receive information about the influence of a certain kind of mobile phone the testing was carried out on three different WAP-mobile phones (Siemens S35i, Nokia 6210 and Motorola Timeport, see also figure 4).

Figure 4: Mobile phones used in the study (Siemens S35i, Motorola Timeport, Nokia 6210)

2.1 Participants

Thirty six participants (18 females and 18 males) took part in this several hours taking test. Participants were tested individually in our usability lab and received financial remuneration. The average age was 29 years. Participants reported that they would use

their mobile phone often (1,6 – on a scale of 1 very often to 5 very little) and described their mobile phone experience as more than average (2,5 – on a scale of 1 very much to 5 very little).

2.2 Method

Participants were randomized over mobile phones, portals and service providers. The first three data services were the same for all subjects (see also figure 3). Following the first three services subjects had to explore one service out of each content category (e.g. Amazon out of the category bookshops).
Participants were asked to solve a number of tasks which represented a typical user situation. The following example will demonstrate this: "You need a present for your mother and you want to order a book via mobile phone. You know that she is very interested in crime-literature. Please try to order the new book of Henning Mankell."

To receive our data we included quantitative as well as qualitative methods. We used questionnaires to measure the experienced acceptance, utility and usability of the services and to ask for the probability of using this service again or to recommend it to other people. The investigator rated the quality of the solved task (performance rating). In observing the participants behavior, their statements and in interviewing them after each explored service we received qualitative data concerning acceptance, usability and utility of the services which afterwards were also quantified.
In a final interview we discussed the anticipated personal use of these services, things that have to be improved, the costs of WAP-services and the future of the mobile internet in general. The structure of the usability test is shown in figure 5.

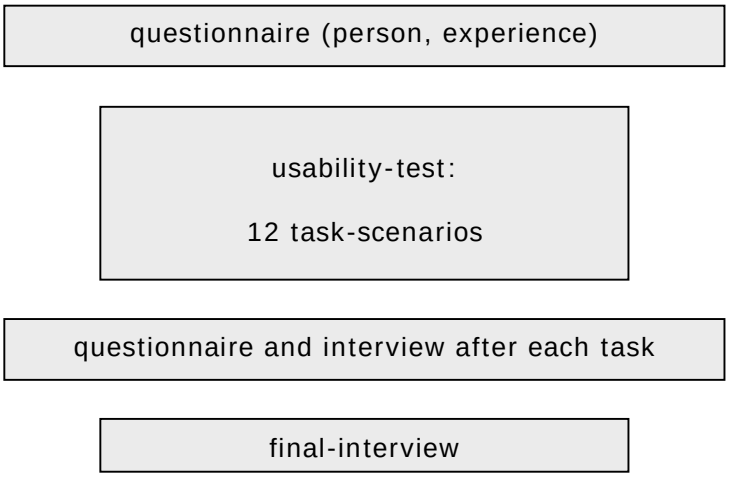

Figure 5: Structure of the usability test.

3 Results of the usability tests

In this chapter we will report the most important results of the usability testing. We will start discussing usability problems of the portals that were involved in the study and the three different mobile phones. Second, we describe and discuss usability problems of three for this purpose selected WAP-services.

3.1 Portals

The best results received the T-D1 portal.

A general problem including all investigated portals was the navigation. Especially the backwards navigation, meaning back to the previous page or back to a higher level in the hierarchy lead to problems. This topic wouldn't be a problem if every WAP-page would have a back-option. The user could easily go to the last page or to the main page. Unfortunately, this is not always the case. A lot of WAP-pages don't have this option. In this case, users have to rely on the mobile phone buttons (mostly a red receiver or a red C-button). But, this handling is similar to the browser back button in the internet – one has to go the whole way back which one has taken before. Especially annoying is the fact, that every page has to be loaded completely new because, it is not saved in the cache like it is in the internet browser. Another option for the frustrated user is to press a certain mobile phone button for a longer time. This will lead him directly back to the original portal-page.
Those problems can not exclusively be blamed on the portals alone because, often services design the WAP-pages totally on their own.
Therefore, we recommend all service designers to provide users on every WAP-page with navigation options via link to the next higher hierarchy level and to the main page!

3.2 Mobile phones

Users with Siemens-mobile phones had generally spoken no problems with the Siemens S35i. This might be due to the fact that throughout different kinds of Siemens-mobile phones basic functionality structures don't change. Our study confirmed the advantage of this usability centered product–strategy by Siemens.
Nokia-users had much more difficulties in handling the new Nokia 6210 mobile phone than e.g. Siemens users. Different Nokia mobile phone models have different buttons and menus, therefore, it takes a big effort for a Nokia-user to get used to a new Nokia model. The question is: What reasons should persuade a Nokia-owner to choose Nokia again, when buying a new mobile phone? Why should he be loyal to the brand Nokia?
Usually, Nokia mobile phones receive very good references concerning usability from customers as well as from sales persons. We think it is a pity that in terms of WAP Nokia is risking it's good reputation. The numerous change of functionality structure is contradicting the idea of a successful customer binding. An interface concept is also always a part of the brand and should, therefore, be changed very slowly and carefully.
The empirical data questioning the relation of mobile phone experience and performance with the mobile phone used in this study revealed an astonishing result: Especially Nokia experienced participants showed the most problems in dealing with the Nokia 6210. On the other hand, Siemens experienced users in all got along quite well with the Siemens S35i and, surprisingly, had less problems with the Nokia 6210 either. Figure 6 demonstrates this result.

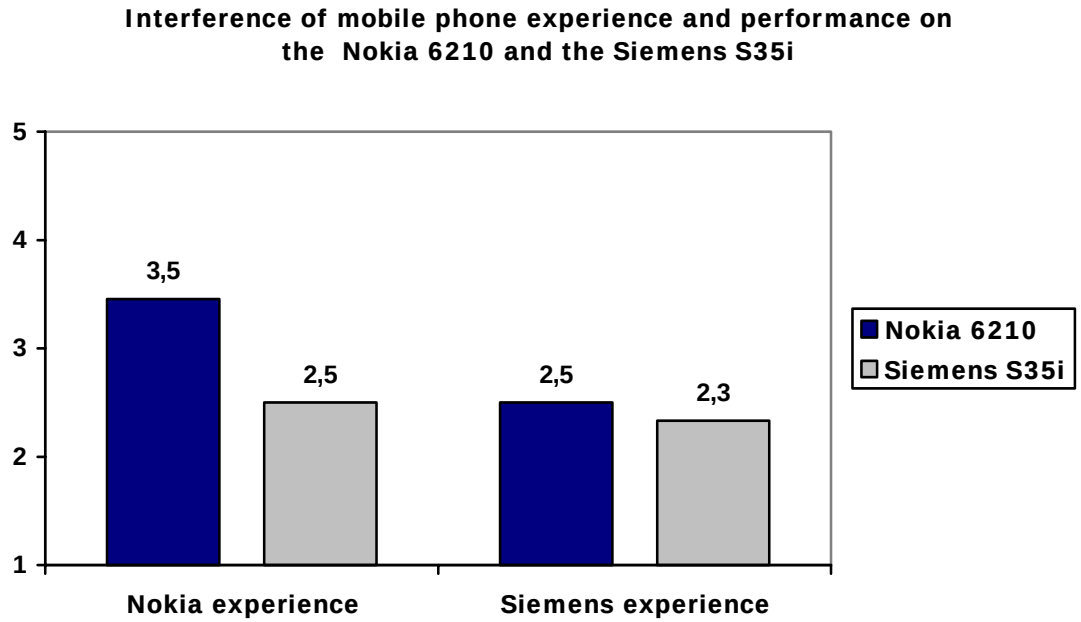

Figure 6: Interference of mobile phone experience and mobile phone performance.

Figure 6 clearly demonstrates the negative influence that experience with another Nokia mobile phone has on the performance with the new Nokia mobile phone model 6210 (the score represents the acceptance within the portal tasks solved by all participants; 1 very high – 5 very low).
It seems that Nokia experienced subjects wanted to transfer their pre-knowledge to the new Nokia model. Because, as mentioned above, the navigation structure within different Nokia mobile phones differs significantly, this pre-knowledge interfered with the actual task solving process. That is why Siemens users demonstrated less problems while exploring the WAP on the Nokia 6210 than the Nokia users did.

3.3 General determinants of acceptance of WAP-services

In order to find out the specific weights of the single factors determining the general satisfaction of users we conducted a multivariate regression analysis. The goal of this statistical analysis was to receive information about the influences of single factors on the general satisfaction with WAP. The score beta (the numbers in figure 7) represents the weight of the single factor concerning the general satisfaction. We used the average scores over the first tasks (portal tasks).
Therefore, the following results of the multivariate regression analysis can be generalized over different WAP-applications. The five questioned predictors resolve in total 81% of the acceptance (explained variance R^2=81%), which represents a relatively high quality of the statistical fit. The scores on the arrows in figure 7 indicate the weight of the factors influence on the general acceptance. The higher the score, the higher the influence of the factor.

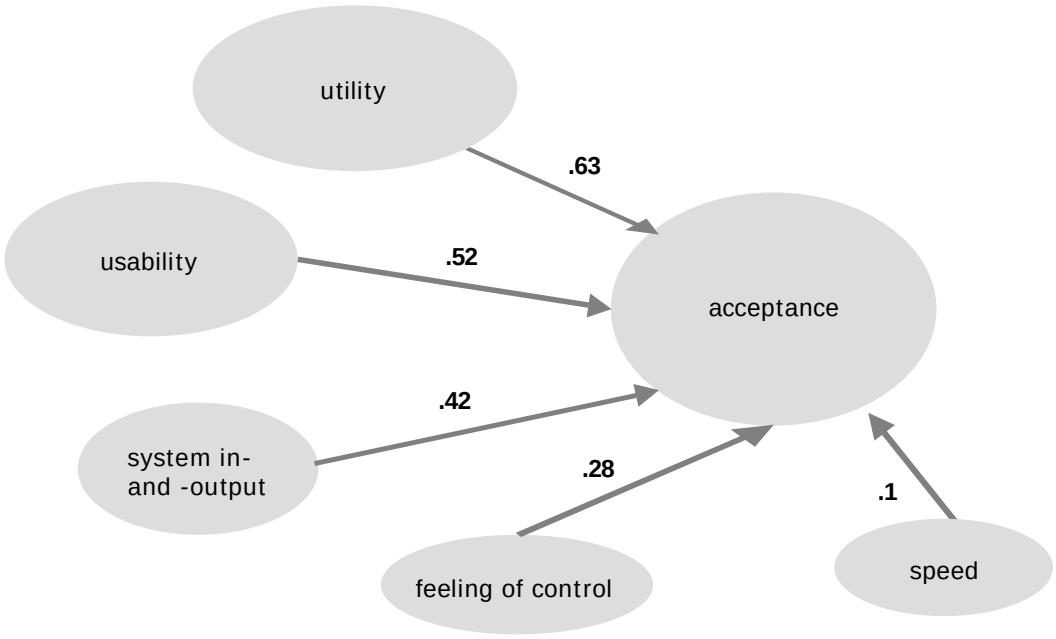

Figure 7: Factors that influence acceptance: multivariate regression analysis.

Figure 7 shows that the acceptance of WAP-pages is mainly determined by utility (score beta .63). In other words, the most important part of the general acceptance lies in the concrete usefulness of the application.
The second important factor is usability (score beta .52).
That means, utility and usability are the most important factors for the general acceptance of WAP-pages.
The third factor is system in- and output, including processes of information in- and output like selection via number buttons, text-input, hierarchy levels of the menu, ... This factor represents the connection between hardware and display (score beta .42).
The factor "feeling of control" describes the subjectively experienced feeling of control over the WAP-page (.28).
Surprisingly, the last factor representing the speed of the system response, is the least important. In other terms, the estimated speed of the system seems not to be important at all. Users are willing to accept longer loading times as long as the main factors utility and usability are not restricted.

3.4 Ranking of the content providers in terms of general acceptance

When calculating the acceptance of the content providers and listing them in a ranking order it reveals the results shown in figure 8:

Hoteldirect	1,7
Cinemaxx	1,8
Starwap	1,9
Max	2,0
Amazon	2,2
Lufthansa	2,2
Comdirect	2,2
Gscout	2,4
ADAC	2,5
Cinema	2,5
N-TV	2,5
Süddeutsche Zeitung	2,5
Deutsche Bahn	2,6
ZDF	2,6
Dresdner Bank	2,9
Berlin 030	3,0
Consors	3,0
Wapup	3,2
Hotelkatalog	3,3
Fireball	3,6
Booxtra	3,7
Wapjag	4,0
BOL	4,4

Figure 8: Ranking of the content provider according to the general acceptance.

A general acceptance score of "good" received Hoteldirect, Cinemaxx, Starwap, Max, Amazon, Lufthansa, Comdirect and Gscout. These providers considered the needs of the users. They all tried to keep their navigation system user-friendly and thought carefully about the application context.
ADAC, Cinema, N-TV, Süddeutsche Zeitung, Deutsche Bahn, ZDF, Berlin 030, Dresdner Bank, Consors, Wapup and Hotelkatalog reached average scores. All of them still have unused potential. Optimizing the usability and a stronger focus on the user in general could help to increase the users acceptance towards those providers.
Very low scores got the providers Fireball, Booxtra, Wapjag and BOL. For those providers it is important to center on the usefulness for the user, a user-friendly navigation system and a user-friendly search-function.

3.5 Results of selected services

In this section we will discuss three selected WAP-services to demonstrate significant usability-problems. We chose the WAP-services of BOL, Deutsche Bahn and Max City Guide as examples.

3.5.6 BOL

Figure 9: Screenshots BOL.

The WAP-bookshop of BOL as shown in figure 9 is an older version which was working at the time of our study. Back then it was characterized by an only very limited selection of available offers. An option of ordering books was also not provided. Therefore, it is not surprising that the general acceptance was very low (4,4). This result describes the worst score out of all tested WAP-services. A similar result was received concerning the utility of the service. Like the score of acceptance, the average score of utility (4,5) received the worst result out of all services too.
Moreover, usability got a bad range as well. Participants scored the experienced usability with 3,8. The task solving quality was very bad (5); none of the participants were able to solve the task. Taken together, the consequences are a very low re-use and recommendations probability of the page (9% each).
If a user enters a WAP-site of a bookshop to order a book he most likely will expect a function with which he can find the desired book in a catalog to finally order it. Within the BOL-bookshop a user has to search through diverse categories to find out at some point that he can only choose within the very limited BOL-selection.
While looking for an option which allows to order a book a user might find the function "note". This function might promise success. If he chooses it he will be asked to type in his e-mail address. First of all, to type in a long e-mail address is not a very handy task and second, BOL implies that mobile phone owners automatically have also an e-mail address. The "help" function could have told our user that it is not possible to directly order a book. So, what's the point of BOL? The only possibility that BOL offers is to send the user an e-mail which will remind him of the wanted book. This e-mail contains an "ordering" link which leads directly to a WWW-site. In other words, it is just impossible to order a book via BOL on the WAP.

The lack of usability lead to significant navigation problems (6 out of 12 participants). Also 6 subjects would have liked to have a search function to find their book. 8 subjects discredited this service completely. Most of our participants could not imagine to use this service.
The following dialog will serve as an example of the experienced frustration of one of our participants:

interviewer	*"... we still have the option 'offers'."*
participant	"'offers', oh well..."
interviewer	*"So, …"*
participant	[sighs]
interviewer	*"... and how is it going?"*
participant	"I just gonna look at the other page..."
interviewer	*"Yes?"*
participant	[sighs] "… well, when I see this, ..., that will take us three hours – at least."
interviewer	*"No."*
participant	"Come on! Yeah, it's nice [slightly cynical], actually, I just have to quickly look where we are right now." ...
participant	"Actually, we just should type in the author ... there are tons of books ... it is totally unrealistic that we will find something here... "

3.5.7 German Railway (Deutsche Bahn)

Figure 11: Screenshots Deutsche Bahn.

The WAP-service of the Deutsche Bahn (see figure 11) provides users to directly get access to the time schedule of trains. This service has big potential to be a successful mobile application. Although, in order to reach this goal – usability will have to be improved. The Deutsche Bahn shows an average result (tendency positive) considering the acceptance score of 2,6. Usability (2,5) and utility (2,5) can as well be interpreted as average scores with positive tendency. The re-use probability (27%) is rather low, which might be due to the fact that most of our participants were car owners. The likelihood of recommending this service to other people demonstrated with 45% a general acceptance.
The most outstanding problem was created by the design of the entrance page. It was not indicated at all that users had to scroll down on this page in order to find the menu. In other words, when entering the Deutsche Bahn site, our participants didn't know how to continue and what to do at all. 11 out of 36 participants revealed heavy problems with this. Users of Siemens mobile phones had the big advantage that the mobile phone browser itself contains arrows pointing downwards, indicating the option to scroll.
A second main problem was the requested input of the city names by hand. Seeing for instance the field "From: [...]" some users thought they could enter their text right away. They did not know that it was necessary to click on this field first in order to activate it (6 out of 36 subjects). The typing in the text itself created big problems for a number of participants (8 out of 36 subjects). It seemed especially hard to find special signs (e.g. point or slash).

11 out of 36 participants mentioned the speed of the site as positive. They were surprised that WAP can work so fast. 5 out of 36 participants emphasized the user-friendly structure.
The direct input of text strongly influenced the experienced usability. This result was also confirmed through the statistical analysis of the questionnaires. In other words, if there are no words to type in usability is experienced as high and vice versa. A possibility would be to present main cities in a menu, so that the input of words is only necessary for towns.

3.5.8 Max City Guide

Figure 12: Screenshots Max City Guide.

Max (see figure 12) reaches a relatively high score of 2,0 on general acceptance. Consistent with this result are the scores of utility (2,2) and usability (1,7). The quality of task solving was scored with 1,3. Participants see the likelihood of using this service again with 42%, whereas, the probability of recommending it to other people lies even higher (50%).

When entering the start page "Max City Guide" it automatically switches to the menu page. The headline is a small space-saving graphic "Max City Guide". At the same time the user has the option of selecting the city of interest. Again, it is a pity that there is no possibility to type in the first letter of the city. The alphabetical list of available cities is considerably long, because, it does not only contain German cities, moreover, one can find an astonishing list of international cities as well (e.g. Beijing). This provides German travelers with many opportunities.
After one has selected Berlin another menu occurs. Again, it contains the title "Max City Guide" and now also the title "Berlin" which maintains full orientation in the navigation process. The following links are listed in the menu: "city information", accommodation", "eating and drinking", "nightlife", "shopping". Max keeps a slightly different focus than Starwap, in that respect, that Max also offers information for tourists.
"Stadtinfo" offers a big compilation of city information starting with the arrival at the three airports of Berlin up to flea-markets, each with detailed texts. Below those texts there is the link "more of the Max City Guide". Where to find this "more" is unfortunately not clear. Really useful city information are not to find under this link. It is also not understandable why this category does exists at all and why it is listed on the top.
If one chooses the category "nightlife" a page comes up which contains a graphic and headline: "Berlin: Nightlife" and the following menu selection: "dancing", "bars", "cafes", "Everything from A-Z". If the user goes on selecting for instance "bars", the next page offers an alphabetical list of different bars and their location (street name). This is meant to give the user a first clue about the area. Of course, this is primarily applying to Berliners and those who know the city very well. The question is, if the street name is

really essential on this hierarchy level or if it would make more sense to save space and to add after each bar just the district in which it is located.
The user has to scroll through an endless list of bars without knowing how many of them are possibly listed. Besides that, the selection is amazing in terms of well known and trendy places and will provide the user a good variety of opportunities. At the end of the page links to the start page as well as a search function are missing.
Once a bar of interest is chosen, the user will get the complete address. In addition he will receive the phone number (which unfortunately can't be dialed directly), descriptions about how to get there (very well!), credit card information and opening times. Clicking the link "more" provides the user with information about history, events, style of music and audience. Those kinds of information will definitely help a user to decide positively or negatively the location. It demonstrates a very positive aspect of Max City Guide. The only obstacle is finding this information. It is hidden behind two extra clicks. There are also no navigation links on those info pages. Instead of mentioning the whole street name on the first page, which takes incredibly much space, it would be better to include two links: one for basic information, one for details.
Despite the very detailed information one can receive from Max City Guide it is still missing options of filtering or restrict the search (e.g. different styles of music, districts of the city). A general search function is missing as well. Concerning those questions the service provider Starwap is more innovative and user-friendly.

There were almost no usability problems (one subject was not able to find Berlin, three subjects would have preferred a selection based on city-districts). In general, Max City Guide got good references from our participants: 5 out of 12 subjects valued the good information, 4 subjects mentioned especially the easy use, also 4 subjects liked the categorization and the selection of the offers. That's why probably almost all of our participants could imagine to use this service on a regular basis.

4 Final interview

Based on the final interview we first show a ranking of the investigated categories of WAP-offers in dependence of personal importance. This will be followed by answers of participants concerning how much WAP met their expectations, what did they think about costs and future of WAP.

4.1 Personal importance of domains

After the actual test, participants were asked to rank the different domains in terms of personal importance. (position 1 = highest level of importance, position 5 = lowest level of importance; see also figure 13).

		absolute frequencies					naming in percent
domain	**total score**	range 1	range 2	range 3	range 4	range 5	
nightlife	**2,5**	7	5	7	2	2	68%
cinema	**2,4**	7	6	5	3	1	65%
German Railway	**2,2**	6	1	8	6	2	68%
traffic info	**1,7**	1	11	0	3	3	53%
health	**1,3**	3	0	4	5	5	50%
flight info	**1,2**	2	3	2	4	4	44%
hotels	**0,9**	1	4	0	2	5	35%
search function	**0,9**	3	1	2	1	2	27%
stocks	**0,6**	1	1	1	4	1	24%
bookshop	**0,5**	2	0	1	1	1	15%
news	**0,4**	0	1	2	1	2	18%

Figure 13: Ranking of domains in terms of personal importance.

Nightlife, cinema and German Railway were placed the most often on the higher ranges. 68% of our participants elected the categories nightlife and German Railway to the top five, 65% mentioned the category cinema in the same manner.

4.2 Fulfilment of expectations, questions about costs and future of WAP

None of the participants had any experience with WAP before the testing. We asked our subjects how much WAP did meet their expectations. As a total result, it is to mention positively that indeed, almost 50% of the participants saw their expectations satisfied. We interpret this result as clear evidence of an acceptance potential within the testers.
Our subjects got introduced to mobile services for the first time while participating in this study. They seemed rather positively surprised and would even consider to make more use of it in the near future (Mean 2,8 on a scale from 1-yes to 5-no).
At the same time participants clearly distanced themselves from accepting the current costs of accessing the WAP. The present time-based price of using the mobile internet is 0,39 DM per minute and receives a mean of 3,8 on a scale from 1-yes to 5-no. In order to raise the willingness of participants to use mobile internet services regularly prices would have to be reduced to at least 0,15 DM per minute.
Many of our participants see the advantages of mobile services in their flexibility, mobility and a general availability. They understand the WAP-medium as an important source of information. Several subjects experience WAP-applications as convenient and uncomplicated. Some even mention speed and saving time as reasons of a possible more intensive use. WAP-services were generally perceived as future oriented and trendy.

On the other hand, WAP-applications are also experienced as too slow and too complicated by some testers. In this respect it clearly shows that slowness is not really referring to the speed of the information transfer as much more to the difficult usage of the system. This is not surprising, because the amount of the transferred data is, due to the momentary text-orientation of the WAP-medium, rather small. Several subjects prefer the big screen-internet and find it generally more comfortable and more

informative. Therefore, the restricted and limited information receivable through WAP-services is seen as a disadvantage.

The following list presents desired improvements that would possible lead to an increased use of the mobile internet:

1. User-friendliness / navigation and information presentation / clearness of structure (20 subjects)
2. Speed (14 subjects)
3. Functionality / error resistance (9 subjects)
4. Reduced costs (8 subjects)
5. Information offers (8 subjects)

The future of the mobile internet lays in mobile applications. Subjects demonstrated an interest in mobile services, like banking, shopping, e-mail or even paying by mobile phone. On top of that, especially video-communication or "mini-tv" on mobiles are seen as potential applications of the future. Participants emphasize hereby the importance of a reduced text input, e.g. via voice-control.

Our study demonstrated that participants show a general positive attitude towards the mobile internet. They see the most important advantage in the flexibility and the independence of location. Nevertheless, it is still absolutely necessary to improve the usability and the quality of the provided information by WAP-services. Besides that, a significant reduction (at least 50%) of the current costs could also lead to a higher general acceptance.

5 General mobile usability recommendations

Throughout the investigated services there are certain usability problems that regularly reoccur. Therefore, we think it makes sense to list general conception oriented usability tips which should help to give developers and managers of mobile data services an orientation. In addition, we would refer to our Mobile Usability Report, in which furthermore concrete recommendations for programming as well as domain-specific design suggestions are included.

1. **Co-development with users! –** In order to respect expectations and skills of users in the best possible manner, it is necessary to adopt an application development strategy in which the intended target group is 100% involved right from the beginning.

2. **Mobile action-focus! –** WAP-services have to be able to provide the user with fast task solutions in mobile situations, e.g. time-schedule of the German Railway via WAP-mobile phone, in case one wants to take a later train.

3. **Reduce to the max! –** This is our main mobile usability-paradigm. Mobile Data-services should only provide the most necessary options and functionalities. Instead of quantity, the quality of the presented information is much more important.

4. **KISS!** – "Keep it simple and stupid!" is a well known slogan to support the easiness of interactive applications. Where ever there is complexity that is either

not necessary or can be hidden from the user, it should be reduced as much as possible.

5. **Personalizing!** – Bookmarks and personalized services are able to increase usability. Bookmarks help users to find their preferred services faster. Personalized services are adaptable to individual needs of the user, it is therefore easier to navigate and it increases the benefit for the user at the same time.

6. **Localizing! –** A localization focuses the service at the local standpoint of the user – a situational factor. The consequences are less clicks for the user in order to reach the anticipated goal. At the same time it is inevitable that a user is able to activate or deactivate the automatic localization function on its own.

7. **Naming in a nutshell!** – It is absolutely necessary that names of categories, options and links fit as closely as possible to the skills and expectations of the user. The naming should put the to be expected content in a nutshell!

8. **Transparent navigation!** – Due to reduced possibilities of interaction (compared to stationary internet) it is especially important to have a really easy and transparent navigation. A user must know where he is, where he is coming from and how to continue.

9. **Scrolling instead of clicking!** – Our participants preferred scrolling through a list in general, to clicking on a serial list which takes several pages. A list should therefore, not contain more than 7 item's.

10. **Minimize text input! –** Systems without or with minimal direct text input were more excepted than others. To type in a text has negative consequences concerning the usability and should be avoided as much as possible.

11. **Consistency!** – Throughout an application there should be used the same names and identical navigation patterns. Helpful are common generalized usability standards, e.g. the link "home" should always lead to the start or home page.
12. **Sharing common factors!** – In order to keep the compatibility between different browser-gateway-combinations it is necessary to find common factors on a simple basis. An extensive application testing will be needed.

13. **Don't talk about technology! –** A consumer is not interested in which technology is included in order to use the mobile internet. The communication with users should focus primarily on functionality and benefits of the system instead of technology standards.

6 Summary: Closing usability gaps

This "mobile usability briefing" is meant to be a practice oriented paper to the still young usability discussion of the mobile internet. We are still in the beginning of the process to change 50 million German mobile phone users into 50 million excited mobile internet users.
We can state, that our participants acknowledge and recognize the potential of the mobile internet. Increasing flexibility and independence raise and offer new possibilities of the private and business lifestyle, which is more and more characterized by mobility. Because the current WAP-experience is rather disappointing, the "player" of the mobile economy will still have lots to do. Our critique is not only directed to portal and service providers, moreover, our study clearly demonstrated that also hardware producers and mobile providers themselves have to take a closer approach to the market and the needs and skills of the ordinary WAP-user.

Right now there are real usability-gaps in the mobile enabling of the user which should be filled as soon as possible. The discrepancy between user expectations and service and product quality are much too big to get the mobile internet accepted by the masses. Especially the harmony between hardware, net, and mobile service has to increase.
The leading determining factors for a general acceptance of mobile data services are the experienced utility and usability. Usability is therefore, a strategic factor of success, as much as the benefit of the service for the user. Only if both criteria are met, an economical success is possible.
The "user-behavior" is characterized by fast problem solving in mobile situations. On the other hand, convenience ("couch surfing": to use the mobile phone at home sitting on the couch in the living room) and mobile "time-killing" are also important situations of a potential use.
The wishes and expectations of our participants are straight forward: The mobile internet has to become easier, cheaper (0,15 DM per minute), more stable and faster. The appliances should have bigger and colored screens and offer also a voice interface as soon as possible. Services should provide users with selected functionalities in maximized qualities and at the same time, satisfy the needs of the people in mobile life situations.
Our mobile economy paradigm **Fit Service to User to Device** and our mobile usability paradigm **Reduce to the Max** are meant to help managers and developers of mobile data services and to remind them on a constant basis on what philosophy mobile internet is based on.
In order to fill the usability gaps we see the necessity of a intensive cooperation between the members of the value web of the mobile economy and especially the users. We would like to see ourselves in the role of a user-advocate, who places technology more in the background and the user as well as the utility and usability of mobile offers more in the foreground.

Looking ahead we support the demands of users of mobile data services:

1. Invest more time and money in usability of mobile data services!
2. Invest more time and money in usability of mobile hardware!
3. The net provider should reduce the costs to access the mobile net!
4. By fair revenue sharing the net provider should pay tribute to the important role of the service provider in satisfying the user!

Those are the most important changes that have to be done in order to use more of the still latent potential of the mobile economy.

7 Looking into the future – the relevance of WAP for mobile data services

A look to Japan is bringing up doubts about the necessity of a WAP-standard in mobilizing internet offers. Over 20 million in Japan use a mobile online service called "i-mode", which is a brand and not a technology. It doesn't need WAP and is based on internet standards like cHTML (compact Hypertext Markup Language), HTTP (Hypertext Transfer Protocol) and TCP/IP (Transmission Control Protocol/Internet Protocol). This service is successful because it works package oriented and on an "always on" mode.
The speeded up world of GPRS (General Packet Radio Service), which also provides a permanent data connection (equivalent to an "always on" mode), should help WAP to a breakthrough. Costs would occur on the basis of data volume (airdata) instead of the time of connection (airtime). The problems are still the current much too expensive GPRS-prices and the slow introduction of GPRS-compatible appliances, which asks for a lot of patience of all involved players of the mobile economy and especially of the users.