Broad study on the usability of mobile phones

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Abstract
A mobile phone the size of a candy bar offers dozens of complex functions, a masterpiece of engineering. Unfortunately, the more functions are available, the less they are accessible to the average user. The design of the user interface suffers from a lack of suitability for the tasks, does not conform to user expectations and a suboptimal self-descriptiveness. The usability of modern mobile phones was tested in a broad survey with over 1300 participants. An internet based simulation offered tasks and an online evaluation. It could be pointed out that mobile phones are not only hard to access for novices but also those who consider themselves experts have difficulties when confronted with unknown functions or another brand of phone. Approaches to increase the usability are discussed.

1 Introduction

It's interesting to note that customers value the ease of use quite a lot. "The best product combines a nice price, a well done user interface, functionality, low weight, good design and a strong in descending order of importance" (ifmm 2004). These findings reproduce the results of an earlier study, where ease of use is of prime importance (66% of all customers) (Allensbach 2002) - usability seems to be of constant and high importance to customers. In addition, the complicated user interface of a mobile phone kept 53% of customers from buying this brand (RID 2004-1). These results are published repeatedly and complaints of people about having to fuss around with their mobile to get it to work are quite common. Nevertheless, in general the usability of mobile phones has to be improved. Some reasons for making this task difficult are:

- The number of functions increases with each new generation
- New functions and their meanings are unknown to a lot of users
- Although displays are growing a bit, they are still quite small compared to the complicated menu systems they have to present
- The naming and icons of functions vary sometimes considerably between brands

Specialised aspects of usability of modern mobiles were studied e.g. in (Bay 2003), (Bay & Ziefle 2003) und (Ziefle 2002-1), (Ziefle 2002-2), (Ziefle & Bay 2004). The psychology of menus, their learnability, design an evaluation in general were e.g. discussed in (Norman 1990) or (Shneiderman).
The goal of this study is to test the usability of different mobiles with as many as possible subjects trying to solve a given set of problems.

2 Design of the study

2.1 Claims

The following claims were set up following the guidelines of ISO 9241-10.

1. mobile phones are not suitable for their task because the user has to perform too many actions compared with the – easy – task he wants to achieve
2. mobile phones are not self explaining because novices or non-frequent users take a lot of time to fulfil their tasks
3. mobile phones don't meet the expectations of the user because even experienced users behave like novices when confronted with an unknown brand

2.2 Set of tasks

In order to test these claims, we set up the following tasks:

1. Send a short message (SMS)
2. Activate a profile that suppresses the ring tone
3. Activate the CLIR (Calling Line Identification Restriction) feature

2.3 Set of brands

We chose 2 models with a modest complexity, considerable market share and distinguishing user interface: the Nokia 6100 and the Siemens S55.

2.4 Internet based simulation

The tasks and a simulation of the mobiles were presented in an internet-site at www.handyergo.de.vu.

A simulation on the internet was chosen due to its many advantages:

- Far reaching, many participants
- Interactive solving of the tasks, Direct feedback to the participants
- Low cost for implementation, delivery and communication
- Digital test data are easy to evaluate

In order to minimise the side effects of the simulation, we took some technical measures to optimize the simulation:

- The devices and some display contents were presented as high quality photographs
- Text menus were mimicked 1:1 in structure and wording
- According to the principle of direct manipulation (Shneiderman 2002) the participants pressed the keys with mouse clicks
- The reaction on user action caused only a small area of the screen to be reloaded. Hence we experienced a reaction time of about 0.5 second approximately

2.5 Independent variables

In a short questionnaire we first asked for only a few demographical data:

- Sex, group of age (<15, 15-20, 21-30, 31-50, >50 years)
- Brand of own mobile (Nokia, Siemens, Samsung, Motorola, Sony-Ericsson or other)
- Opinion of own expertise concerning using mobile phones (novice, advanced, expert)

After that, a model was chosen at random and presented to the participant together with the three tasks.

After finishing the tasks, we asked for frequency of usage of features: phone, SMS, alarm clock, calendar, WAP, ring tones, wallpaper, user groups, profiles, CLIR (Calling Line Identification Restriction), MMS (Multimedia Messages), address book, notes, games, camera.

2.6 Dependent Variables

Because the participants were connected via the internet and were not performing their tasks under controlled conditions, time was not measures. Instead, we counted the clicks, i.e. keys pressed, as a means to measure effort. Each click therefore counts as one selection or step of navigation in the menu tree. Additionally, we counted the number of dead ends. Dead ends were introduced in the menu tree to signal that the user was completely wrong. This was meant to keep the motivation up and cost of implementation down.

3 Results

3.1 Participants

The study was conducted from January 2004 to April 2004. More than 1300 people took their time to complete the questionnaires and give the tasks a try. Only data of those who worked on all tasks and filled out all questions are included in the evaluation. 72% were male,

28% female. 50% were between 21 and 30 years, 24% in the age group of 15-20, 20% in 31-50, 4% were below 15 and 3% were above 50 years. Most participants (45%) owned a Nokia phone, followed by Siemens owners (29%). Most participants considered themselves advanced mobile users (57%), 33% thought they were experts and 11% called themselves novices.

3.2 Average Effort

More complexity of the task yielded more effort, more than linear. The following shows average efforts of all users for each task:

	Task 1 SMS	Task 2 Profile	Task 3 CLIR
Successfully solved tasks	73%	62%	59%
Clicks per participant (Minimal with Nokia /Siemens)	7 (3/5)	20 (8/5)	30 (12/11)
Dead ends per participant	0,1	0,4	0,4

The average effort in terms of number of keys pressed is quite high (30 keys!) compared to the simplicity of the task and also to the necessary number of keys. The excess of keys pressed are due to the high number of faulty navigation and the way back to the home level as correction.
Also the success rate declines to a mere 59% for the least easy task. This shows clearly the shortcomings in self explanation in the menu.

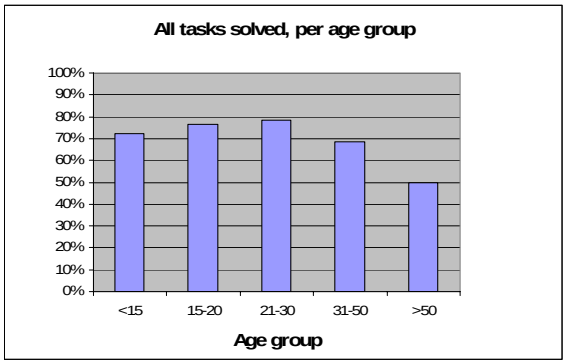
3.3 Own brand vs. unknown brand

The success rate of those participants dealing with an unknown brand of mobile phone in the simulation was only two thirds compared to those who solved the tasks with their own brand.

	Task 1 Send SMS		Task 2 Set profile mute		Task 3 Activate CLIR	
Brand	**Own**	**Not known**	**Own**	**Not known**	**Own**	**Not known**
Task solved	98%	64%	89%	51%	85%	49%
Clicks on avg.	6	7	17	22	27	32

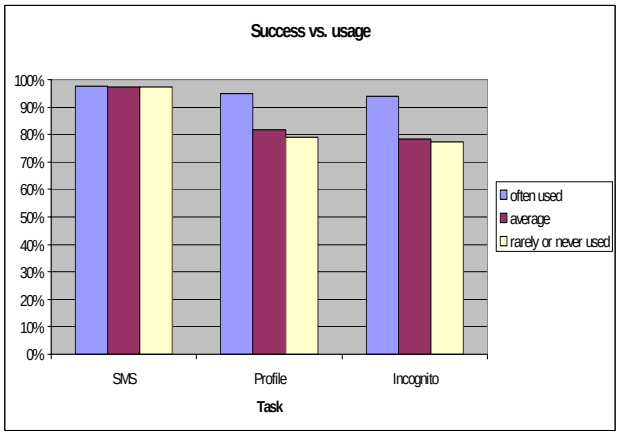
This evaluation shows very clearly that expertise cannot be transferred from one brand, i.e. menu structure and naming, to another. Hence follow shortcomings in self description and conformance to user expectations.

3.4 Age and Sex



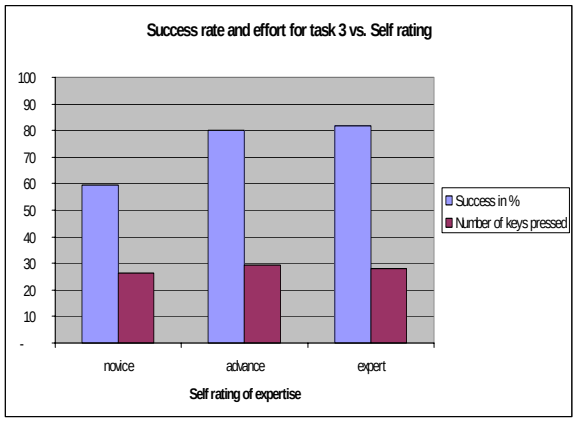
Quite noticeable here was that the very participants were not among the best performers. So, contrary to current rumours, young people are not better accustomed to modern media than older ones. Using a modern mobile is far from being child's play.
As expected, older users were not as successful in solving all tasks. Another hint that the user interface needs to be more self explanatory.
On the other hand, even the best age groups could make it in less than 80%, i.e. more than 20% of the participants were not able to solve all tasks.
There was no gender effect to be seen: 75 of both males and females solved all tasks.

3.5 Success vs. usage



As expected, those who used a feature often, could solve the respective task quite easily, but failed quite often, when the task was new or unfamiliar - another notch in the belt for the lack of self explanation.

3.6 Success vs. expertise



The most demanding task 3 was not solvable for over 40% of all novices. Interestingly, almost 20% of all self-defined experts were not successful too. Even those who use their mobile a lot are frequently at a loss, when the have to solve unknown tasks. Again, this can be attributed to a lack of self explanation and non-conformance to the users' expectations.

4 Conclusion

Our claim, that the usability mobile phones can be much improved was backed up by the results.
Let's now discuss, what can be done to achieve a better user interface for mobiles

4.1 Consistency and Conformance to user's expectation

One way to enhance Consistency and Conformance to user's expectation is to standardise naming and use of icons. Even the most common features are called inconsistently across brands. For example "SMS" is never used, perhaps the designer of the menus thought this to be too technical a term to confront the average user with. Instead they each came up with a different name: "Mitteilung" (Nokia), "Nachricht" (NEC) or "Meldung" (Siemens). Additionally, some manufacturers heighten the confusion by introducing proprietary features with similar names such as "smart messages" (Nokia).

Another approach could be "branding", i.e. the definition of the user interface not by the manufacturer but by the mobile service provider. This way, a customer could switch mobile brands without having to learn yet another menu structure and logic of use as long as he is a loyal customer to the same service provider. Although this idea has its charms, it is not embraced by manufacturers because they want the customers to stick to their models and they want and need to differentiate themselves on the market by their own and distinguished user interface.

4.2 Self descriptiveness

The Menus could describe the functions better if

- The naming is unambiguous, e.g. "Services", "SetUp" and "Tools" are hard to distinguish
- There are no abbreviations which can be misunderstood or not understood at all, e.g. "MyM." could mean anything
- Special or uncommon wording should be omitted, e.g. "incognito" for CLIR

Icons on their own usually do not describe very well what they stand for. They should be accompanied by text. An envelope alone is not enough nowadays. It could stand for SMS, MMS, email or any specialised messaging service. Therefore some explanation must be added. Unfortunately, the small display makes it difficult to display icon plus text. On the other hand, display sizes grow from 2 lines of text to 176x208 pixels (Nokia 6670) or even 240x320 pixels (Sharp TM100).

Unfortunately, some manufacturers take the opportunity of a bigger display to pack more icons on it, e.g. Sony displays 12 icons compared to the common number of 9 or even icons. This has two disadvantages: less space for explanation and too many items for the cognitive memory of the user, whose capacity holds about 7(+-2) items. Orientation and navigation thus becomes more difficult.

Another approach to better usability is to offer a task-oriented rather than a function-oriented user interface. E.g. incoming message could be collected in one "incoming basket" no matter what source they came from. Hence, if a new message arrives at a mobile phone, the user does not have to react differently according to the type of message but look only in one place. Such a central in-point offers e.g. the Siemens S65. In contrast to this, on a Nokia the user has to follow different menu trees for "Mitteilungen (i.e. SMS and MMS)" and "email and Cell-Broadcast" messages, what ever the latter technical term means.

4.3 Support of learning

In order to come to terms with one's ubiquitous electronic companion, one has to learn how to use it. A great way to help on the learning curve is to display orientation when navigating through the menu tree: Where am I, where can I go, what can I do here? This can be done graphically but text only suffices. This way, the user is supported in building a mental model of the menu, which in turn helps him to find his way through. The Nokia 6670 shows a good example of orientation.

Manuals should support the learning as well, that's what they're there for. Alas, mostly only each function is explained for itself, no matter in what context this function is needed or how often is normally used. A summary would greatly help, as would a visual representation of the menu tree, like a site map. Although the cost is very small and the effect would be immense, both are rarely found in manuals. Instead, the non-technical user is confused with heaps of technical terms. Not very helpful.

4.4 Older mobile phone users

In many societies, the rate of older people increases. Technical devices on the other hand are designed to appeal to younger customers. Older customers need very often phones to - surprise - make phone calls with. A lot of the widgets and gadgets are neither necessary nor helpful to current "silver customers". Au contraire, the number of unwanted features clog the menus and make orientation and navigation more difficult.
A restriction to the bare bone is very helpful for these potential customers, which else shy away from using, leave alone buying, a complicated device they fear cannot master.
A technical solution which is sometimes offered is speech control. But this is just another gimmick, requiring the user to learn the magic words by heart rather than recognising them on the screen.

4.5 Summary

Modern mobile phones offer an awful lot of features, yet become more and more difficult to use. A broad study with 1300+ participants backs the call for improvement of mobile user interfaces in terms of consistency, conformance to user expectations, self descriptiveness, support of learning and accessibility especially for novice and older customers.

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