CELL PHONE DESIGN FOR TEENAGE USE

Arjan Geven, Johann Schrammel, Manfred Tscheligi
CURE - Center for Usability Research and Engineering
Hauffgasse 3-5,
1110 Wien, Austria
{geven; schrammel; tscheligi}@cure.at

Markus Mayer
Mobilkom Austria AG
Obere Donaustrasse 29
1020 Wien, Austria
m.mayer@mobilkom.at

ABSTRACT
In this paper we present a study that addresses teenager preferences about and attitudes towards mobile devices. We specifically addressed physical aspects such as input modalities, form-factor, size and weight, based on discussion groups (a total of 31 participants) with two different target groups defined by age: 15-17 and 20-25 years old.
In addition to physical aspects, we addressed the features that are particularly important to the participants based on user-created design sketches of their ideal mobile phone of the future. In a follow-up, 3 workshops (21 participants) were held aimed at developing new ideas for services that are designed for the target group.

We found a remarkable preference for numeric keypad as the input method of choice. Touch screen interaction was mentioned as appealing, but this feeling was mediated by concerns regarding durability and usability. Form-factors varied between participants, users are open for new and innovative form factors, where the final looks are more important than the specific form ("it has to look cool").
The discussions on functionality and features can roughly be classified in rough trends of ideas focussing on integration and standardization, security, and personalization.

KEY WORDS
Mobile HCI, teenagers, adolescents, user requirements

1. Introduction

What makes a design of a mobile device successful? On the one hand, users want to have a certain basic set of functionality which is rather simple. It should be able to make calls, have a way to manage contacts, send and receive SMS, and last several days on one battery. However, specific devices are performing much better in the market than others, due to specific differences in the way one can use its navigation functionality, its robustness, and particular style elements.

Teenagers represent a large share of early adopters. Although their income might not be very high, their expenditures follow a different pattern than that of adults. Besides their expenditures, the adoption of mobile phones by teenagers is also different than for adults. The mobile phone has completely been accepted as a lifestyle object in this target group, and users highly personalize the device and use them as fashion statements [1]. In this paper, we therefore present key findings from a study we conducted in October 2007.

Features and functionality

There has been quite some research into usage patterns of mobile phones by teenagers. At least in Europe, teenagers make extensive use of SMS, not only because it is 'easy and cheap', but primarily because it provides a sense of connectedness and is rooted in the social practice of gift-giving [2]. Other features that mobile phone users often use are the alarm clock, the calendar and the calculator, as well as the new logos and ringtones which are amongst the most heavily used functions. [3].

Different patterns in usage have been described by Wilska, distinguishing between technology enthusiastic use, trend conscious use, and addictive use; and linked the different usage styles to consumption styles [4] and found among other things interesting gender differences within the group of teenagers.

In this study, we try to add to the increasing body of literature about the features users are interested in at the moment as well as predict which features they would use and how they would envision their ideal mobile device in the (near) future.

Input modalities

In addition to style elements, we are specifically interested in the factor of 'input modality', or which kind of text entry and (menu) navigation functionality is available on the device. As MacKenzie and Soukoreff state, "research in mobile text entry is flourishing in part because user needs are not currently met" [5]. Many alternative text entry methods have been introduced in the research community and partly also commercially, e.g. predictive text entry such as T9 [6], alternative key mapping such as TNT [7] or LetterWise [8], alternative keyboard layouts such as Fastap [9], or other concepts such as Dasher [10] or RollTap [11]). However, most of them are not widely adopted even though their theoretical performance is higher than that of simple numeric keypads. Rather, people tend to go with the options that they already know.

We hypothesize that teenagers in particular might be so experienced in using a numeric keypad for text input that their preference would align with these facts and would prefer numeric keypads. Furthermore, we presume that their experience with numeric keypad is so high that this group would prefer a numeric keypad over a full QWERTY keyboard layout.

2. Study of Physical Aspects

Four workshops were held to find answers to the question which physical aspects would be interesting to the group of teenagers, particularly focusing on input modalities, form-factor, size and weight.

A total of four different discussion groups were organized with two different target groups defined by age: 15 to 17 year olds and 20 to 25 year olds, held in Vienna and Mistelbach (Austria) in October 2007.

2.1 Setup

First the workshop facilitators introduced themselves, explained the overall procedure and asked for written allowance to videotape the session. After this a round of introduction was done, where every participant shortly introduced him/herself and answered two more questions related to the topic of the discussion:

- Which functionalities to you use on your mobile phone?
- How often do you use these functionalities?

Next, participants were asked to brainstorm functionalities they think should be provided on mobile phones or they would add to mobile phones. The facilitator collected the ideas and wrote them on a flip chart.

In order to ensure a common language next the facilitator explained different available input technologies for mobile phones. These presented technologies were numeric keyboard, qwerty-keyboard, T9 text input, touch screen (finger), stylus input on the screen, joystick, click wheel, track ball and voice control. Participants were given a handout that showed examples of the different techniques. The figure below shows the used images for explaining the different techniques:

Figure 1: Eight input methods discussed

In the next step workshop participants were asked to design their own optimal mobile phone. Participants where provided with a form where they had to specify the characteristics and design of the phone. These characteristics were:

- Functionalities (limited: telephony was pre-filled out, plus five free choices)
- Input technologies (limited to four free choices)
- Sketch of the phone
- Type of the phone (Clamshell, Slider, Candybar, other)
- Proportions and screen size of the phone
- Weight with regard to three reference phones (60, 105, and 135 grams)

A prize of 20 Euros was announced for the best design.

After the individual design participants were asked to rate the most important functionalities and input technologies. Every participant got four dots for functionalities and another four dots for input technologies that then were placed on the flipchart next to the most important item.

Then each participant presented his/her design and the workshop participants voted the best design with regard to the guiding question "I would like to use this mobile phone".

2.2 Physical Aspects

Input modality

In the analysis of the preferred input modalities, we can see some interesting results. Here, users were given 3 points, which they could divide over the mentioned input modalities whichever way they choose (i.e. three modalities each receive one point, or one modality receives three points, etc). In addition, users said why they rated these input modalities. The results are summarized in Figure 2.

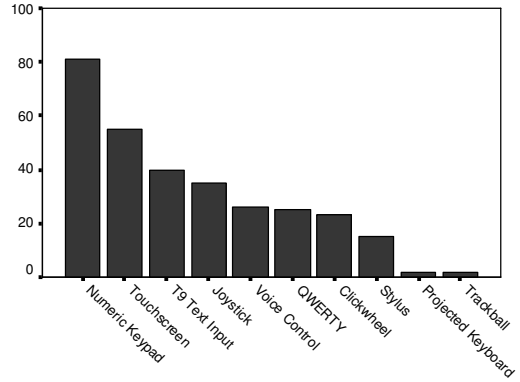

Figure 2: Input modality votes across all groups

First off, we can see that traditional input methods are rated highly by the participants, with a clear preference (chosen 81 times) for the numeric keypad ("because I know how to use it", "it goes fast", "I can use it without looking at it", "I can operate it using only one hand"). T9 as an extension or speed-up of the numeric keypad is also chosen often (40x). A full QWERTY keyboard is chosen

a total of 25 times, with opinions both in favour and against it ("it is possible to use it with both hands, "input goes faster with such a keyboard", against "it makes a device too large, "I'm not used to it", "you still can't use ten fingers because of its small size"). The joystick is mentioned fairly often as common way for navigating through menus, but not for text input. However, it was also mentioned that a joystick is difficult to use with longer fingernails and that they break rather quickly.

We see that in these 'traditional' input methods, the numeric keypad is clearly preferred. When we detail the analysis to separate between younger and older adolescents, we see that the QWERTY keyboard is not at all interesting to the younger group, whereas the older group tends to highlight it more often, in favour of the numeric keypad. Younger participants seem to be more acquainted with the numeric keypad and are therefore less willing to use larger devices which are not significantly faster.

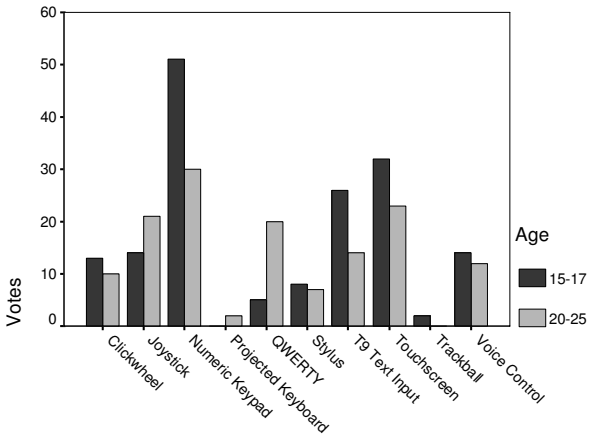

Figure 3: Votes for input modality, by age group

Touch screen devices are rated fairly high. This is especially interesting as none of the participants had experience with a touch screen device. Nonetheless, it was seen as an interesting possibility by the participants. Concerns were raised by participants particularly concerning it becoming quickly dirty, about battery performance and its usability in sunlight compared to input methods with hard buttons. A touch screen that can be used with finger is still much more attractive to participants than a touch screen that is operated by stylus (rated 55 versus 15 times). The main disadvantages of a stylus were the fact that it is a separate element which can be lost much too easily, as well as the fact that it requires two-handed operation (i.e. one hand to hold the device and one hand to hold the stylus).

Other novel input ideas for mobile devices were not evaluated as highly as touch screens. A click wheel similar to the IPod's click wheel was given 23 votes, mainly as a way to navigate through menus and not so much for text entry. Some participants mentioned a 'projection' keyboard which they'd seen somewhere once and received 1 vote only. Other participants mentioned concerns with the need for a flat projection area and the lack of haptic feedback. A trackball like the one implemented by RIM on recent Blackberry models was voted for only by 1 participant. Others mentioned that they did not see the added value of such trackball.

Some participants (total of 26 times) also voted for voice control, i.e. using speech-to-text in some future form to input text, which can then be sent by SMS to a recipient (as opposed to calling them directly or sending a voice message).

2.4 Design Sketches

Based on the discussions on input methods and functionality, participants were asked to design their own 'perfect' mobile device that incorporates their wishes, with a limited amount of features. These design sketches revealed some interesting discrepancies to the initial discussion.

The design sketches confirm that fashion elements are completely accepted and the mobile phone is a part of the lifestyle. Many participants introduced elements in their sketches that are mainly there to please the eye, such as colors, fancy diamante-shaped keys and rounded edges, see also the examples in Figure 4.

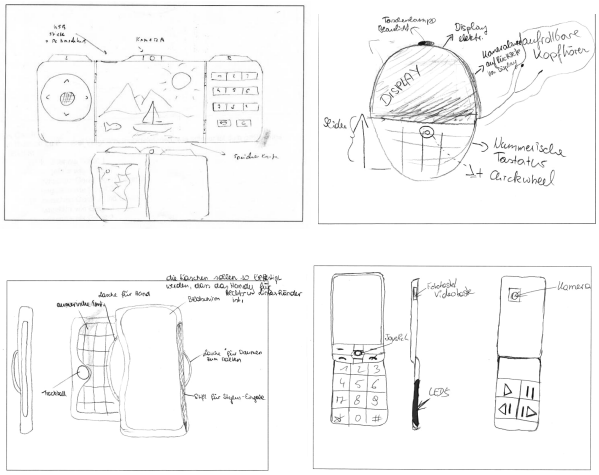

Figure 4: Design sketches from four users

The participants in the discussions, mainly the younger participants, were very open and created interesting features that highlight problems and possible solutions to them in the design.

12 phones were in the candy bar design, 7 used clamshell approach and 7 slider phones were designed. 4 designs used different approaches. These approaches typically could be characterized by additional folding functions (see e.g. Figure 4 for some variations) and therefore can

be seen as advanced clamshells. In general, it can be said that according to the participants the detailed design is very important in the final decision on whether to buy a specific handset.

Extensions
One participant created a mobile phone with integrated retractable earphones, since they always entangle other items while in pockets. Another user integrated speakers in the mobile phone that created high quality sound. Even at the cost of increasing the size of the device, the additional feature of using the mobile phone to share music with others was important to her.
Yet another participant created a mobile phone where additional modules could be attached, such as a QWERTY keyboard, which could be optionally carried along (division between core and extensible functions).

Non-electronic extensions
Users often integrated some gadgets into the mobile phone, highlighting again its function as all-in-one device and the advantages of always carrying the device with you. Examples of integrated non-electronic elements were a mirror, a nail file, lipstick and a bottle opener.

Privacy and security
Another element that was mentioned in multiple workshops was security. With the increased amount of personal information available on a device (photos, etc), a pin code protection seemed to be insufficient. Instead, users requested ways to remotely lock the device/erase data. Another suggestion was made to integrate a fingerprint scanner as a way to protect the device. This would solve the problem of some of the participants that they occasionally forget their mobile phones, as they are only very rarely turned off.

Dimensions and display size
The designed mobile phones had an average length of 9.3 cm and breadth of 5 cm. thickness of the phones was only provided by about half of the participants, and was in average 1.2 cm. The designs on average had a relation length/breadth of 1.95; the average display size was about 40 % of the total device size.

The average weight for the mobile phones was stated as between reference phones 1 (60g) and 2 (105g) (for reference, two of the most common devices for teenagers, Motorola's RAZR V3 and SonyEricsson's K750i, weigh 95g and 99g respectively). This was guided by various tendencies; some participants wanted the mobile phone simply to be as light as possible, whereas others wanted to have something that gives a certain feeling of robustness, and a third group aimed mainly at realism (i.e. "I expect a device to offer all this functionality to be rather heavy").

3. Functionality
In addition to the design sketches and the input modalities, users also were asked about the functionality and the features that they often use. Moreover, they brainstormed and discussed about potential future services and functionality that would be interesting to them.

This part of the study was set up in two parts. The first part – voting based discussions – was performed in all seven workshops. In the first round of this element, participants named all the functionalities that they use as a basis for further discussion. The whole list of elements is than ranked: each participant receives three stickers and can assign these to the functions on the list.

The second part of the study focused on new services and functions that the participants could imagine on their mobile phones. This part was the focus of the three last workshops. After a 'warming up' where participants were asked to brainstorm about positive and negative aspects of mobile devices, they were given a large word cloud with words related in some way to mobile devices. They were asked to combine these into word-pairs that represent the name of a service or functionality of a possible future mobile phone (e.g. Music and Alarm becomes AlarmMusic). A short discussion focuses on the possible features of such a service. Based on the ambiguity in the word combination, the discussion becomes very open and creative. After generating word pairs and possible meanings of the word pairs, the users picked their favourites and further discussed the advantages and disadvantages of the services discussed.

3.1 Voting based discussions
To analyse differences between the different user groups we focused on the functionalities that are mentioned summarized in Figure 5.

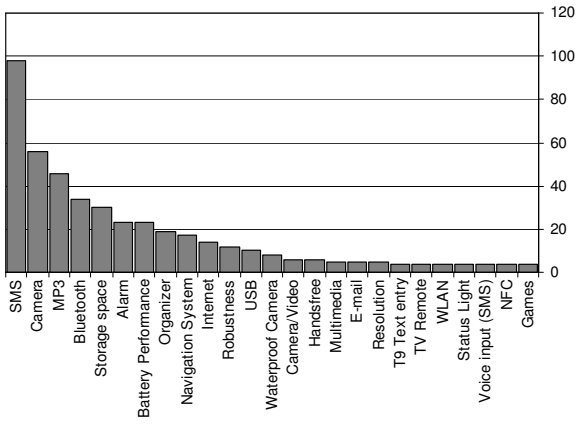

Figure 5: Votes for functionality of mobile device

The figure shows the obvious result that SMS capability is required by practically all participants (98 votes). In Europe, these findings are not so strange, especially in this target group, where sending 15 to 20 SMS per day on average is not an exception.

We also see that camera capability is an important feature to many participants (56 votes), as well as MP3 playback

capability. (46 votes), showing that the mobile phone has really become an integrated portable multimedia device. Users do mention the concern that they are often disappointed by the quality of pictures when they review them on a larger screen. The functionality however is much appreciated. As a participant says: "I do have another digital camera, but I simply always have my mobile phone with me (..)". Users also appreciate the MP3 functionality of their integrated portable device, as it saves the effort of having to carry an additional device.
One small but important program was mentioned fairly often is the alarm clock (23 votes).

Other functionalities that were mentioned often deal with *storage*, namely increased amount of storage for MP3, video and photos (22 votes) and USB memory stick capability (10 votes) which should make it easy to transfer documents. Particularly this last functionality again highlights the mobile phone as an all-in-one device that combines many portable electronic devices into one.

Connection capabilities were mentioned frequently, with Bluetooth being the first and foremost (34 votes), followed by internet (14 votes), and wifi (4 votes). Although these are all ways to connect to a network or other system, they are mentioned in fairly different contexts. Bluetooth is mainly mentioned for its sharing purposes among peers as well as synchronisation of the mobile device with a home computer. Internet is mentioned as a way to quickly access information such as bus departure times. Wifi is mentioned as a way to circumvent carrier charges.

Participants also often listed attributes that are associated with mobile devices in general: increased *battery performance* (23 votes, as users are generally dissatisfied with the current performance), and more *robust design* for everyday use (12 votes). The participants mention that they have the feeling that the physical quality of mobile devices has dropped over the last years and wish for devices that are more robust to use. Additionally, to their perception battery performance has not kept up with the trend toward more capabilities in other areas of the device.

3.2 Idea creation

Users came up with various ideas for additional functionality in additional brainstorm sessions. Particularly the following suggestions were made:

- Personalised alarm clock (with music, reading of news, etc)
- Power savings function similar to notebook computers
- Using the mobile phone as USB device
- Organizer functions with social aspects (group calendar with friends, family)
- Public transport information directly on the handset (particularly at night)
- Device management
- Dictionary for foreign languages
- Location based services with bar guide or museum guide (with ratings)
- Back-up solutions for multimedia and contact data
- Weather display (temperature, forecast)

Partly, these suggestions match with the suggestions that we gathered from the first round of discussion groups.

4. Discussion

4.1 Inputs

Most participants choose numeric keypad. Interestingly, there seems to be a slight difference between younger and older participants in the study, where the older participants are more receptive to QWERTY keyboards, but younger participants do not accept these at all. Users also do not mention that they experience performance problems in writing SMS, although they are interested in novel input techniques. Particularly do they appreciate speech input (without having any experience with actual systems) and but also a click wheel is mentioned for text entry as well as navigation. Some initial translation of a click wheel into text entry is under development [12], who presents a way to map a scroll wheel to keyboard input.

4.2 Design

The design sketches offer us some interesting perspectives to the lifestyle aspect of mobile devices. In the sketches we see fashion statements in designs from both male and female participants. Moreover, we found strong indications towards customizability through extensions (related and unrelated to the device).

We also found that participants mention more and more security and privacy related aspects due to the more and more personal nature the device is acquiring. This has already been noted in other studies where personal features are added to the mobile phone, such as NFC [13], and will only increase as more personal information and personal services are incorporated in the device. Users are worried about their data when a device is stolen. As statistics show already a high number of mobile phone thefts (e.g. in 2002/2003 in a UK-wide study, 6.9% of interviewed people report that a mobile phone was stolen in the 12 months prior to the interview [14]). With the risks becoming larger, security becomes a more important aspect to deal with and users recognize it as such.

Concerning dimensions, users have reported very typical device sizes and device weights in line with the size and weight of the popular smaller currently available devices with an average weight between 60 and 105 grams. This however excludes most devices that incorporate a full keyboard as well as many UMTS devices. This relates well to non-UMTS devices being relatively popular amongst teenagers. The study shows that internet access is not rated as important which matches with the finding such devices are perceived as too cumbersome and large to use.

Idea creation

Some interesting patterns can be observed in the idea creation workshops. We can see that many of these are either:

(1) Services that are currently available on desktop or notebooks that can be further miniaturized and implemented in the mobile phone, such as the power savings function,
(2) Services that make specific use of the mobility aspect where always-available is a key factor, such as the bar guide, or
(3) Services that integrate more functions into the mobile phone, increasing its functionality but also potentially its complexity, such as the dictionary and the USB-stick.

Each of these three provides ways for improving the functionality of the mobile phone, but care must be taken not to overstock such device with functionality.

5. Conclusions

Through a total of seven workshops with in total around 45 participants we have gotten insights in the user needs of a specific group of mobile phone users. These insights are directed at both physical aspects of the device as also on the functionality and services that can be offered on the mobile phone to this target group.

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