

## HOW TO OFFER EXCELLENT USER EXPERIENCE TO BILLIONS OF DIFFERENT END USERS?

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**Abstract.** Mobile communication devices are the most widespread technical appliances worldwide and they have the most heterogeneous user group. This causes specific challenges to user experience designers. In addition the increasing number of features along with the miniaturization of the devices are strong troublemakers. Based on the experience of interaction design for over 100 million cell phones, we propose proven ideas and concepts to cope with these challenges. Redundancy, adaptation techniques and emotional design are the keywords of our answer.

### 1. Usability Challenges for Mobile Telecommunication Devices

Mobile telecommunication devices such as mobile phones or PDAs have long become a mass phenomenon. Market penetration has surpassed 2 billion users worldwide in 2006 and is still growing quickly. Along with radios and TVs, mobile terminals are the most commonly used consumer electronic appliances, outnumbering automobiles, PCs, landline phones and MP3-players.

User experience experts are facing specific challenges when optimizing the usability for such devices (compare e.g. Weiss, 2002; Kiljander, 2004; Lindholm et. al, 2003; Leiner et. al., 2006). This paper will deduce and outline major usability issues and then propose answers on how to solve or at least mitigate some of them. We will focus on mobile devices, however many results can be transferred to fixed devices and non-communication domains to a large extend.

#### 1.1. DIVERSITY OF USER GROUPS

The high number of users and the global dissemination of the devices cause utmost heterogeneous user groups. Virtually everybody is or will soon be a

potential user, maybe with the exception of inhabitants of the least developed countries which are still excluded from today's communication networks.

Users will differ according their country or region of origin, in gender and age, in intensity of use, in preferred features, in domain knowledge and educational level, to mention but a few relevant criteria (Pedell and Vedere, 2005). This diversity will make the classical contextual design approach rather difficult, to study sociological, cultural and usage specific user preferences and utilize the results as starting point for use cases and interaction design (Beyer and Holtzblatt, 1998).

There might also be the idea to solve the challenge of end user variety by offering specific solutions for at least the most relevant target groups. Surprisingly, this approach is not very wide spread for mobile devices. Market segmentation is basically done by life style target groups and feature levels (Pietralla, 2005). In terms of user interface, consistency throughout the whole product range and overarching even several product generations is clearly preferred (Lindholm et. al., 2003).

Only a limited number of specific solutions for niche user group have reached the market with quite humble success: Some "simple phones" for seniors such as the device "Katharina das Große" or kids phone like the one from Kandy Mobile (Baumann, 2006; Kandy Mobile, 2008).



Figure 1. Examples for a seniors and a kids phone.

Due to the small relevance of these solutions, we will focus on ideas, which make the user experience of standard devices flexible enough to suit as many users' needs as possible.

## 1.2. LIMITED HARDWARE CAPABILITIES

The second huge challenge while interacting with mobile (and many stationary) communication devices is their small size. This miniaturization eases portability, yet constrains the design space for input and output elements significantly. Compared to a standard 19" PC screen, even a 2" mobile screen offers only 1% of output space. Compared to a standard keyboard, even a Blackberry or an iPhone keypad is a poor makeshift solution.



*Figure 2. Size comparison of a PC and a mobile display.*

There are various approaches to cope with these restrictions: Reduced screen content and selection options per interaction step (Leiner, 2003); modality change like speech input or vibration output and assistive technologies such as T9 or sloppy text input from AOL Tegic. This paper will focus on the user variety, but some of the proposed techniques are also apt to overcome usability weaknesses due to hardware size restrictions.

## 1.3. INCREASING NUMBER OF APPLICATIONS

The third topic to be addressed is the heavily increased and still growing number of different applications to be realized in a single gadget. Their variety and likewise the complexity of each of them have risen tremendously. Beyond the basic voice and text communication, camera and music functions, organizer and e-mail services, navigation and internet access and many more new features have found their way into these mobile all-rounders.

The lacking usability caused by excessive featurism has been criticized regularly (e.g. Stollenmeyer, 2004) but rarely products with clearly reduced

feature sets have been launched. Maybe the iPhone's success is to a certain degree also founded in a sound feature selection (Sicking, 2007).

In an ideal user experience design process, usability experts will be involved in the selection and prioritization of features from the very beginning with the clear goal to get rid of the lesser relevant ones. In the most real life situations, usability experts are confronted with a feature list, more or less carved in stone. In this situation, we have developed a design method that we called biased or majority-oriented design (Leiner et. al., 2006).

Even for heterogeneous user groups, a carefully conducted requirement and use case analysis will reveal a set of core use cases and features, which are rated as essential by a majority of users. The feature architecture and interaction design shall now be intentionally biased favoring these features in access paths and usage flows over the more exotic ones, which shall be hidden down in menus or grouped in expert extensions.

#### 1.4. SHORT PROCESS CYCLES

Last but not least, communication terminals as well as all short living consumer products are facing a methodological challenge for user experience designers. The overall development time is extremely short, which turns out to be a severe handicap, since the standard usability process (requirement analysis, concepts, prototypes, test and iterations) is usually incompatible with the product time line.

Two methodological innovations are needed to progress in these challenges: Firstly we need a seamless integration of the usability parts in the overall product development process (Schonowski, 2008) with main focus on involvement in the early stage. Secondly, user experience experts have to find speed-up methods to accelerate their own tasks (Holtzblatt et. al., 2005).

## 2. Special Solutions for Heterogeneous User Groups

After this presentation of main usability challenges for mobile communication devices and having proposed several solutions, we return to the main question: How to offer satisfying usability to a broad variety of users in one and the same device.

### 2.1. REDUNDANCY IN USER INTERFACE DESIGN

The first idea to suit different users' cognitive strengths and mental models is to offer different ways to achieve the same desired goal. Within this redundancy design, we see a threefold arrangement of activities.

### 2.1.1. Multimodal Interaction

The utilization of many if not all human senses is essential to cover diverging cognitive preferences and capabilities. This applies to various kinds of disabilities, but even average users have their favored interaction channel, be it visual, acoustic, or tactile.

A vintage wired phone as in the image below is signaling an incoming call via ringing, using the sense of hearing only. Whereas state-of-the-art mobile phones will ring, blink and vibrate and offer a lot of caller information, addressing various human senses at the same time.



Figure 3. State-of-the-art phone versus vintage device: addressing 3 senses instead of 1.

Also the situation the user is currently in, might decide on the preferred interaction style. Entering text via keypad and simple reading of messages is normally the common interaction style, however in a car use case it is crucial to have the choice to change interaction mode and sensual channel to voice command input and speech output.

### 2.1.2. Redundancy of Information

The next user experience design guideline for heterogeneous user groups is to repeat the relevant information in various forms. Again, this will comply with the variety of users' preferred cognitive channels, but at the same time it will increase the chance to bring the relevant information across by simply repetition.

A nice example is given by a stock exchange portal (Conyors, 2007) which offers the current stock quotations as numerical, graphical, and incremental value adding color coding and icon, thus duplicating the central information to six fold redundancy.

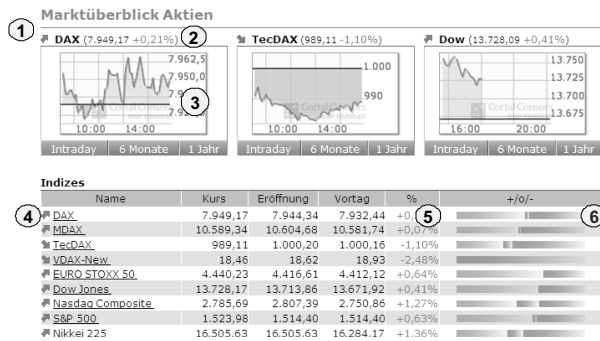


Figure 4. A stock quote overview repeating the same information 6 times.

### 2.1.3. Variety of Interaction Flows

Probably the most powerful technique to get positive usability ratings from very different user types is to offer versatile logical ways to conduct a task or to step through a use case. This procedure needs a significant additional investment in interaction design, since not only one, but several flows have to be analyzed, conceptualized, tested and implemented.

However the payoff is substantial. It opens the possibility to offer a standard solution which e.g. focuses on clearly separated steps and at the same time providing an expert shortcut, which will meet a more experienced user's expectation.

Knowledge from different cultural backgrounds can also be covered as the messaging example shows: Text messages on mobile devices in Europe were based on the letter metaphor, which started writing the content first, then putting it in an envelope and finally writing the addressee. In America however, e-mail messaging was transferred from fixed to mobile devices, including the order to write the recipient first and then adding the message's body. The obvious, but not undisputed solution for a global device was to offer bold sequences to create and send a text message.

## 2.2. ADAPTATION AND PERSONALIZATION

Beyond redundancy, flexibility is the next keyword to cope with heterogeneous user groups. Settings that enable the user to adapt the device to his or her preferences, special needs or usage behaviors will increase the chance of positive experience and user satisfaction. There are basically two kinds of adaptation: explicit ones and implicit.

### 2.2.1. *Explicit user driven adaptation*

Explicit adaptation is done by the user intentionally choosing or changing settings of the appliance. Be it a ring tone, a shortcut key, a theme, the structure of the menu or the applications themselves, there is always an explicit user action needed for the change to become effective.

User experience experts might think that such degrees of flexibility disburden him from finding a good solution. This is however wrong, since nearly every personalization option requires a fitting default value.

### 2.2.2. *Implicit adaptation*

There are many ideas and already some solutions, where a communication device tracks the user behavior and other ambient information. Based on this data, auto-adaptation is done.

Typical implementations, which have hit the market, include word order adaptation to frequency of use, creation of a personal most often called list, time dependant skinning or profile-appointment connection to avoid acoustic interrupts during meetings. The research field of ambient intelligence will force such implicit adjustment in the near future.

## 2.3. EMOTIONAL ATTRACTIVENESS

Eventually, many users have a similar sensation for the beauty, the emotional attractiveness of a solution. Hardware, screen and audio design will influence the overall experience sometimes more than ergonomic factors or interaction logic and structure (Burmester, 2007).



Figure 4. If you had to wait, which design did you prefer?

This insight should make user experience designers extremely sensitive, since it could become the last, though not recommended, option to save a mediocre solution by making the user smile.

### 3. Conclusion

The variety of users, use cases and applications will continue to grow. User experience designers will stay in the defensive role. But unsatisfied users and lack of revenue for misdesigned applications will keep pressure on device manufacturers to increase usability efforts as it is one of the decisive customer retention or churn rate criteria.

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