

Vorlesung Advanced Topics in HCI (Mensch-Maschine-Interaktion 2)

Ludwig-Maximilians-Universität München
LFE Medieninformatik
Heinrich Hußmann & Albrecht Schmidt
WS2003/2004

<http://www.medien.informatik.uni-muenchen.de/>

Chapter 3: Mobile HCI

Table of Content

- Input & Output Devices
- Input & Output Techniques
- Guidelines
- Mobile Gaming
- System Architectures for Mobile UIs
- Example: Applications for Mobile Phones

Form Filling - Motivation

	T-Mobile	O2 Germany	E-Plus Germany
Top 5 Services	1. Ring tones	1. Live chat	1. Ring tones
	2. Download games	2. eBay	2. Playboy
	3. Chat	3. O2 E-Mail	3. Sport news
	4. Soccer	4. O2 ring tones	4. Poptone
	5. MMS-services	5. O2 Games	5. eBay
Format	WAP/WML	WAP/WML	cHTML, i-mode

- Applications use minimal input

Form Filling – one Approach



- Acquire user data
- Hold local profile information
- Predict expected defaults from
 - Variable name
 - Variable type
 - labels
 - Context
- Pre-fill forms (any form) with personalized predicted default values
- Within EU-Project Simplicity
 - Interested?
 - Student project / HIWI job available
 - Enrico Rukzio

Capture & OCR

- Mobile phones with cameras
- Augmented reality scenarios
- Marker recognition

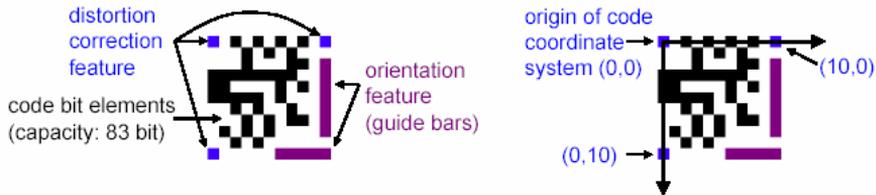


Figure 1. Components of the visual code (left) and code coordinate system (right).

Michael Rohs, Beat Gfeller. Using Camera-Equipped Mobile Phones for Interacting with Real-World Objects. In: Ferscha, Hoertner, Kotsis (Eds.): Advances in Pervasive Computing, Austrian Computer Society (OCG), ISBN 3-85403-176-9, pp. 265-271, Vienna, Austria, April 2004

Capture & OCR

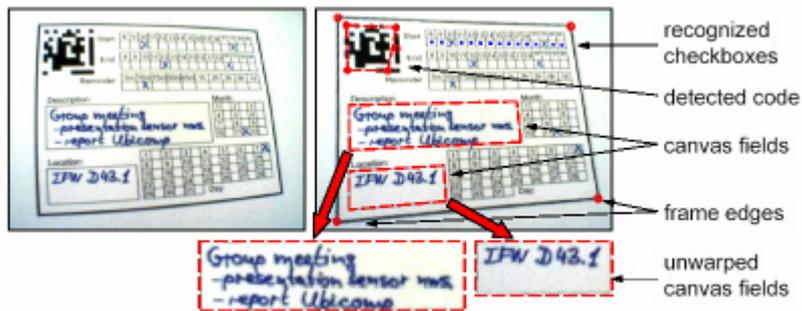


Figure 3. Calendar entry form: code, frame, checkboxes, and canvas fields recognized.

Michael Rohs, Beat Gfeller. Using Camera-Equipped Mobile Phones for Interacting with Real-World Objects. In: Ferscha, Hoertner, Kotsis (Eds.): Advances in Pervasive Computing, Austrian Computer Society (OCG), ISBN 3-85403-176-9, pp. 265-271, Vienna, Austria, April 2004

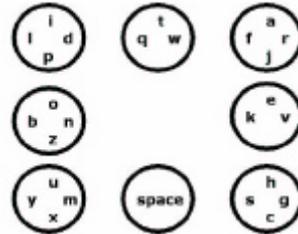
<http://www.vs.inf.ethz.ch/publ/papers/rohs-gfeller-visualcodes-2004.pdf>

Unigesture - experiment

tilt-to-write to enable one-handed input



- Aimed at small devices where buttons and touch screens are not suited
- 8 directions to tilt
- Simple recognition algorithm
- Predictive input



V. Sazawal, R. Want, G. Borriello. The Unigesture Approach: One-Handed Text Entry for Small Devices. Mobile HCI, Pisa, Italy, pp. 256-270, September 2002.

Mobile workers need

- Ubiquitous connection to organization's current events
- Secure communication with corporate infrastructure
- Full access to appropriate company files
- Role-based access to specific corporate data
- Short delays in responding to calls or stored text messages
- On-the-fly updates for in-the-field sales quotes or job-tasking information
- Access to (subsets of) Web page information from corporate intranet and external Web pages

From: Tasks of the Mobile Worker (Nokia Forum)

(Mobile) Usability

Do's

- Ask for the user's input often.
- Let the user experiment.
- Select users who represent your target group.
- Imagine the user's point of view.

Don'ts

- Don't take everything the user says as the absolute truth.
- Don't interrupt with your opinions.
- Don't use your friends for testing – they are easily affected by your presence or opinions.
- Don't be blinded by your own expertise.

From: Tip Of The Month: Usability Is The Heart Of Development (Nokia Forum)

Mobile Usability

Context-of-Use
is a key in
mobile settings!



- A general definition, as provided by ISO 9241-11 (1998), defines usability as follows:
Usability is 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.

From: Series 60 Developer Platform 2.0: Usability Guidelines For Enterprise Applications Forum.Nokia.com

Basic Design Rules for Mobile UIs

1. Know the user and context of use.

Prioritizing application features and designing dialogs according to user workflow requires a deep understanding of the intended users, their objectives, and the usage context.

Making **assumptions is not good enough**, unless your application is going to be used by UI designers and application developers only.

2. Test with real users early and often.

Actual users of the application should be **involved in every** phase of application design.

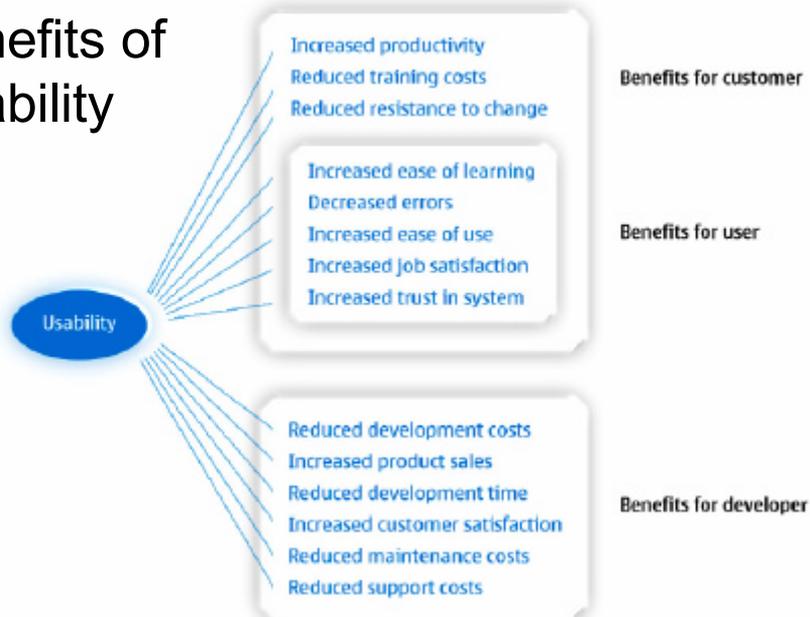
The first user tests can be conducted with paper prototypes before any code has been written.

3. Choose simplicity.

Designing **simple user interfaces** is especially important in mobile devices. It is often hard to make things simple, but easy to make them complex. A functional and simplistic user interface is the result of hard work *with actual users* in the early design phases.

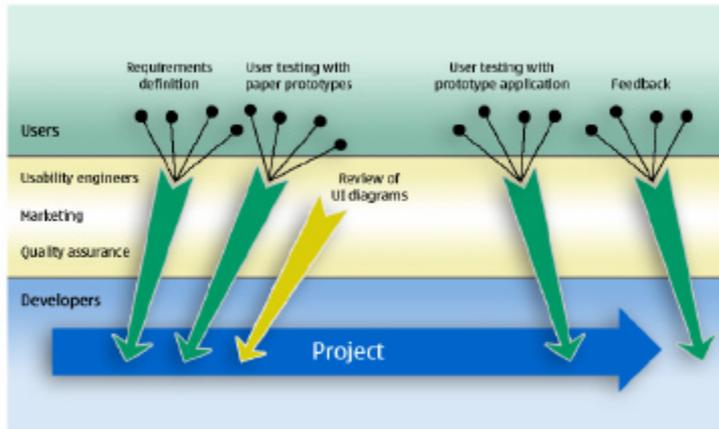
From: Series 60 Developer Platform 2.0: Usability Guidelines For Enterprise Applications Forum.Nokia.com

Benefits of Usability



From: Series 60 Developer Platform 2.0: Usability Guidelines For Enterprise Applications Forum.Nokia.com

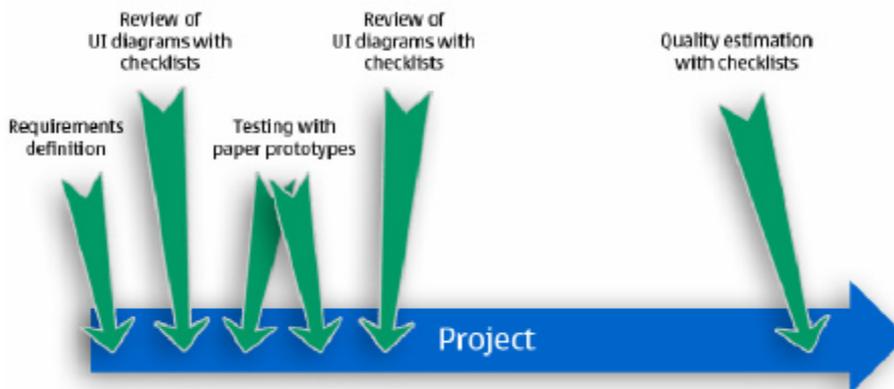
Usability in the Development Process for Mobile Applications (1)



- user involvement throughout the process

From: Series 60 Developer Platform 2.0: Usability Guidelines For Enterprise Applications Forum.Nokia.com

Usability in the Development Process for Mobile Applications (2)



From: Series 60 Developer Platform 2.0: Usability Guidelines For Enterprise Applications Forum.Nokia.com

Usability Methods

- Usability guidelines
 - list of recommendations concerning the concept, user interface, and information architecture
 - with guidelines, the most typical usability problems can be avoided.
- Expert analysis
 - A usability specialist evaluates the product from the user's perspective.
 - The result is a list of potential and existing problems.
- Single-user testing
 - Real end users use the product and are observed
 - find out where they encounter problems and if they use all the features.
- Group testing
 - focus group users using the products and discussing them with their peers
- Satisfaction surveys
- End-user analysis
 - The analysis helps developers design applications to fill the market's needs and locate possible openings for new product ideas.
- Usability expert

From: Tip Of The Month: Usability Is The Heart Of Development (Nokia Forum)

Steps: How to build mobile applications?



- From mobile game design
- Applicable in other domains

From: Tip Of The Month: Usability Is The Heart Of Development (Nokia Forum)

Requirements

- Concept definition
- Testing the idea of the game or application
- End-user analysis
 - Are the users interested
 - Do they get the concept/idea of the application
 - Is there a need (market) for the product
- Guidelines
 - Define specific usability requirements

From: Tip Of The Month: Usability Is The Heart Of Development (Nokia Forum)

Design and specifications

- Application design and technical specification
- UI design and usability specifications
- Define the way the user interacts with the application
- Define Interaction between the UI and the application.
- Define entire navigation structure of the application.
- End-user analysis:
 - ensure the product design fits the target group
- Guidelines:
 - Verify that the specifications are according to guidelines

From: Tip Of The Month: Usability Is The Heart Of Development (Nokia Forum)

Implementation

- Program a first version of the application
- Implement the user interface
- As the program is not fully functional evaluation is often done by an usability expert
- Get a view from the user's perspective (through the usability expert).

- Consulting
 - If it is not clear how to implement a feature ask an user interface expert – is cheaper in the long run.
- Guidelines
 - Implement according to standards
- Expert analysis
 - Evaluate and improve the user interface continuously
 - avoid designs that may pose problems for the users

From: Tip Of The Month: Usability Is The Heart Of Development (Nokia Forum)

Testing

- tested thoroughly
 - Ensure the application meets the requirements
- Product is ready to be tested by users
 - see how the users react
 - changes are likely
- Expert analysis
 - Make sure the user interface is functional, without severe flaws, and receive concrete suggestions on how to improve it.
- Individual testing
 - Find out how real end users use the application
 - Identify problems.
 - record information (e.g. which keys are preferred, which views they like)
- Group testing
 - Interesting for group applications (e.g. multiplayer games)

From: Tip Of The Month: Usability Is The Heart Of Development (Nokia Forum)

Release

- Analyze market acceptance
- Analyze potential areas of improvement

- Satisfaction survey
 - To find out which parts of the application users like and which need improvement
 - effects of possible usability problems can be evaluated.
- End-user analysis
 - Does it fit the market?
 - Do users want it?

From: Tip Of The Month: Usability Is The Heart Of Development (Nokia Forum)

Maintenance

- changes and updates
- different language versions
- porting to new devices,
- Extending content (e.g. game levels, new episode)

- Group testing
 - How would users modify the application,
 - Why would they want an update or another version?
- Satisfaction survey
 - Competition
 - Long term effect
- End-user analysis

From: Tip Of The Month: Usability Is The Heart Of Development (Nokia Forum)

Guidelines

- Example – Nokia Series 60

Navigation

- Basics

Where am I?

Where can I go from here?



Interaction - Basics

- **Consistency** is the key to designing applications that are easy to learn
- choose user **interface elements** and **interaction principles** that are already **familiar to the user** (e.g. like the other applications on the phone)
- **design** an application that works **as the user expects** it to work

From: Series 60 Developer Platform 2.0: Usability Guidelines For Enterprise Applications (Nokia Forum)

16/07/04

LMU München ... Mensch-Maschine-Interaktion 2 ... SoSe04 ... Schmidt/Hußmann

25

Interaction Style

- *Use the navigation key as a primary control.*
 - Users are likely to be very familiar with a five-way navigation key.
 - move focus with the navigation key and select items with it.
 - context-sensitive menu is recommended if there is no single intuitive default action.
- *Use softkeys consistently.*
 - *Display softkey labels – always*
 - *Use the left softkey as an Options menu, and as a secondary selection key.*
 - *Use the right softkey for Exit / Cancel / Back.*
- *Use terms consistently.*
 - Be consistent with other applications
- *Provide automatic saving and loading.*
 - when opening and closing an application.
 - Or use multitasking features
 - Interrupting a task is most common on the phone (e.g. incoming call, crossing a road, ...)
- *Use familiar key shortcuts.*

From: Series 60 Developer Platform 2.0: Usability Guidelines For Enterprise Applications (Nokia Forum)

16/07/04

LMU München ... Mensch-Maschine-Interaktion 2 ... SoSe04 ... Schmidt/Hußmann

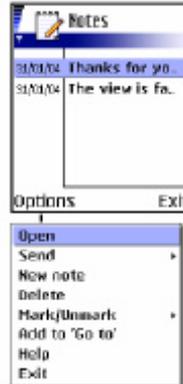
26

Main Menu (1)

- The application's core features should be directly available from the main view of the application, preferably with only one to four key presses.



No focus



Using focus

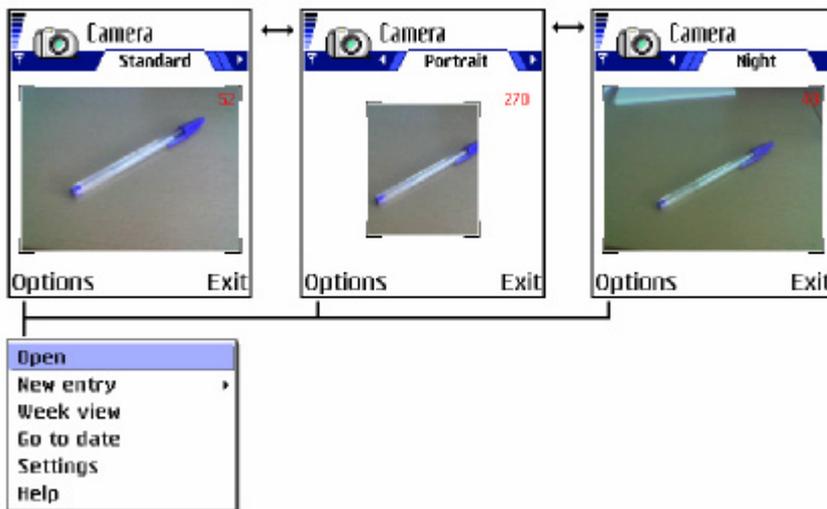
From: Series 60 Developer Platform 2.0: Usability Guidelines For Enterprise Applications (Nokia Forum)

16/07/04

LMU München ... Mensch-Maschine-Interaktion 2 ... SoSe04 ... Schmidt/Hußmann

27

Main Menu (2) - Using tabs



From: Series 60 Developer Platform 2.0: Usability Guidelines For Enterprise Applications (Nokia Forum)

16/07/04

LMU München ... Mensch-Maschine-Interaktion 2 ... SoSe04 ... Schmidt/Hußmann

28

Options Menu

- When possible, use the same terms that are used in other Series 60 applications for the same purpose.
- Order items in the list according to frequency of usage.
- Order items logically, placing related items near each other. Use submenus to hide related items and make the **Options** menu shorter.
- The default action(s) available with the **navigation key** should also be available from the **Options** menu
- Avoid scrolling in submenus of the **Options** menu, since users may not notice that they can scroll the submenu, too.
- Do not display unavailable items in the **Options** menu. It is recommended to hide these items.
- Do not try to implement third-level submenus. Use queries instead.

From: Series 60 Developer Platform 2.0: Usability Guidelines For Enterprise Applications (Nokia Forum)

16/07/04

LMU München ... Mensch-Maschine-Interaktion 2 ... SoSe04 ... Schmidt/Hußmann

31

Interruptions

- A mobile phone is a phone
 - There may be calls or SMS
- In every application you should be able
 - Answer and reject incoming calls
 - View incoming Short Message Service (SMS) and Multimedia Messaging Service (MMS) messages
 - View incoming Bluetooth transmissions
 - View calendar, timer, or clock alarms
 - View battery alarms
 - “Panic exit” the application by pressing the **End key** or **Application key**
- May require automatic saving

From: Series 60 Developer Platform 2.0: Usability Guidelines For Enterprise Applications (Nokia Forum)

16/07/04

LMU München ... Mensch-Maschine-Interaktion 2 ... SoSe04 ... Schmidt/Hußmann

32

... more

- Scrolling
- Shortcuts
- Actions & Feedback
- Full canvas mode
- Multitasking
- Tabs and folder
- ...

Entering Information

- Consider all options – keys, audio, camera
- Don't ask the user for information you can get somewhere else
- Prefer selection over text input
- Do not force text entry for non essential fields
- Do not force a specific format / length
- Support copy and paste
- Provide whenever possible a default value
- Switch of predictive text when not entering plain text
- Learn from user input
- Make natural groupings and order of fields
- Be tolerant – accept and correct misspellings if possible
- Respect the user's work – automatic saving and loading

From: Series 60 Developer Platform 2.0: Usability Guidelines For Enterprise Applications (Nokia Forum)

Information Presentation (Text)

- Provide chunks of reasonable size
- Use terminology that is familiar to the target users.
- Avoid abbreviations
- Keep the amount of text in applications to a minimum.
- Text should not be ALL CAPS.
- Do not truncate text, especially in menus.
- Employ the user's native language. Always test localized versions of the application with native users.
- Use simple, readable fonts – san serif for screens
- Do not force the user to scroll long text row by row.
- Structure text, e.g. use lists, bullets, paragraphs
- Do not force the user to scroll long text row by row.

From: Series 60 Developer Platform 2.0: Usability Guidelines For Enterprise Applications (Nokia Forum)

16/07/04

LMU München ... Mensch-Maschine-Interaktion 2 ... SoSe04 ... Schmidt/Hußmann

35

Information Presentation (Graphics)

- The background should be less detailed and less colorful than the foreground. Consider outdoor use in bright light.
- To make graphics near the edge of the screen more distinguishable, use a one-pixel white border around the screen.
- If the user needs to monitor the phone screen for longer times, consider keeping the backlight active.
- Icons
 - Icons should not be used to replace text containing essential information
 - Icons should be familiar to target users. (cultural differences)
 - Icons should be simple and clearly visible (contrast to the background)
 - colors of icons should never conflict with the meaning of the icon.
 - Highlights are drawn on the upper left corner of icons and elements
 - Shadows should be placed below and to the right side of the element.

From: Series 60 Developer Platform 2.0: Usability Guidelines For Enterprise Applications (Nokia Forum)

16/07/04

LMU München ... Mensch-Maschine-Interaktion 2 ... SoSe04 ... Schmidt/Hußmann

36

...more

- Colors
- Sounds
- Errors
- Help
- Connectivity

Checklists

- Navigation Checklist
- Information Entry Checklist
- Information Presentation Checklist
- Connectivity Checklist

See PDF file

Navigation Checklist

Guideline	True	Almost	False	N/A
Core features of the application are directly available from the main view of the application, preferably with only 1-4 key presses.	[]	[]	[]	[]
The Navigation key is used as a primary control.	[]	[]	[]	[]
Softkey labels are always displayed.	[]	[]	[]	[]
The left softkey is used as an Options menu, and as a secondary selection key.	[]	[]	[]	[]
The right softkey is used for Exit/Cancel/Back.	[]	[]	[]	[]
Terminology is consistent with Series 60 applications.	[]	[]	[]	[]
Shortcut keys are consistent with Series 60 applications.	[]	[]	[]	[]
A default action(s) available with the navigation key is also available from the Options menu.	[]	[]	[]	[]
No scrolling is required in submenus of the Options menu.	[]	[]	[]	[]
Users get instant feedback on their actions.	[]	[]	[]	[]
If action takes between 0.5 to 2 seconds, the user is provided with an indication that something is happening.	[]	[]	[]	[]
If the expected pause is longer than 2 seconds, a progress bar or an animation is displayed.	[]	[]	[]	[]
If the application has tabs, the most essential functionality is displayed in the first tab.	[]	[]	[]	[]
If more than five tabs are displayed, there is a list or grid for selecting a tab directly from the previous level of the navigation structure.	[]	[]	[]	[]
If use of an application requires knowledge about multitasking, users are assisted in this.	[]	[]	[]	[]
The application does not interfere with incoming calls, messages, or notifications.	[]	[]	[]	[]
If the user exits the application with the End key or Application key , the application does not close, but is switched to the background and paused, if necessary.	[]	[]	[]	[]

From: Series 60 Developer Platform 2.0: Usability Guidelines For Enterprise Applications (Nokia Forum)

16/07/04

LMU München ... Mensch-Maschine-Interaktion 2 ... SoSe04 ... Schmid/Hußmann

39

Information Entry Checklist

Guideline	True	Almost	False	N/A
When possible, alternative forms of information entering are used (for example, camera, microphone, drawing, etc.).	[]	[]	[]	[]
The application does not ask for data that it can find on its own.	[]	[]	[]	[]
Selection controls are preferred over text entry controls.	[]	[]	[]	[]
The application supports the copy/paste feature.	[]	[]	[]	[]
The application provides reasonable default values for data requested from the user.	[]	[]	[]	[]
Predictive text entry is not used when entering something other than normal text.	[]	[]	[]	[]
Fields in forms are grouped logically and presented in a natural sequence.	[]	[]	[]	[]
Common misspellings are accepted.	[]	[]	[]	[]
The user is not forced to enter data that s/he might consider unimportant.	[]	[]	[]	[]
When entering (small) numbers, the user can increase/decrease numbers with the navigation key.	[]	[]	[]	[]
If possible, the application could learn from user input.	[]	[]	[]	[]
The user is not forced to guess the right format for information.	[]	[]	[]	[]
Appropriateness of the application's graphics, language, colors, and features are checked with real users from target cultures.	[]	[]	[]	[]

From: Series 60 Developer Platform 2.0: Usability Guidelines For Enterprise Applications (Nokia Forum)

16/07/04

LMU München ... Mensch-Maschine-Interaktion 2 ... SoSe04 ... Schmid/Hußmann

40

Information Presentation Checklist

Guideline	True	Almost	False	N/A
The most important content is presented first.	[]	[]	[]	[]
The amount of text in applications is minimal.	[]	[]	[]	[]
The target users' native language is used.	[]	[]	[]	[]
Terminology familiar to target users is used instead of technical terminology.	[]	[]	[]	[]
Paragraphs and headings are used to make long text more readable.	[]	[]	[]	[]
Simple, readable fonts are used.	[]	[]	[]	[]
Text has good contrast with the background.	[]	[]	[]	[]
The user is not forced to scroll long text row by row.	[]	[]	[]	[]
In long text, scrolling speed gradually increases when the user holds button down.	[]	[]	[]	[]
Text is not ALL CAPS.	[]	[]	[]	[]
Text is not truncated.	[]	[]	[]	[]
Obscenity or foul language is not used.	[]	[]	[]	[]
No essential information is displayed with icons only. Textual presentation of the information is also available.	[]	[]	[]	[]
When information is displayed with different colors, they are clearly distinguishable from each other by different levels of contrast.	[]	[]	[]	[]
The user should be able to interrupt any sound with a key press.	[]	[]	[]	[]
Sound is always used in conjunction with a visual indication.	[]	[]	[]	[]
The user always has control over sounds.	[]	[]	[]	[]
No sounds are played after the application has lost its focus.	[]	[]	[]	[]
Pop-up messages are not overused.	[]	[]	[]	[]

From: Series 60 Developer Platform 2.0: Usability Guidelines For Enterprise Applications (Nokia Forum)

16/07/04

LMU München ... Mensch-Maschine-Interaktion 2 ... SoSe04 ... Schmid/Hußmann

41

Connectivity Checklist

Guideline	True	Almost	False	N/A
Short network coverage problems do not cause loss of users' work.	[]	[]	[]	[]
It is possible to view recently retrieved information without a network connection.	[]	[]	[]	[]
Cached sending of information is enabled.	[]	[]	[]	[]
A confirmation dialog is displayed before actions that may incur a cost to the user. The exact price is displayed, if possible.	[]	[]	[]	[]
The application does not rely on the user to constantly refresh the information. Automatic connections can be enabled from the application's Settings menu.	[]	[]	[]	[]
If automatic updating is not used, the application reminds the user, and preferably asks if s/he wants the information updated.	[]	[]	[]	[]
Terms referring to <i>closing the application</i> , <i>establishing connection</i> with the server, <i>logging in</i> or <i>out</i> , and <i>reporting in</i> for work orders are not confused with each other.	[]	[]	[]	[]
The current status is displayed clearly. For example, "Not connected," "Not logged in," or "Not reported in" display when appropriate.	[]	[]	[]	[]
Feedback clearly communicates if an action succeeded or not. If possible, it also provides additional information.	[]	[]	[]	[]
Identifying the handset with IMEI or SIM is preferred over logging in with a password.	[]	[]	[]	[]
The user is not forced to enter passwords repeatedly.	[]	[]	[]	[]
Sensitive data is stored with appropriate encryption.	[]	[]	[]	[]
The user is allowed to erase his/her data.	[]	[]	[]	[]

From: Series 60 Developer Platform 2.0: Usability Guidelines For Enterprise Applications (Nokia Forum)

16/07/04

LMU München ... Mensch-Maschine-Interaktion 2 ... SoSe04 ... Schmid/Hußmann

42

Paper prototyping (as introduced last term)

- Paper prototypes are one of the most efficient user interface prototyping methods. Paper prototypes focus on prototyping the essential elements of the user interface: screen layouts, dialogs, and interaction between the user and the application.



The lack of detail and unfinished look is their strength, because it forces test users to concentrate their comments on the essential issues, rather than technical details. Use of paper prototypes is highly recommended, even if you feel that “real” prototyping happens only with rapid prototyping tools. Instead of concentrating on *how* prototypes are implemented, concentrate on *what* prototypes are used *for*. With paper prototypes it is possible to explore multiple design options, test them with real users, and refine designs in just a few hours.

HiWi Jobs in den Semesterferien!!!

- EU Projekt Simplicity
- DFG Projekt Eingebettete Interaktion

- Was?
 - Programmieren – Telefone, Microcontroller, PCs in C, JAVA, Flash, Visual Basic
 - Löten
 - Experimentieren

References

- Poika Isokoski, at NIT2001, 12.2.2001
http://www.cs.uta.fi/kurssit/Interact/NIT2001_PI.ppt
- Example: POBox - An Efficient Text Input Method for Handheld and Ubiquitous Computers. Toshiyuki Masui. HUC99
<http://www.csl.sony.co.jp/person/masui/papers/HUC99/HUC99.pdf>
- Michael Rohs, Beat Gfeller. Using Camera-Equipped Mobile Phones for Interacting with Real-World Objects. In: Ferscha, Hoertner, Kotsis (Eds.): Advances in Pervasive Computing, Austrian Computer Society (OCG), ISBN 3-85403-176-9, pp. 265-271, Vienna, Austria, April 2004
- V. Sazawal, R. Want, G. Borriello. The Unigesture Approach: One-Handed Text Entry for Small Devices. Mobile HCI, Pisa, Italy, pp. 256-270, September 2002.
- Nokia Forum (forum.nokia.com):
 - Tasks of the Mobile Worker
 - Tip Of The Month: Usability Is The Heart Of Development
 - Series 60 Developer Platform 2.0: Usability Guidelines For Enterprise Applications
 - Tip Of The Month: Usability And Fun – Best Friends In Mobile Games
 - Series 40 Game Usability Study (Goodliving, RedLynx Laboratories, and Sumea Interactive;
http://www.forum.nokia.com/main/0,6566,si_p_39,00.html