

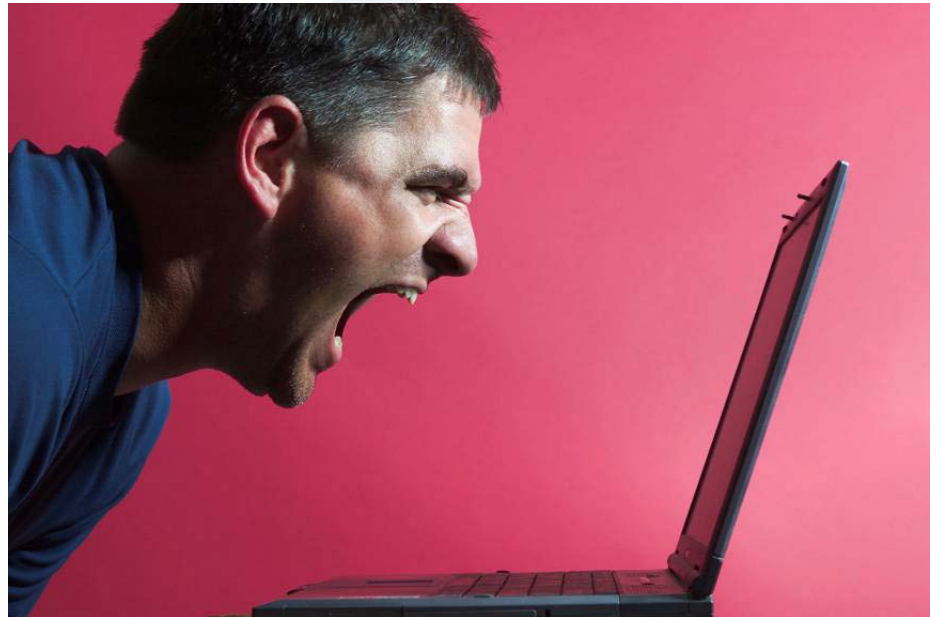
Lecture No. 2

Design of Mobile Applications & Services: HCI Issues

Mobile Business II (SS 2009)

Prof. Dr. Kai Rannenberg

Chair of Mobile Business and Multilateral Security
Johann Wolfgang Goethe-Universität Frankfurt a. M.



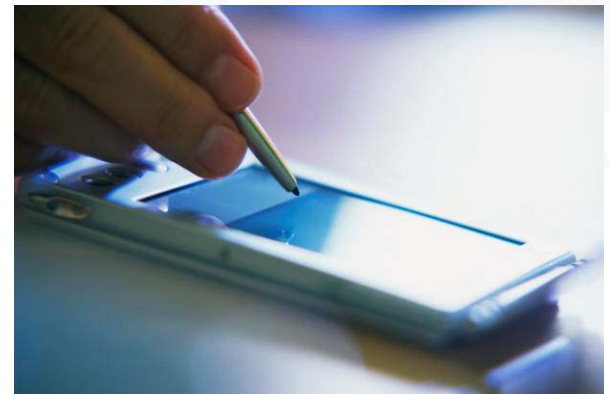
- Introduction to HCI
- Mobile Interaction Styles
- Mobile Interaction Design
 - Understanding Users
 - Developing Prototype Designs
 - Evaluation
- Mobile Information Access

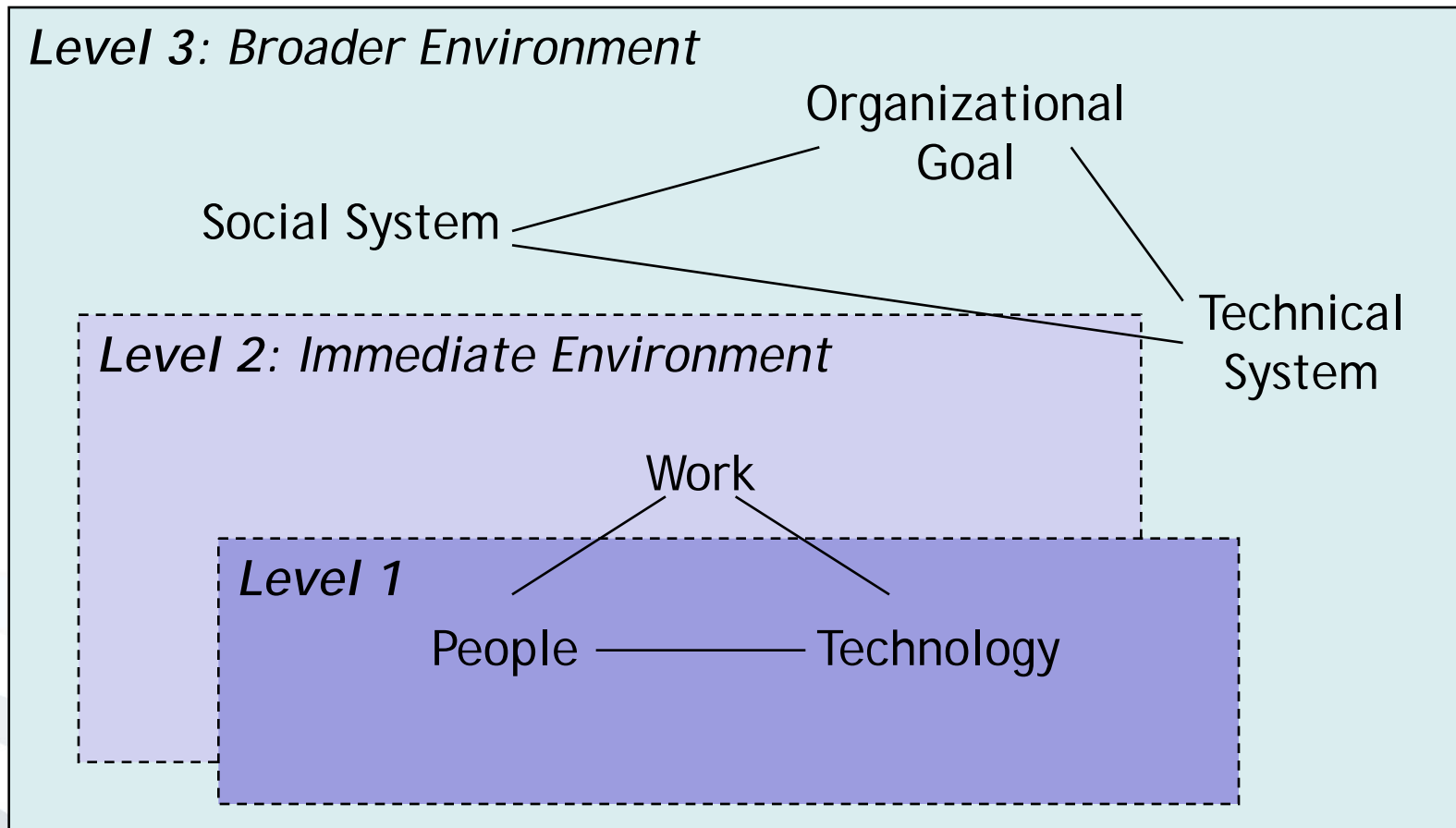
“Human-computer interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them.”

[Hewett et al. 1992]

“Human-computer interaction is the scientific study of the interaction between people, computers, and the work environment.”

[Beard and Peterson 1988]



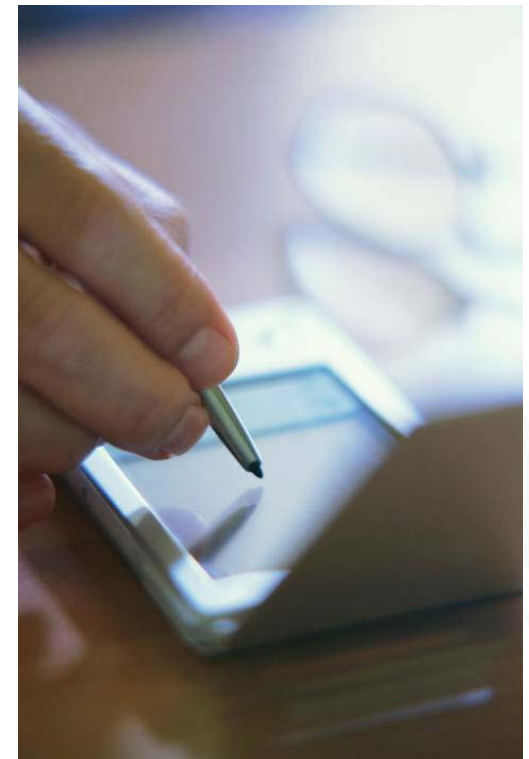


[Based on Preece et al. 1994]

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The interaction between users and mobile devices is multidimensional.

- Text entry
- Speech input
- Menu navigation
- Earcons
- Metaphors



[Love 2005]

Possible interaction via text entry:

- Keyboard entry
- Touch screen
 - Palm-Graffiti
 - Recognition of handwriting
 - Multitouch
 - Virtual keyboard
- Tegic T9
- Octave
- ...

- Text entry via classic keyboard solution.
- For higher mobility, keyboards become foldable and virtual.



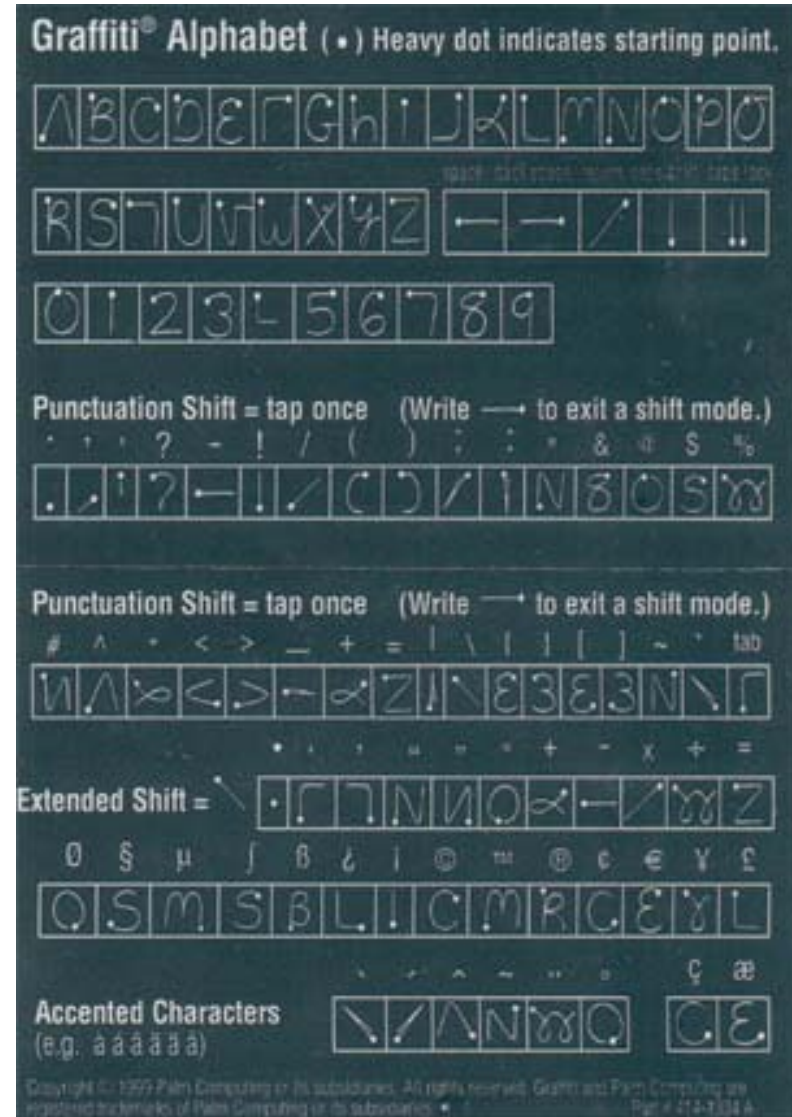
[Source: www.palm.com]



[iBIZ Technology Corp]

➔ Adaptation of a traditional text entry concept

- Handwriting recognition software
- Artificial script, based on upper-case characters
- Can be drawn blindly with a stylus on a touch-sensitive panel



[Source: Palm Inc.]

- Input by using gestures



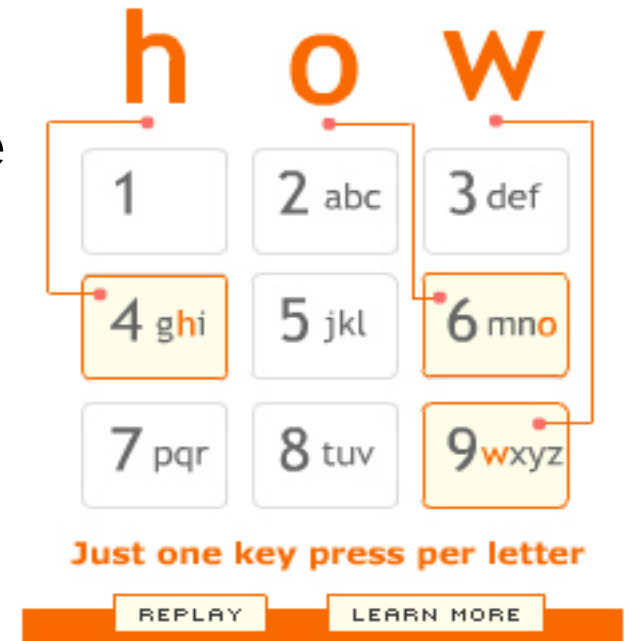
[Source: technovelgy.com]

- Virtual keyboard on the screen
- Can be used with a stylus or with fingers



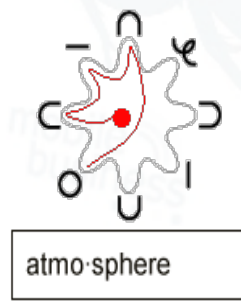
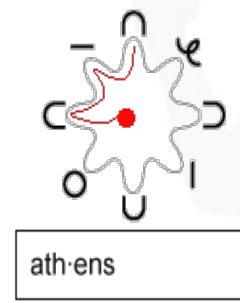
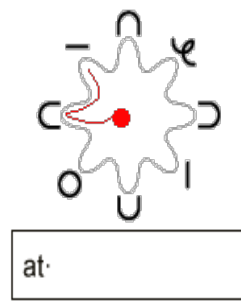
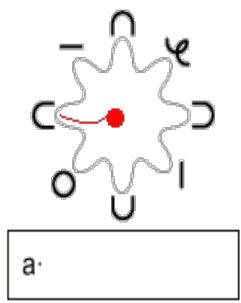
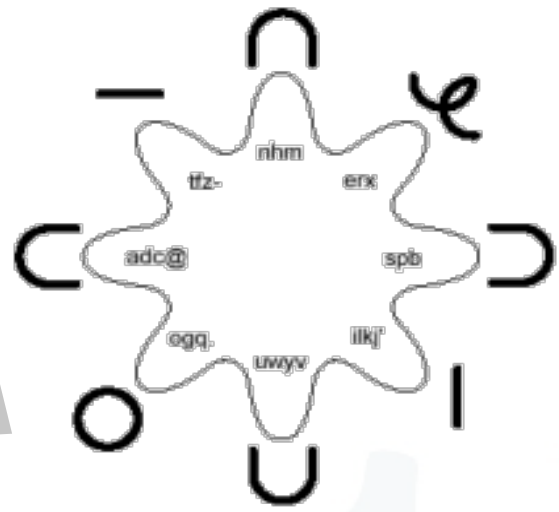
[Source: HTC Inc.]

- T9 (*Text on 9 keys*) is a predictive text technology developed by Tegic Communications.
- Widely used by: LG, Samsung, Nokia, Siemens, Sony Ericsson, Sanyo
- Uses a dictionary of words, which is used to look up all the possible words, corresponding to the sequence of keys pressed.
- Available in 27 languages



[Source: www.t9.com]

- Text can be entered via key navigation



- Speech input relies on speech recognition technologies used by the mobile application.
 - *Speaker-dependent*
Recognition technologies “learns” from a set of sample words spoken by the user (system training).
 - *Speaker-independent*
Pre-defined vocabulary that has been set up by a large number of speech samples.

[Love 2005]

Mobile Interaction Styles: Menu Navigation



- Mobile phone applications usually have a hierarchical structured navigation menu providing a list of menu choices.
- Menu hierarchies are often not self-explanatory (switching costs for users).
- Long menu lists can overload the users' short-term memory.

connect your memory card to a computer

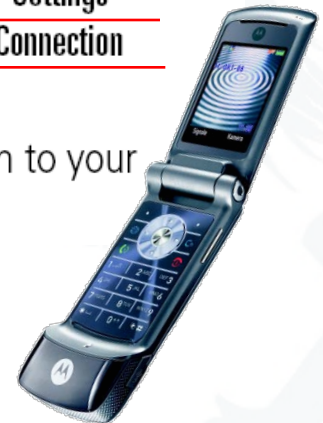
You can use a cable connection to access your phone's memory card with a PC.

Note: When your phone is connected to a computer, you can only access the memory card through the computer.

On your phone:

Disconnect the cable from your phone, if it is connected, then press  >  Settings
> Connection > USB Settings > Default Connection
> Memory Card.

This directs the USB connection to your memory card.



[Source: Motorola]

- Earcons are abstract musical tones that produce sound messages to represent parts of an interface.
- Event-driven:
 - Incoming text messages
 - Alarm clock
 - ...
- Menus augmented with earcons can support user navigation.

[Blattner et al 1989]



- Interface metaphors work by applying prior knowledge from a familiar to a new domain.
- Goal: Reducing people's perception of the complexity of the device used.

[Love 2005]



[Source: Nokia]

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Main activities of effective interaction design

Understanding users

(Capabilities and limitations)

Developing prototype designs

(Demonstration of proposed interaction design)

Evaluation

(Identification of strengths and weaknesses of a design)

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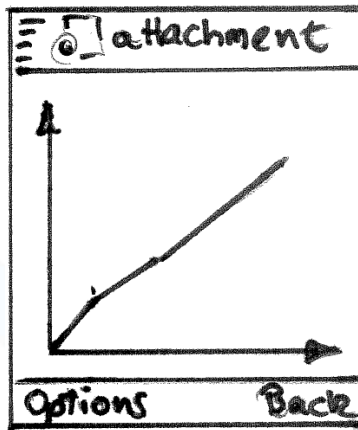
- For an effective interaction design, it is necessary to understand potential users of a system.
- Possible methodologies
 - Field studies (observe and probe a particular group in situations of interest)
 - Laboratory experiments (observe and probe a particular group within a controlled environment)
 - Direct questionnaire (e.g. to validate impressions and interpretations from the field)

- The user group needs to have a significant impact on the design process.
- User-centered service design can significantly effect the user's perception of mobile devices and services.
- Exemplary user characteristics:
 - Spatial ability:
dealing with spatial relations and visualization of spatial tasks
 - Verbal ability:
comprehend spoken or written words
 - Working memory:
limited capacity of short-term memory
 - Previous experience:
user's experience with an actual interface used

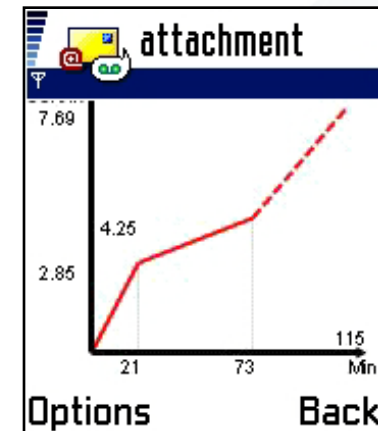
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- HCI-Prototypes are built in order to express a design idea as quickly as possible.
- One can differentiate how closely a prototype resembles the appearance of the final product.

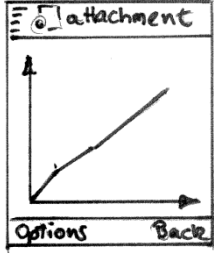
[Jones and Marsden 2006]



Low-fidelity



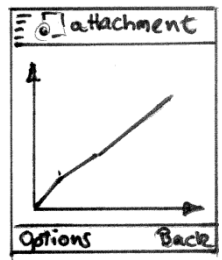
High-fidelity



Low-fidelity

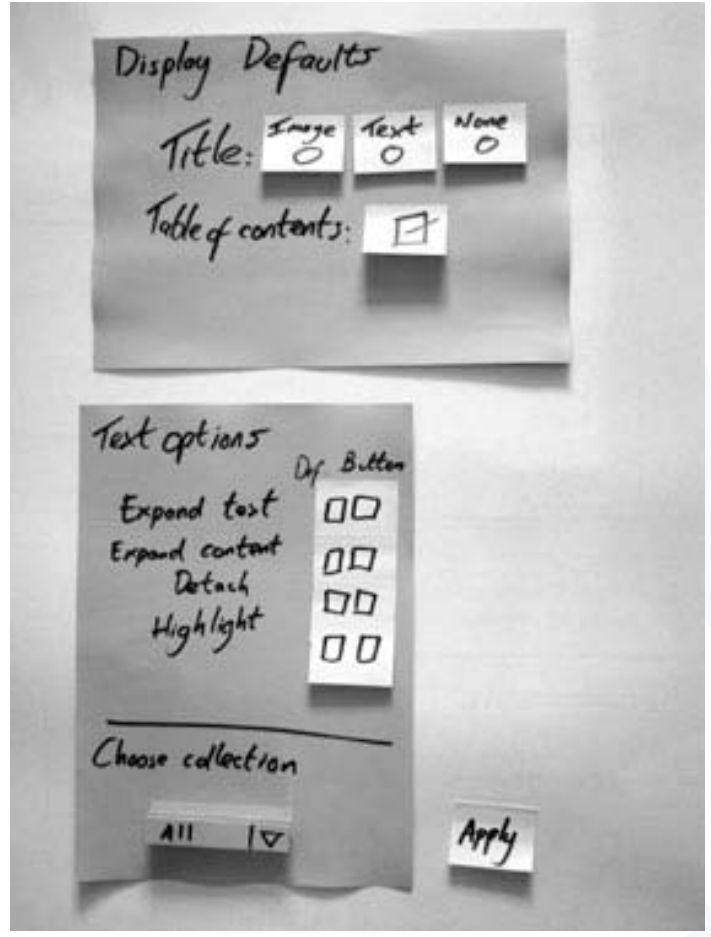
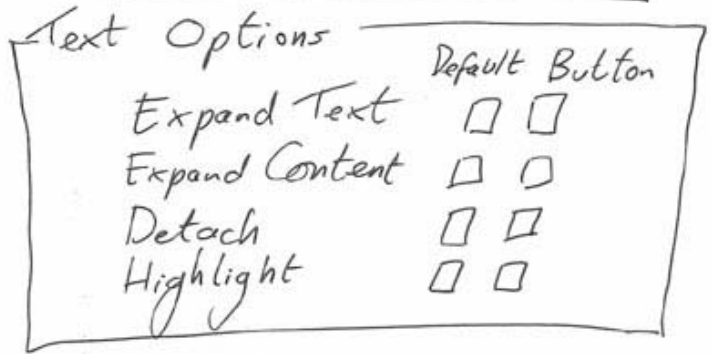
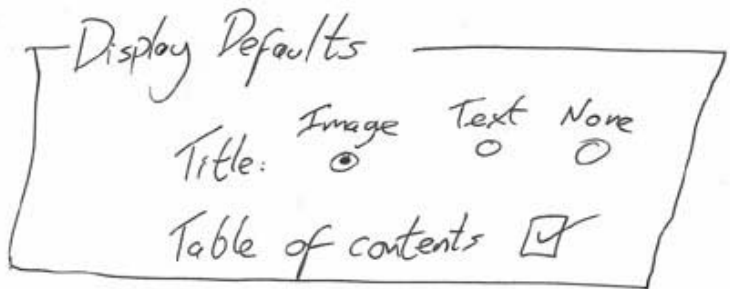
The prototype uses materials different to those in the final incarnation.

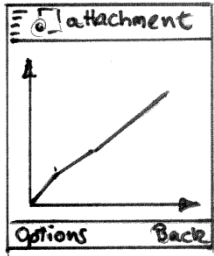
- Check for inconsistency
- Give a common specification for the design team
- Afford reflection
- Check interaction scenarios



Basic Layouts

[Source: www.wiley.com/go/mobile]

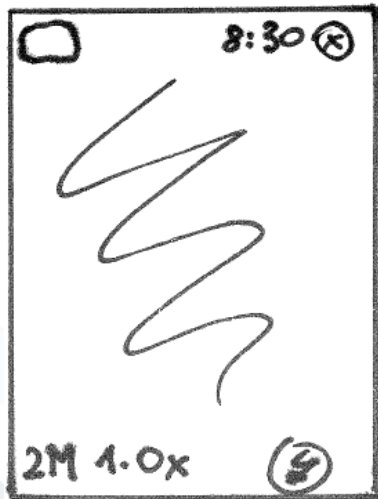




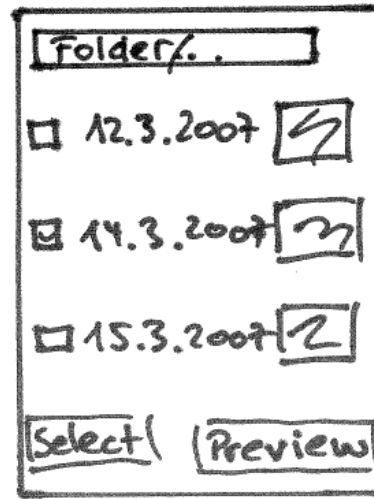
Self-Checking

Building a low-fidelity prototype for testing the feasibility of ideas.

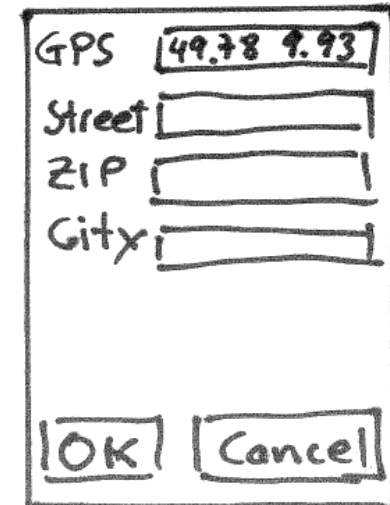
Example:



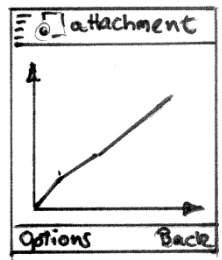
Take pictures



Choose a picture



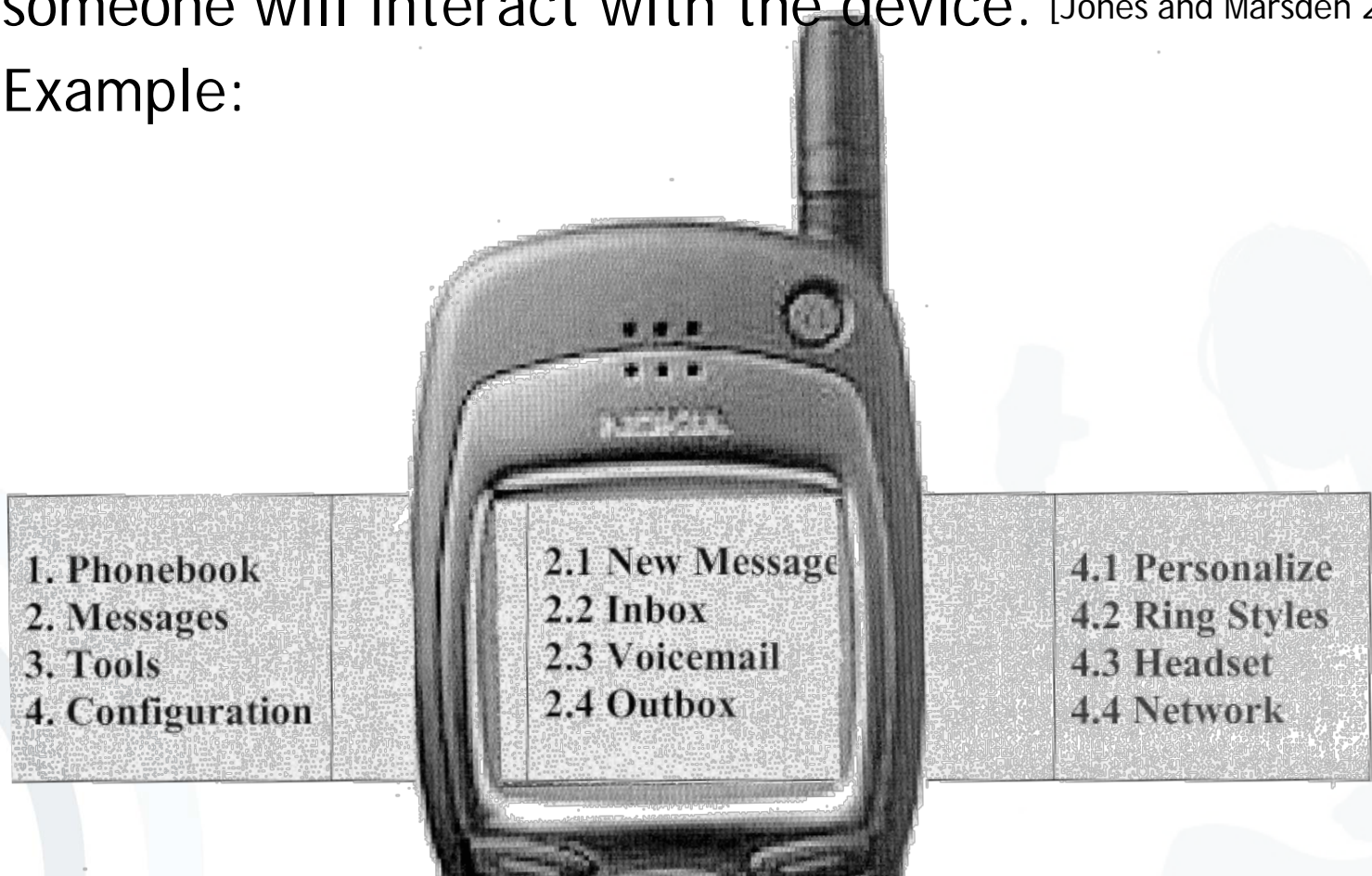
Get location via
GPS or manual input

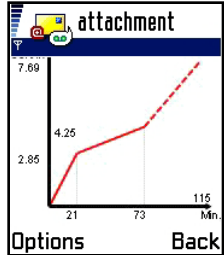


Interaction Prototyping

Building a low-fidelity prototypes for considering how someone will interact with the device. [Jones and Marsden 2006]

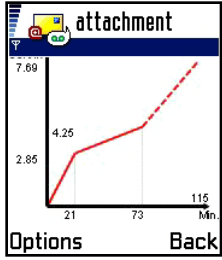
Example:



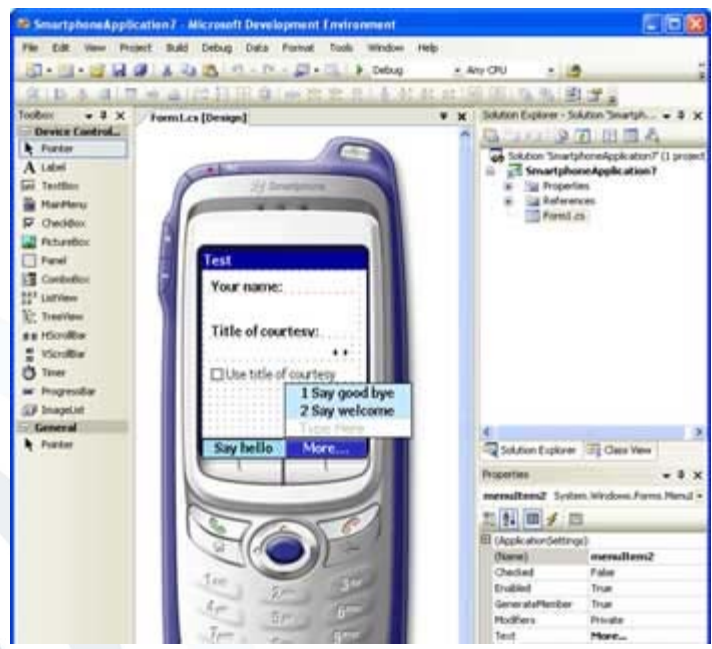


High-Fidelity Prototype Designs

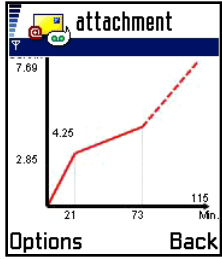
- The results of a low-fidelity prototyping process comprise a list of features that should be tested with representatives of the target group.
- High-fidelity prototype designs provide the functionality to evaluate critical tasks and functionalities that should be supported by the final product.
- Therefore, most critical features must be identified to be included in the prototype design.



PC-based prototype designs ...
... can be developed by using standard programming environments (e.g. Visual Studio) and software emulators.



[Source: www.aremobil.de]



Platform-specific prototype designs ...

... can provide a proof-of-concept and can be used for evaluations.



Take pictures

Choose a picture

Get location via GPS or manual input

[Fritsch et al. 2005]

Type	Advantages	Disadvantages
Low-fidelity	<ul style="list-style-type: none"> ▪ Less time ▪ Lower costs ▪ Evaluate multiple concepts ▪ Useful for communication ▪ Address screen layout issues 	<ul style="list-style-type: none"> ▪ Little use for usability test ▪ Navigation and flow limitation ▪ Facilitator driven ▪ Poor detail in specification
High-fidelity	<ul style="list-style-type: none"> ▪ Partial functionality ▪ Interactive ▪ User-driven ▪ Clearly defined navigation scheme ▪ Use for exploration and test ▪ Marketing tool 	<ul style="list-style-type: none"> ▪ Creation time-consuming ▪ Inefficient for proof-of-concept ▪ Blinds users for major representational flaws ▪ Users may think prototype is 'real'

[Source: Jones and Marsden 2006]

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Why evaluation?

- Understanding how users will use the design in the real world,
- Comparing different prototype designs,
- Assessing whether the product to be developed meets usability requirements, and
- Ensuring that the product conforms to industry standards.

[Love 2005]

- The evaluation of HCI prototype designs can be based on different methodologies addressing different aspects, e.g.:
 - Direct observation
 - Interviews
 - Questionnaires
 - Experiments
 - ...

[Jones and Marsden 2006]

Direct observation

Observe or video users how they use the HCI design, e.g. in order to check:

- the intuitive and correct usage of design by the users,
- ability of users to manage pre-defined tasks.

- **Conducted by:** End-Users
- **Equipment:** Interactive prototype
- **Results:** Qualitative
- **Where:** Controlled setting

[Jones and Marsden 2006]

Interviews

- Often made in conjunction with observations,
- Provision of direct feedback from the users,
- Observed problems can be addressed.

- Conducted by: End-Users
- Equipment: Interactive prototype
- Results: Qualitative
- Where: Controlled setting

[Jones and Marsden 2006]

Questionnaires

- Tool for gathering users' opinions,
- Tool for comparing different designs by using quality scales,
- Example: *"I was able to enter text easily"*
Disagree [1] [2] [3] [4] [5] Agree

- Conducted by: End-Users
- Equipment: Interactive prototype & Questionnaire
- Results: Qualitative & Quantitative
- Where: Anywhere

Experiments

- Usually hypothesis-based
(e.g., '*navigation within application A is more quickly compared to application B*')
 - Results provide insight how much 'better' a certain design is.
- Conducted by: End-Users
 - Equipment: Interactive prototype
 - Results: Quantitative
 - Where: Usually laboratory-based

[Jones and Marsden 2006]

- Design shortcomings of products can have different reasons, such as:
 - A lack of user-based evaluation during the design process,
 - Perceived financial costs of better design,
 - An overemphasis on technology over purpose.

[Love 2005]

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- Are mobile devices “information appliances”?
What will people want to access?
 - Snippets of information?
 - Web sites?
 - Novels?
- Content design issues:
 - Simplicity
 - Format
 - Context-adapted
 - Source
 - User interaction: push vs. pull and hybrid.

[Source: www.wiley.com/go/mobile]

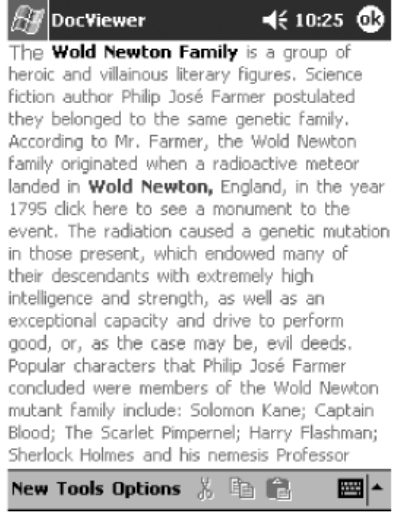
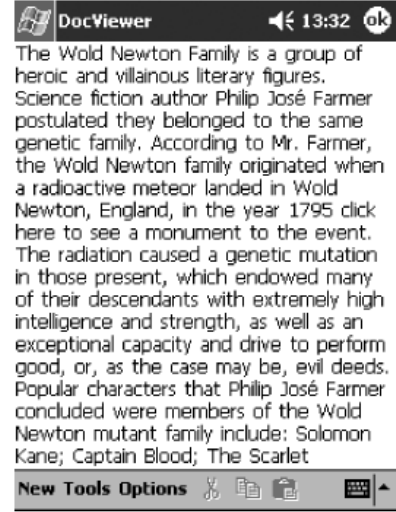
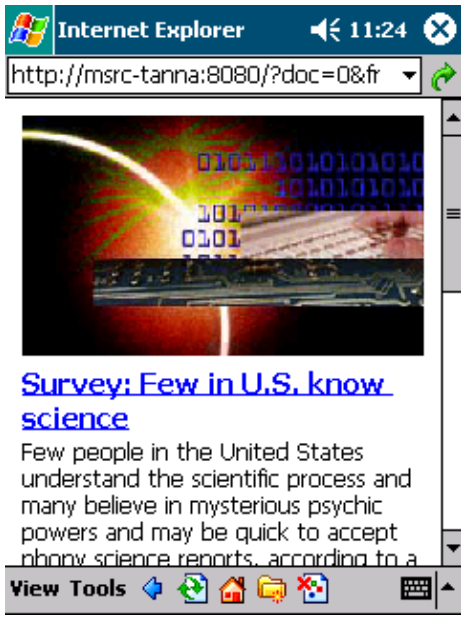
- Is the small screen a fundamental limitation?
 - Physical size vs. resolution
 - Other display technologies
 - e.g. FOLED screens (Flexible Organic LED)
- Previous research on non-mobile small screen devices
 - Simple text/ menus are usable
- Browsing and searching Web
 - Need to consider adaptations to avoid usability disasters



[Source: www.wiley.com/go/mobile]

Overview examples

- Key phrases picked out automatically for skim reading
- MSR SmartView



(a)

(b)

FIGURE 9.2

Two small-screen views of a document: (a) plain-text version; (b) with two keyphrases picked out in bold, and non-keyphrase text using much lower contrast

[Source: www.wiley.com/go/mobile]

overview page layout (left) detailed regions of the page (right)

[Source: Milic-Frayling et al. 2004]

Reducing cognitive burden of scroll:

- 1-D approach

Reduces scroll by placing navigation at top;
and, single dimension scroll improves
orientation

Example: Opera mobile browser.
Standard web pages are rendered as
a vertical film-strip to improve
small-screen usability.

[Source: www.wiley.com/go/mobile]

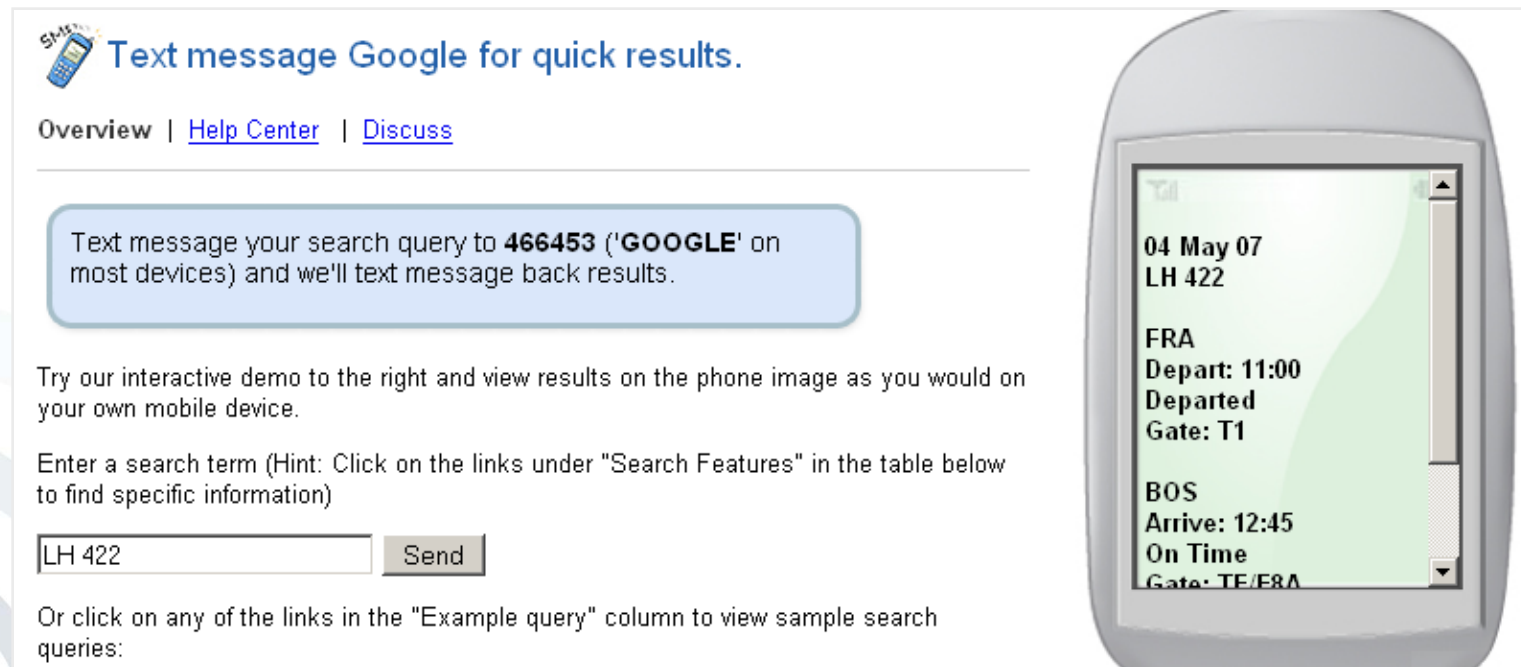


Ways of meeting goals

- Categorizing search results
- Providing more meta-data for each search result (e.g. keyphrases extracted from documents)

Extreme case: Google SMS (beta)

[Source: www.wiley.com/go/mobile]



The screenshot shows the Google SMS interface on the left and a mobile phone displaying flight information on the right. The interface includes a header with a mobile phone icon and the text "Text message Google for quick results." Below this are links for "Overview", "Help Center", and "Discuss". A blue box contains the instruction: "Text message your search query to **466453** ('GOOGLE' on most devices) and we'll text message back results." Below this is a text input field with "LH 422" and a "Send" button. To the right, a mobile phone screen displays flight details for LH 422, including departure from FRA at 11:00 and arrival at BOS at 12:45.

Text message Google for quick results.

[Overview](#) | [Help Center](#) | [Discuss](#)

Text message your search query to **466453** ('GOOGLE' on most devices) and we'll text message back results.

Try our interactive demo to the right and view results on the phone image as you would on your own mobile device.

Enter a search term (Hint: Click on the links under "Search Features" in the table below to find specific information)

Or click on any of the links in the "Example query" column to view sample search queries:

04 May 07
LH 422

FRA
Depart: 11:00
Departed
Gate: T1

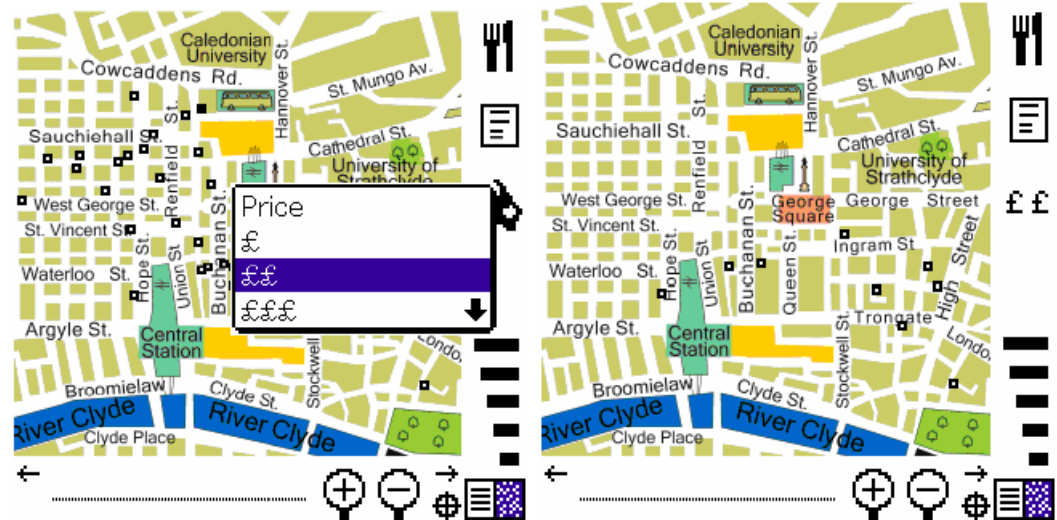
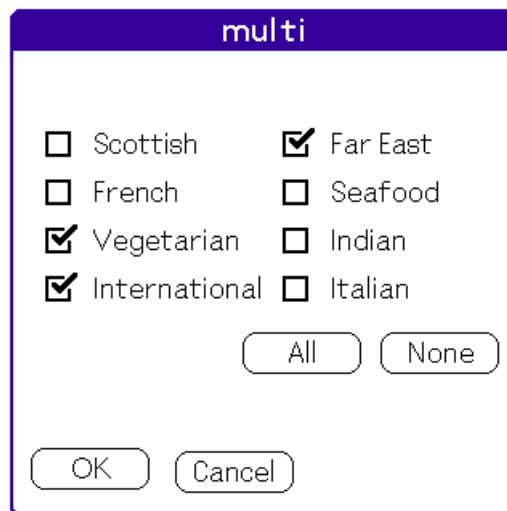
BOS
Arrive: 12:45
On Time
Gate: TE/E8A

[Source: www.google.com/sms]

Information visualization literature:

- Multiplicity of innovative schemes for presenting vast information space (e.g. star field querying).
- Consideration of applicability of these schemes to small screen devices (where every infospace is vast!)

[Source: www.wiley.com/go/mobile]



[Source: Dunlop et al. 2004]

- **Beard, J. and Peterson (1988)**
A Taxonomy for the Study of Human Factors in Management Information Systems, in: J. Carey (Ed.) *Human Factors in Management Information Systems*, Greenwich, CT, Ablex Publ., pp. 7-26
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Earcons and Icons: Their Structure and Common Design Principles, *Human-Computer Interaction* (4:1), pp. 11-44
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Focussed palmtop information access combining starfield displays and profile-based recommendations, *Proceedings of workshop on Mobile and Ubiquitous Information Access*, LNCS v2954, pp. 79-89
- **Fritsch, L.; Stefan, K. and Grohmann, A. (2005)**
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- **Milic-Frayling, N.; Sommerer, R.; RoddenK. and Blackwell, A. (2004)**
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Human-computer interaction, Reprinted, Addison-Wesley Publ. Co, Wokingham, UK