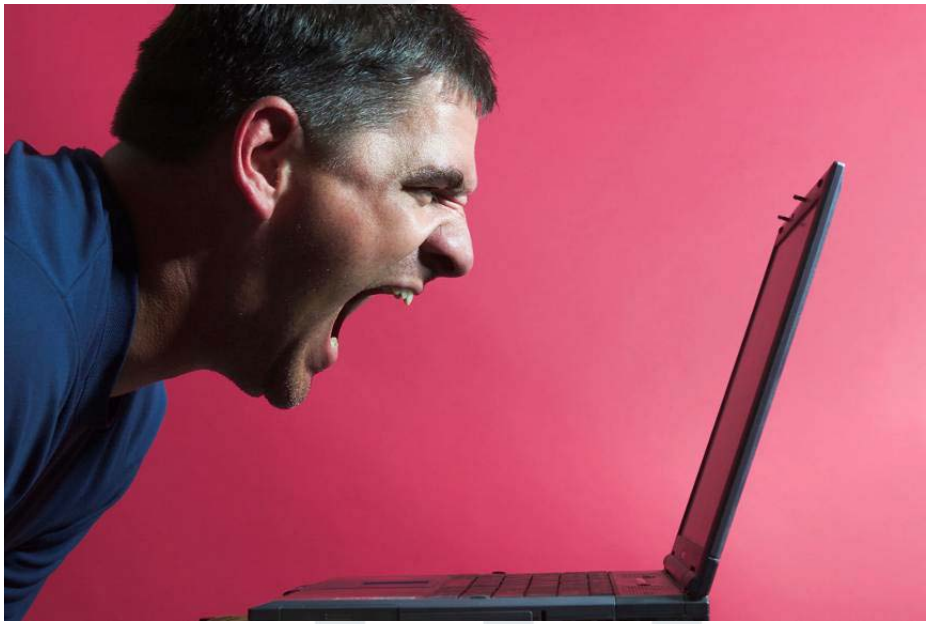
mobile business

Lecture 2

Design of Mobile Applications & Services: HCI Issues



Mobile Business II (SS 2010)

Prof. Dr. Kai Rannenberg

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

Agenda

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

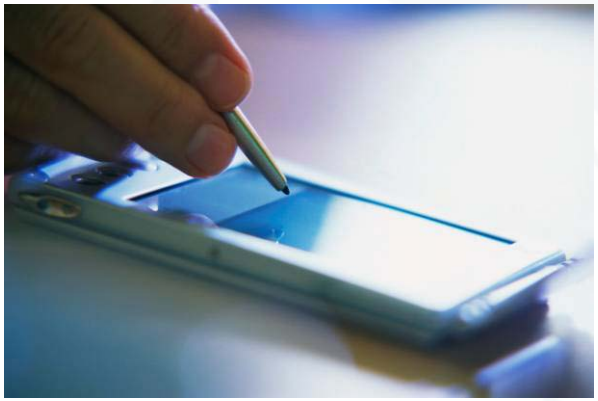
Definition

"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."

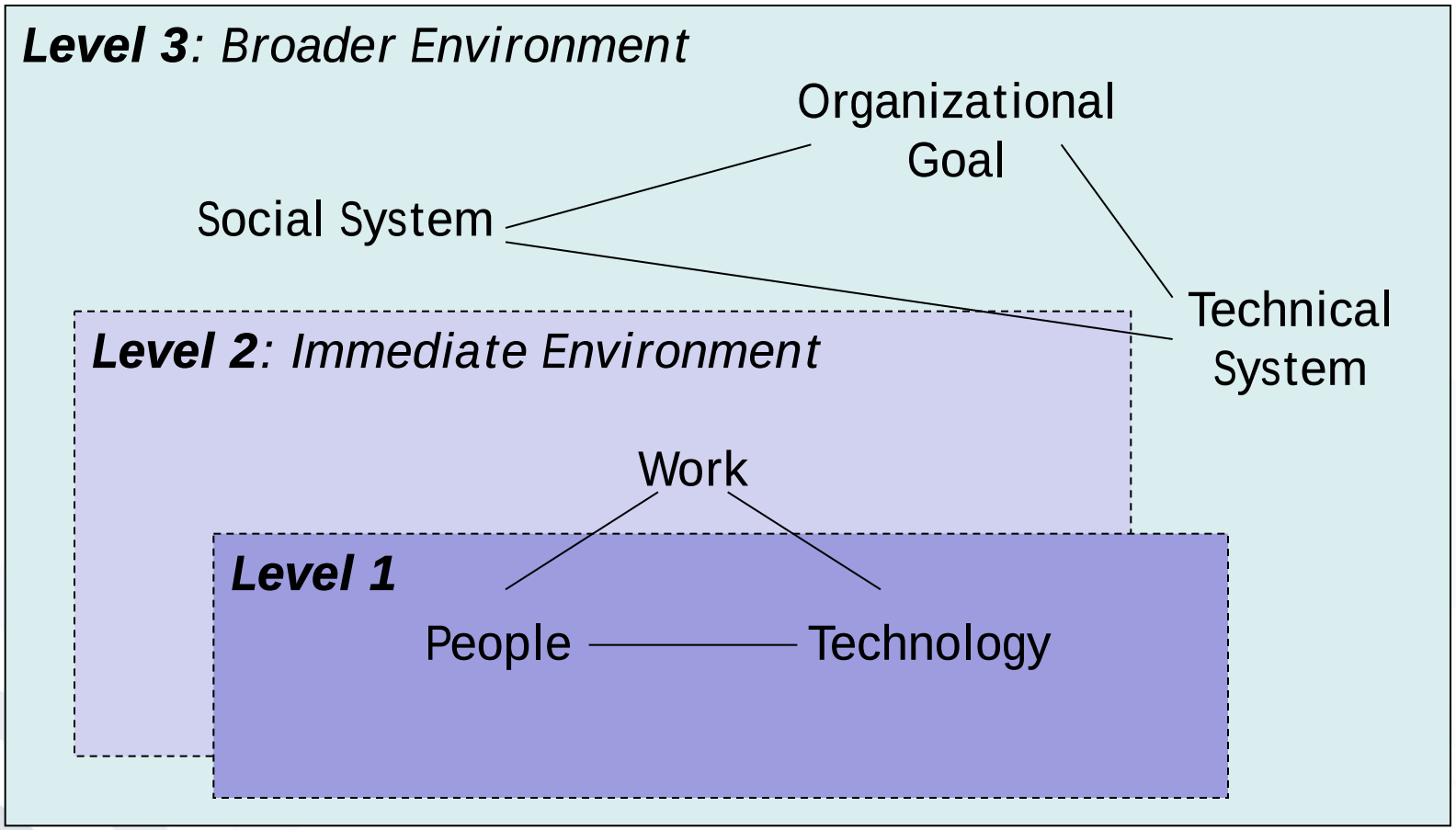
[Hewett et al. 1992]

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

[Beard and Peterson 1988]



Focus of HCI



[Based on Preece et al. 1994]

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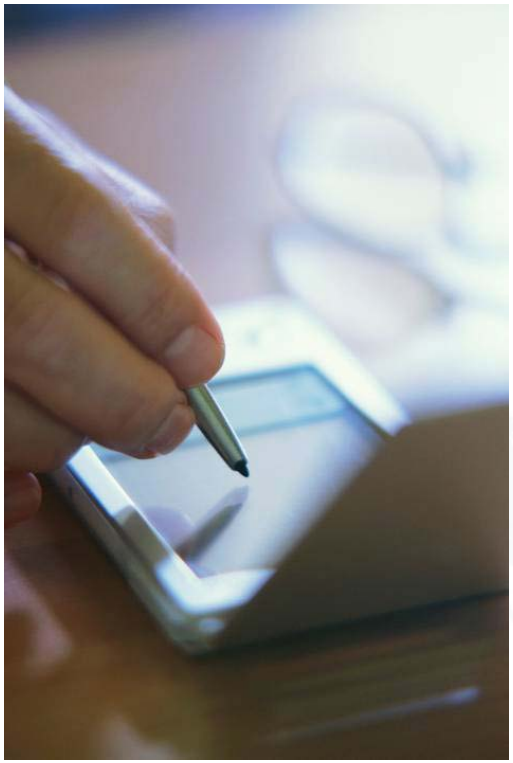
Mobile Interaction Styles

The interaction between users and mobile devices is multidimensional.

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

[Love 2005]



Mobile Interaction Styles: Text Entry

Possible interaction via text entry:

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

Mobile Interaction Styles: Keyboard Text Entry

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

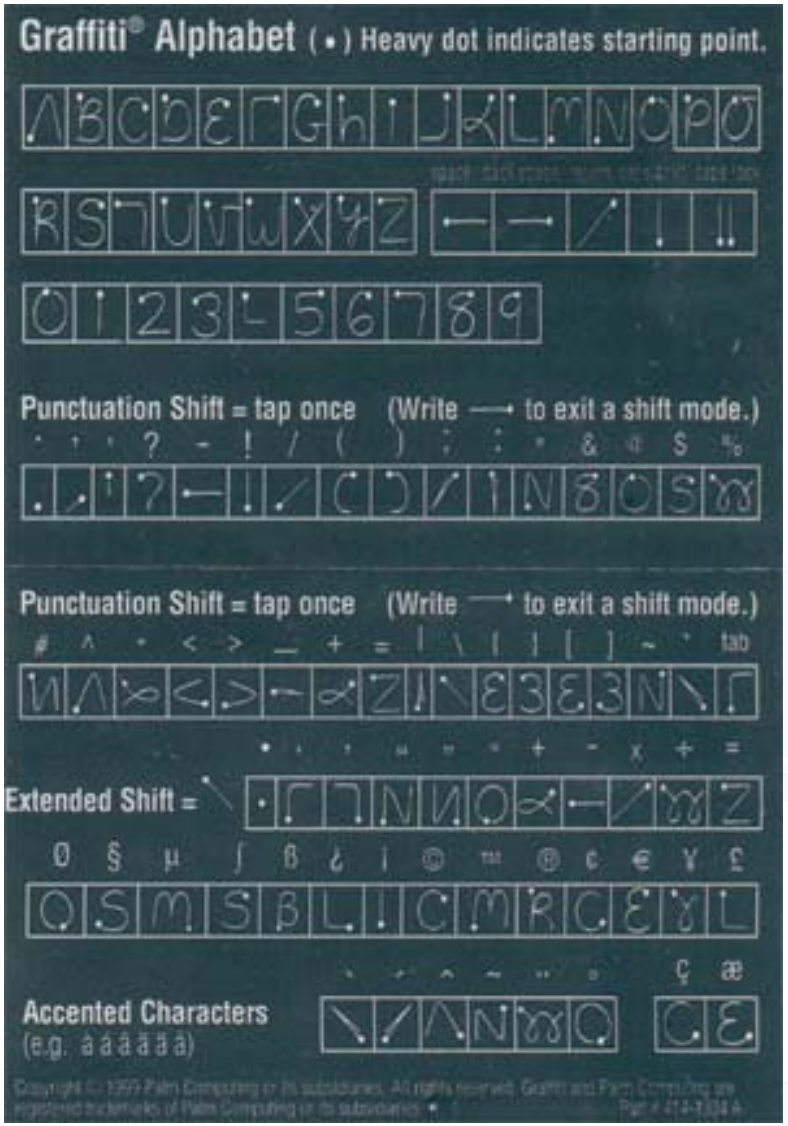
[Source: www.palm.com]

[iBIZ Technology Corp]

➲ Adaptation of a traditional text entry concept

Mobile Interaction Styles: Touch Screen – Text Entry

- 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.]

Mobile Interaction Styles: Touch Screen – Multitouch

- Input by using gestures

[Source: technovelgy.com]

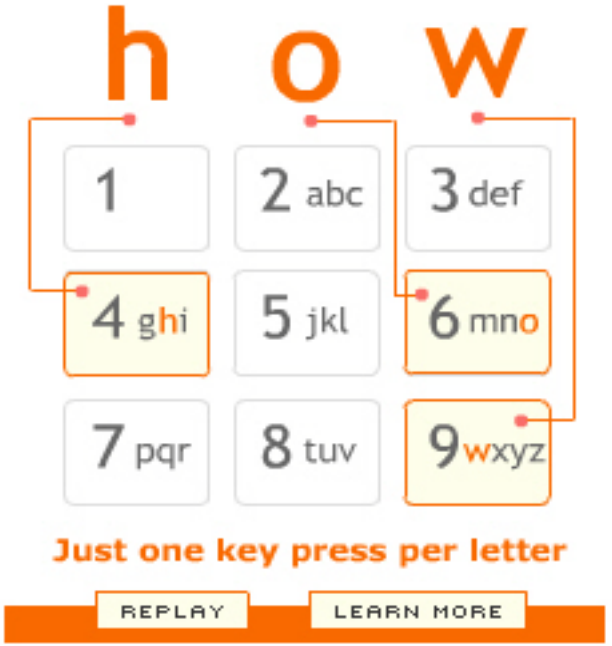
Mobile Interaction Styles: Touch Screen – Virtual keyboard

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

[Source: HTC Inc.]

Mobile Interaction Styles: Tegic Communications T9 – Text Entry

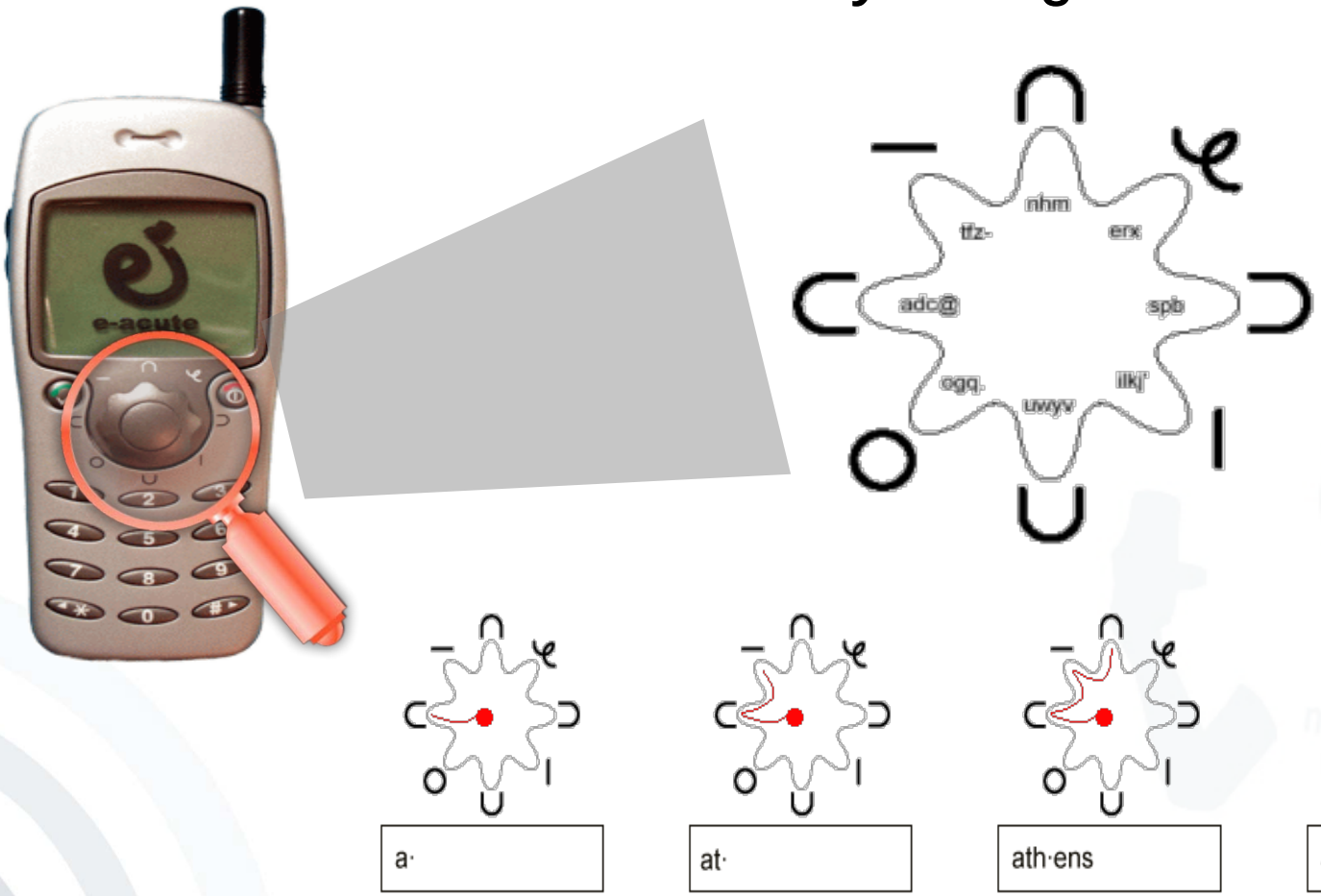
- T9 (***T****ext on* ***9*** *keys)* is a predictive text technology developed by Tegic Communications.
- Widely used by: LG, Samsung, Nokia, Siemens, Sony Ericsson, Sanyo
- Uses a dictionary of words, which is used to look up all the possible words, corresponding to the sequence of keys pressed.
-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



[Source: www.t9.com]

Mobile Interaction Styles: Octave – Text Entry

- Text can be entered via key navigation



Mobile Interaction Styles: Speech Input

- 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

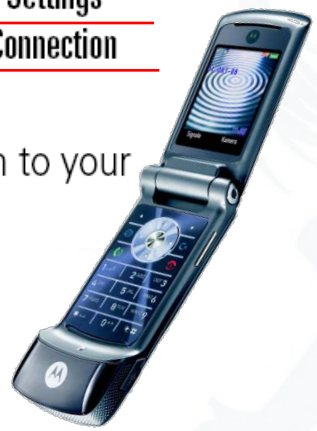
You can use a cable connection to access your phone's memory card with a PC.

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]

Mobile Interaction Styles: Earcons

- 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]

Mobile Interaction Styles: Metaphors

- 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)

[Jones and Marsden 2006]

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Mobile Interaction Design: Understanding Users

- 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)

[Jones and Marsden 2006]

Mobile Interaction Design: Understanding Users

- The user group needs to have a significant impact on the design process.
- User-centered service design can significantly affect 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

[Jones and Marsden 2006]

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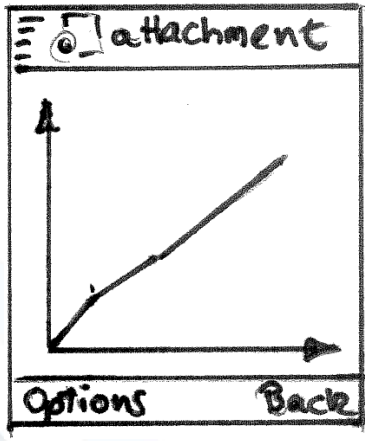
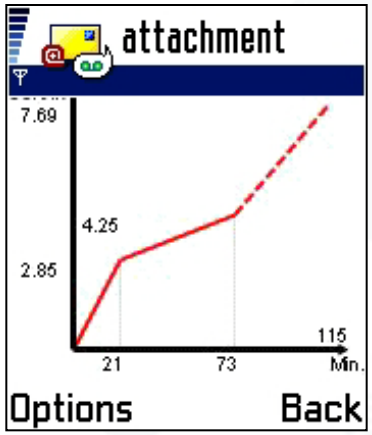
Mobile Interaction Design: Developing Prototype Designs

- 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.

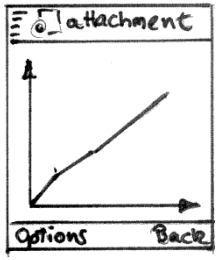
[Jones and Marsden 2006]





Low-fidelity

High-fidelity

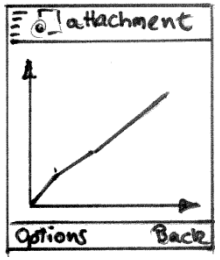


Low-fidelity

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

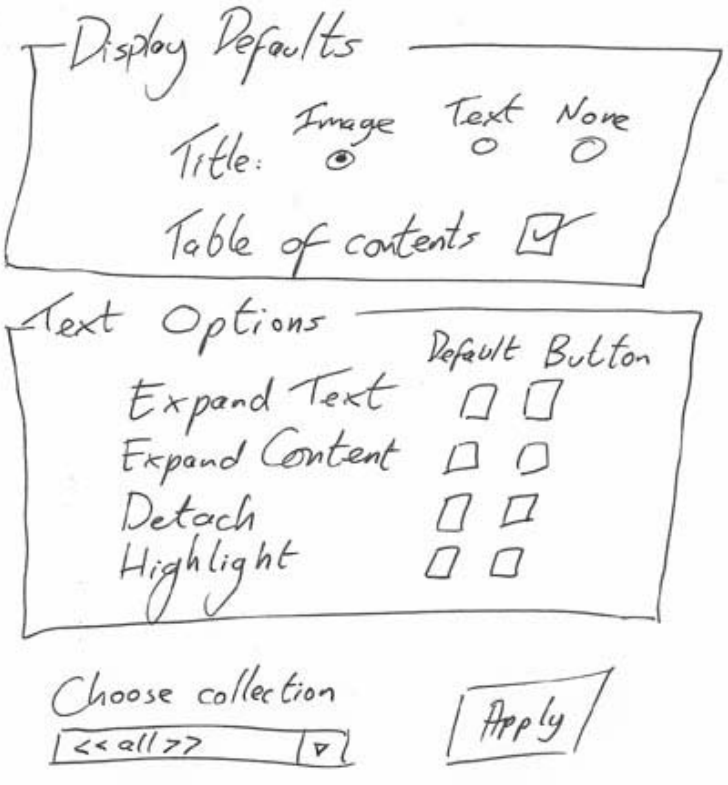
- Check for inconsistency
- Give a common specification for the design team
- Afford reflection
- Check interaction scenarios

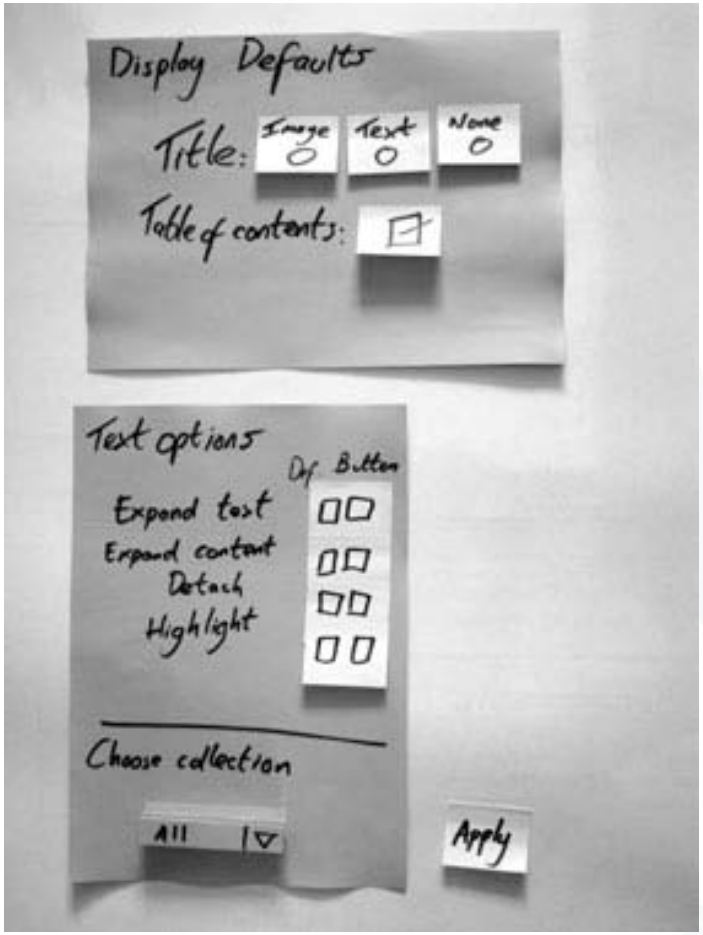
Mobile Interaction Design: Low-Fidelity Prototype Designs

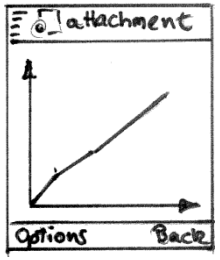


Basic Layouts

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



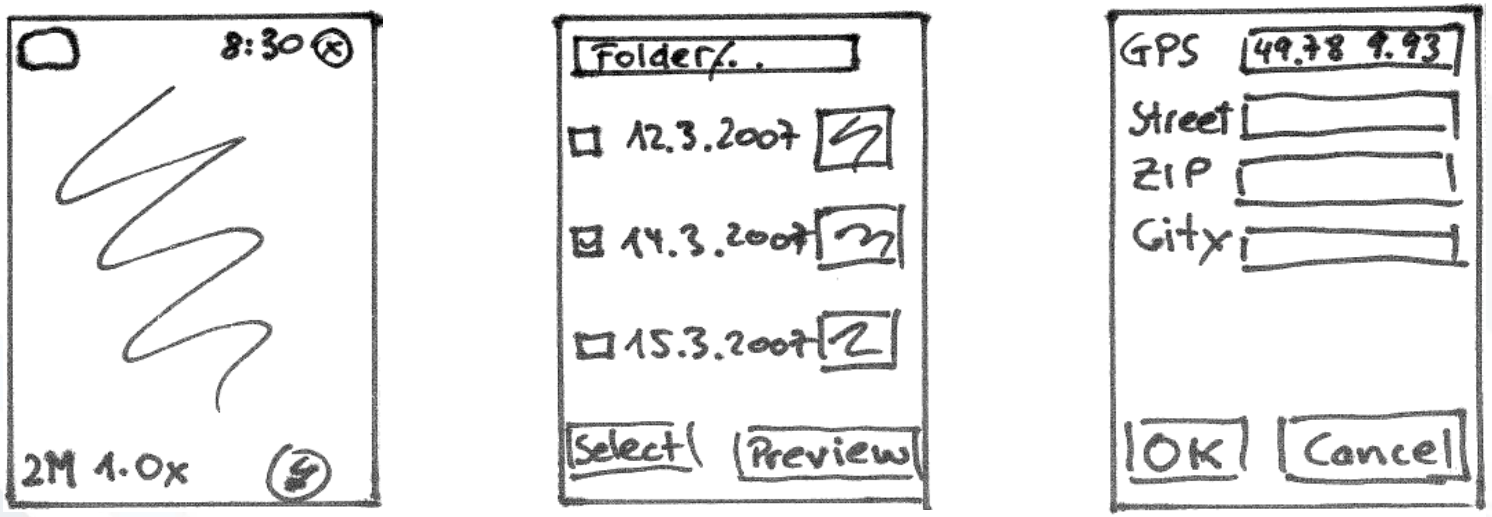




Self-Checking

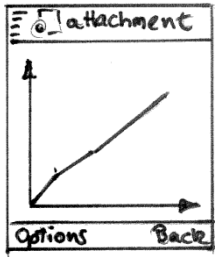
Building a low-fidelity prototype for testing the feasibility of ideas.

Example:



Take pictures **Choose a picture** **Get location via GPS or manual input**

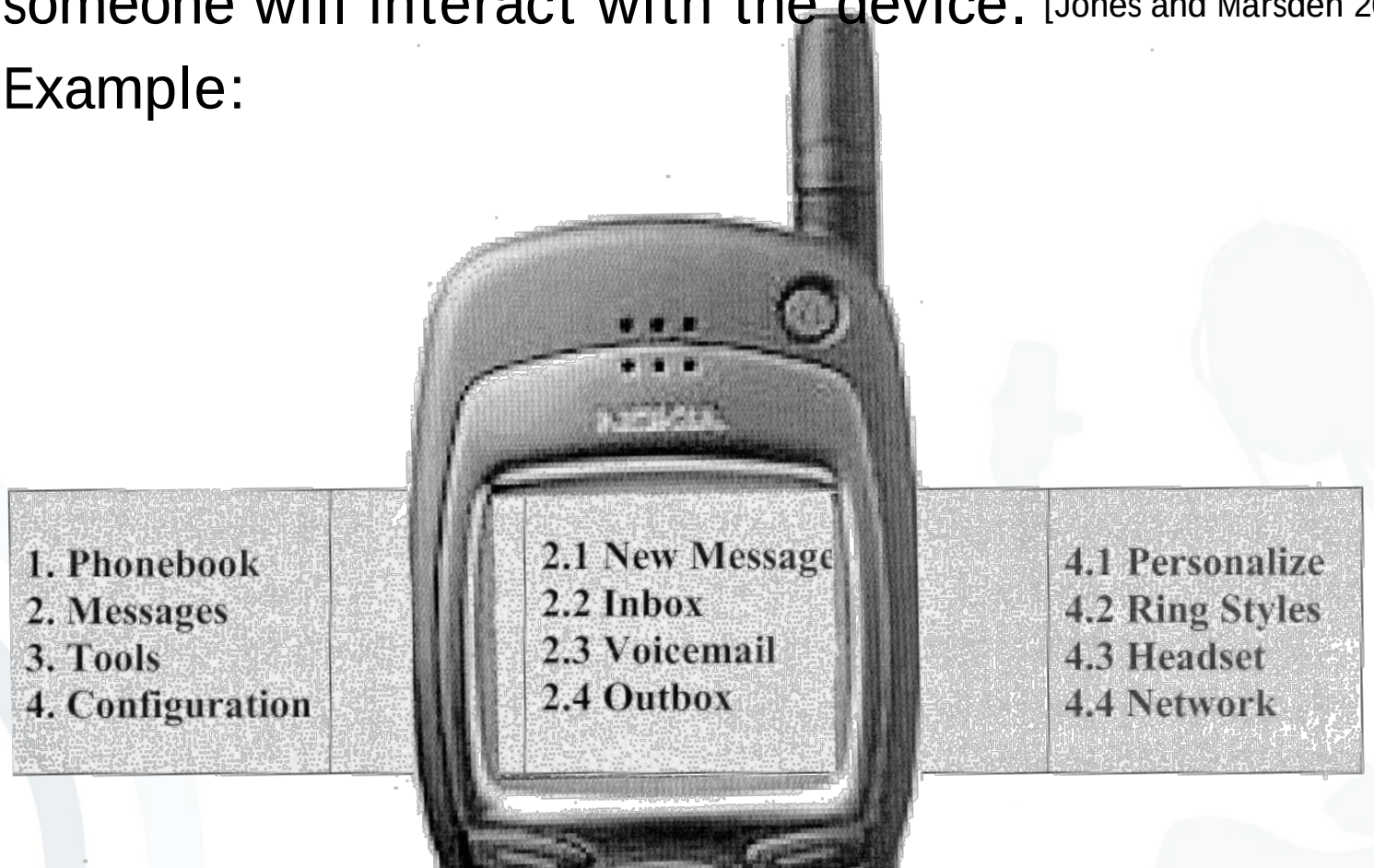
[Jones and Marsden 2006]

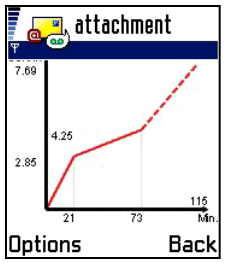


Interaction Prototyping

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

Example:

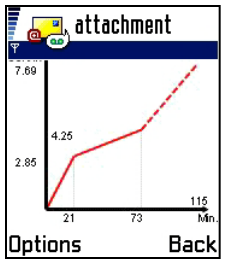




High-Fidelity Prototype Designs

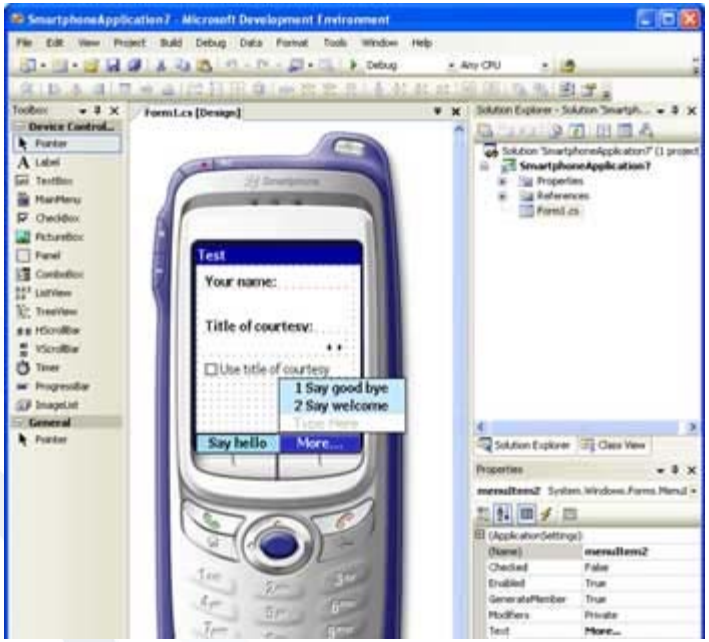
- The results of a low-fidelity prototyping process comprise a list of features that should be tested with representatives of the target group.
- High-fidelity prototype designs provide the functionality to evaluate critical tasks and functionalities that should be supported by the final product.
- Therefore,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

Mobile Interaction Design: High-Fidelity Prototype Designs



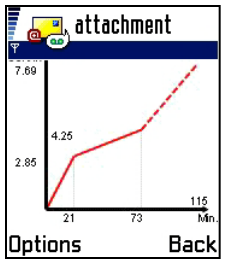
PC-based prototype designs …

… can be developed by using standard programming environments (e.g. Visual Studio) and software emulators.



[Source: www.areamobile.de]

Mobile Interaction Design: High-Fidelity Prototype Designs



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]

Mobile Interaction Design: Key Issues in HCI Prototyping

Type	Advantages	Disadvantages
Low-fidelity	▪ Less time ▪ Lower costs ▪ Evaluate multiple concepts ▪ Useful for communication ▪ Address screen layout issues	▪ Little use for usability test ▪ Navigation and flow limitation ▪ Facilitator driven ▪ Poor detail in specification
High-fidelity	▪ Partial functionality ▪ Interactive ▪ User-driven ▪ Clearly defined navigation scheme ▪ Use for exploration and test ▪ Marketing tool	▪ 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]

Mobile Interaction Design: Evaluation

- 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 correctly 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

[Jones and Marsden 2006]

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]

Mobile Interaction Design: Evaluation

- 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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Mobile Information Access

- 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]

Information Access: Small Screen Impacts

- 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]

Information Access: Browsing Content

Overview examples

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

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

[Source: Milic-Frayling et al. 2004]

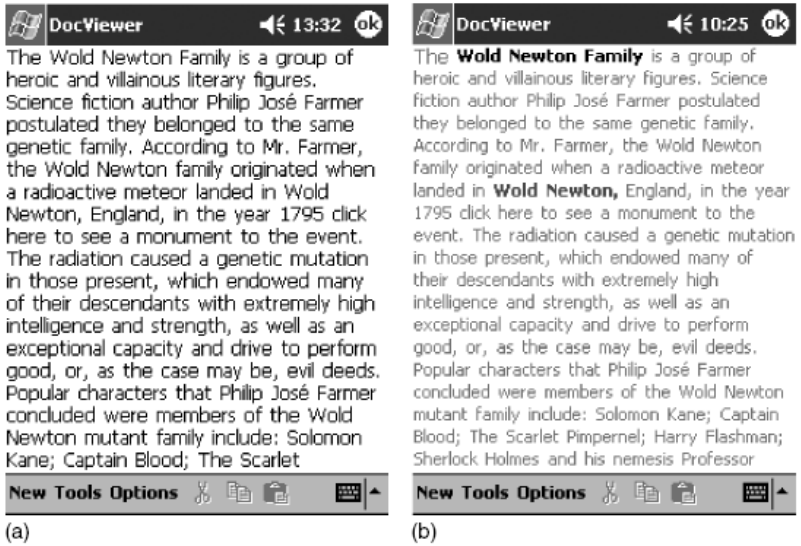


FIGURE 9.2

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]

Information Access: Browsing Content

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.

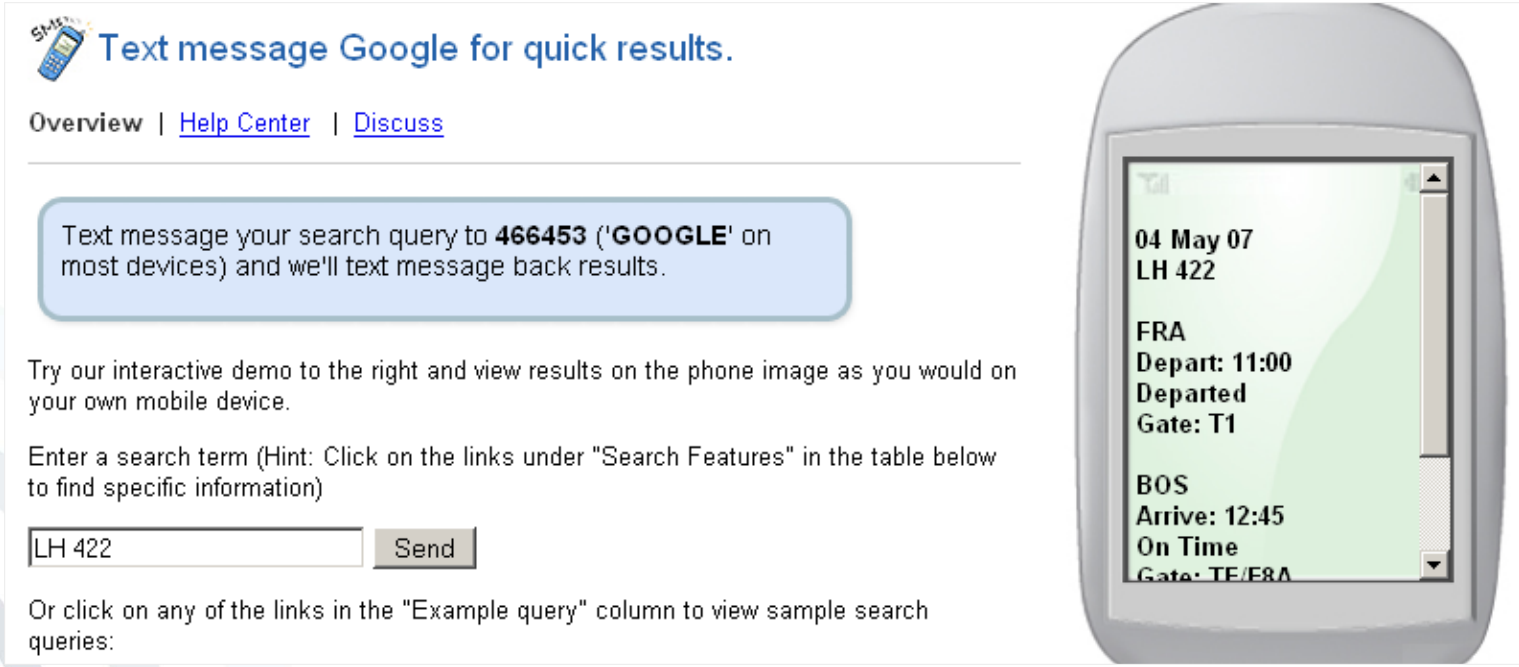
[Source: www.wiley.com/go/mobile]

Information Access: Mobile Searching

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]



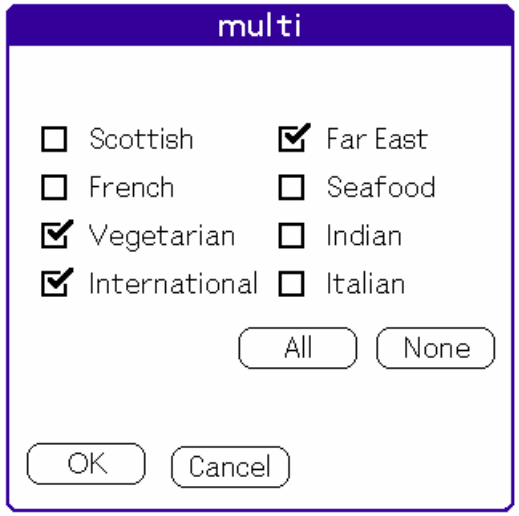
[Source: www.google.com/sms]

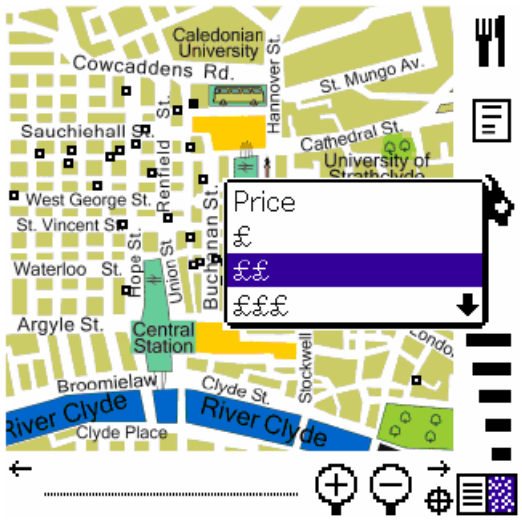
Information Access: Information Visualization and Mobiles

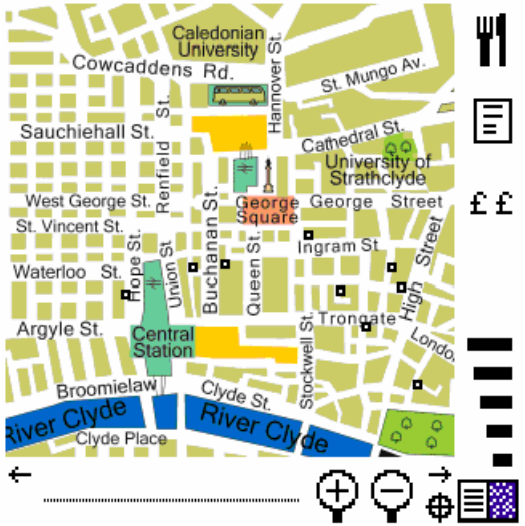
Information visualization literature:

- 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]

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