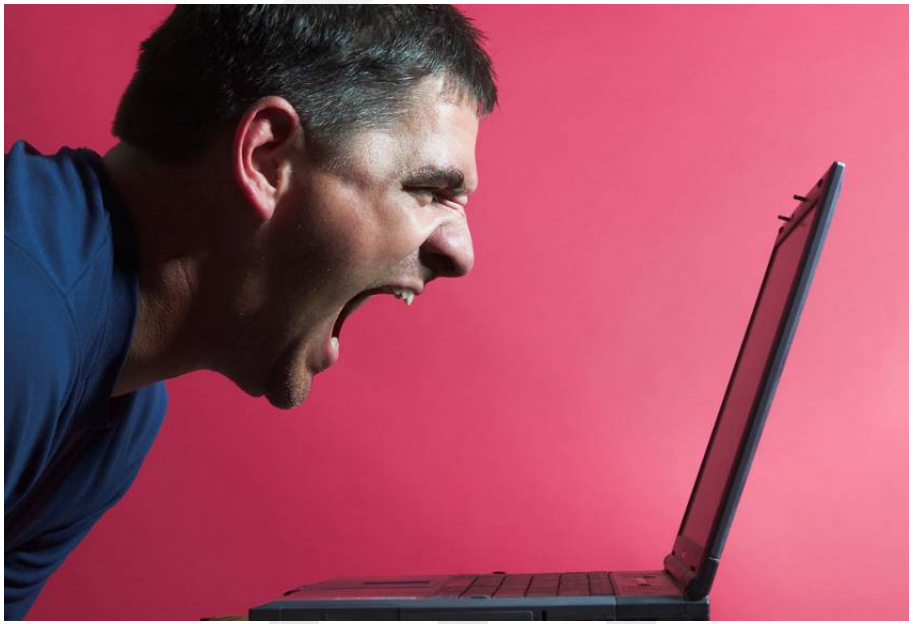
mobile business

Lecture 11

Design of Mobile Applications & Services: HCI Issues



Mobile Business II (SS 2016)

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Agenda

- Introduction to HCI
- Mobile Interaction Styles
- Mobile Interaction Design
  - Understanding Users
  - Developing Prototype Designs
  - Evaluation
- Example of Enhanced App Store

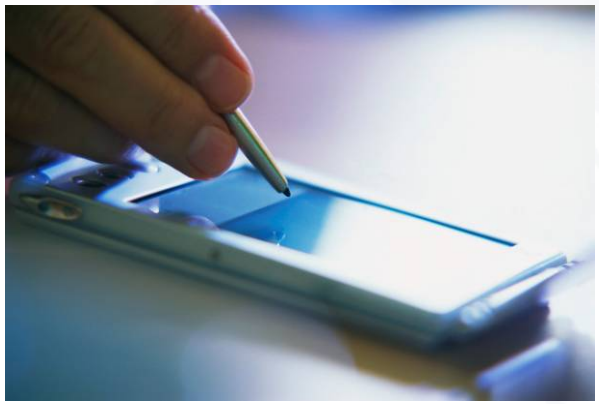
Definition

"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."

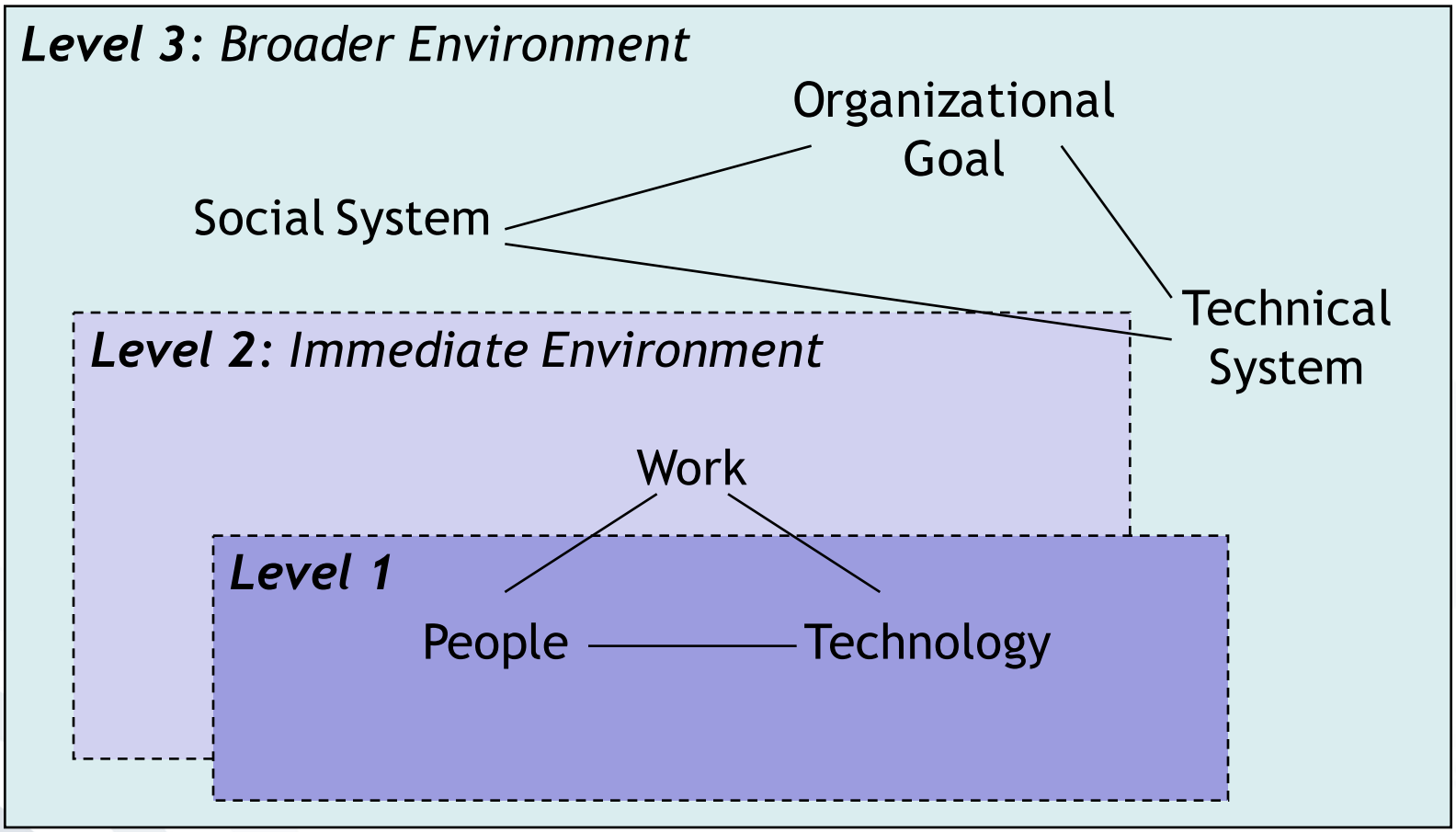
[Hewett et al. 1992]

"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]

Definition of Usability

- According to ISO 9241-11:1998-03, **usability** is

"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."

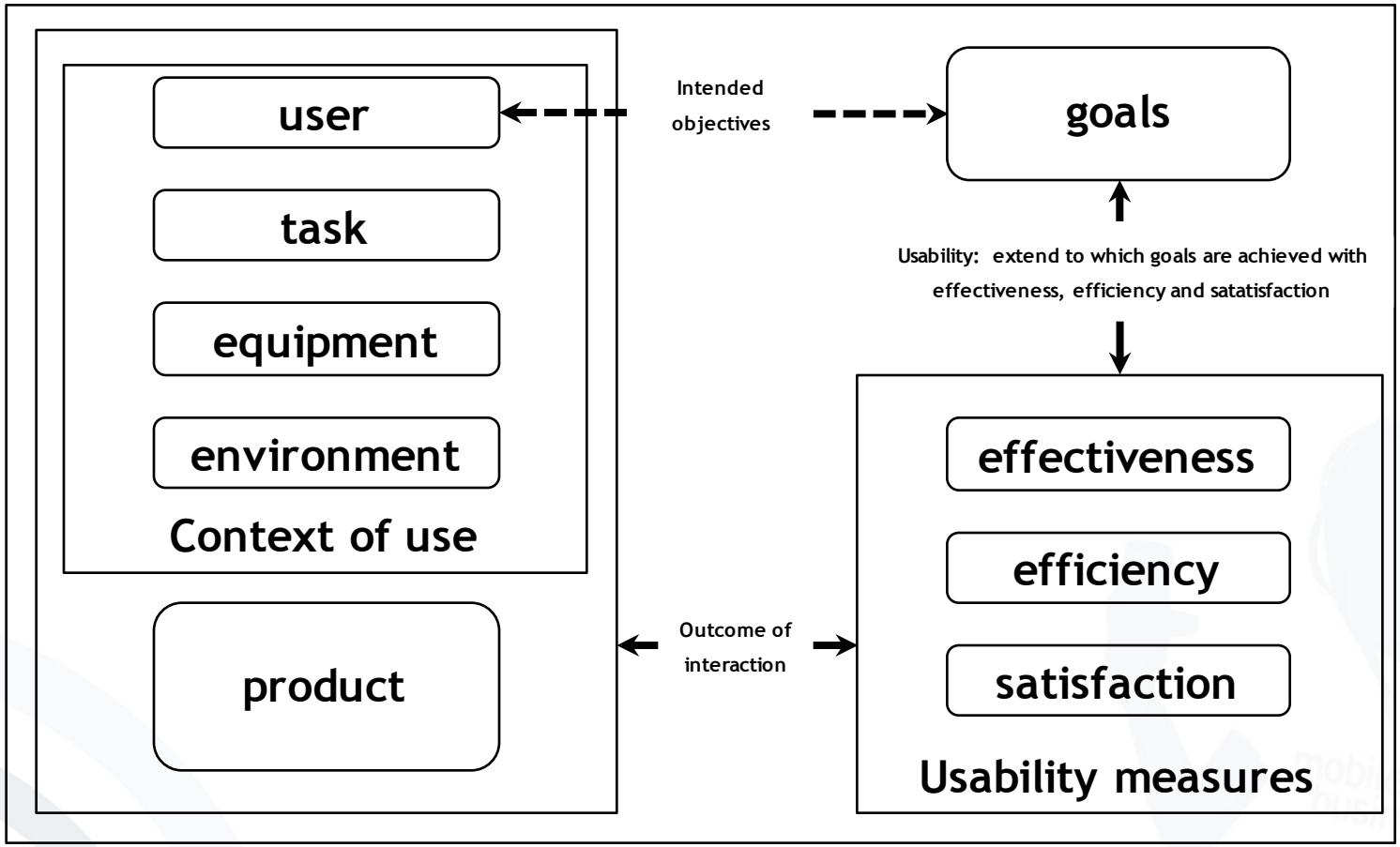
Source: Ergonomic requirements for office work with visual display terminals (VDTs) Part 11: Guidance on usability (ISO 9241-11:1998-03)

Elements of the Usability Definition

- **effectiveness**: Accuracy and completeness with which users achieve specified goals.
- **efficiency**: Resources expended in relation to the accuracy and completeness with which users achieve goals.
- **satisfaction**: Freedom from discomfort, and positive attitudes towards the use of the product.
- **context of use**: Users, tasks, equipment (hardware, software and materials), and the physical and social environments in which a product is used.
- **user**: Person who interacts with the product.
- **goal**: Intended outcome.
- **task**: Activities required to achieve a goal.
- **product**: Part of the equipment (hardware, software and materials) for which usability is to be specified or evaluated.

Source: Ergonomic requirements for office work with visual display terminals (VDTs) Part 11: Guidance on usability (ISO 9241-11:1998-03)

Usability Framework



Source: ISO 9241-11:1998-03

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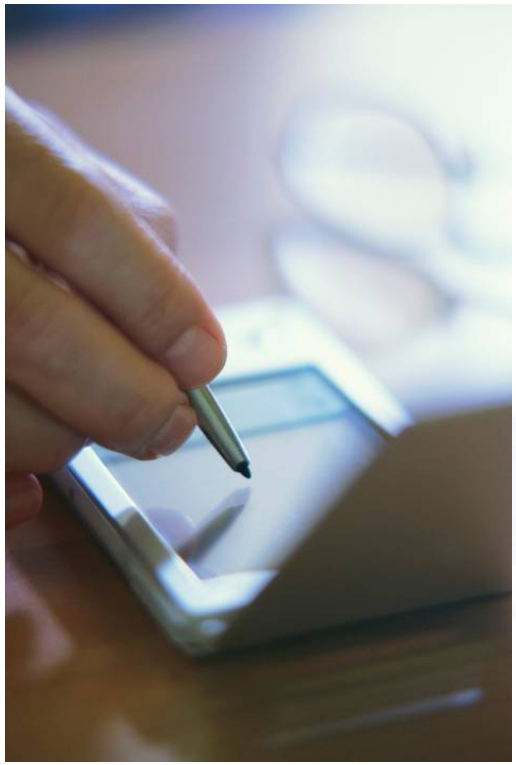
Mobile Interaction Styles

The interaction between users and mobile devices is multidimensional.

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

[Love 2005]



Mobile Interaction Styles: Text Entry

Possible interaction via text entry:

- Keyboard entry
- Touch screen
  - Recognition of handwriting
  - Palm-Graffiti
  - Virtual keyboard
  - Swype
- Tegic T9
- Octave
- …

Mobile Interaction Styles: Text Entry - Keyboard

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

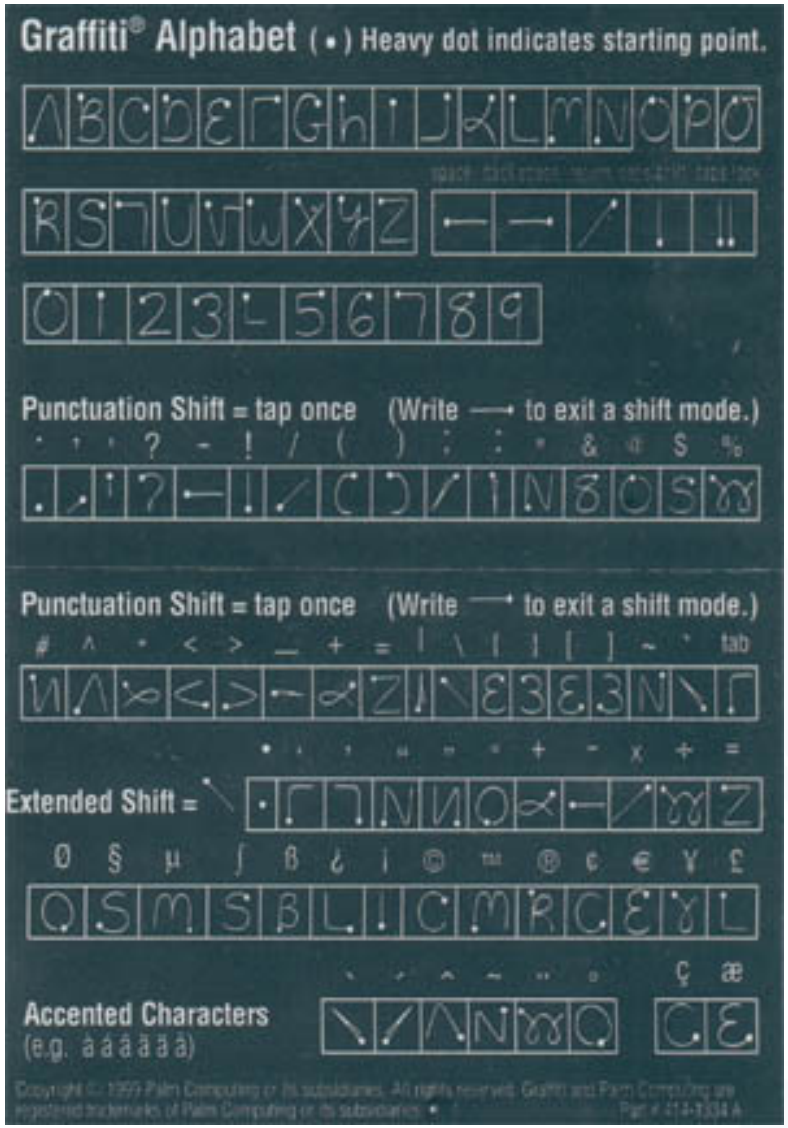
[Source: www.palm.com]

[iBIZ Technology Corp]

➲ Adaptation of a traditional text entry concept

Mobile Interaction Styles: Text Entry - Touch Screen

- 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: Text Entry - Touch Screen – Virtual keyboard

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

[Source: HTC Inc.]

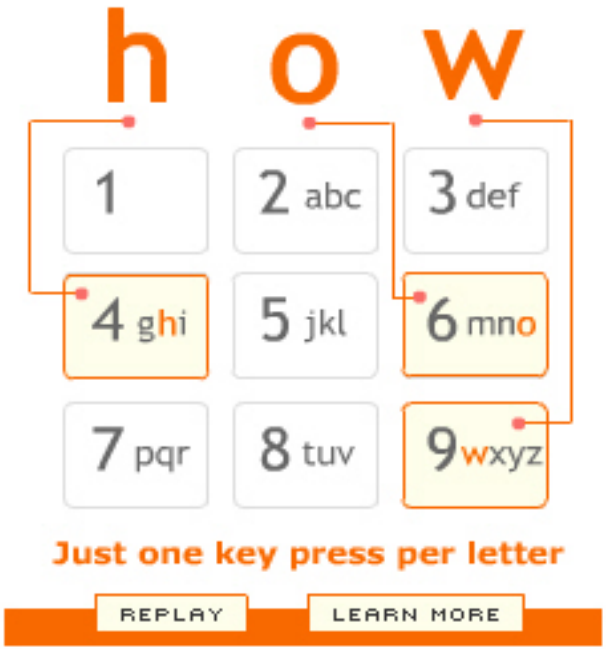
Mobile Interaction Styles: Text Entry - Swype

- Swype is an input method for touch screens developed by Swype Inc.
- Available on Samsung, HTC, and also on Android and Symbian.
- Three major components: An input path analyzer, word search engine with corresponding database, and a manufacturer customizable interface.
- Available on >40 languages.

[Source: http://swypeinc.com/]

Mobile Interaction Styles: Text Entry - Tegic Communications T9

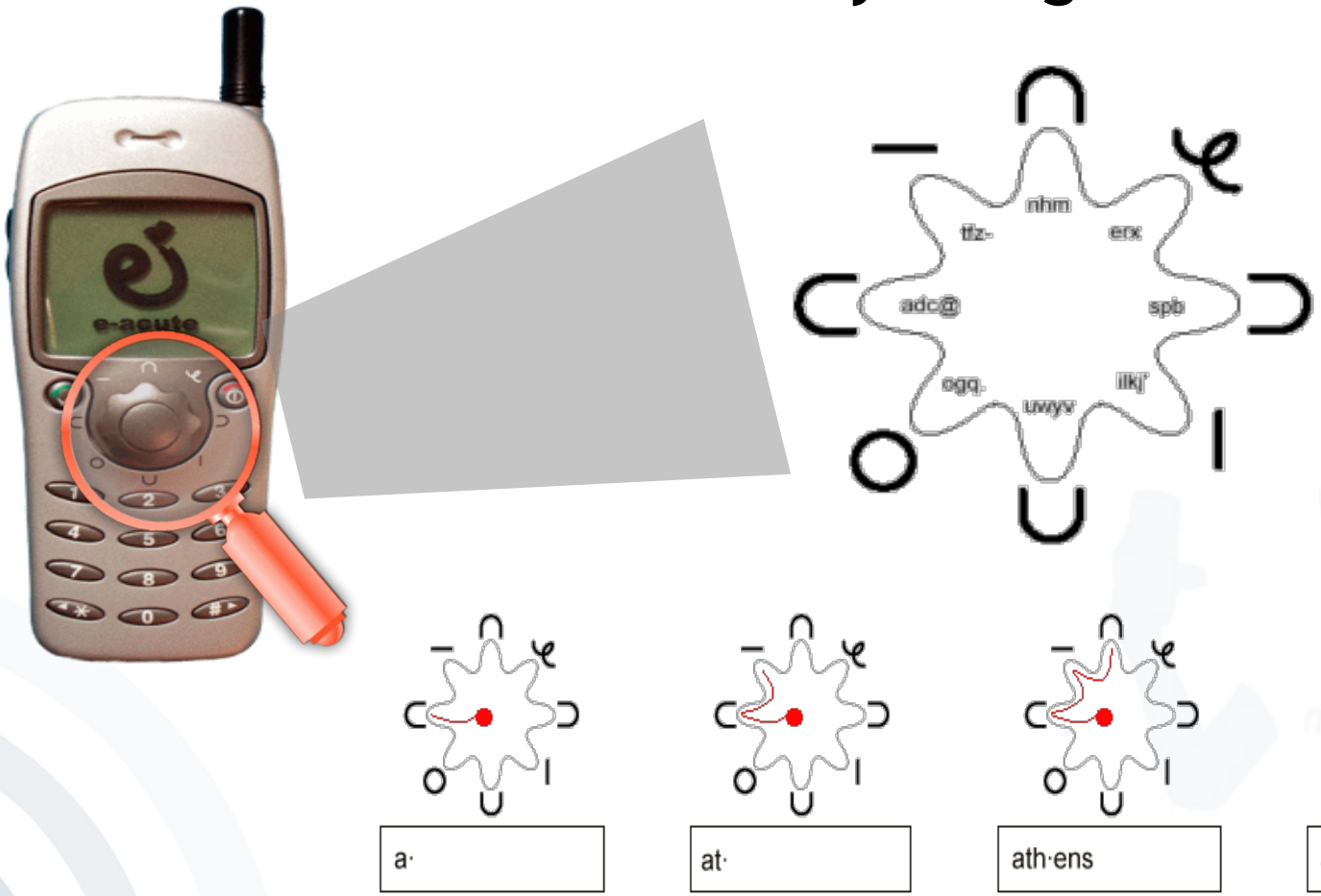
- T9 (*Text on **9** keys)* is a predictive text technology developed by Tegic Communications.
- Widely used by: LG, Samsung, Nokia, Siemens, Sony Ericsson, Sanyo
- Uses a dictionary of words, which is used to look up all the possible words, corresponding to the sequence of keys pressed.
- Available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



[Source: www.t9.com]

Mobile Interaction Styles: Text Entry - Octave

- 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 hierarchically 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

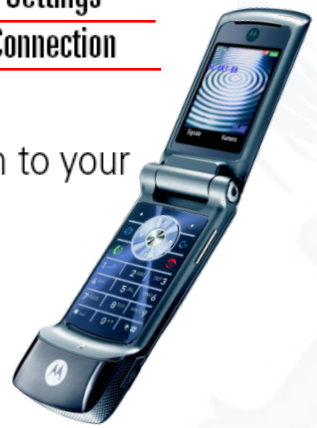
You can use a cable connection to access your phone's memory card with a PC.

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: Touch Screen – Multi-touch

- Input by using gestures
- Up to three (or more) fingers simultaneously

[Source: Wikipedia]

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 (1)

- 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 (2)

- 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.
- Examples of 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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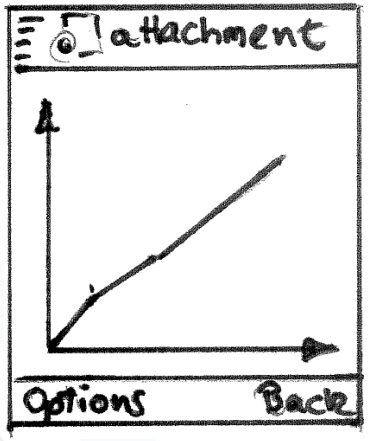
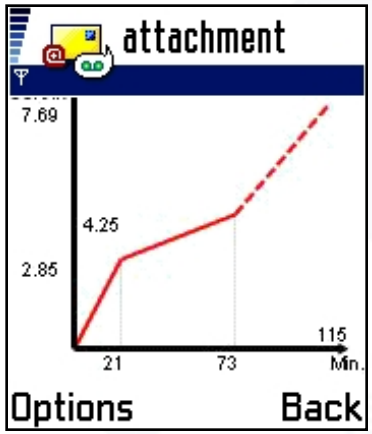
Mobile Interaction Design: Developing Prototype Designs (1)

- 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]

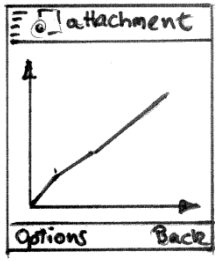




Low-fidelity

High-fidelity

Mobile Interaction Design: Developing Prototype Designs (2)

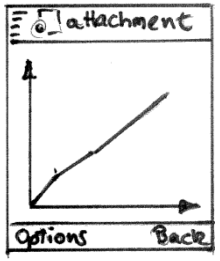


Low-fidelity

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

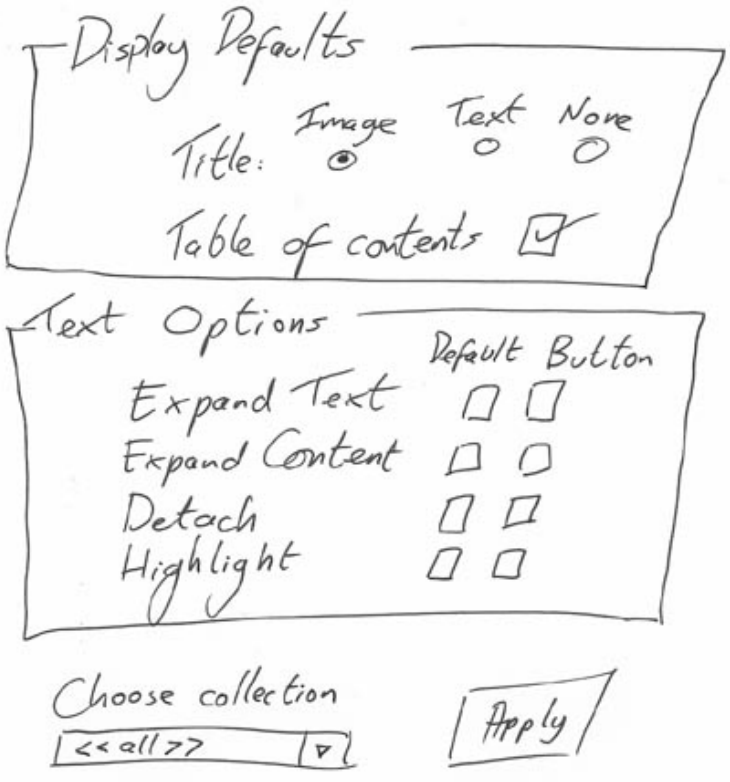
- Check for inconsistency
- Give a common specification for the design team
- Afford reflection
- Check interaction scenarios

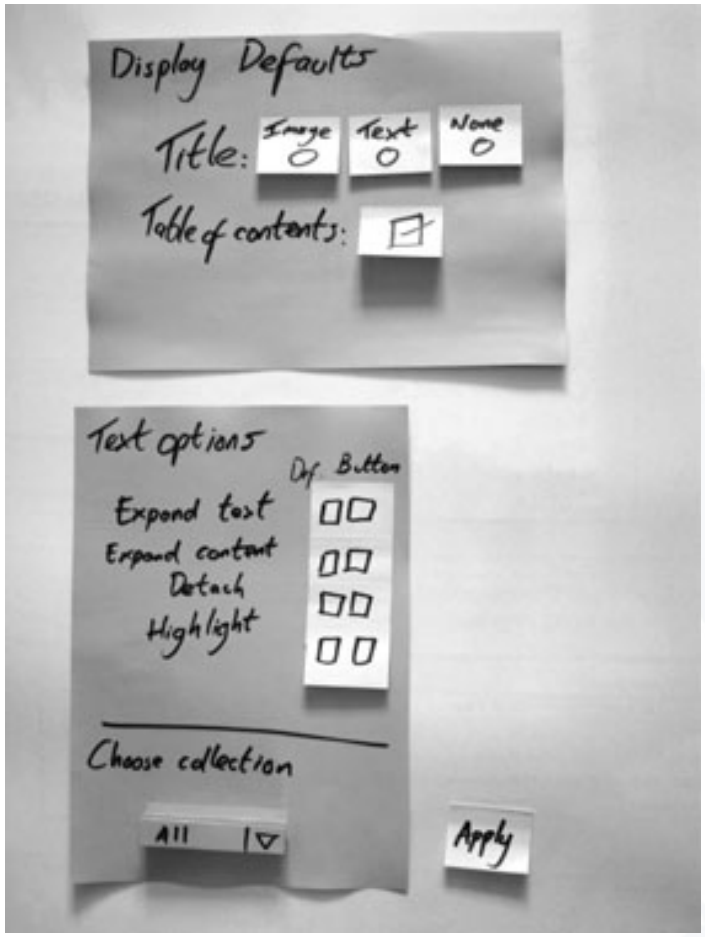
Mobile Interaction Design: Low-Fidelity Prototype Designs (1)



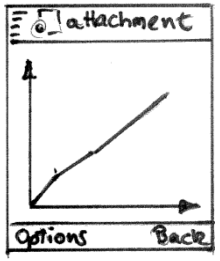
Basic Layouts

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





Mobile Interaction Design: Low-Fidelity Prototype Designs (2)



Self-Checking

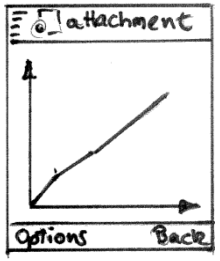
Building a low-fidelity prototype for testing the feasibility of ideas.

Example:

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

[Jones and Marsden 2006]

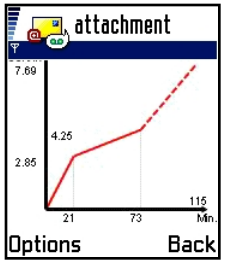
Mobile Interaction Design: Low-Fidelity Prototype Designs (3)



Interaction Prototyping

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

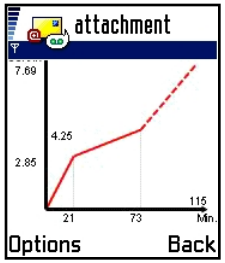
Example:



High-Fidelity Prototype Designs

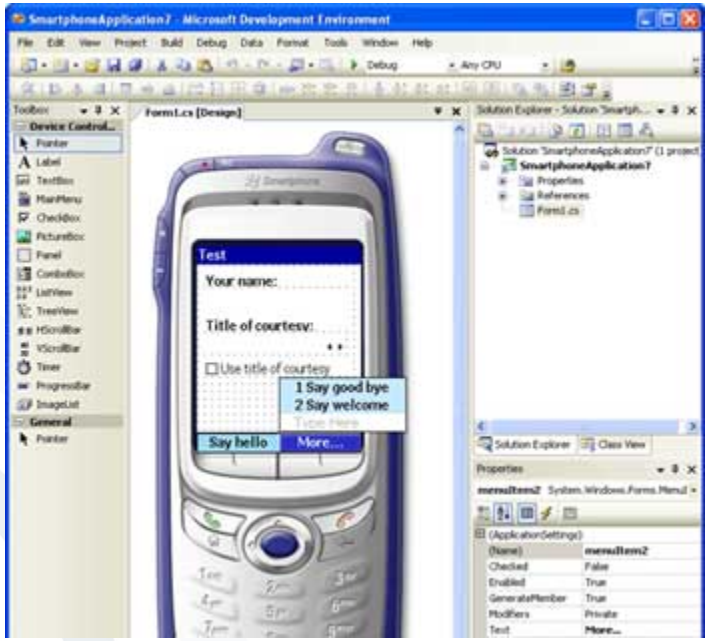
- The results of a low-fidelity prototyping process comprise a list of features that should be tested with representatives of the target group.
- High-fidelity prototype designs provide the functionality to evaluate critical tasks and functionalities that should be supported by the final product.
- Therefore,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

Mobile Interaction Design: High-Fidelity Prototype Designs (2)



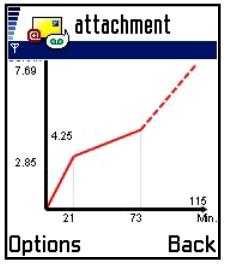
PC-based prototype designs …

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



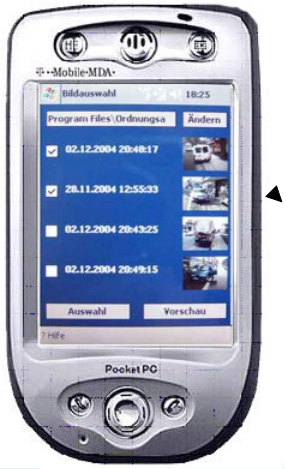
[Source: www.areamobile.de]

Mobile Interaction Design: High-Fidelity Prototype Designs (3)



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 (2)

- 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 quicker than within 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 (7)

- 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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Privacy Enhanced App Store Motivation

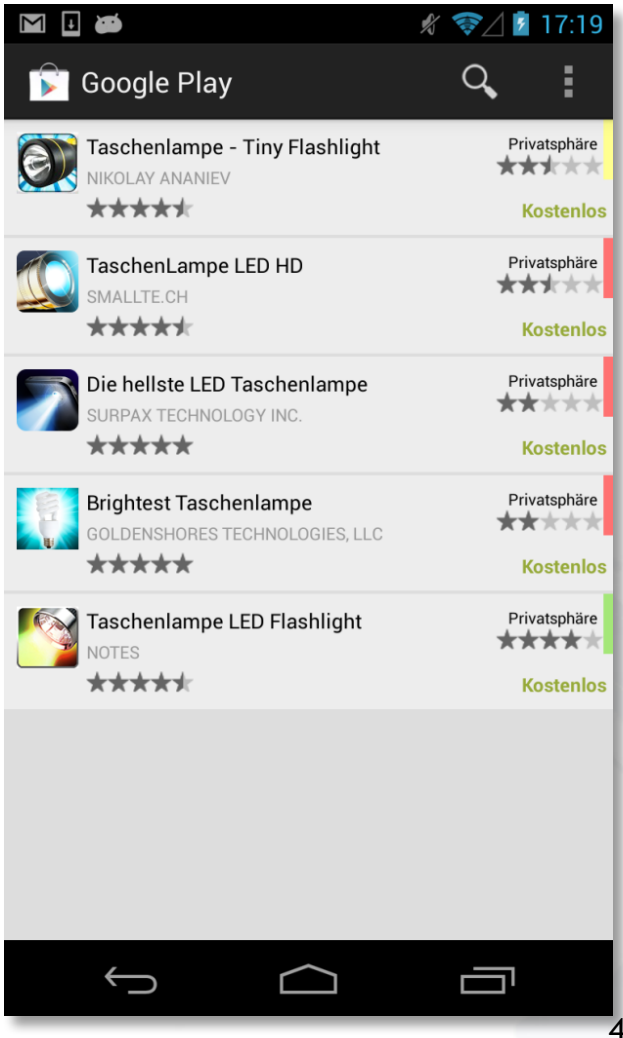
- ✓ Enhance **privacy transparency** and **privacy awareness** in app markets.
- ✓ Foster **informed choice** of apps.
- ✓ Integrate more effective **privacy risk indicators** into app markets.
- ✓ **Develop and evaluate** proof of concept for Google‘s Play Store.

Privacy Enhanced App Store Privacy Indicators

1. Search results enhanced with privacy score.

2. App description enhanced with visual privacy information.

3. App description enhanced with textual privacy information.



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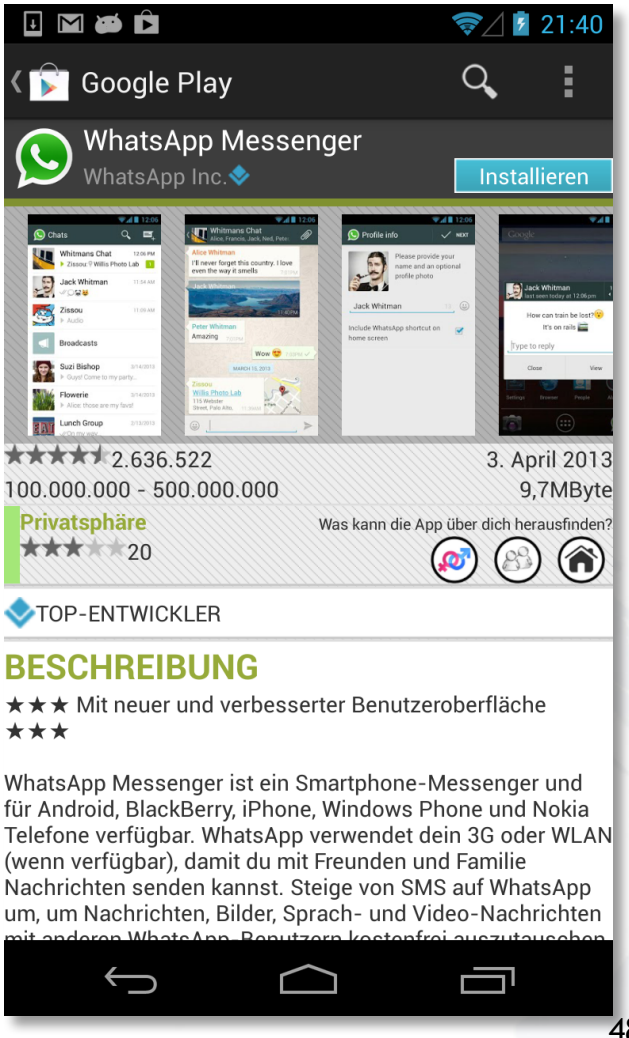

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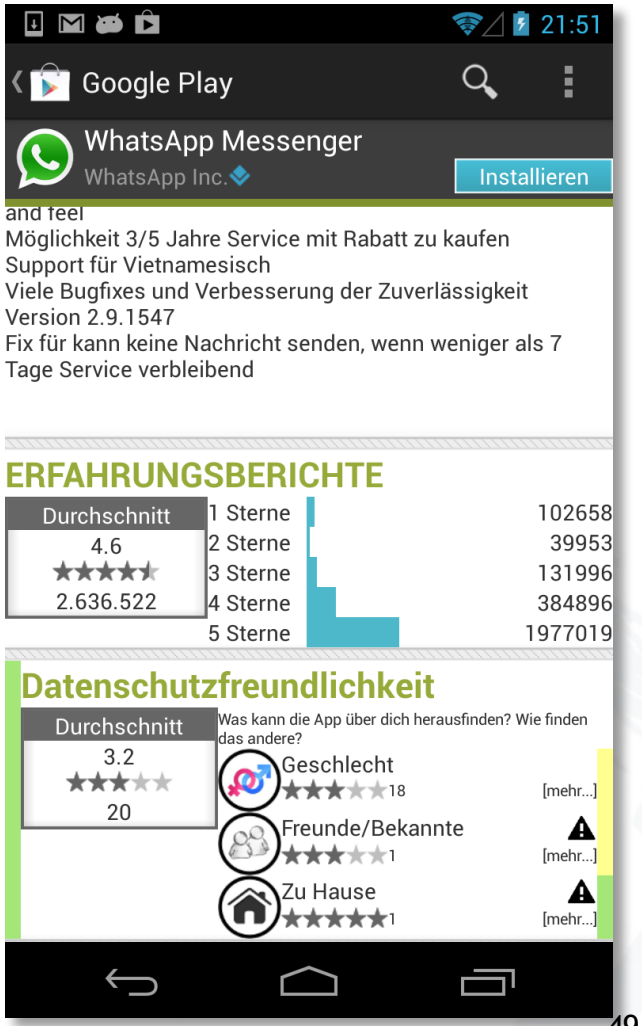
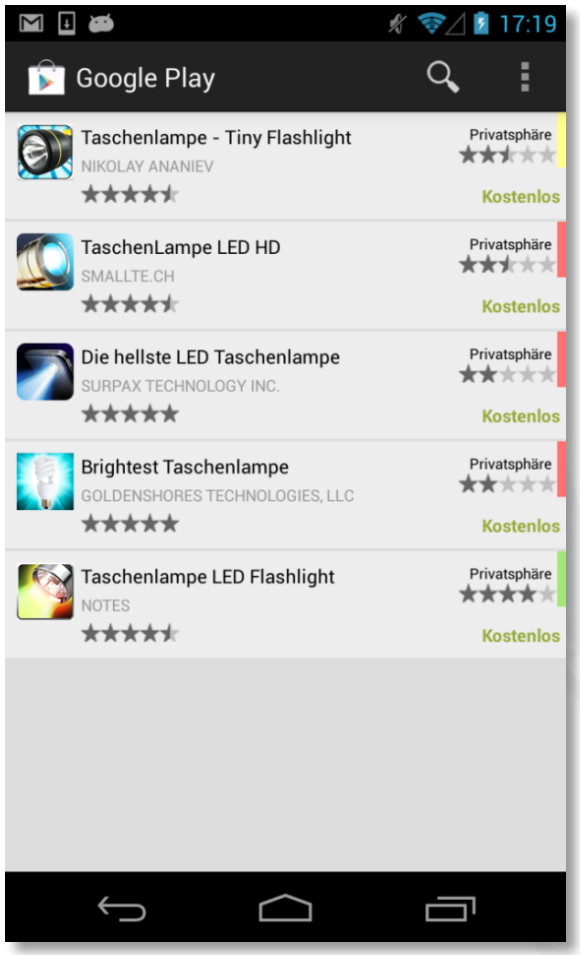


Privacy Enhanced App Store Conclusion

- Result of an experimental user study: better privacy risk communication leads to:
  - increased privacy and risk awareness,
  - better comprehension of risks,
  - better comparison of apps,
  - privacy as a stronger decision factor,
  - safer app choices.



Literature

- **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
- **Blattner, M.M.; Sumikawa, D.A. and Greenberg, R.M. (1989)**
  Earcons and Icons: Their Structure and Common Design Principles, *Human-Computer Interaction* (4:1), pp. 11-44
- **Dunlop, M.D; Morrison, D.; McCallum, S.; Ptaskinski, P.; Risbey, C. and Stewart, F. (2004)**
  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)**
  Mobile Gemeinschaften im E-Government: Bürger-Verwaltungs-Partnerschaft als Mittel zur Kosteneffizienz und Effizienz bei öffentlichen Aufgaben am Beispiel der Verkehrskontrolle, *Proceedings of the Workshop on Gemeinschaften in Neuen Medien*, Dresden
- **Hewett, Baecker, Card, Carey, Gasen, Mantei, Perlman, Strong and Verplank (1992)**
  ACM SIGCHI Curricula for Human-Computer Interaction, http://sigchi.org/cdg/cdg2.html
- **Jones, M. and Marsden, G. (2006)**
  Mobile Interaction Design, John Wiley, Chichester, UK.
- **Love, S. (2005)**
  Understanding Mobile Human-Computer Interaction, Information Systems Series, Elsevier, Oxford, UK.
- **Milic-Frayling, N.; Sommerer, R.; RoddenK. and Blackwell, A. (2004)**
  SearchMobil: Web Viewing and Search for Mobile Devices, *Proceedings of the 12th International World Wide Web Conference*, Budapest.
- **Preece, J. (1994)**
  Human-computer interaction, Reprinted, Addison-Wesley Publ. Co, Wokingham, UK