Mensch-Maschine-Interaktion 1

Chapter 2 (May 12th, 2011, 9am-12pm):
Basic HCI principles 1
Overview

• Introduction
• Basic HCI Principles (1)
• Basic HCI Principles (2)
• User Research & Requirements
• Designing Interactive Systems
• Capabilities of Humans and Machines
• Implementing Interactive Systems
• User Study Design & Statistics
• Basic HCI Models
• User-Centered Development Process
Basic HCI Principles and Models

• Users and Developers
• 3 Usability Principles by Dix et al.
• 3 Usability Principles by Shneiderman
• Background: The Psychology of Everyday Action
What the User Sees

• Users see only what is openly visible!
What the Developer Knows

• Users have little idea about:
  – architecture,
  – state transitions,
  – dependencies
  – application context
  – system restrictions
  – …

• And users often do not want to know about it.
A Computer Screen and its Interpretation

• What do we see?

• What is shown?

• What is the meaning?
Answers from Skilled Computer Users

- Win2000 desktop
- Text and figures
- Icons and toolbars
- Overlapping windows
- Scroll bars and menus
- Task bar and status information
- Representations of documents
Basic (Naive) Technical Answers

- 2-D surface
- Controllable pixels
- Image with a resolution of 1400x1050 pixels
- For each pixel the colour can be set
- The change of colour can be controlled rapidly
Perfect User’s Answers

• My work environment
• Meeting notes
• Budget for next year
• Request to write a technical article
• Background information on a psychological phenomenon
Metaphor Example 1 – Overlaying Windows

• What is the meaning of the fact that a window is behind another window?

• What is real? What is illusion?

• What does iconizing do?

• Models? Conceptual… Implementation… Represented…
Metaphor Example 2 – Scrollbar vs. Hand

- Moving up the hand moves up the document
- What happens in reality?
  What do we imagine?
  What is the metaphor?
Metaphor Example 2 – Scrollbar vs. Hand

• Moving up the scroll bar moves down the document
• What happens in reality?
  What do we imagine?
  What is the metaphor?
Metaphor Example 2 - Scrollbar vs. Hand

• Adequacy of interaction mechanism depends on content displayed
Types of Design Rules

- **Principles**
  - abstract design rules
- **Golden rules and heuristics**
  - more concrete than principles
- **Standards**
  - (very) detailed design rules
- **Design pattern**
  - generic solution for a specific problem
- **Style guides**
  - provided for devices, operating systems, widget libraries

- **Authority**: whether or not a rule must be followed or whether it is just suggested
- **Generality**: applied to many design situations or focused on specific application situation.
Usability 101 (by Jakob Nielsen)

• “Usability is a quality attribute that assesses how easy user interfaces are to use. The word ‘usability’ also refers to methods for improving ease-of-use during the design process.”

• Usability has five quality components:
  – Learnability: How easy is it for users to accomplish basic tasks the first time they encounter the design?
  – Efficiency: Once users have learned the design, how quickly can they perform tasks?
  – Memorability: When users return to the design after a period of not using it, how easily can they reestablish proficiency?
  – Errors: How many errors do users make, how severe are these errors, and how easily can they recover from the errors?
  – Satisfaction: How pleasant is it to use the design?
Basic HCI Principles and Models

• Users and Developers

• 3 Usability Principles by Dix et al.

• 3 Usability Principles by Shneiderman

• Background: The Psychology of Everyday Action
Principles to Support Usability

• Learnability
  – the ease with which new users can begin effective interaction and achieve maximal performance

• Flexibility
  – the multiplicity of ways the user and system exchange information

• Robustness
  – the level of support provided to the user in determining successful achievement and assessment of goal-directed behavior

Principles of Learnability (1 / 2)

• Predictability
  – determining effect of future actions based on past interaction history
  – operation visibility

• Synthesizability
  – ability of the user to assess the effect of past operations on the current state
  – the user should see the changes of an operation
  – immediate vs. eventual feedback
Principles of Learnability (2 / 2)

• Familiarity
  – how prior knowledge applies to new system
  – affordance (guessability)

• Generalizability
  – extending specific interaction knowledge to new situations

• Consistency
  – likeness in input/output behavior arising from similar situations or task objectives
Principles of Flexibility (1 / 6)

- Ways in which the user and the system exchange information
- Dialogue initiative
  - freedom from system imposed constraints on input dialogue
  - user preemptiveness: user initiates dialog
  - system preemptiveness: system initiates dialog
Principles of Flexibility (2 / 6)

• Multithreading
  – ability of system to support user interaction for several tasks at a time
  – concurrent multimodality: simultaneous communication of information pertaining to separate tasks
    • multi-modal dialog
    • editing text and beep (incoming mail) at the same time
  – interleaving multimodality: permits temporal overlap between separate tasks, dialog is restricted to a single task
    • window system, window = task
    • modal dialogs
    • interaction with just one window at a given time
Principles of Flexibility (3 / 6)

• Task migratability
  – passing responsibility for task execution between user and system
  – example: spell checking
Principles of Flexibility (4 / 6)

• Substitutivity
  – allowing equivalent values of input and output to be substituted for each other
  – representation multiplicity

– equal opportunity: blurs the distinction between input and output
Principles of Flexibility (5 / 6)

• Customizability
  – modifiability of the user interface by the user (adaptability) or system (adaptivity)
  – adaptability: users ability to adjust the form of input and output
  – adaptivity: automatic customization of the user interface by the system
Principles of Flexibility (6 / 6)

- Customizability
  - modifiability of the user interface by the user (adaptability) or system (adaptivity)
  - adaptability: users ability to adjust the form of input and output
  - adaptivity: automatic customization of the user interface by the system
Principles of Robustness (1 / 2)

- → Level of support provided to the user in determining successful achievement and assessment of goal-directed behavior

- Observability
  - ability of the user to evaluate the internal state of the system from its perceivable representation

- Recoverability
  - ability of the user to correct a recognized error
  - reachability (states): forward (redo) / backward (undo) recovery
  - commensurate effort (more effort / steps for deleting a file than for moving it)
Principles of Robustness (2 / 2)

• Task conformance
  – degree to which system services support all of the user's tasks
  – task completeness; task adequacy

• Responsiveness
  – how the user perceives the rate of communication with the system
  – preferred: short durations and instantaneous responses (< 100ms)
  – stability and indication of response time
3 Usability Principles by Dix

- Learnability
  - Predictability
  - Synthesizability
  - Familiarity
  - Generalizability
  - Consistency

- Flexibility
  - Dialogue initiative
  - Multithreading
  - Task migratability
  - Substitutivity
  - Customizability

- Robustness
  - Observability
  - Recoverability
  - Responsiveness
  - Task conformance

[Section 7.2 in Dix. “Human Computer Interaction”]