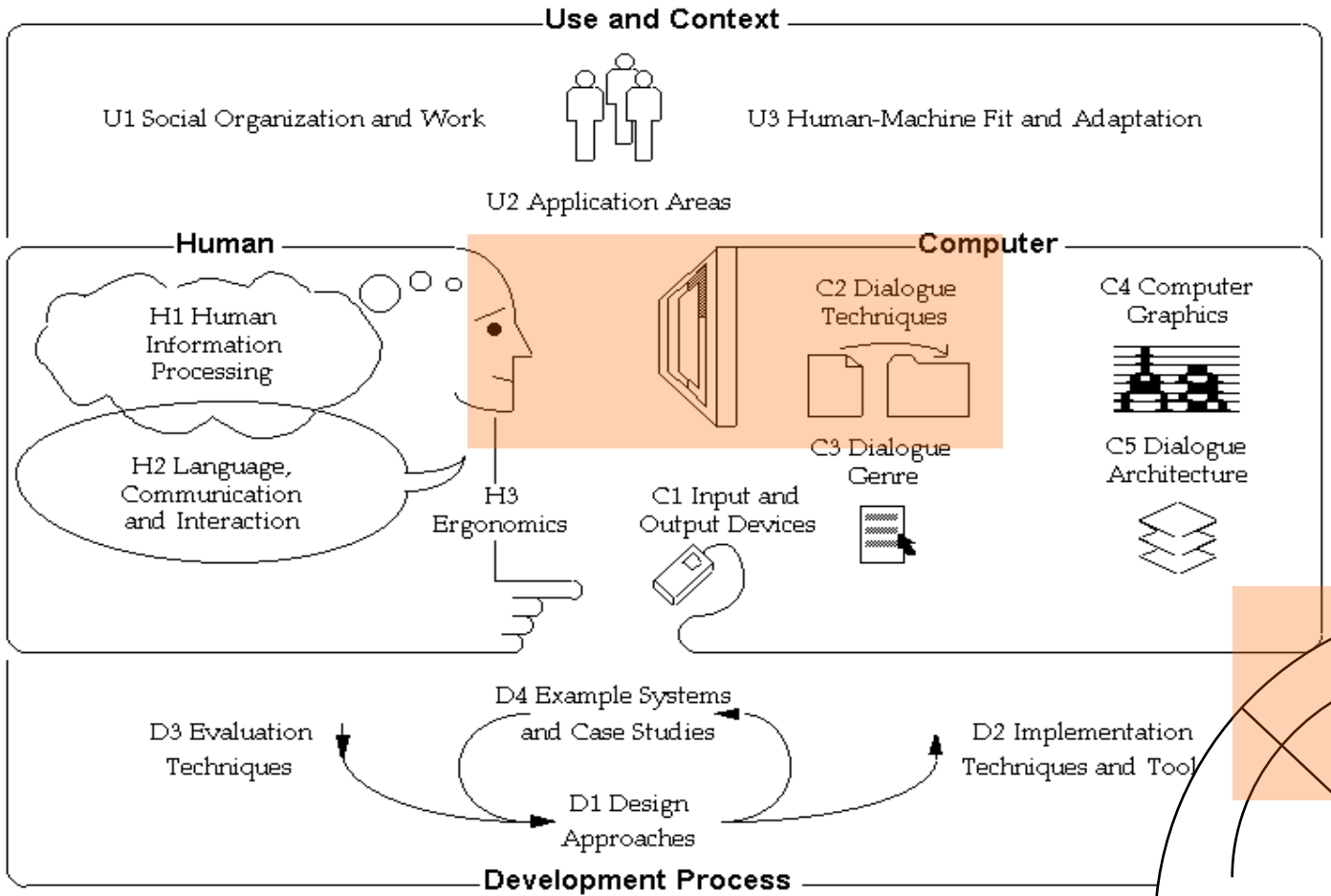
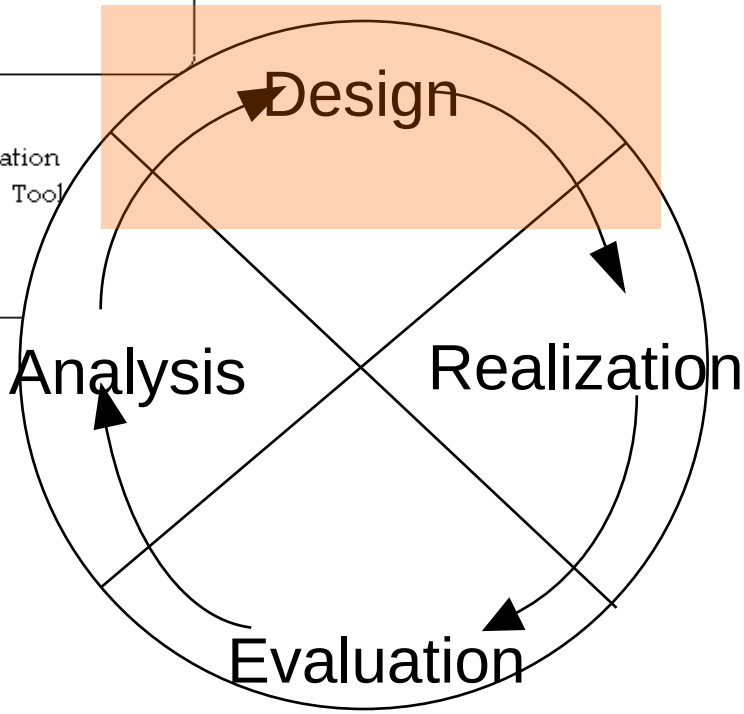
3 Basic HCI Principles and Models





This is a first (and not yet very deeply discussed) approach to design for usability

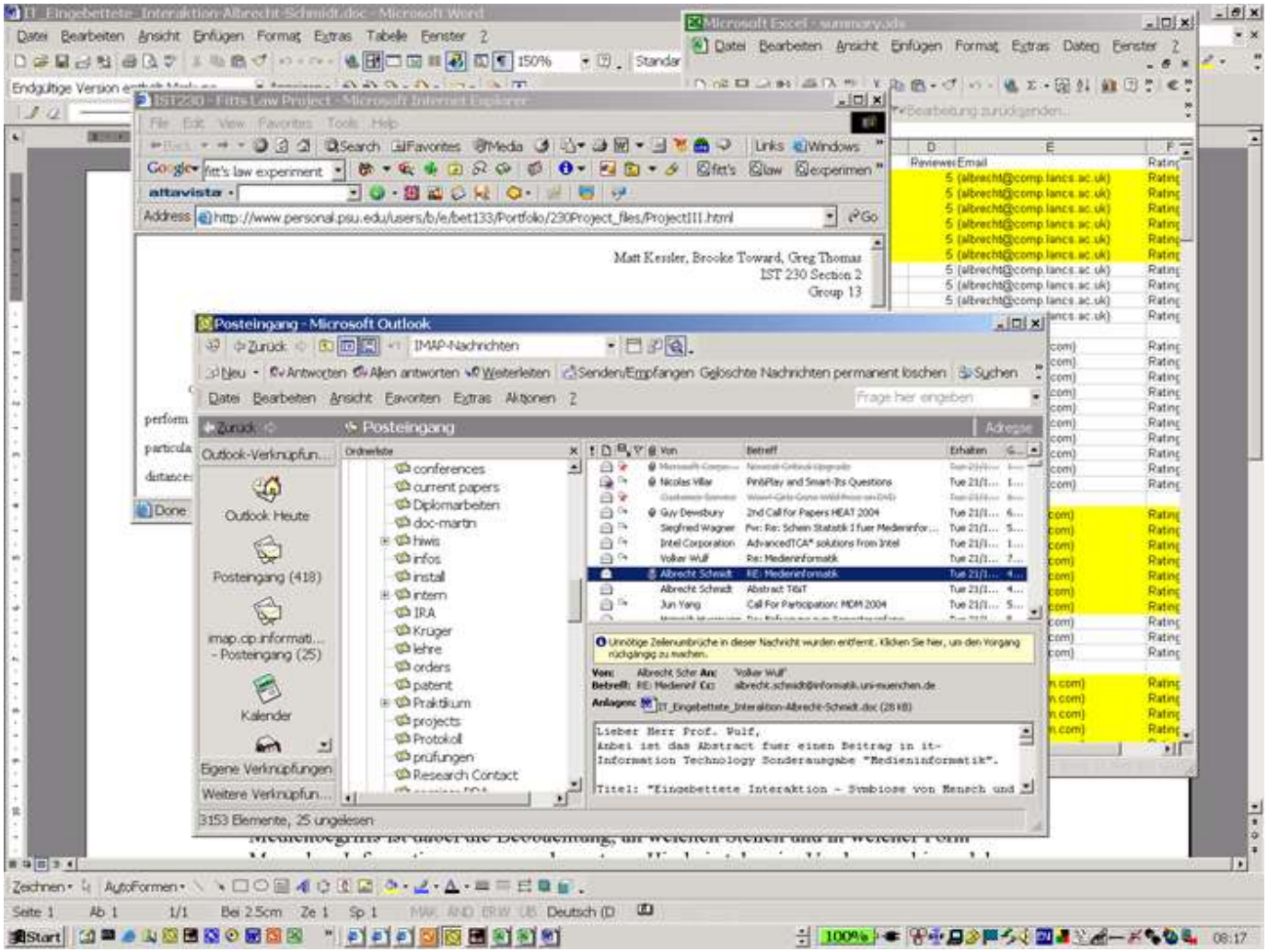
What the User Sees

- 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.

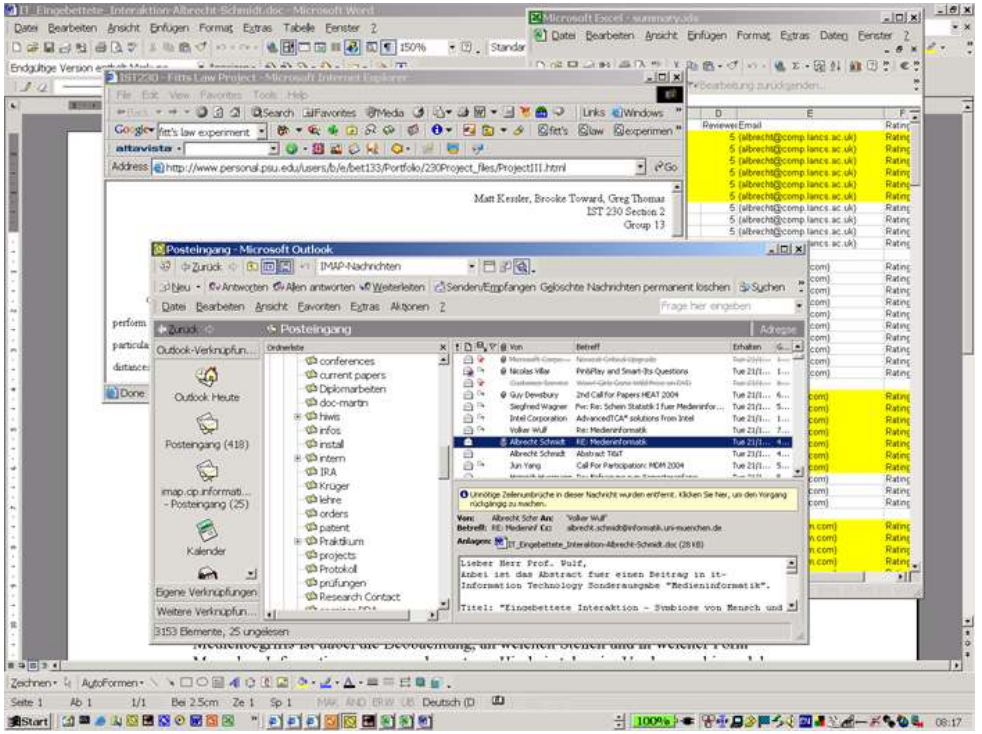
A Computer Screen and its Interpretation



- What do we see?
- What is shown?
- What is the meaning?

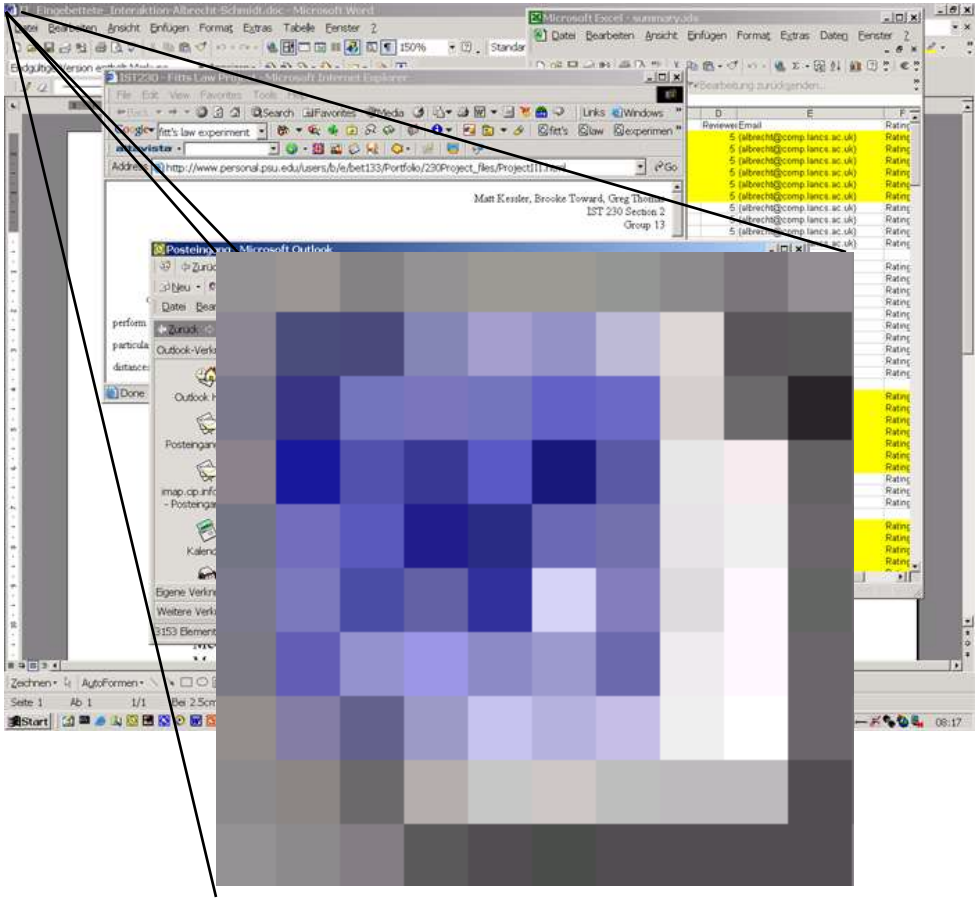
Answers from Skilled Computer Users

- 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

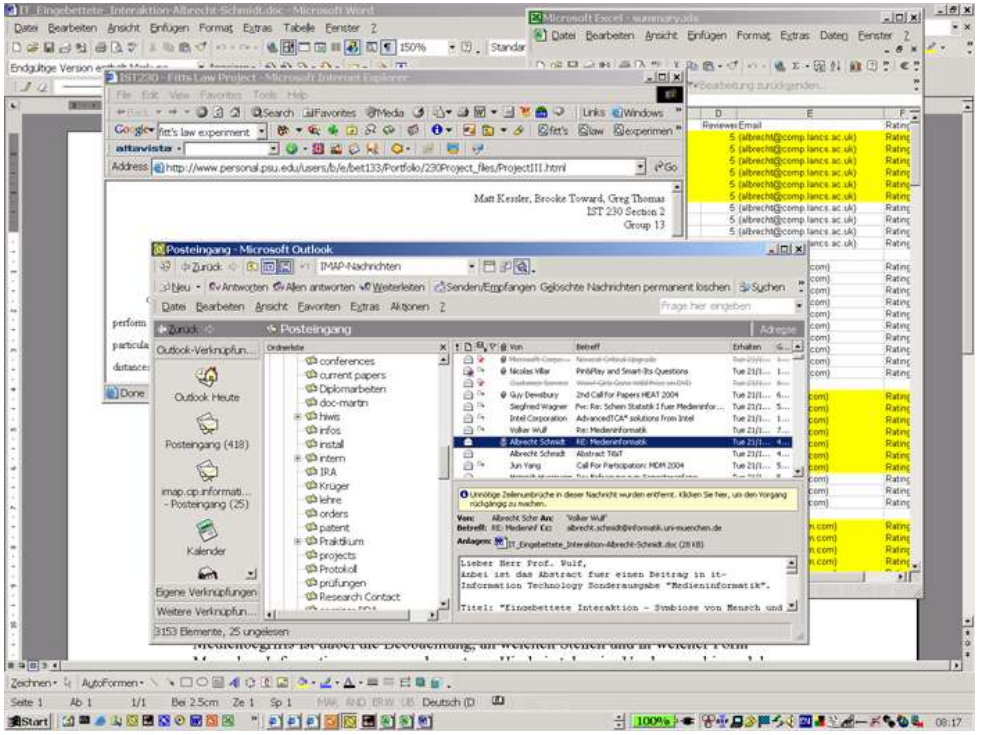
- 2-D surface
- Controllable pixels
- Image with a resolution of 1400x1050 pixels
- For each pixel the colour can be set
- The change of colour can be controlled rapidly



Perfect User's Answers

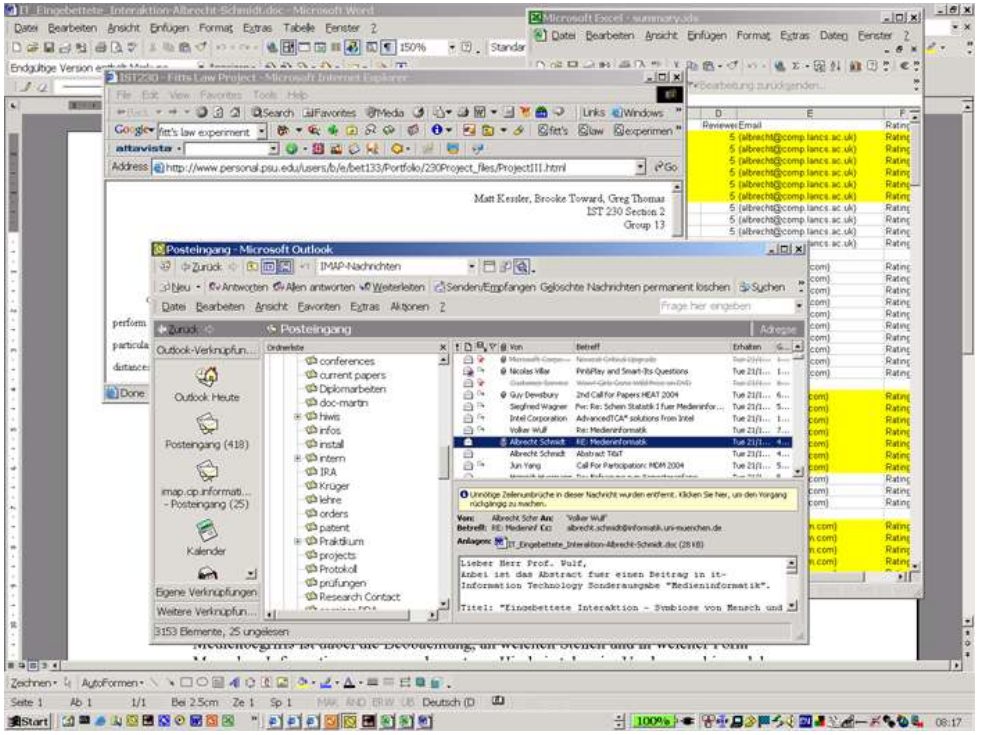
- My work environment

- Meeting notes
- Budget for next year
- Request to write a technical article
- Background information on a psychological phenomenon



Metaphor Example 1 – Overlaying Windows

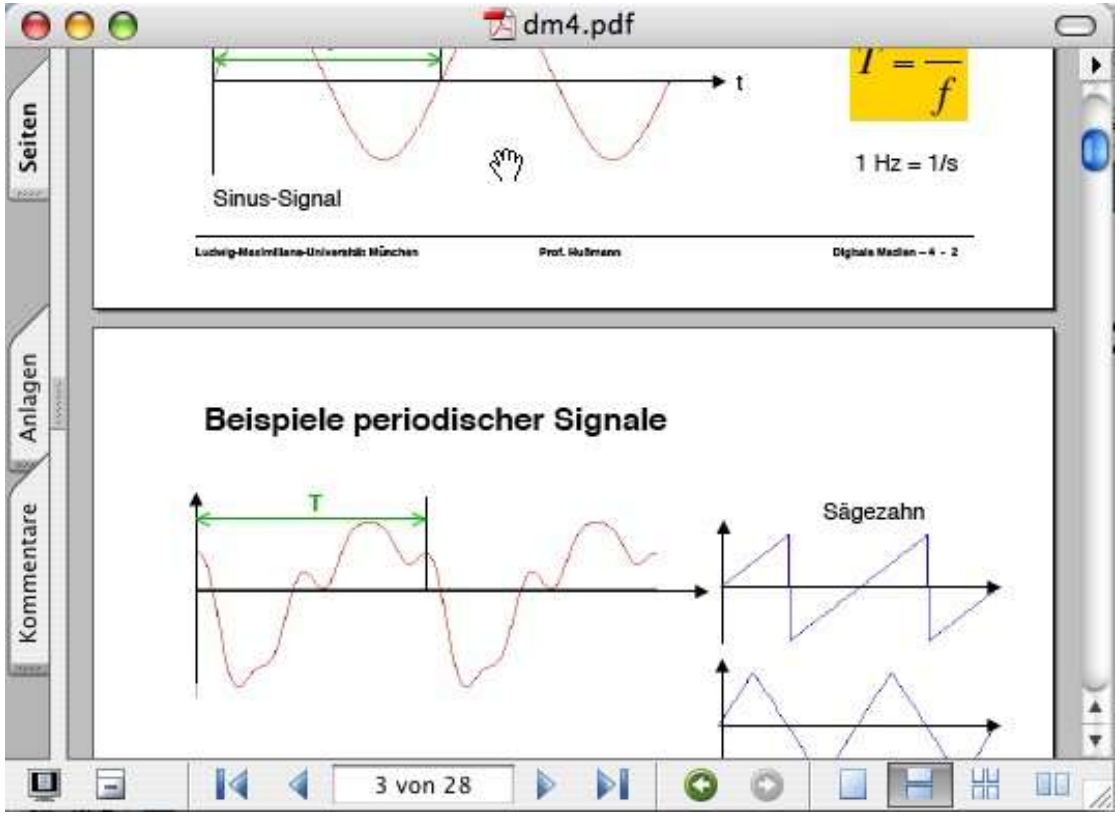
- What is the meaning of the fact that a window is behind another window?
- What is real? What is illusion?
- What does iconizing do?
- Models? Conceptual… Implementation… Represented…



Metaphor Example 2 – Scrollbar vs. Hand

- Moving ***up*** the hand
  Moves ***up*** the document

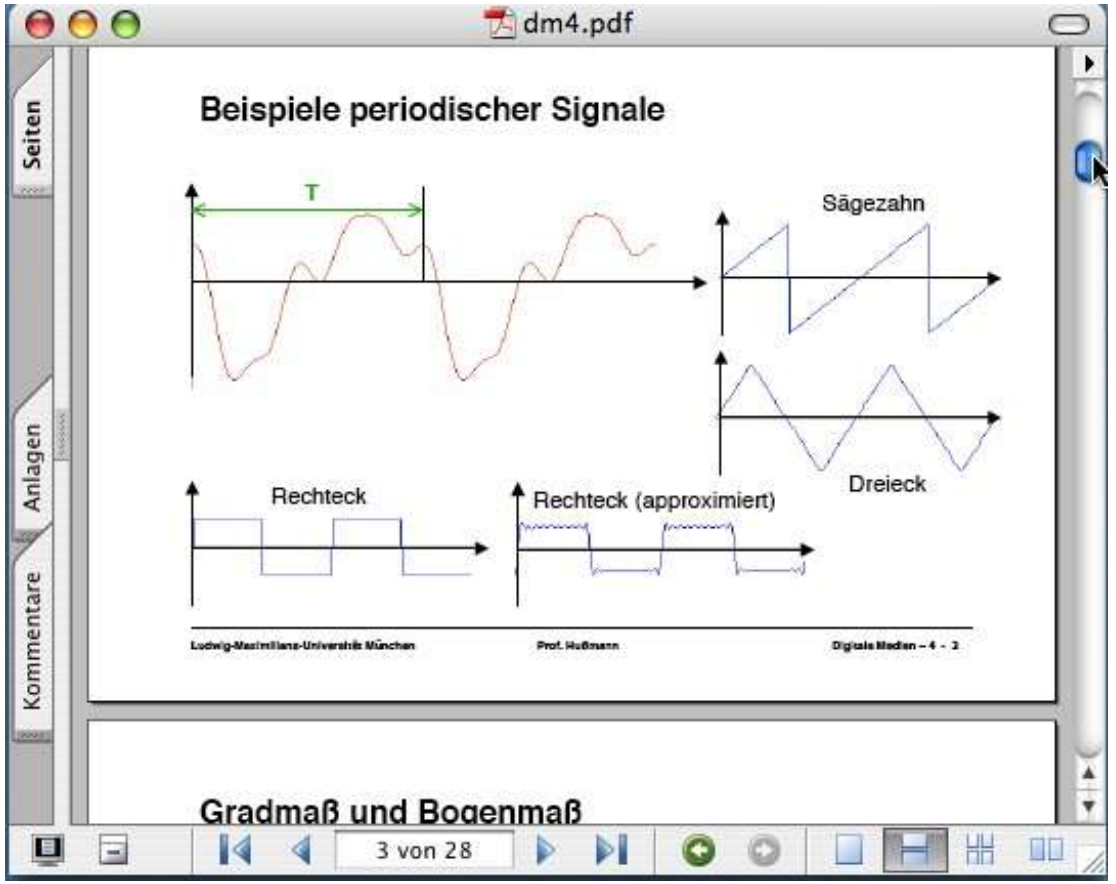
- What happens in reality?
  What do we imagine?
  What is the metaphor?



Metaphor Example 2 – Scrollbar vs. Hand

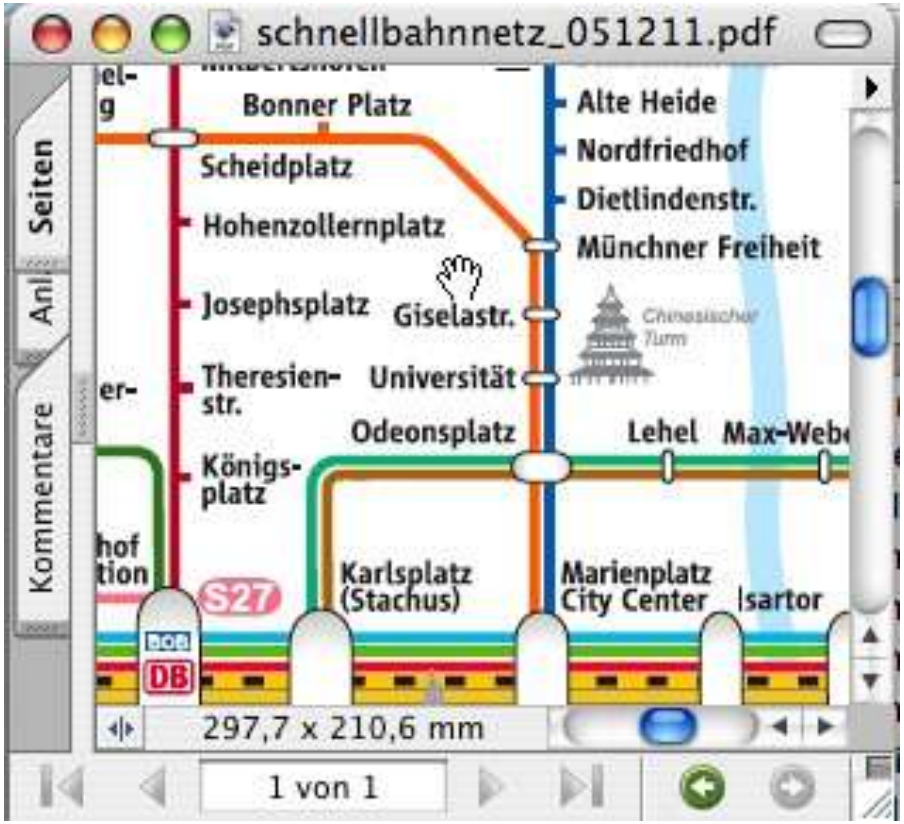
- Moving ***up*** the scroll bar moves ***down*** the document

- What happens in reality?
  What do we imagine?
  What is the metaphor?



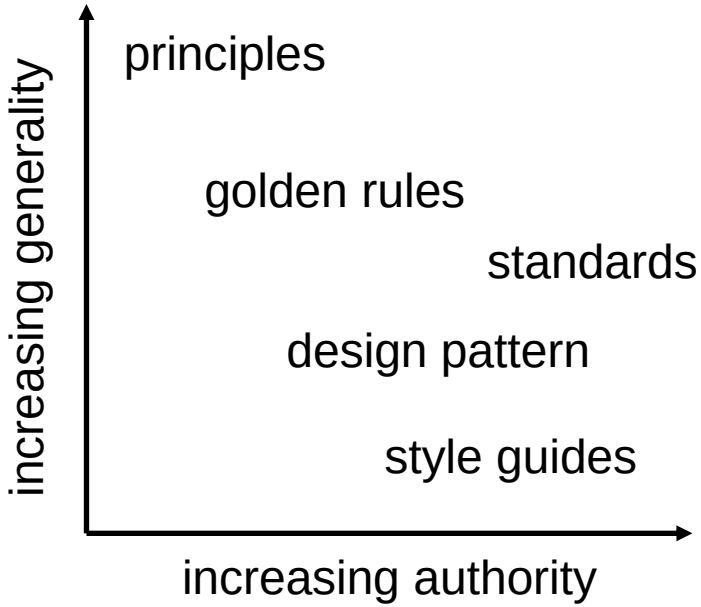
Metaphor Example 2 - Scrollbar vs. Hand

- 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 Nielson)

- *"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?

3 Basic HCI Principles and Models

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

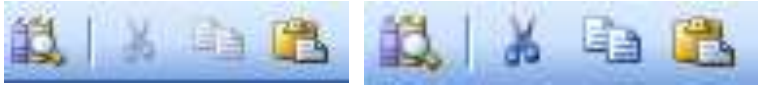
Dix, A. J., Finlay, J., Abowd, G., Beale, R. Principles to support usability, *Human-Computer Interaction, 260-*273, Third Edition

Principles of Learnability (1 / 2)

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

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

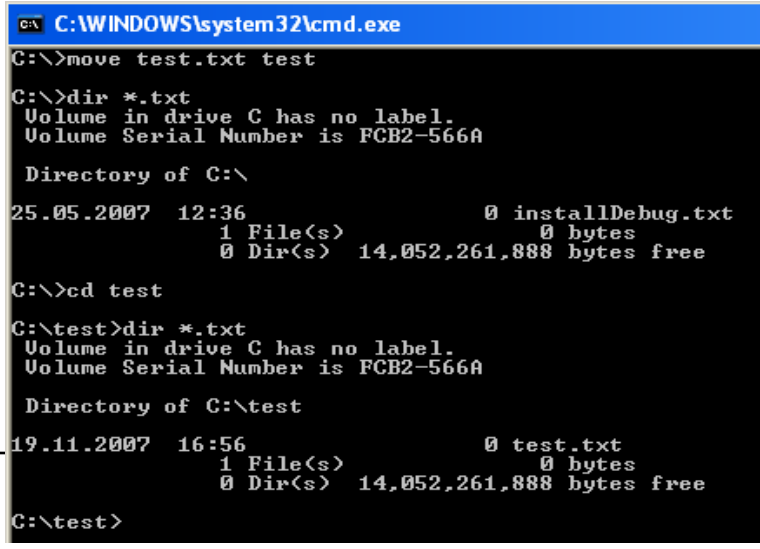
- Synthesizability
  - ability of the user to assess the effect of past operations on the current state
  - the user should see the changes of an operation
  - immediate vs. eventual feedback



1.

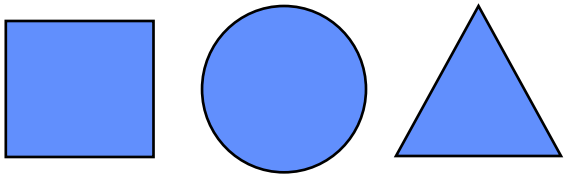
2.

3.



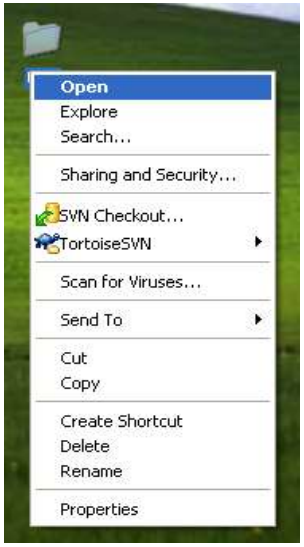
Principles of Learnability (2 / 2)

- 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

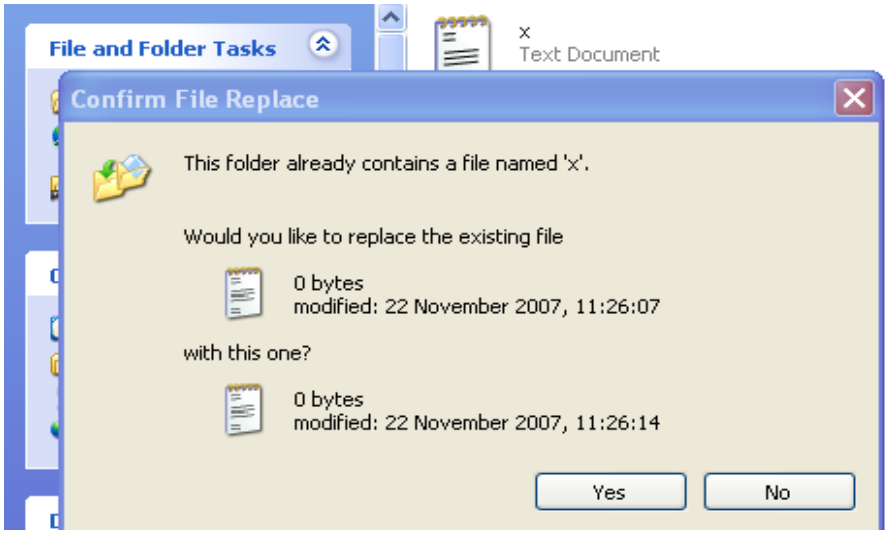


Principles of Flexibility (1 / 6)

- 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



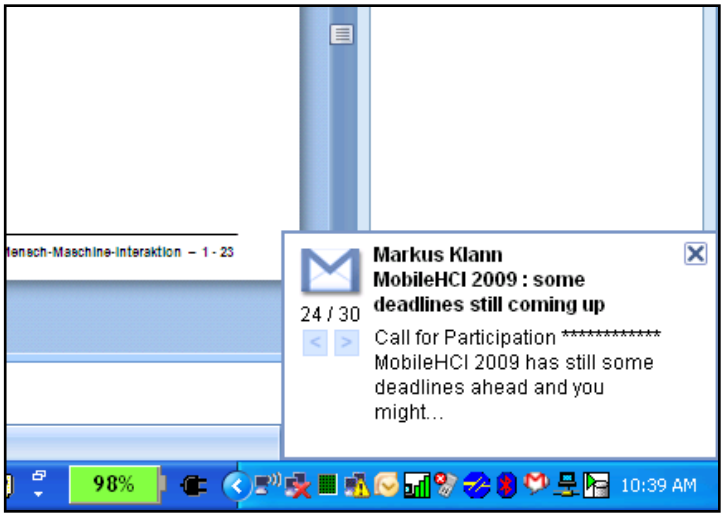
user preemptiveness



system preemptiveness

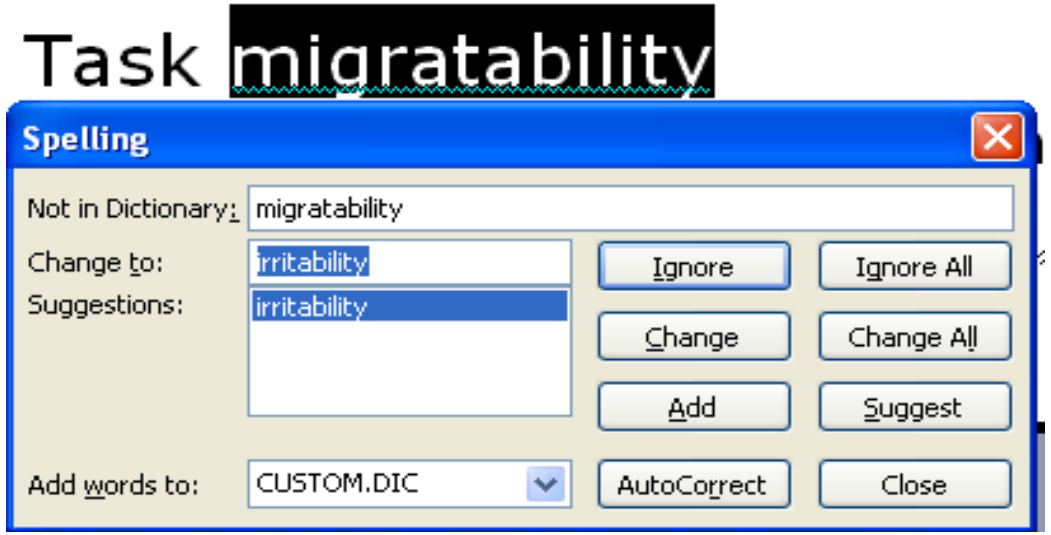
Principles of Flexibility (2 / 6)

- 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-model 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



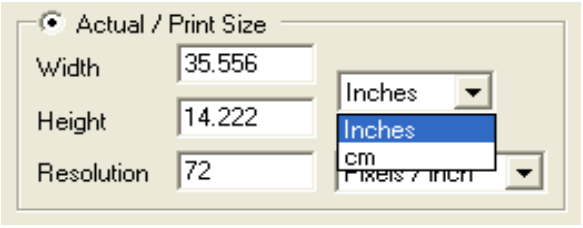
Principles of Flexibility (3 / 6)

- Task migratability
  - passing responsibility for task execution between user and system
  - example: spell checking

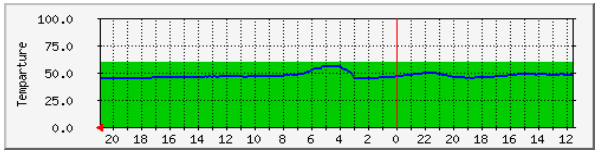


Principles of Flexibility (4 / 6)

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



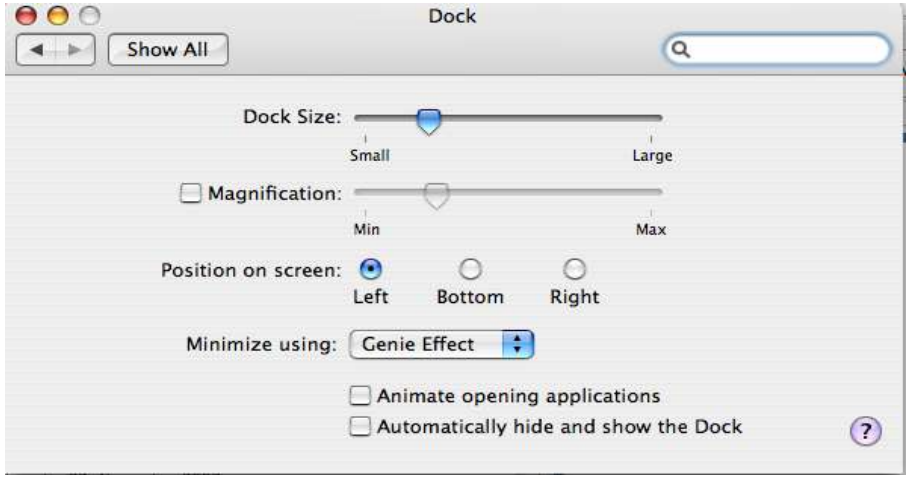
  - equal opportunity: blurs the distinction between input and output

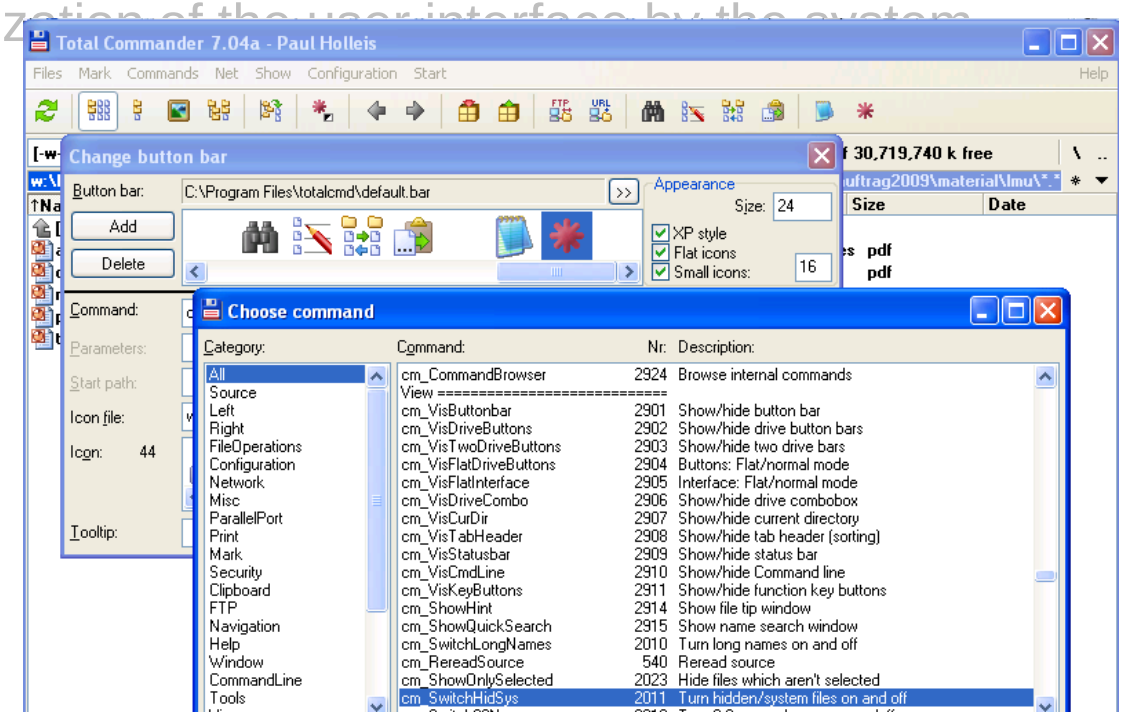


	A	B	C	D
1				
2	Summand 1	1	2	1
3	Summand 2	2	2	2
4	Summand 3	3	3	3
5	Total sum	6	7	6

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
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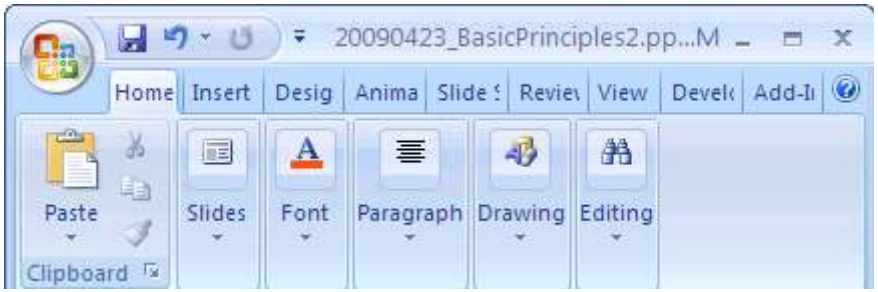
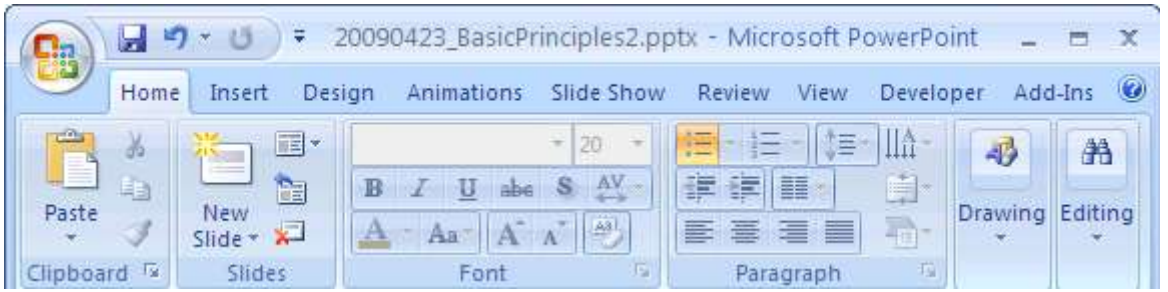
  - adaptability: users ability to adjust the form of input and output
  - **adaptivity**: automatic customization of the user interface by the system





Principles of Robustness (1 / 2)

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

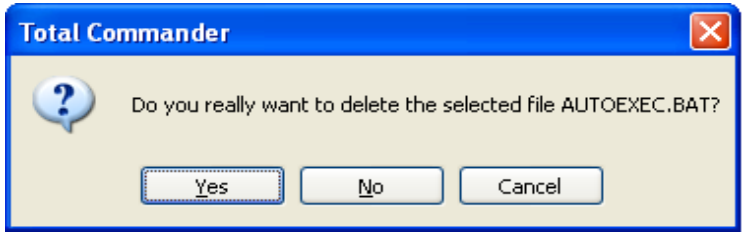
→ Level of support provided to the user in determining successful achievement and assessment of goal-directed behavior

- Observability

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

- Recoverability

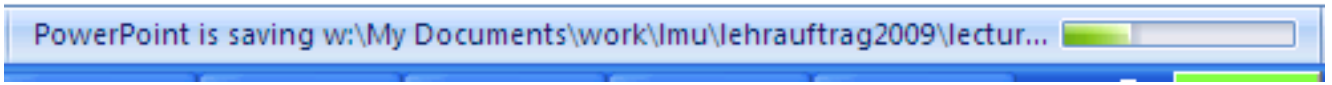
  - ability of the user to correct a recognized error
  - reachability (states): forward (redo) / backward (undo) recovery
  - commensurate effort (more effort / steps for deleting a file than for moving it)

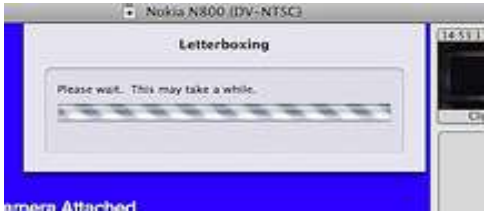


Principles of Robustness (2 / 2)

- 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





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3 Usability Principles by Dix

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  - Consistency
- Flexibility
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  - Customizability
- Robustness
  - Observability
  - Recoverability
  - Responsiveness
  - Task conformance

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

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