Mensch-Maschine-Interaktion 1

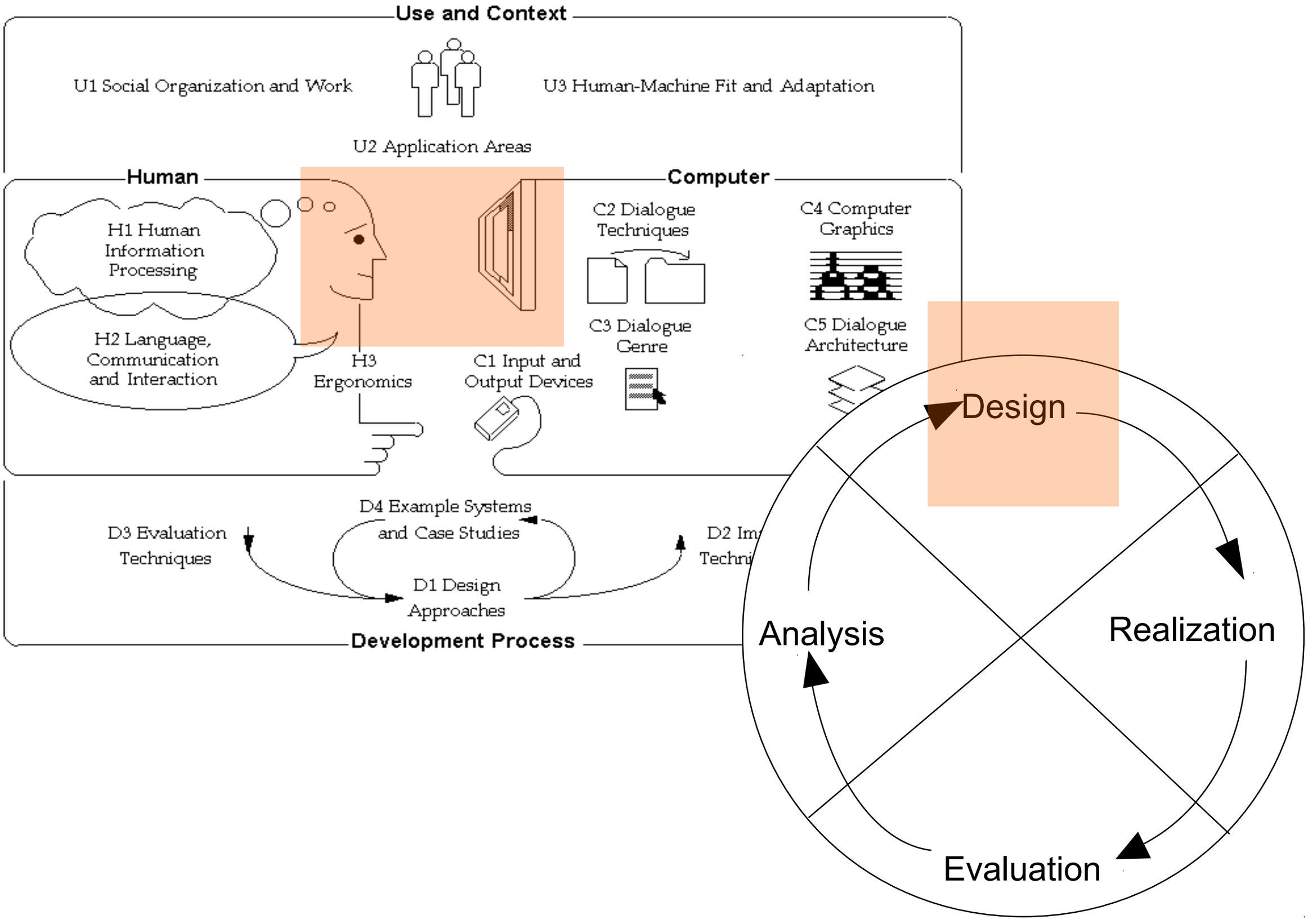
Chapter 2 (May 12th, 2011, 9am-12pm):
Basic HCI principles 1

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


Use and Context
U1 Social Organization and Work
U2 Application Areas
U3 Human-Machine Fit and Adaptation
Human
Computer
H1 Human Information Processing
H2 Language, Communication and Interaction
H3 Ergonomics
C1 Input and Output Devices
C2 Dialogue Techniques
C3 Dialogue Genre
C4 Computer Graphics
C5 Dialogue Architecture
D1 Design Approaches
D3 Evaluation Techniques
D4 Example Systems and Case Studies
Development Process
Design
Analysis
Realization
Evaluation

What the User Sees

- Users see only what is openly visible!

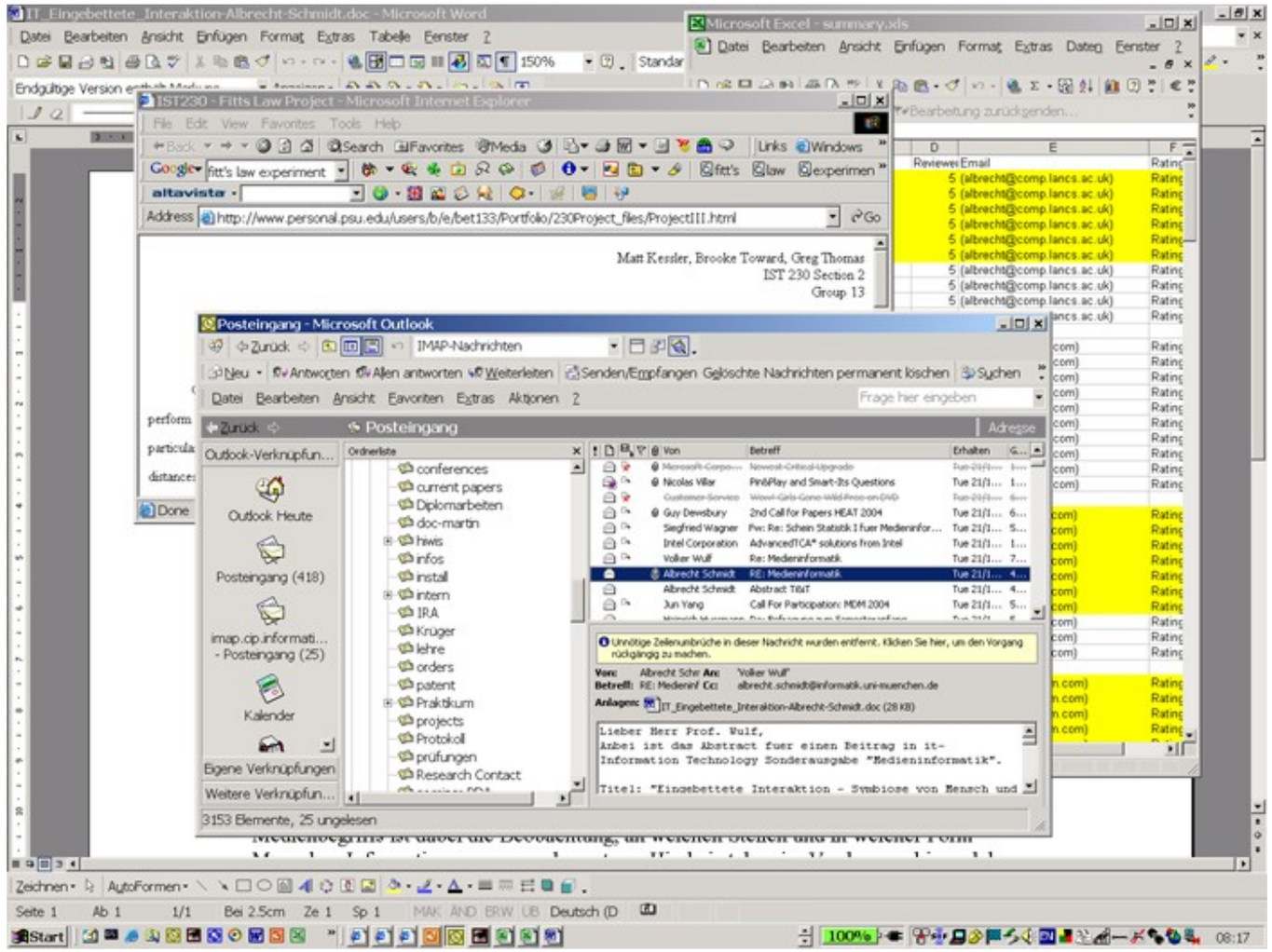
What the Developer Knows

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

- And users often do not want to know about it.

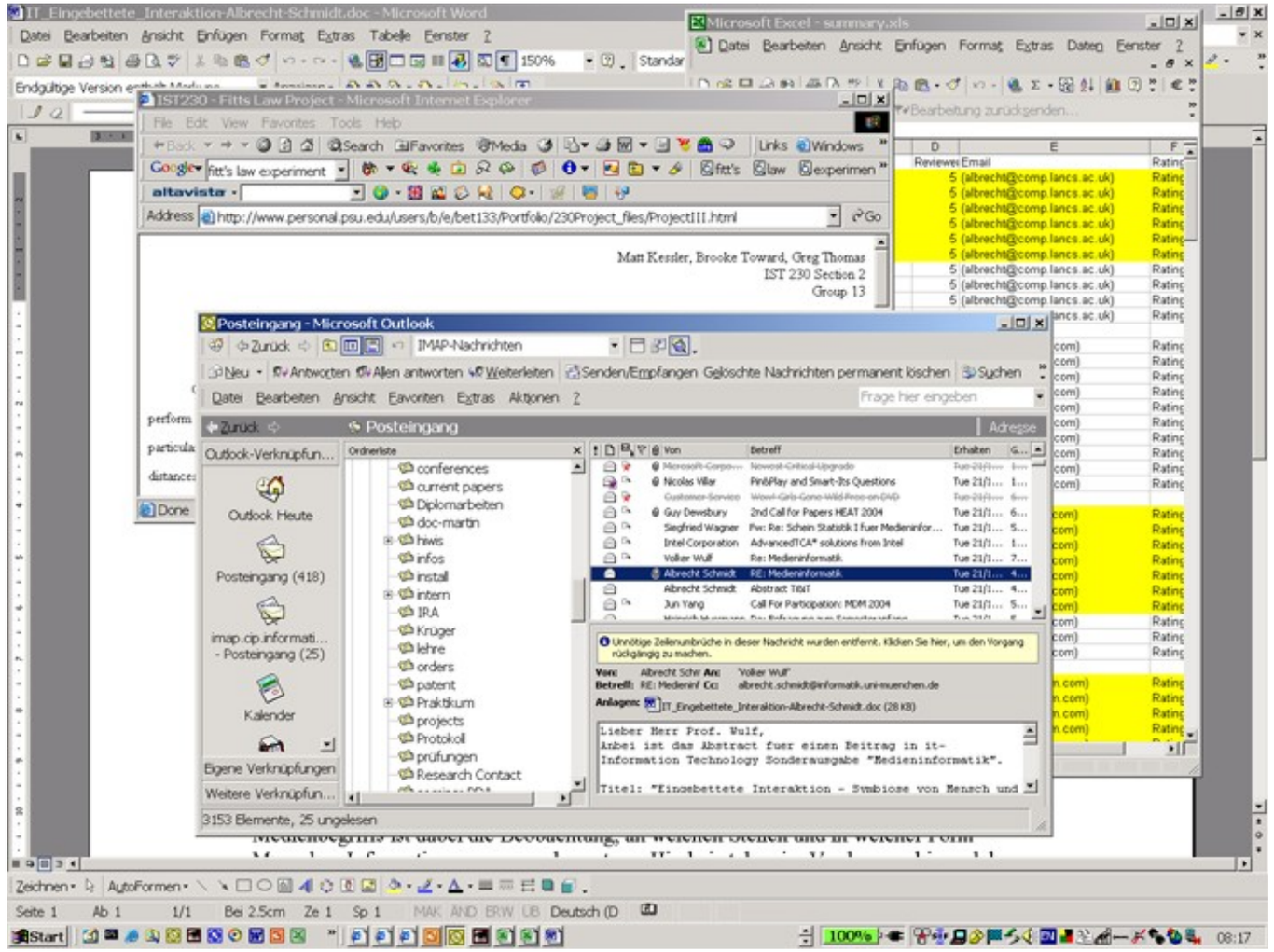
A Computer Screen and its Interpretation

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



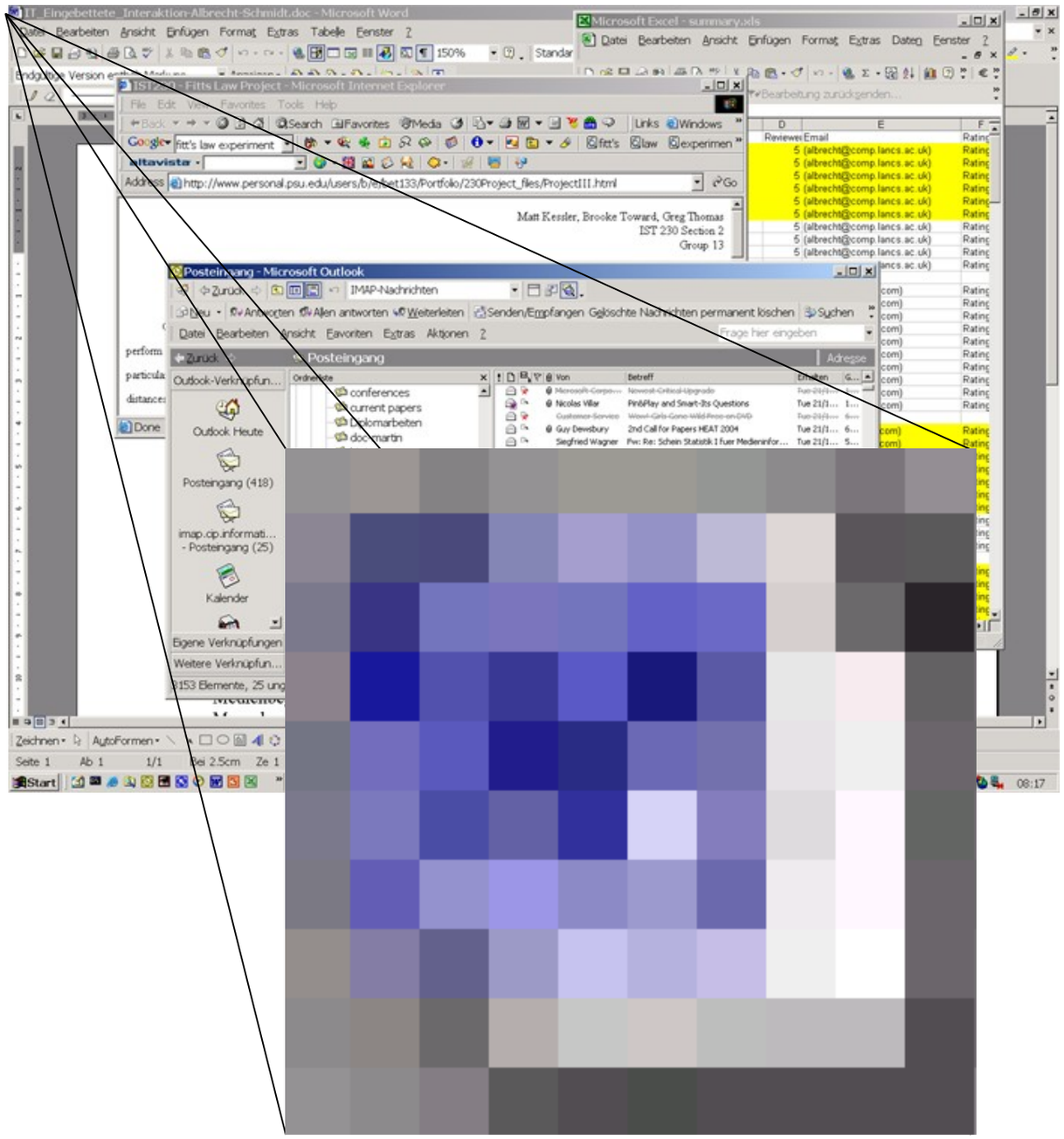
Answers from Skilled Computer Users

- 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

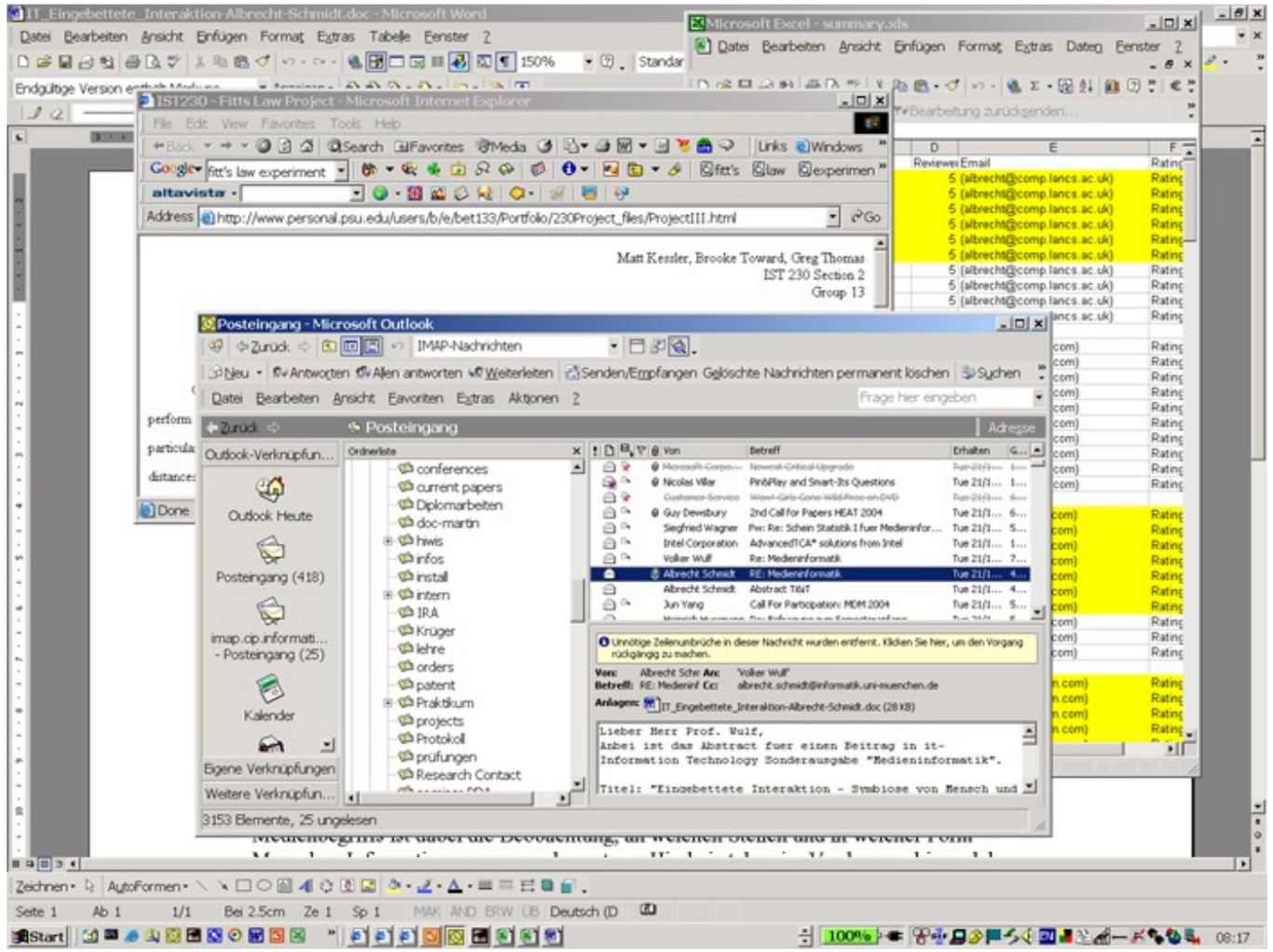


Perfect User's Answers

- My work environment

- Meeting notes
- Budget for next year

- Request to write a technical article
- Background information on a psychological phenomenon



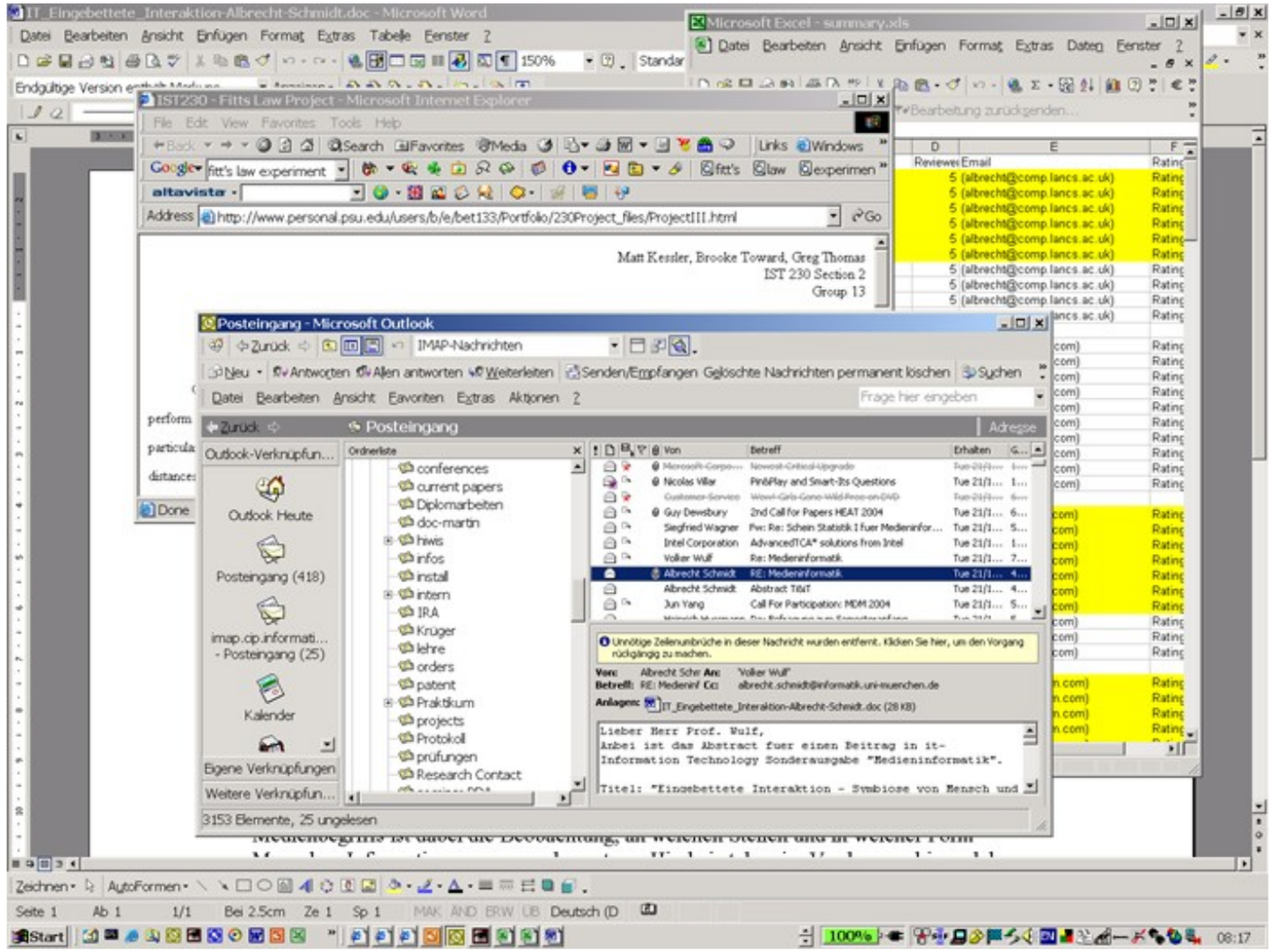
Metaphor Example 1 – Overlaying Windows

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

- What is real?
  What is illusion?

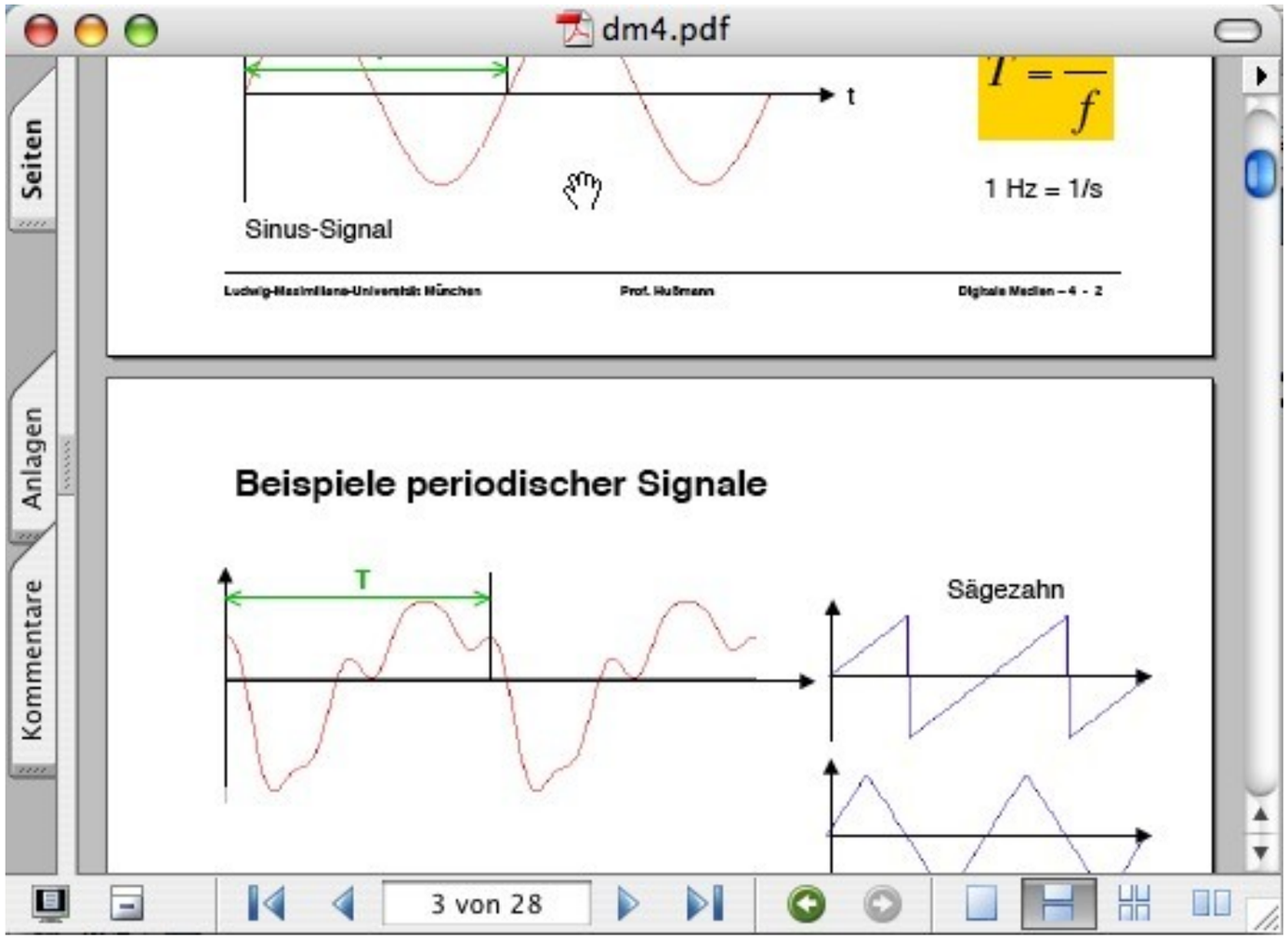
- What does iconizing do?

- Models?
  Conceptual…
  Implementation…
  Represented…



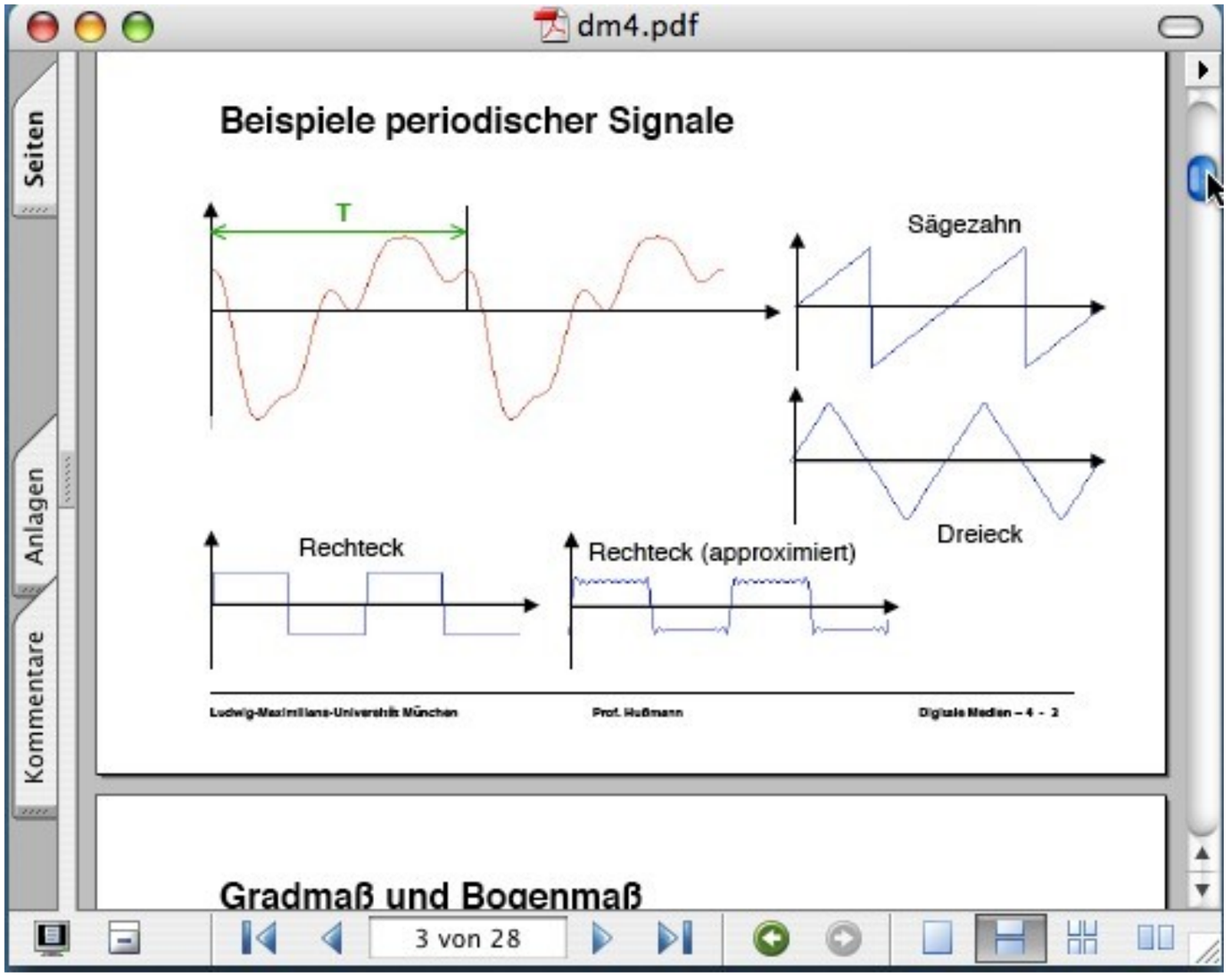
Metaphor Example 2 – Scrollbar vs. Hand

- Moving up the hand moves up the document
- What happens in reality?
  What do we imagine?
  What is the metaphor?



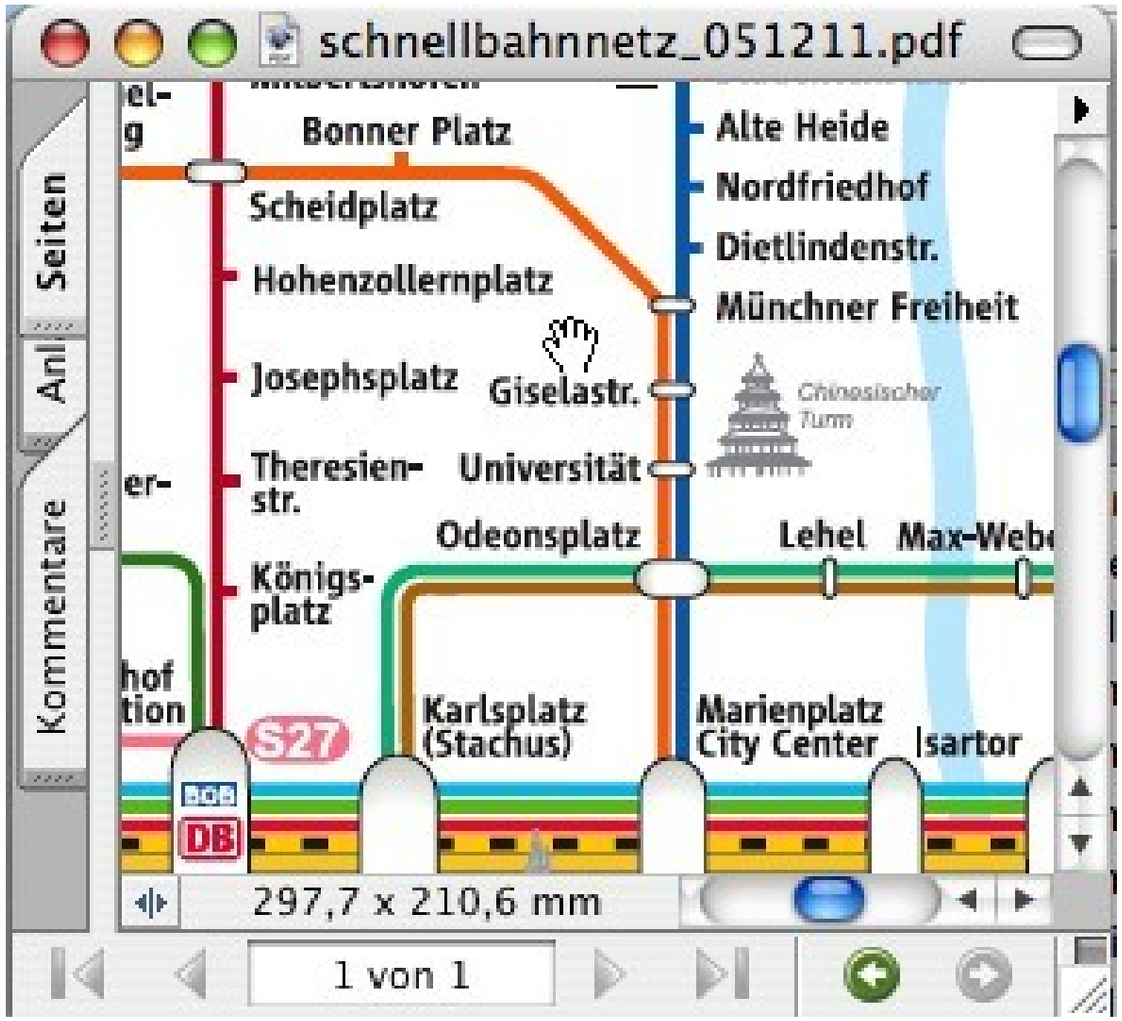
Metaphor Example 2 – Scrollbar vs. Hand

- Moving up the scroll bar moves down the document
- What happens in reality?
  What do we imagine?
  What is the metaphor?



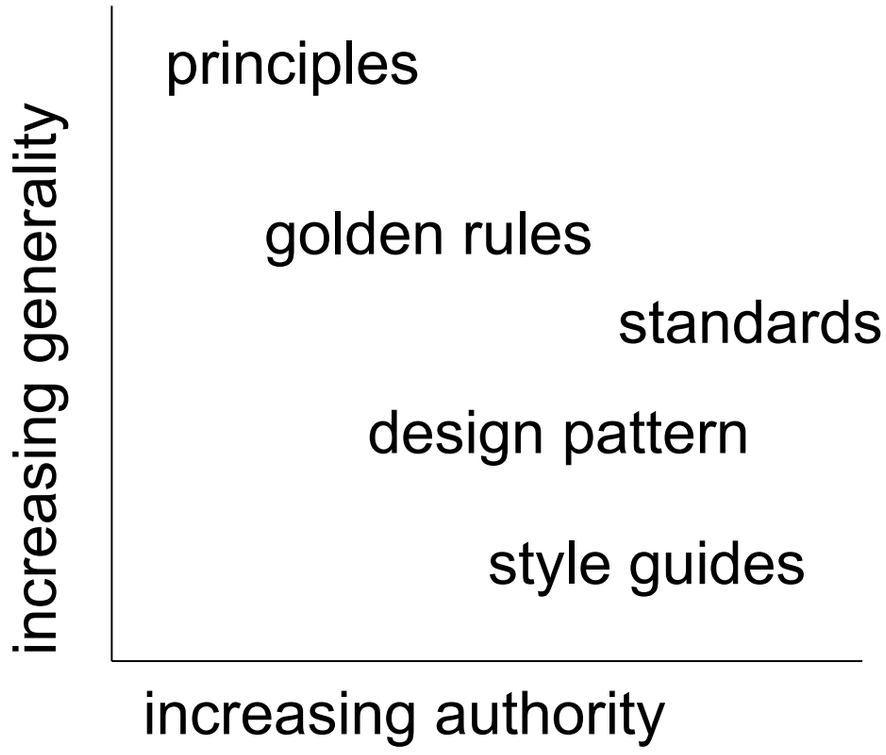
Metaphor Example 2 - Scrollbar vs. Hand

- 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.**
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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

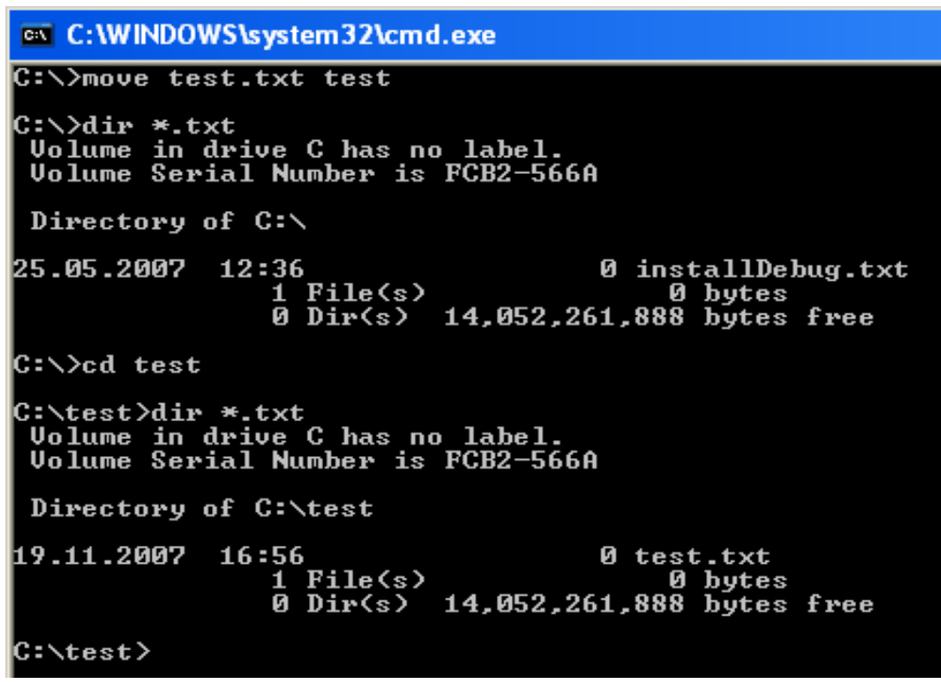
1.

2.

A

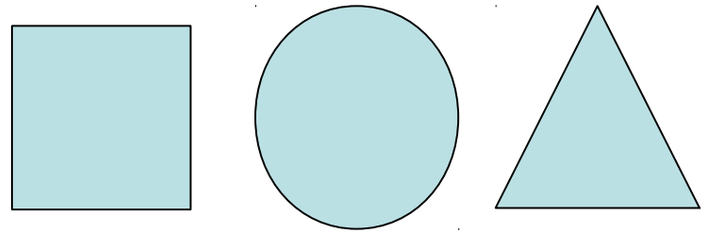
3.

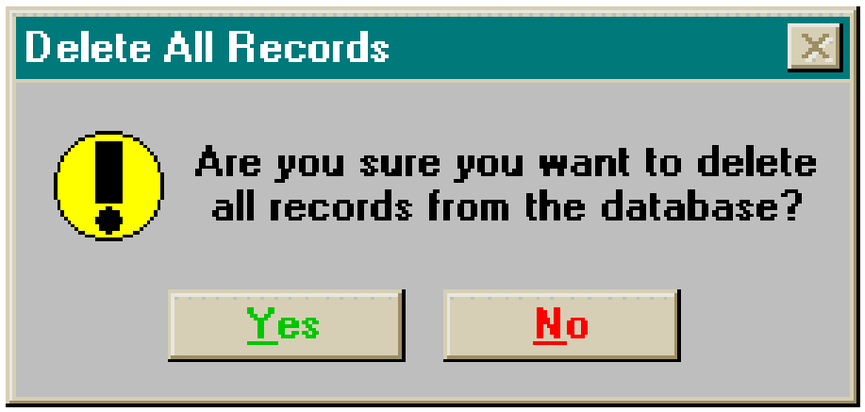
test
Text Document
0 KB



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

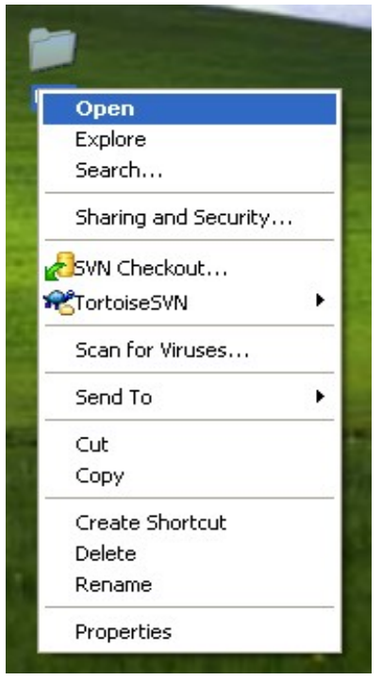




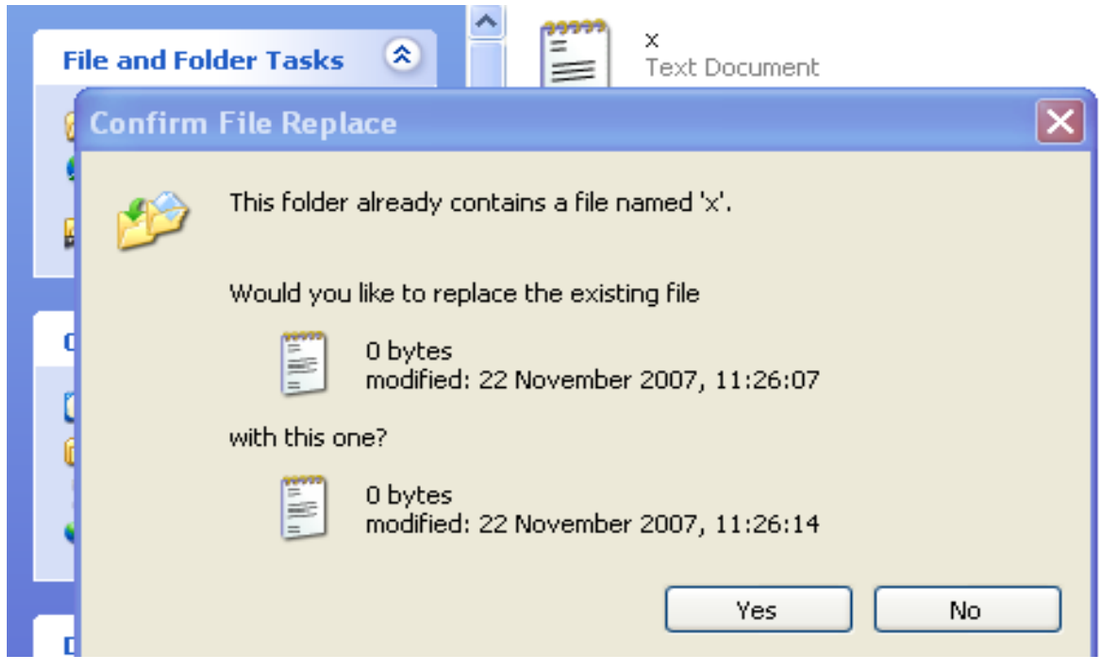
Principles of Flexibility (1 / 6)

the multiplicity of ways the user and system exchange information

- 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



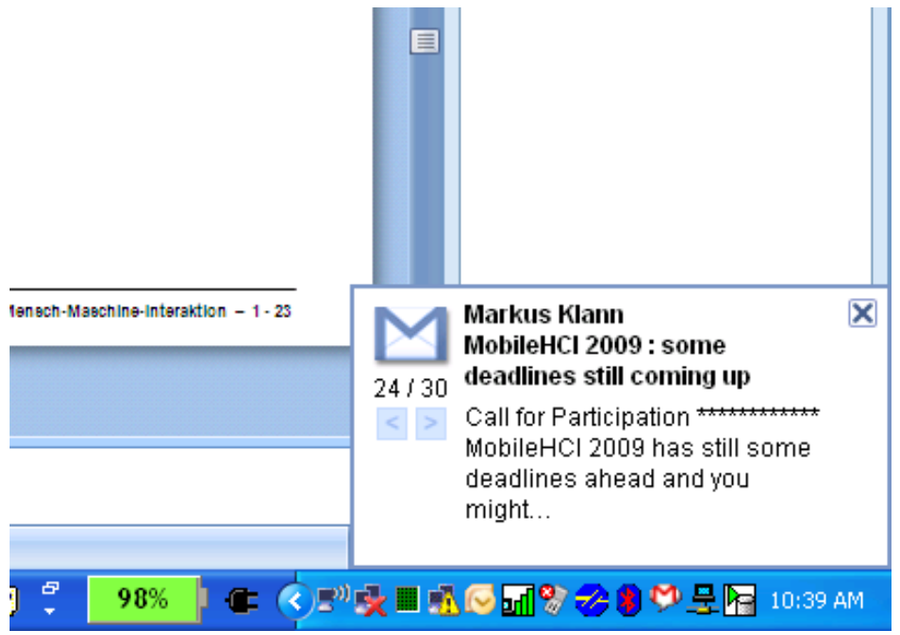
user preemptiveness



system preemptiveness

Principles of Flexibility (2 / 6)

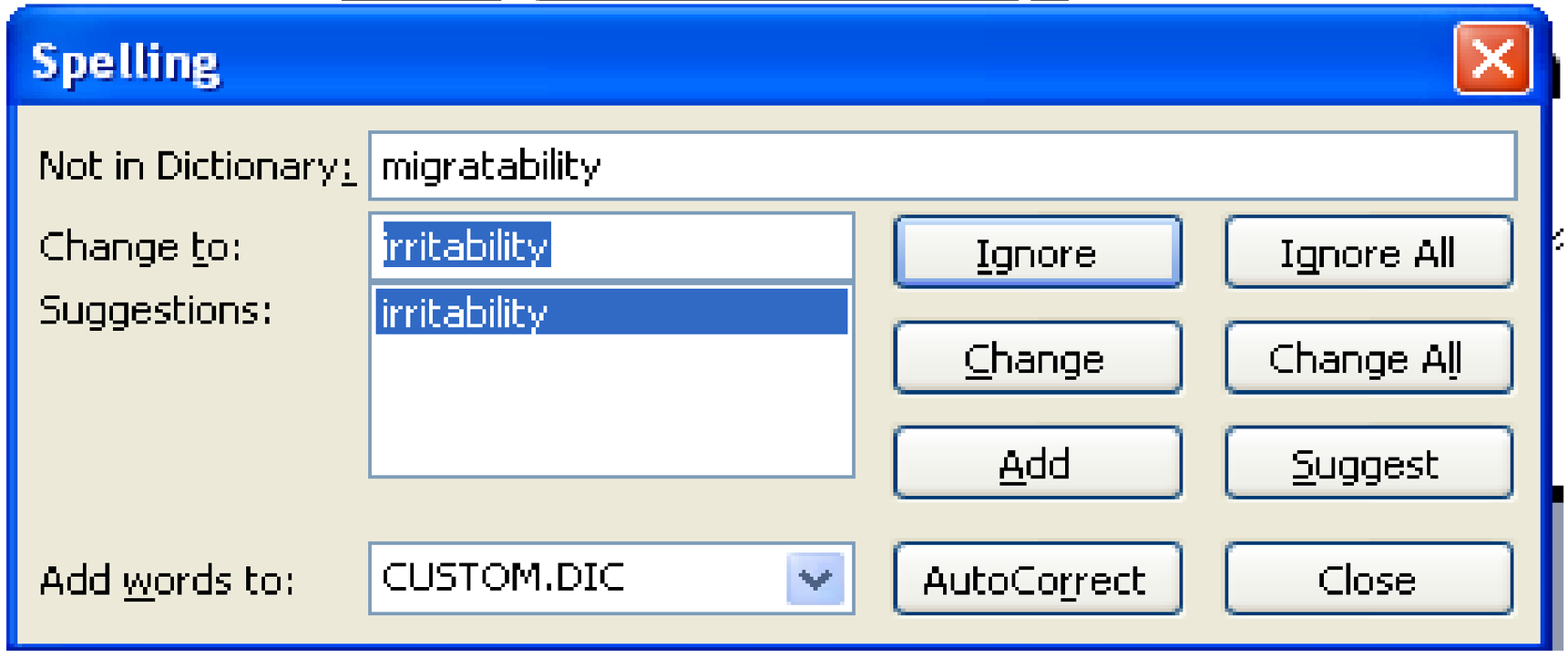
- Multithreading
  - ability of system to support user interaction for several tasks at a time
  - concurrent multimodality: simultaneous communication of information pertaining to separate tasks
    - multi-modal dialog
    - editing text and beep (incoming mail) at the same time
  - interleaving multimodality: 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)

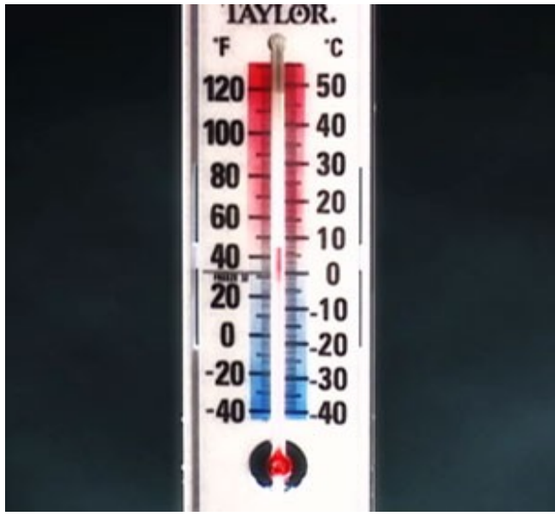
- Task migratability
  - passing responsibility for task execution between user and system
  - example: spell checking

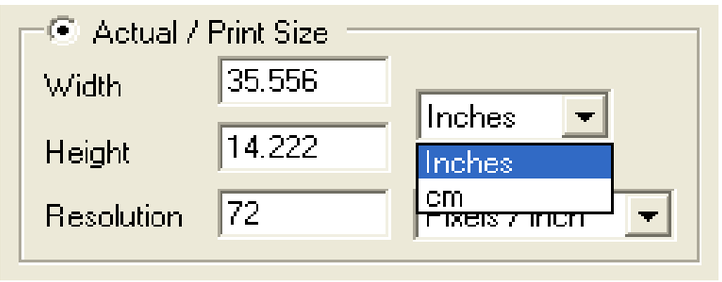
Task migratability



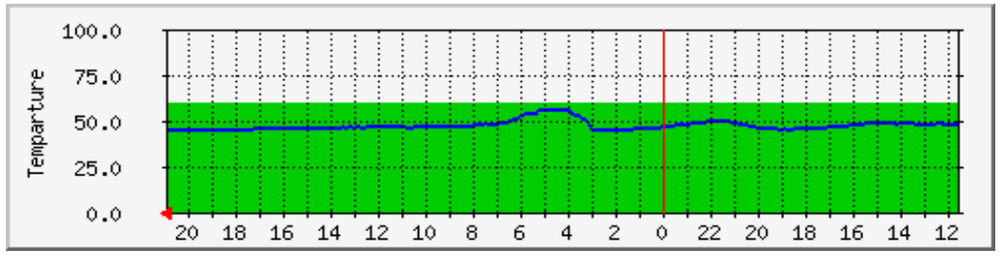
Principles of Flexibility (4 / 6)

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





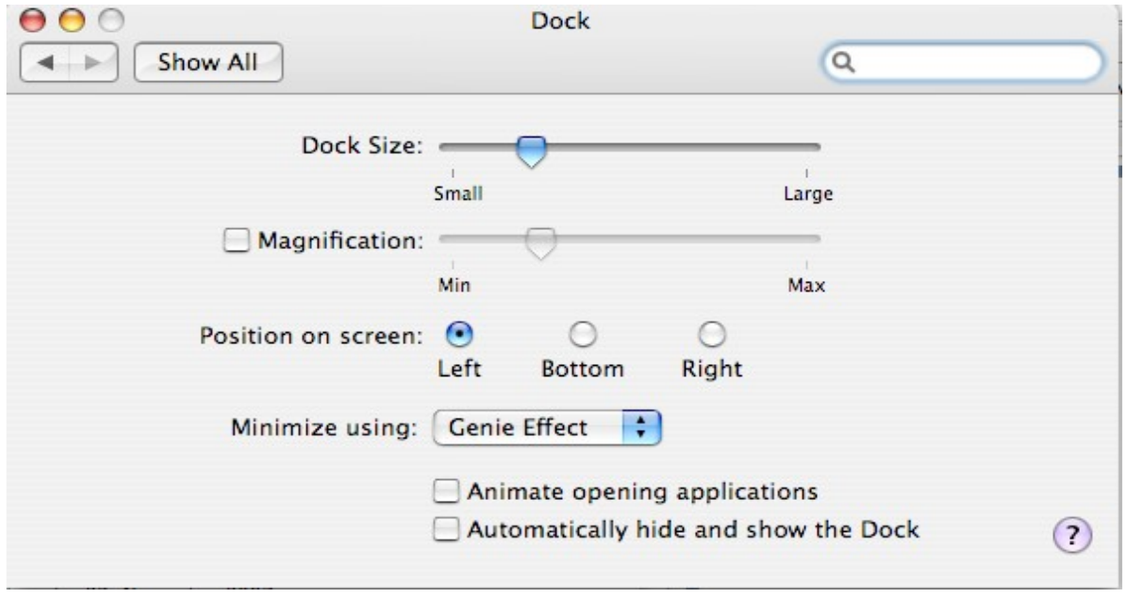
  - equal opportunity: blurs the distinction between input and output

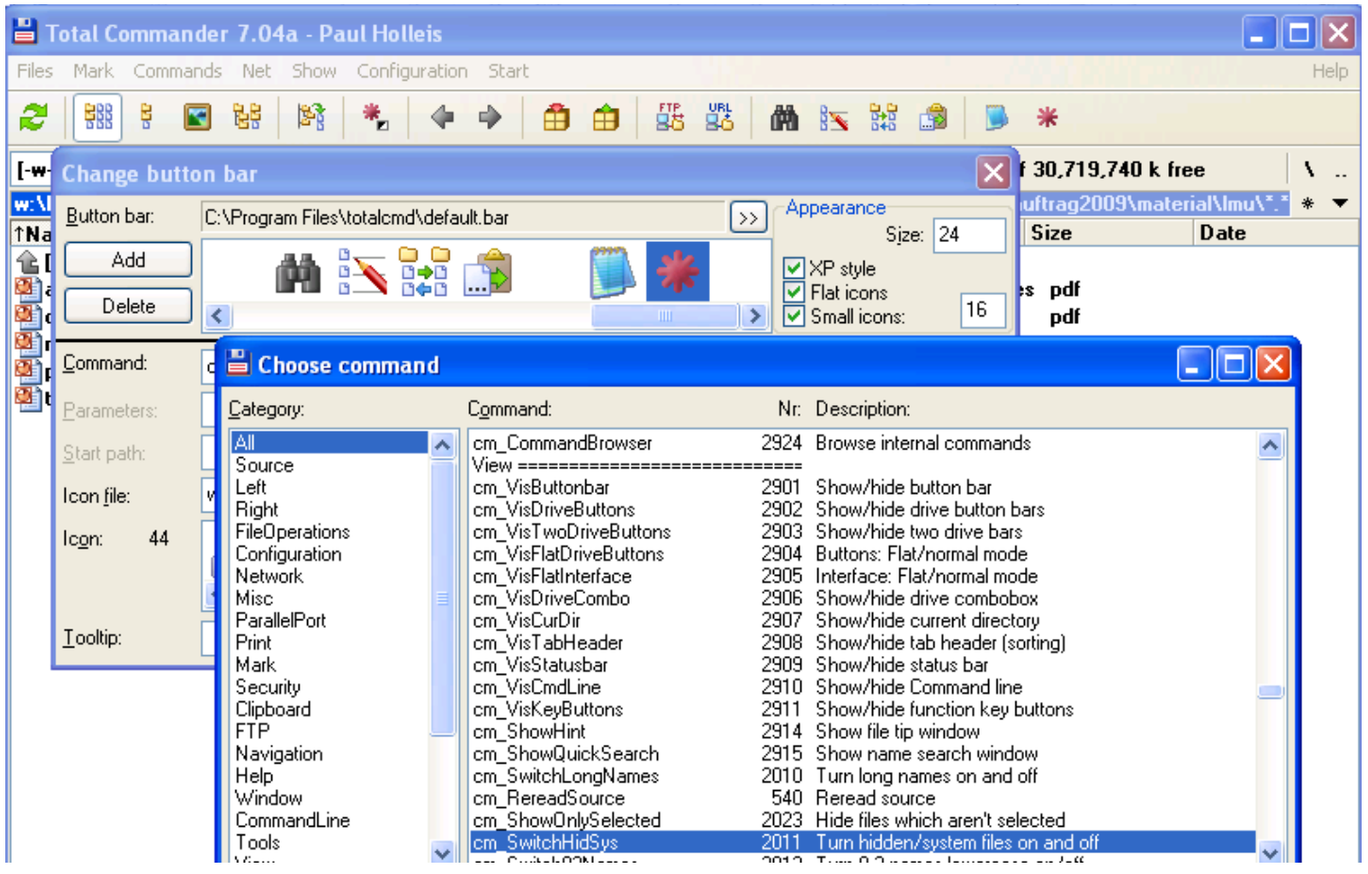


	A	B	C	D
1				
2	Summand 1	1	2	1
3	Summand 2	2	2	2
4	Summand 3	3	3	3
5	Total sum	6	7	6

Principles of Flexibility (5 / 6)

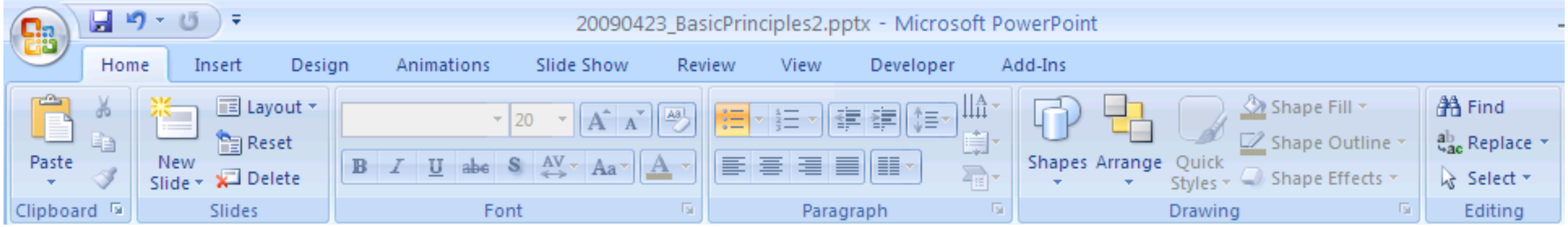
- Customizability
  - modifiability of the user interface by the user (adaptability) or system (adaptivity)
  - adaptability: users ability to adjust the form of input and output
  - adaptivity: automatic customization of the user interface by the system

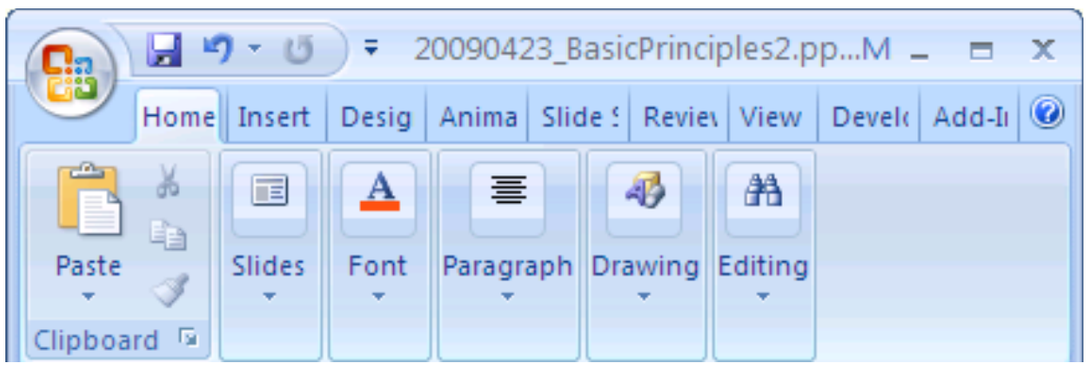


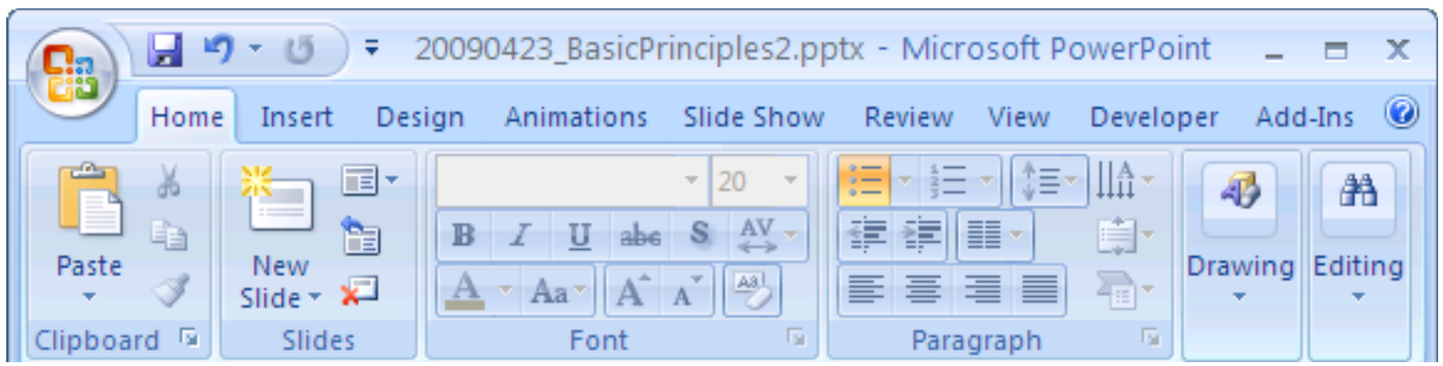


Principles of Flexibility (6 / 6)

- Customizability
  - 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





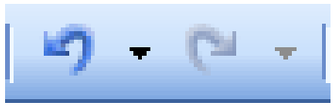


Principles of Robustness (1 / 2)

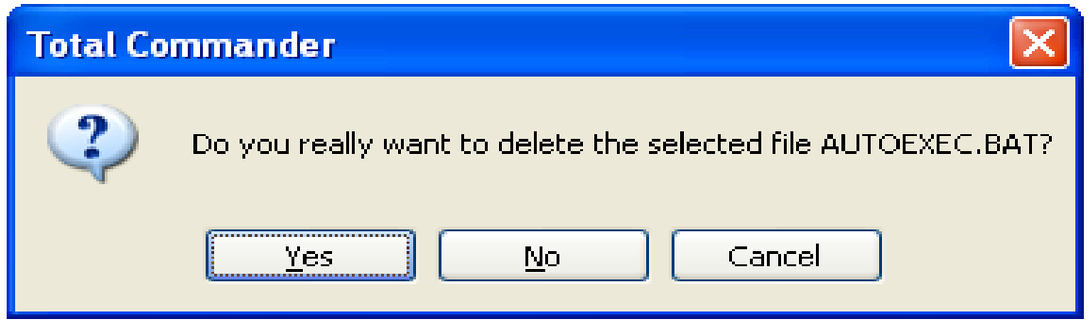
- → Level of support provided to the user in determining successful achievement and assessment of goal-directed behavior

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

- Recoverability



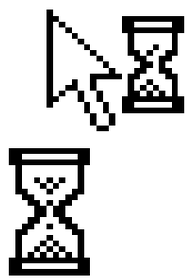
  - ability of the user to correct a recognized error
  - reachability (states): forward (redo) / backward (undo) recovery
  - commensurate effort (more effort / steps for deleting a file than for moving it)

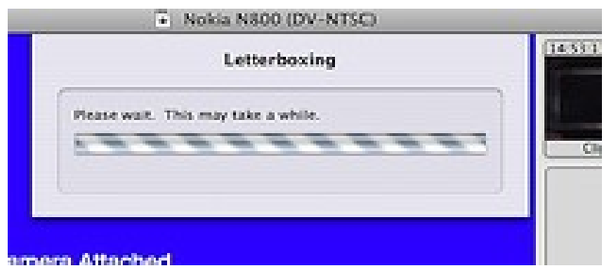


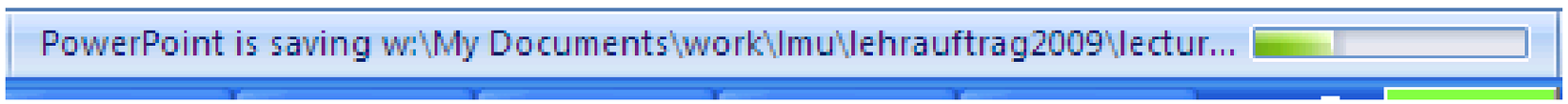
Principles of Robustness (2 / 2)

- 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







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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”]