

Mensch-Maschine-Interaktion 1

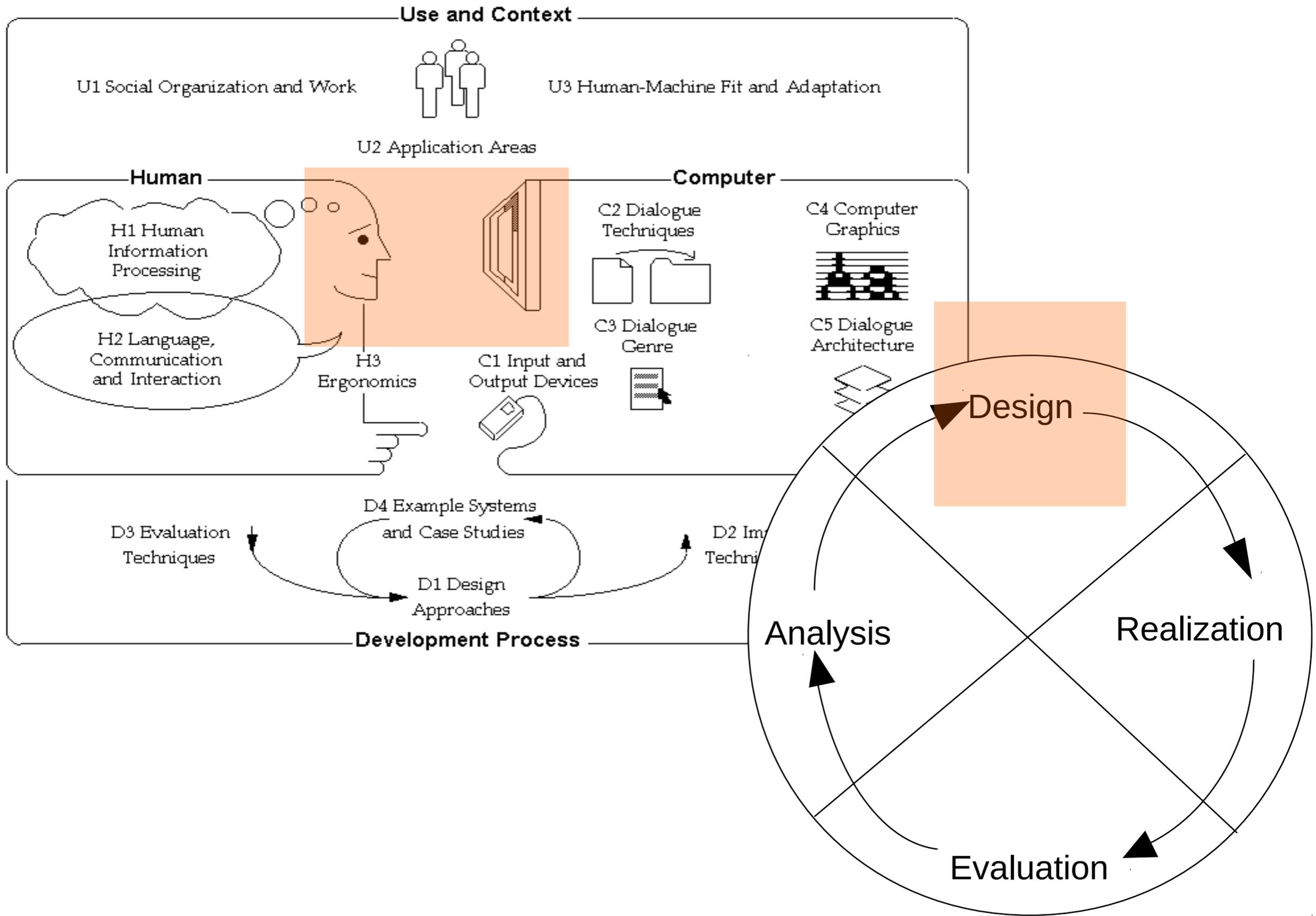
Chapter 2 (April 26th, 2012, 9am-12pm):
Basic HCI Principles 1

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!



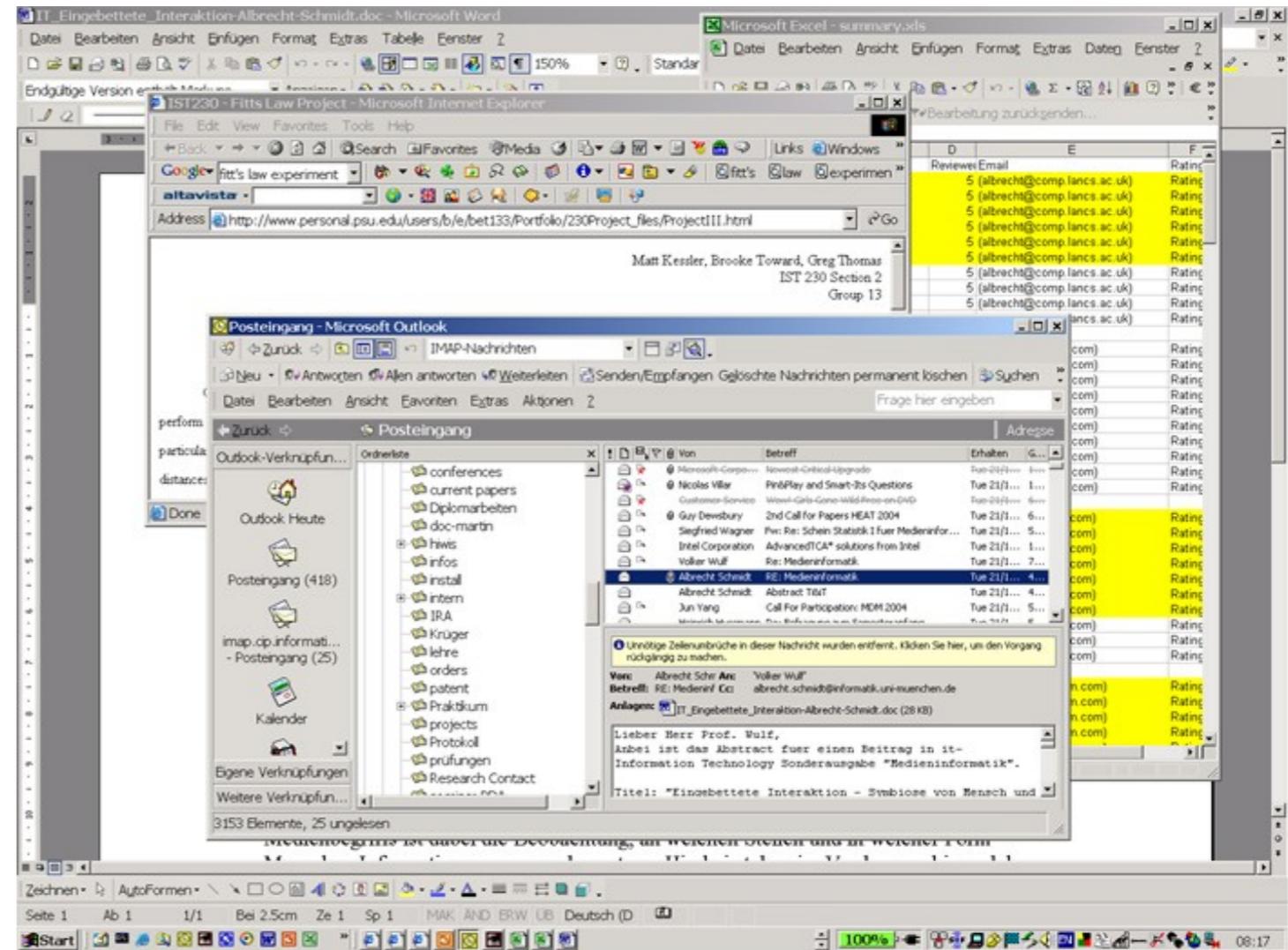
What the Developer Knows

- Users have little idea about:
 - architecture,
 - state transitions,
 - dependencies
 - application context
 - system restrictions
 - ...
- And users often do not want to know about it.



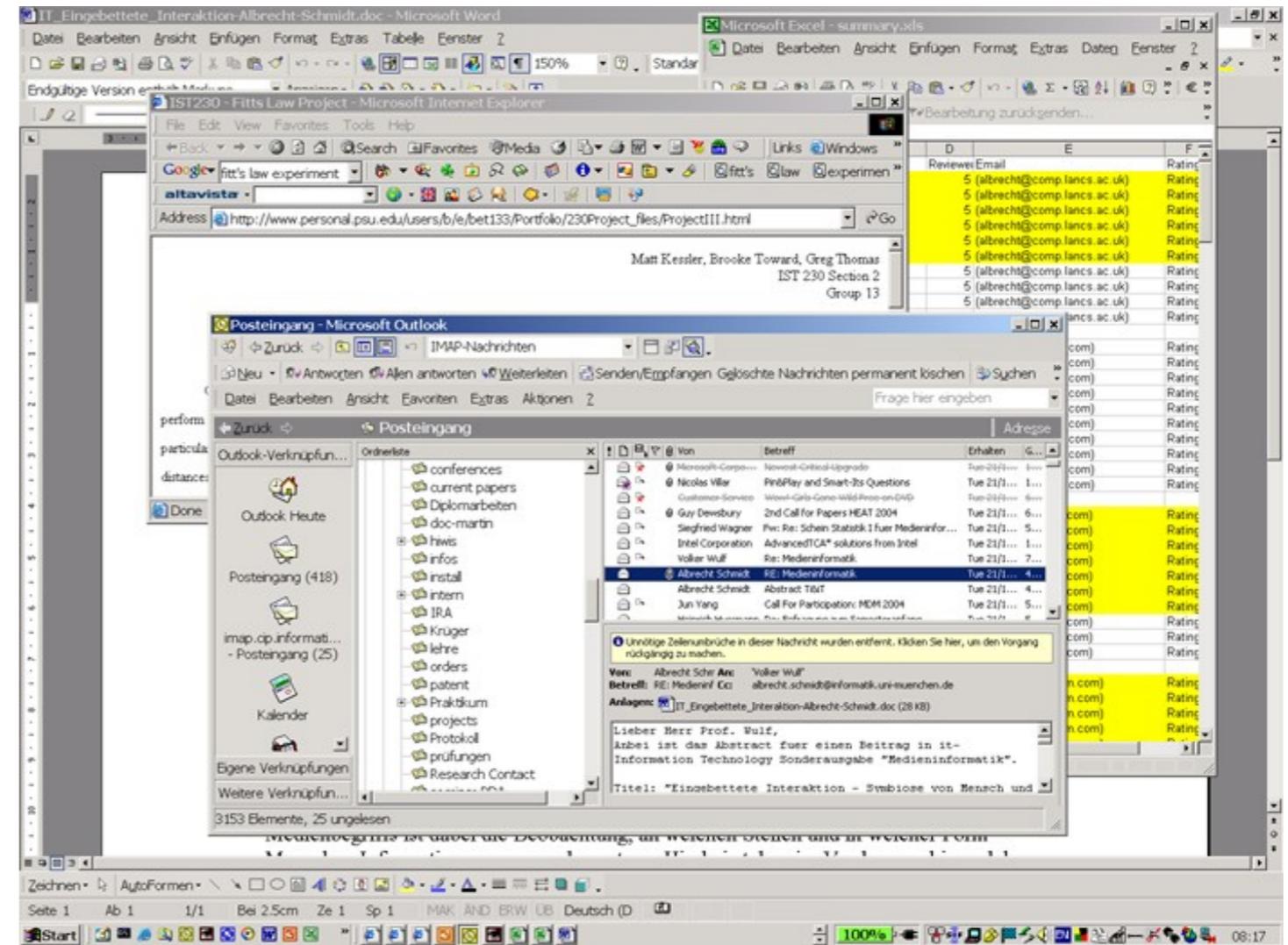
A Computer Screen and its Interpretation

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



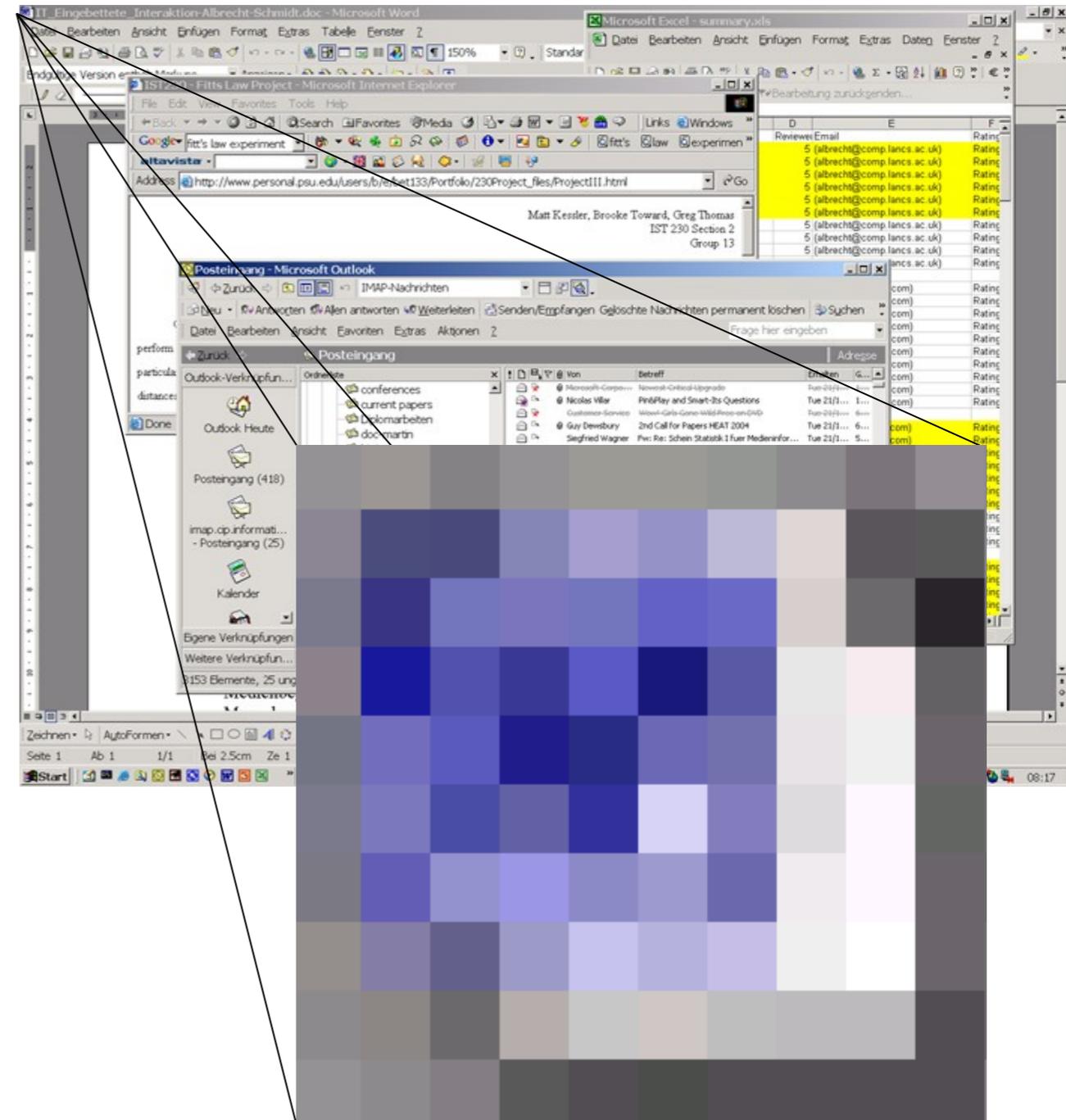
Answers from Skilled Computer Users

- Win2000 desktop
- Text and figures
- Icons and toolbars
- Overlapping windows
- Scroll bars and menus
- Task bar and status information
- Representations of documents



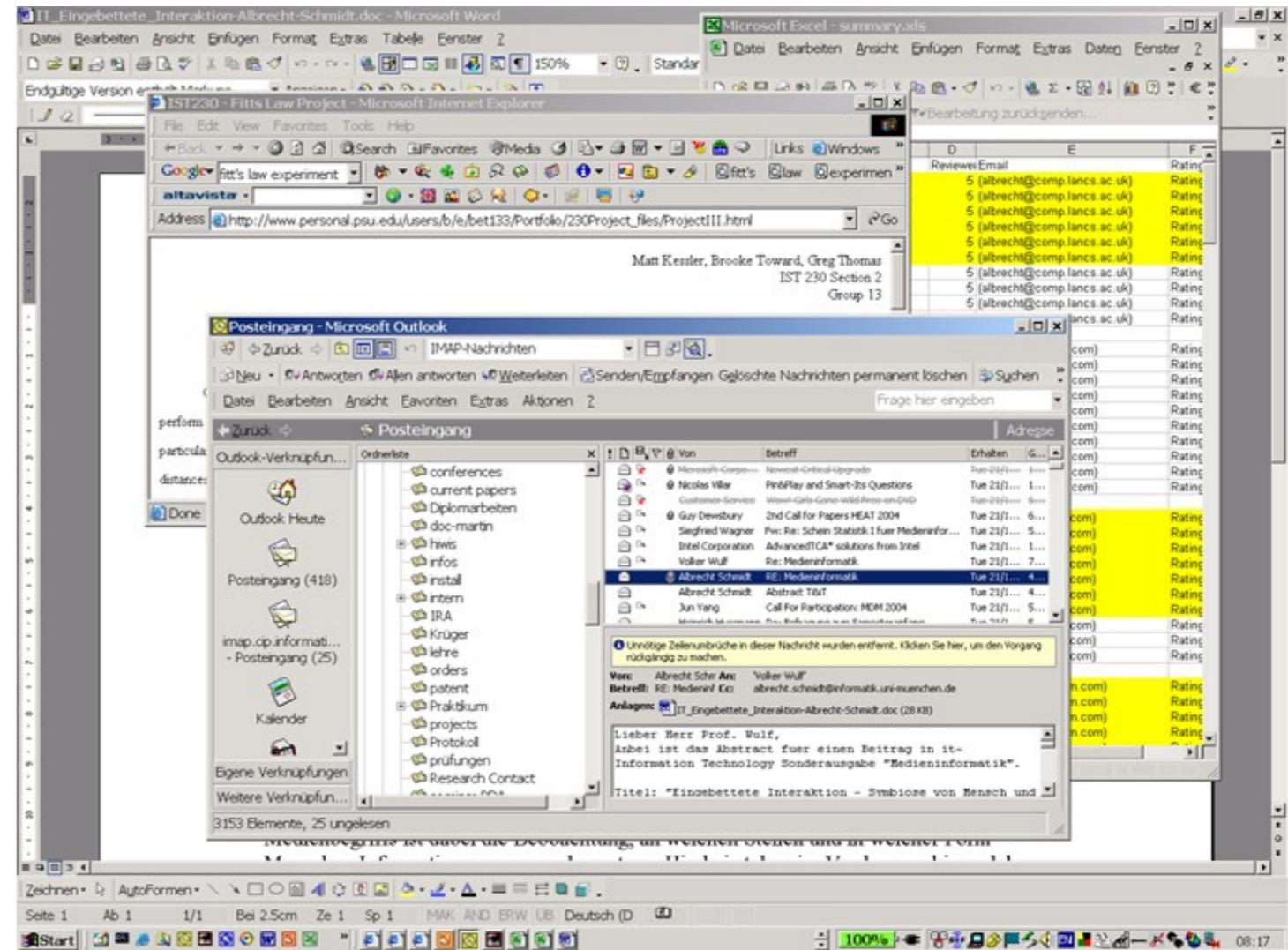
Basic (Naive) Technical Answers

- 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



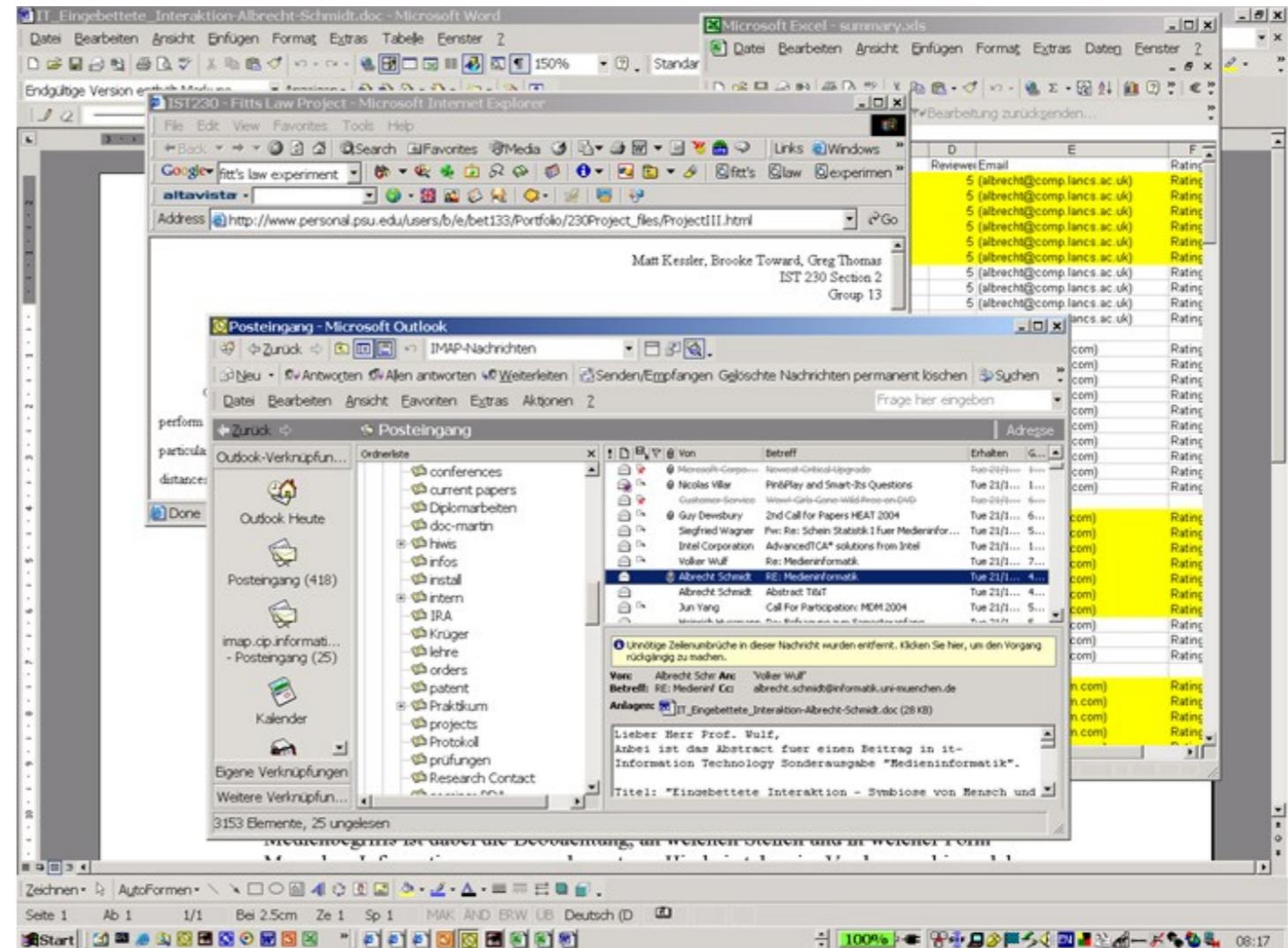
Perfect User's Answers

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



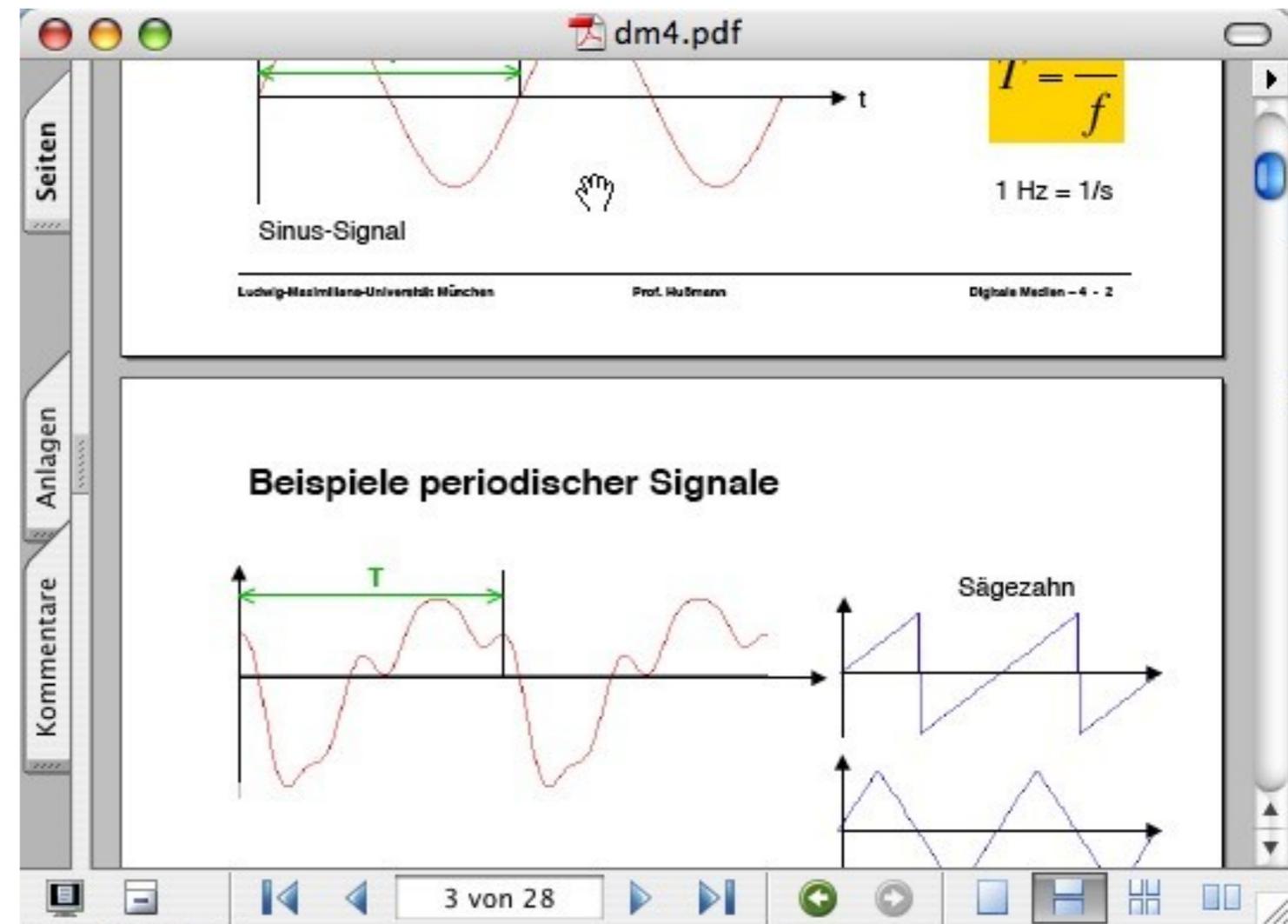
Metaphor Example 1 – Overlaying Windows

- 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...



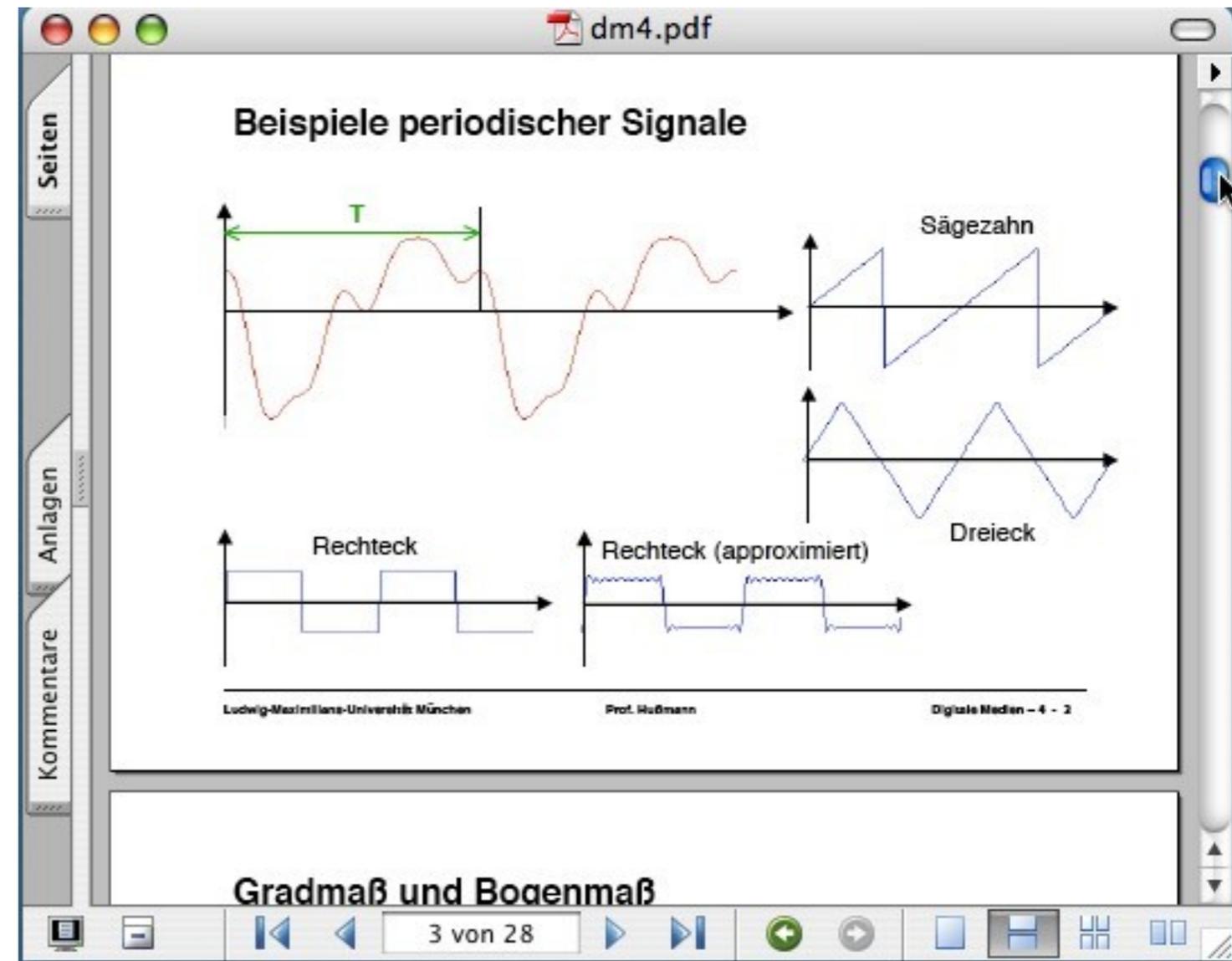
Metaphor Example 2 – Scrollbar vs. Hand

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



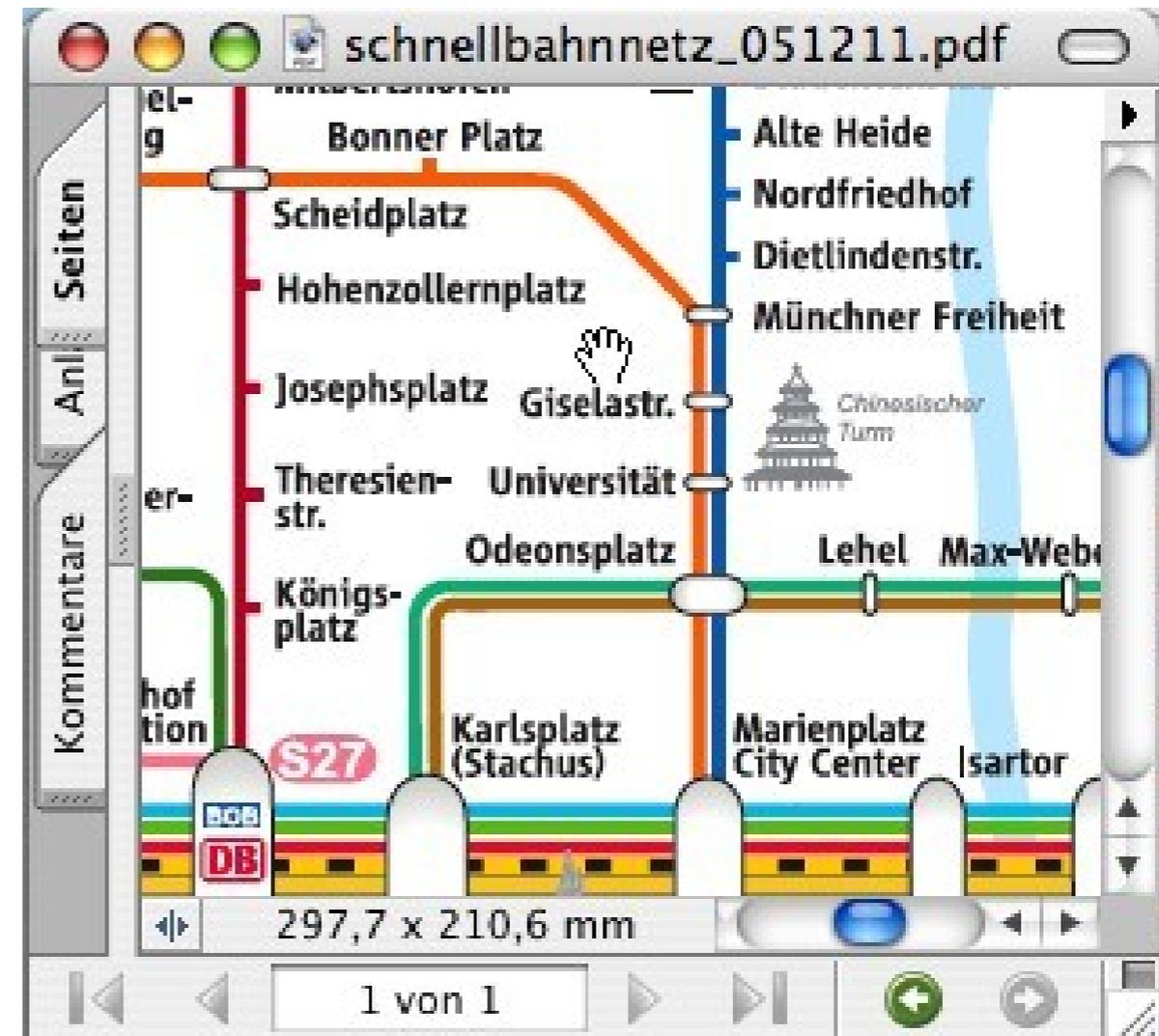
Metaphor Example 2 – Scrollbar vs. Hand

- 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.**
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- 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

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

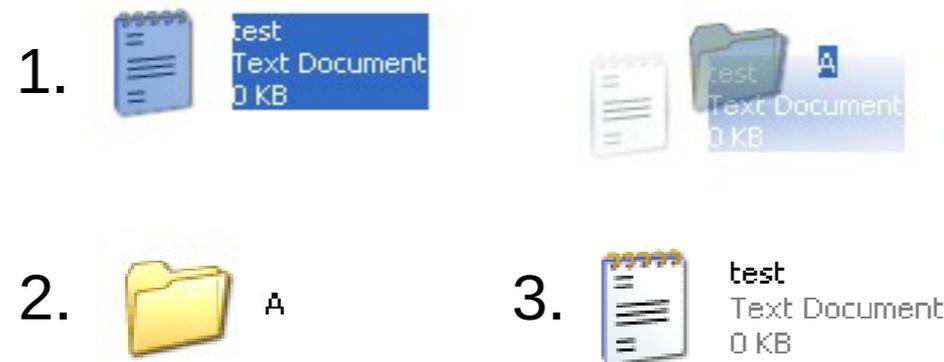
- Predictability

- 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



```
C:\WINDOWS\system32\cmd.exe
C:\>move test.txt test
C:\>dir *.txt
Volume in drive C has no label.
Volume Serial Number is FCB2-566A

Directory of C:\
25.05.2007  12:36                0 installDebug.txt
                1 File(s)                0 bytes
                0 Dir(s)  14,052,261,888 bytes free

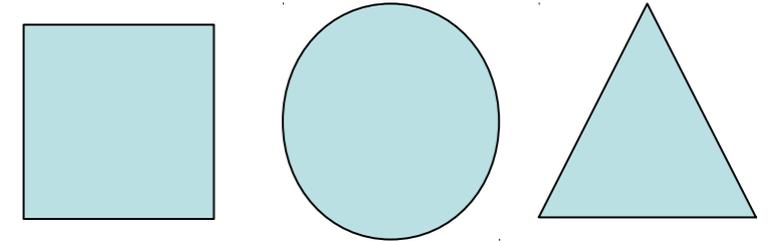
C:\>cd test
C:\test>dir *.txt
Volume in drive C has no label.
Volume Serial Number is FCB2-566A

Directory of C:\test
19.11.2007  16:56                0 test.txt
                1 File(s)                0 bytes
                0 Dir(s)  14,052,261,888 bytes free

C:\test>
```

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

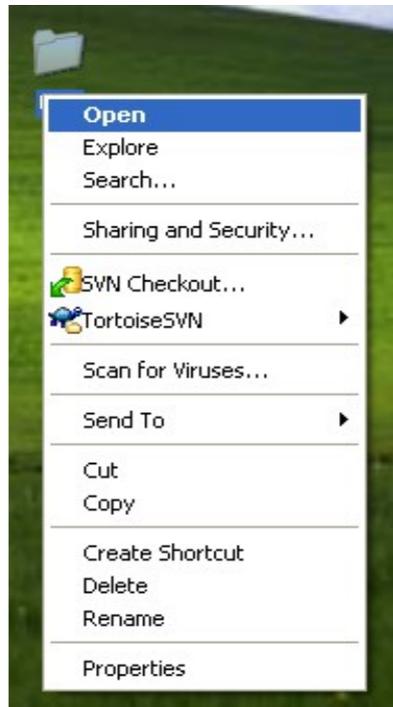




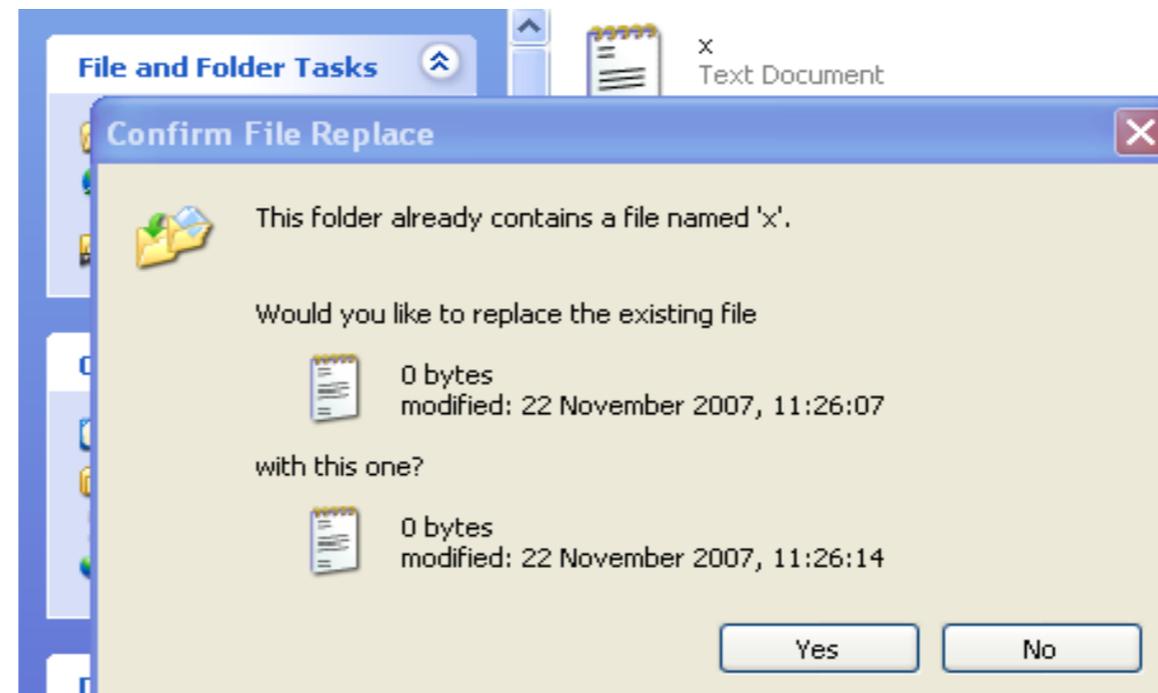
Principles of Flexibility (1 / 6)

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

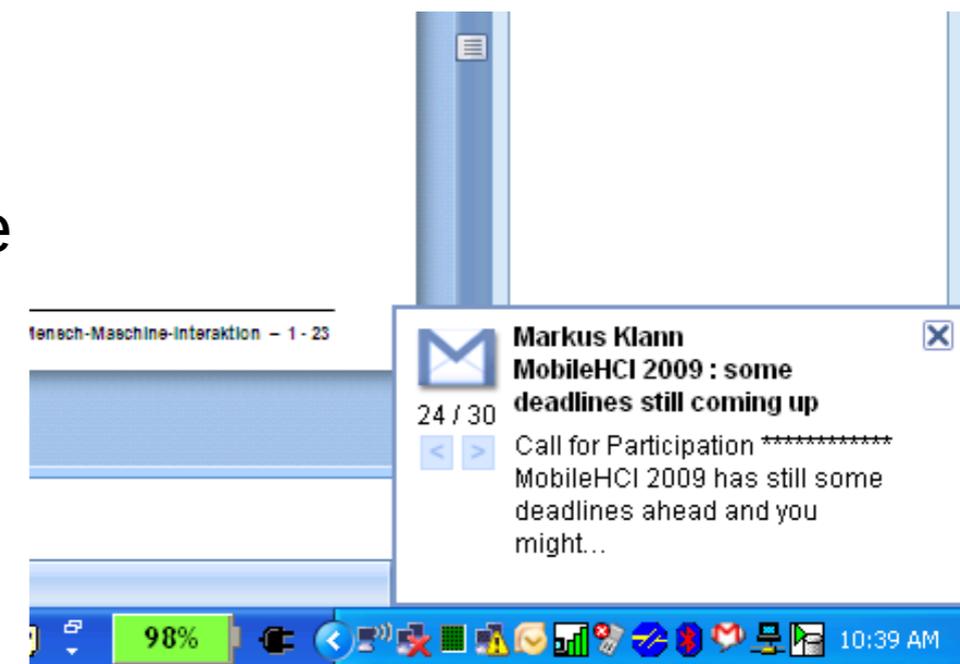


system preemptiveness

Principles of Flexibility (2 / 6)

- Multithreading

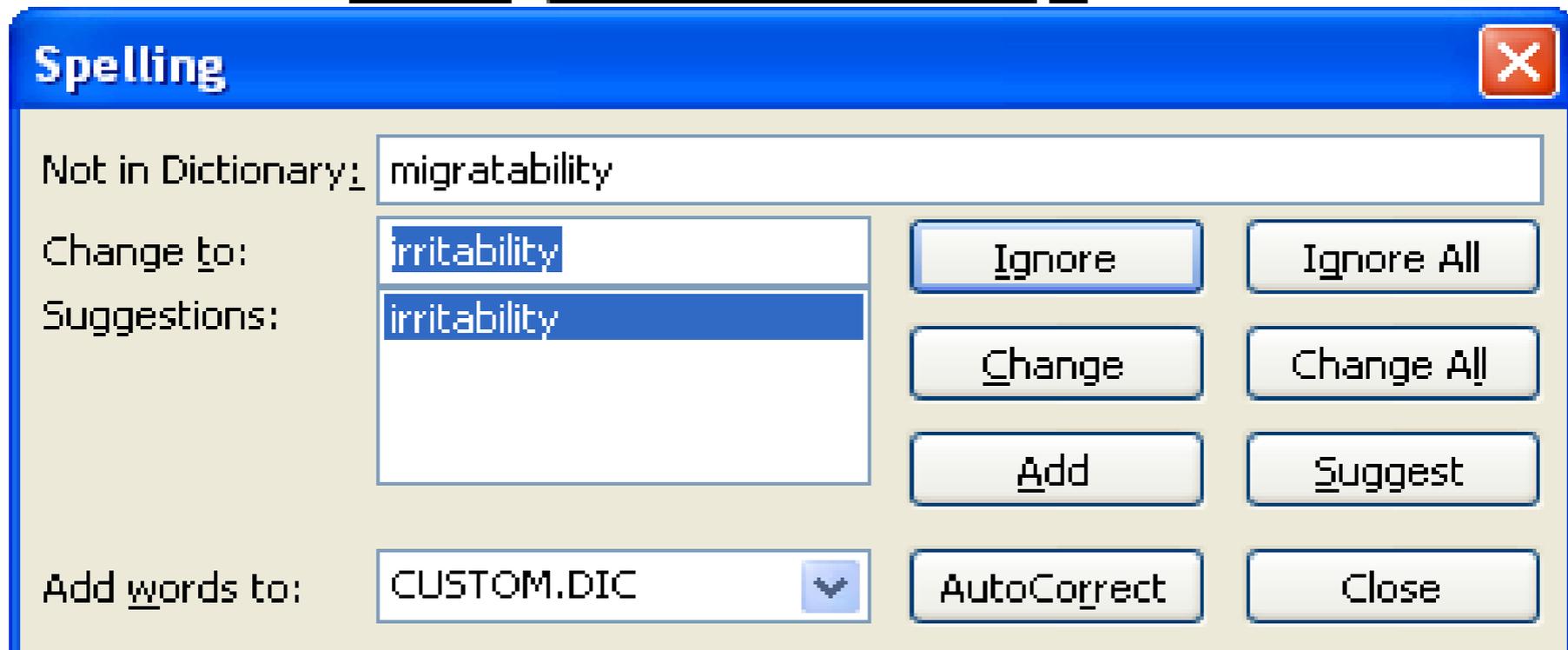
- ability of system to support user interaction for several tasks at a time
- concurrent multimodality: simultaneous communication of information pertaining to separate tasks
 - multi-modal dialog
 - editing text and beep (incoming mail) at the same time
- interleaving multimodality: permits temporal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

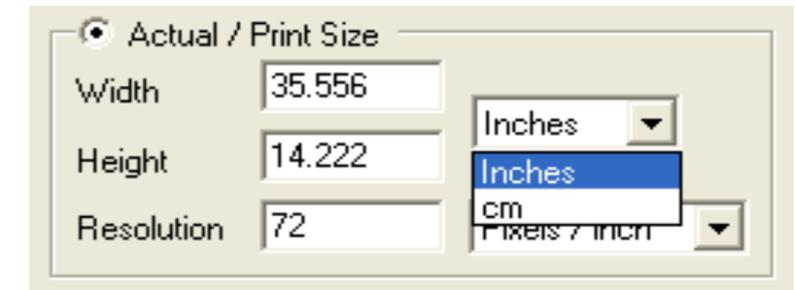
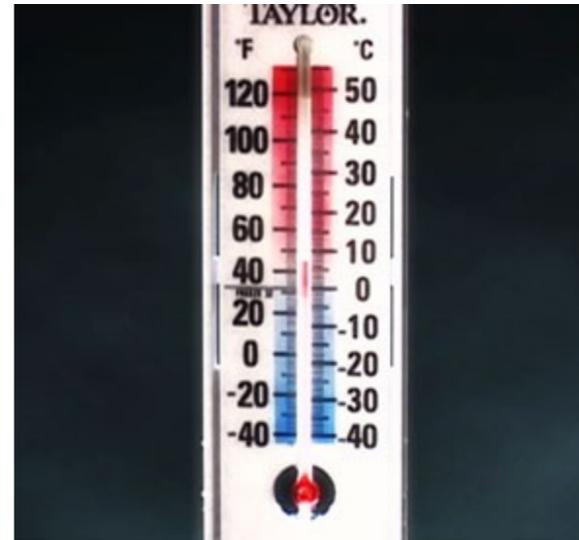
Task **migratability**



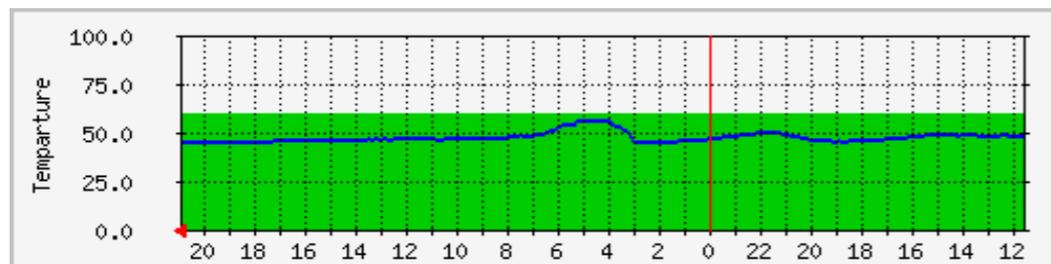
Principles of Flexibility (4 / 6)

- 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

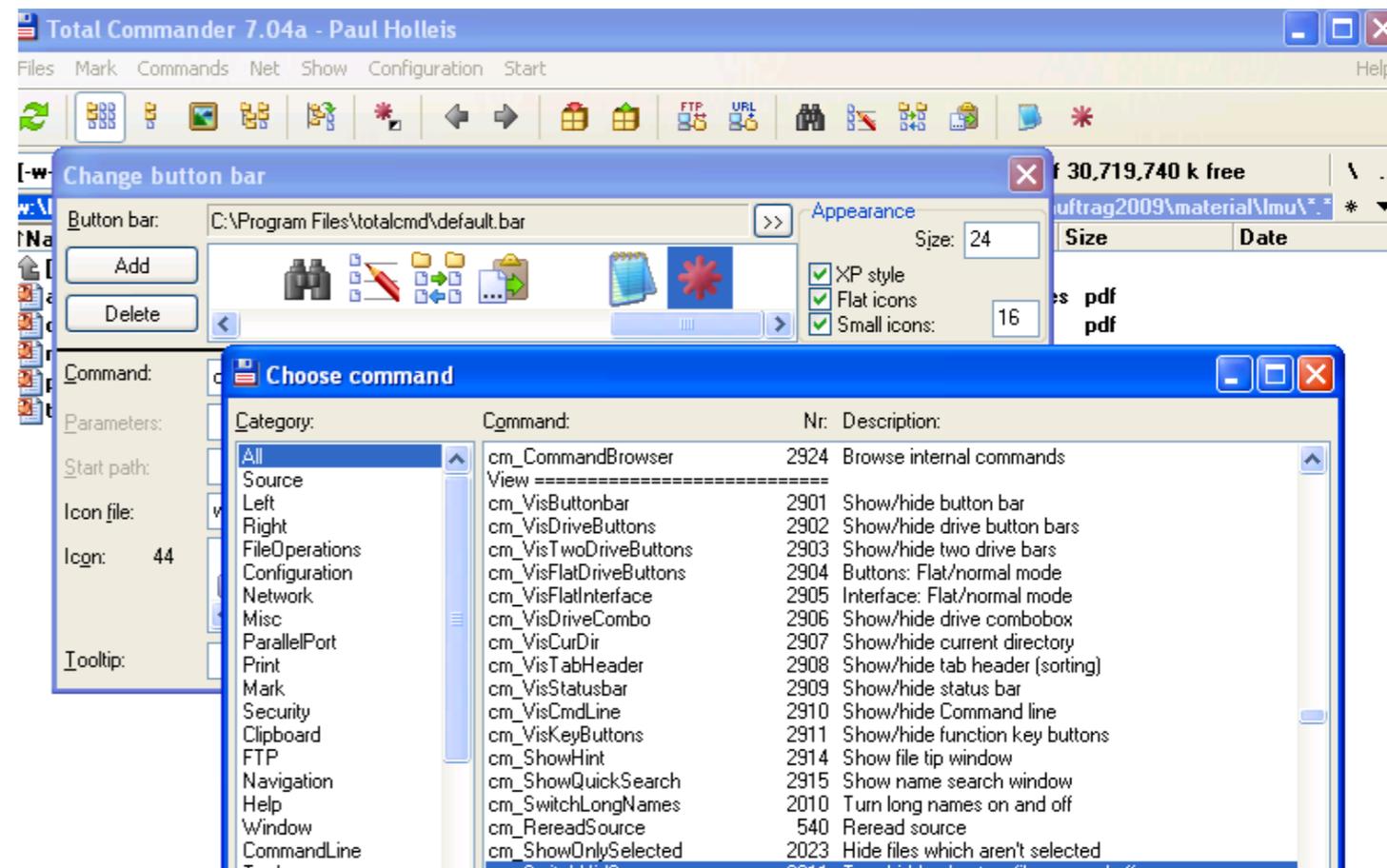
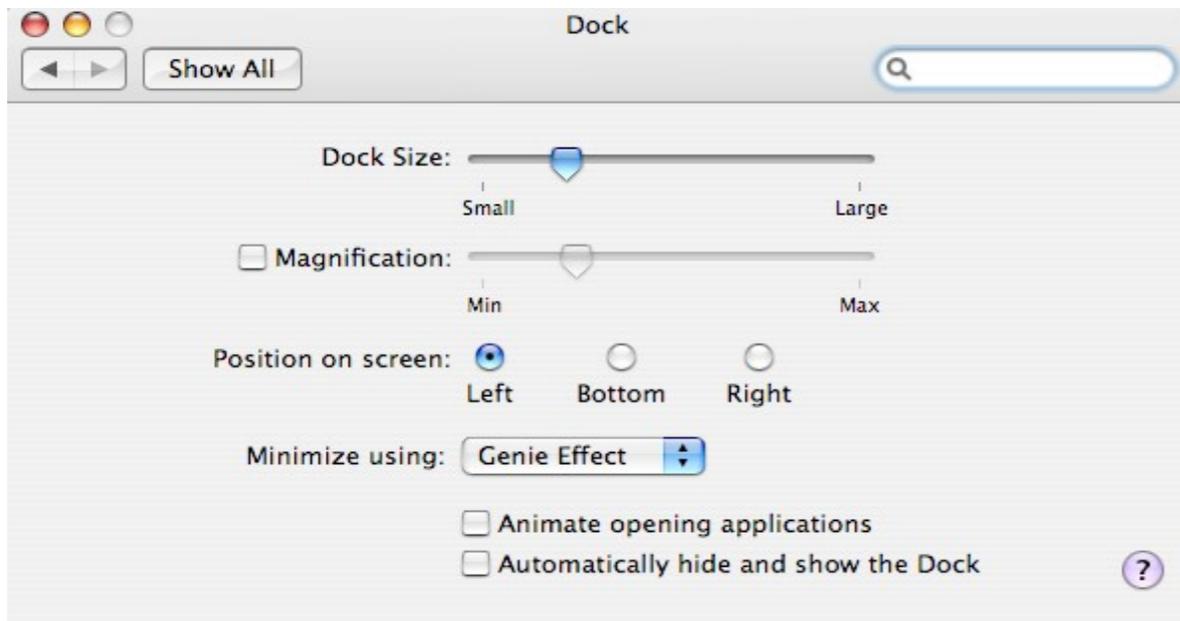


	A	B	C	D
1				
2	Summand 1	1	2	1
3	Summand 2	2	2	2
4	Summand 3	3	3	3
5	Total sum	6	7	6

Principles of Flexibility (5 / 6)

- Customizability

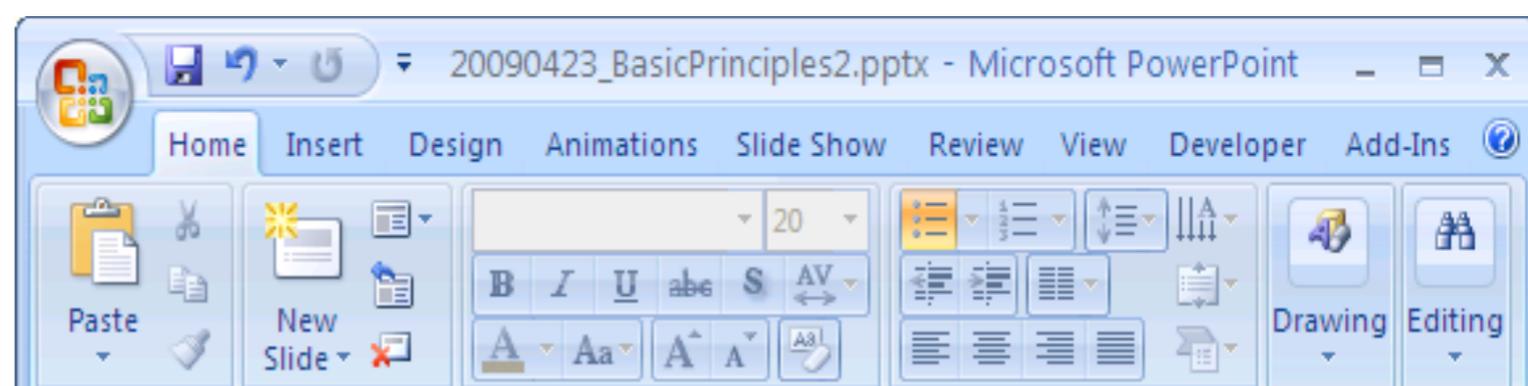
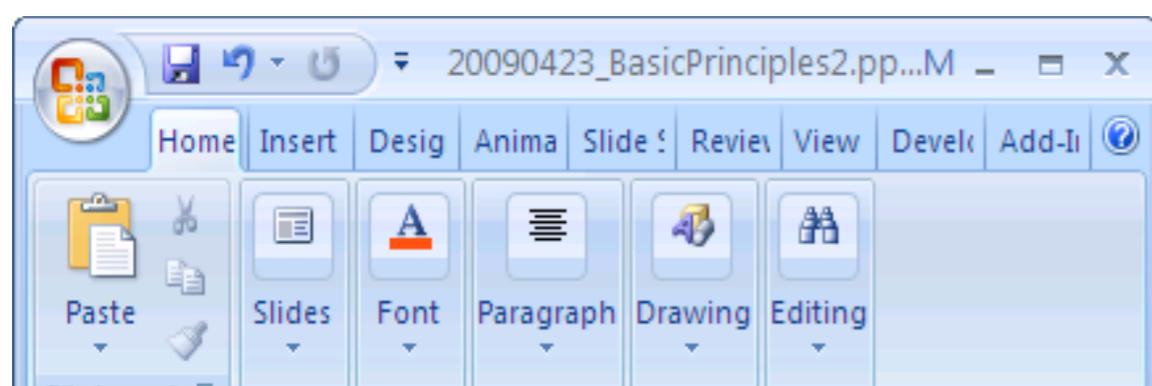
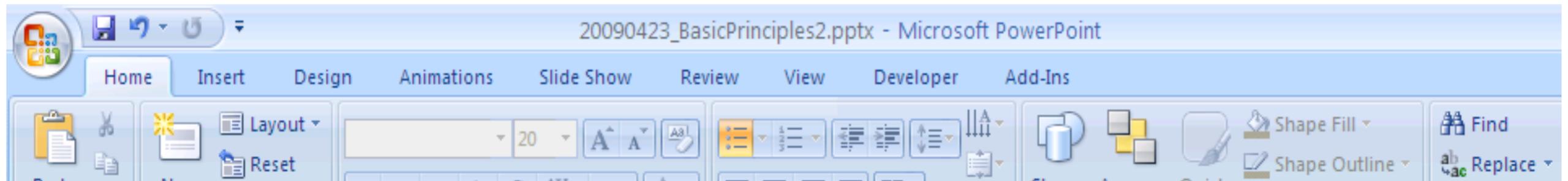
- modifiability of the user interface by the user (adaptability) or system (adaptivity)
- adaptability: users ability to adjust the form of input and output
- adaptivity: automatic customization of the user interface by the system



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



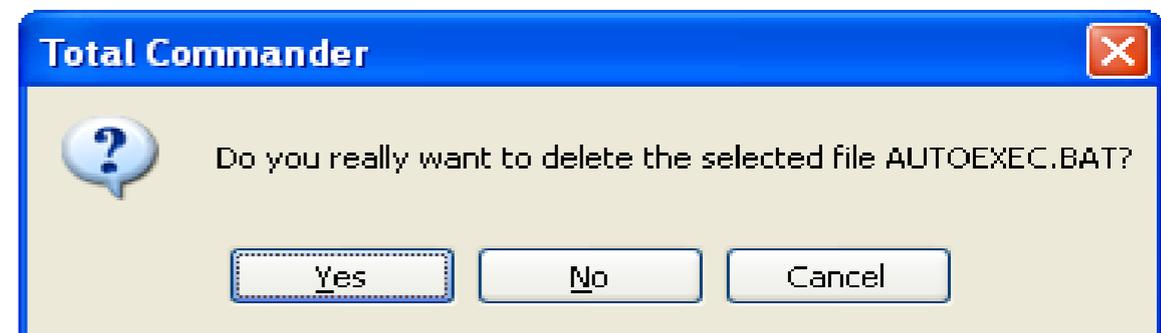
- Observability

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

- Recoverability

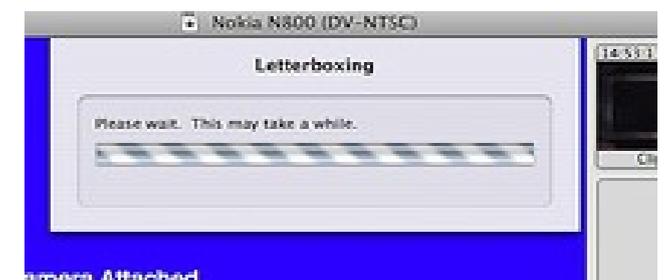
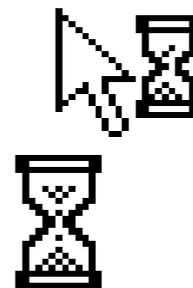


- ability of the user to correct a recognized error
- reachability (states): forward (redo) / backward (undo) recovery
- commensurate effort (more effort / steps for deleting a file than for moving it)



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”]