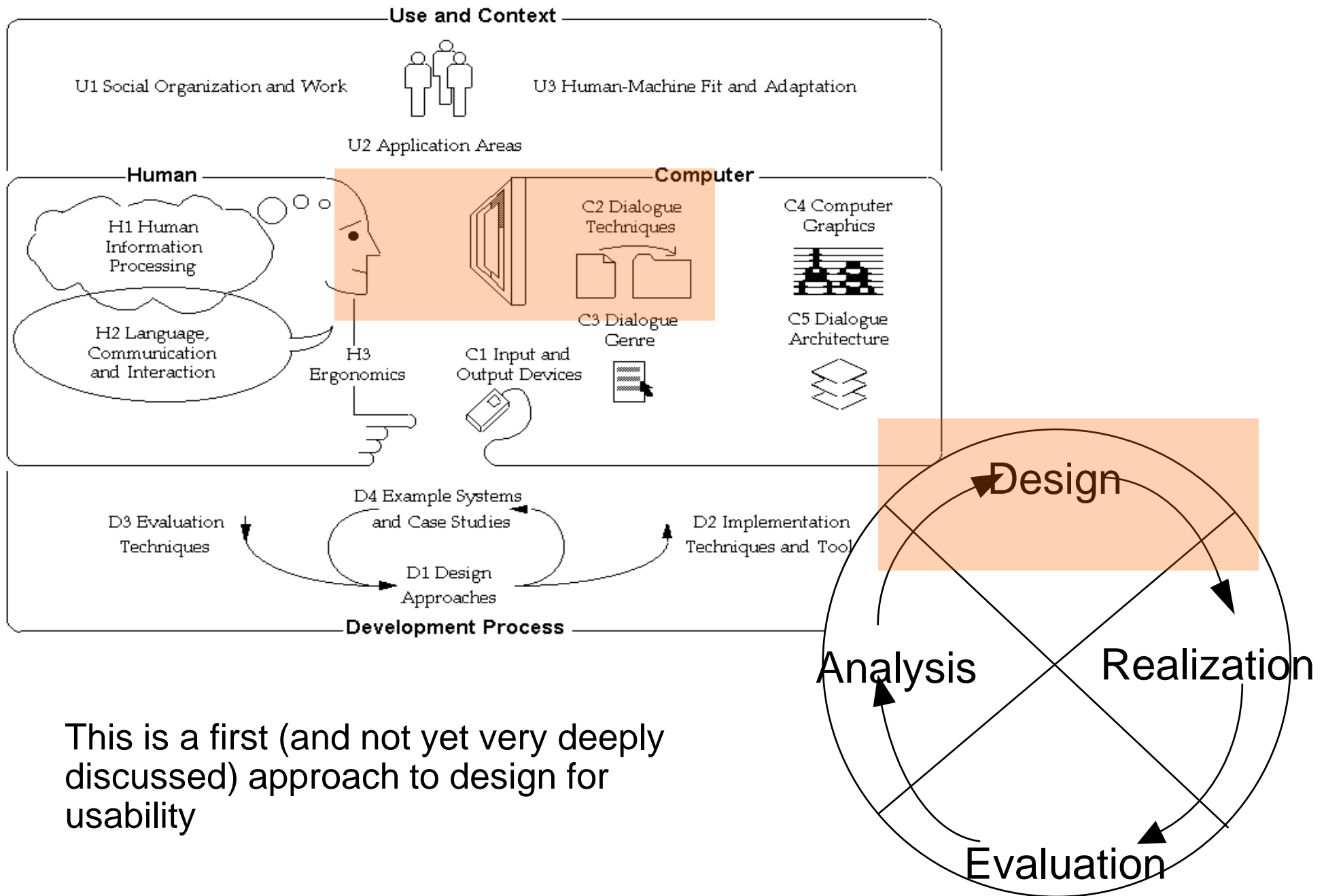


3 Basic HCI Principles and Models

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- 3.2 Descriptive Models for Interaction: GOMS / KLM
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- 3.4 3 Usability Principles by Dix et al.
- 3.5 3 Usability Principles by Shneiderman
- 3.6 Background: The Psychology of Everyday Action



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!



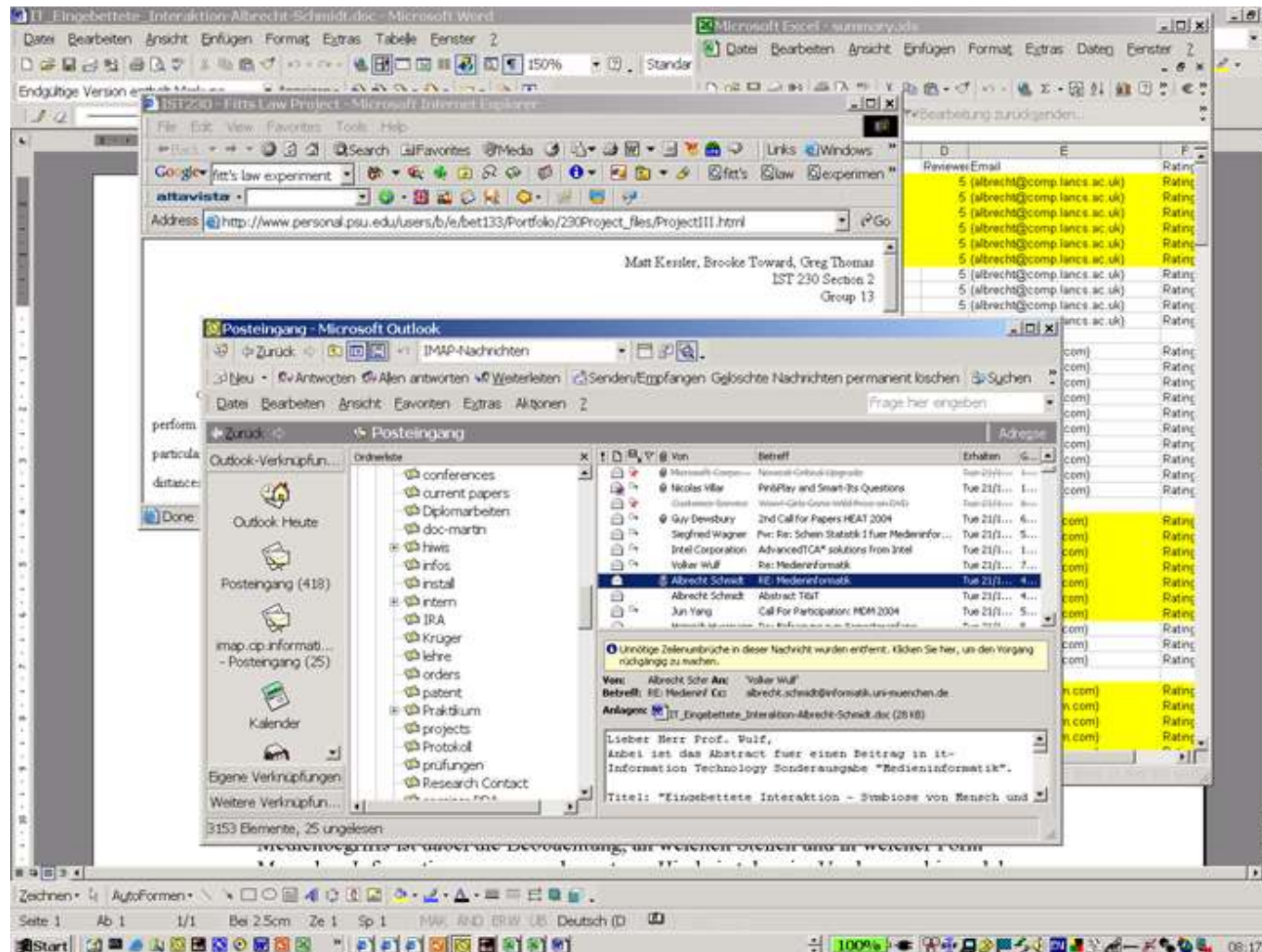
What the Developer Knows



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



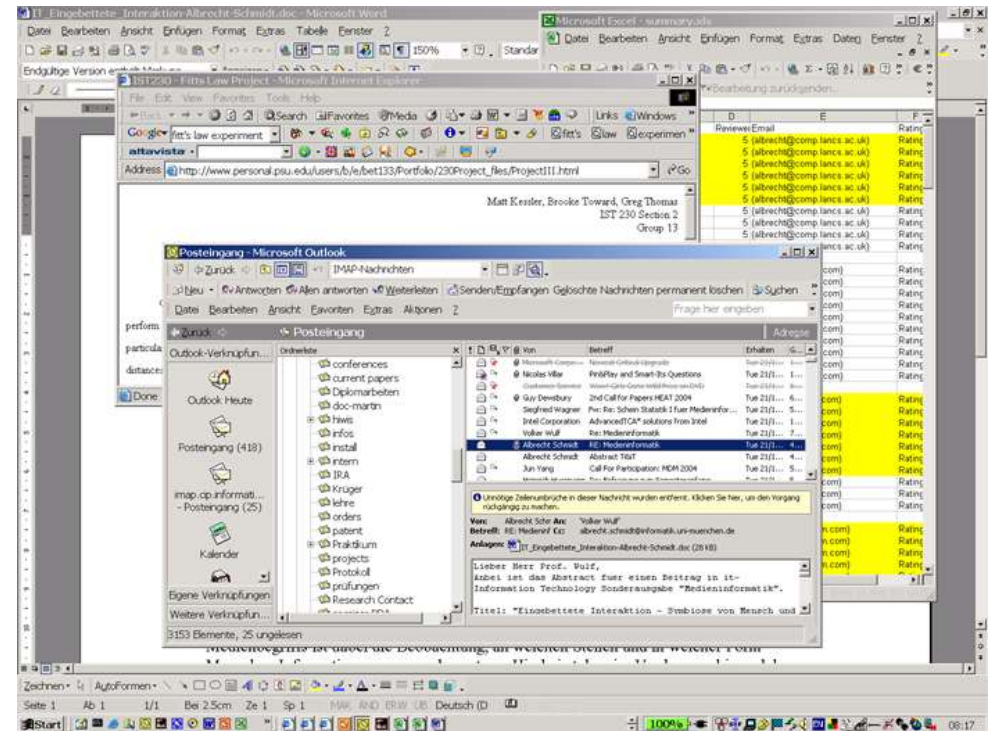
A Computer Screen and its Interpretation



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

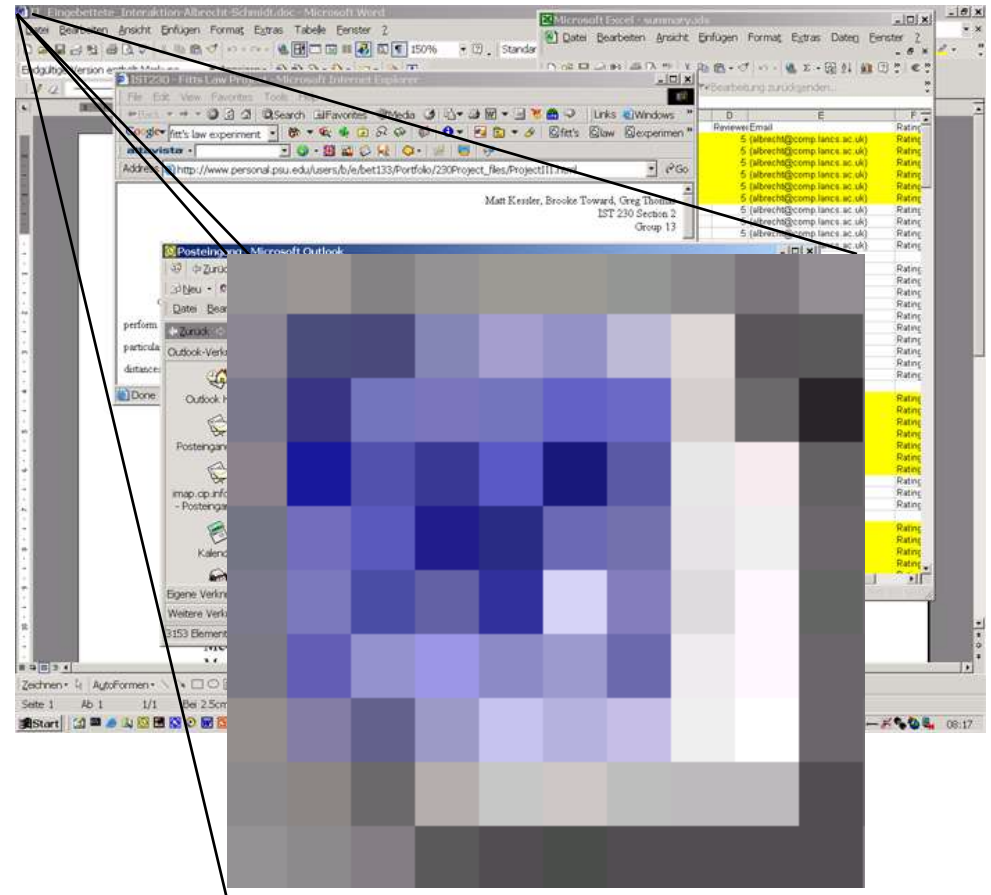
Answers from Skilled Computer Users

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



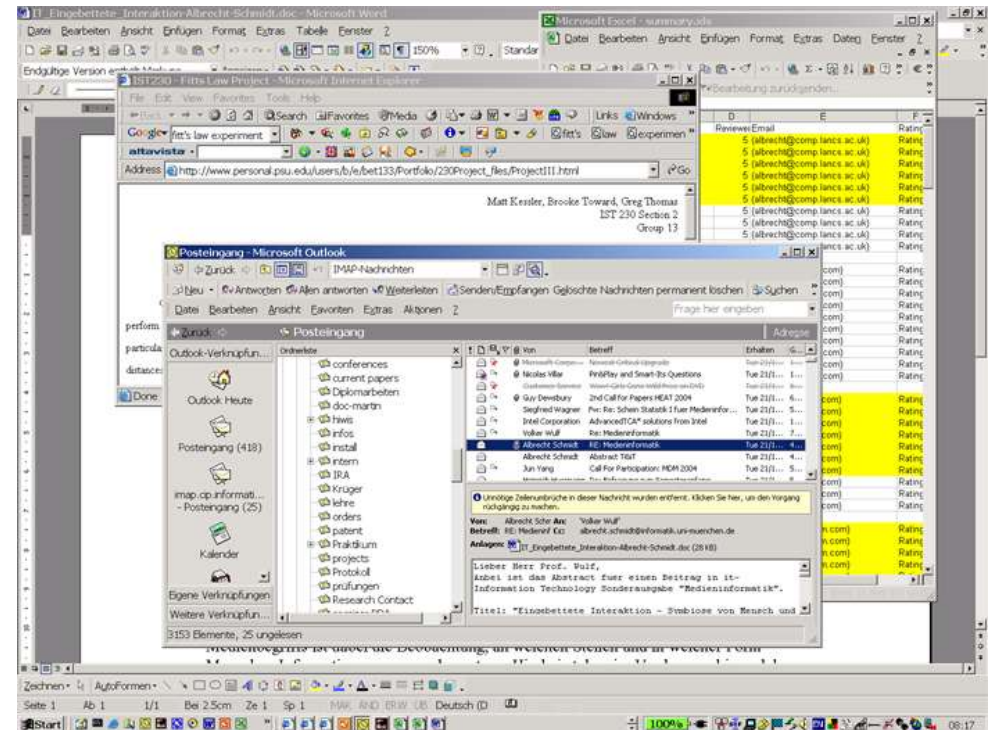
Basic (Naive) Technical Answers

- 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



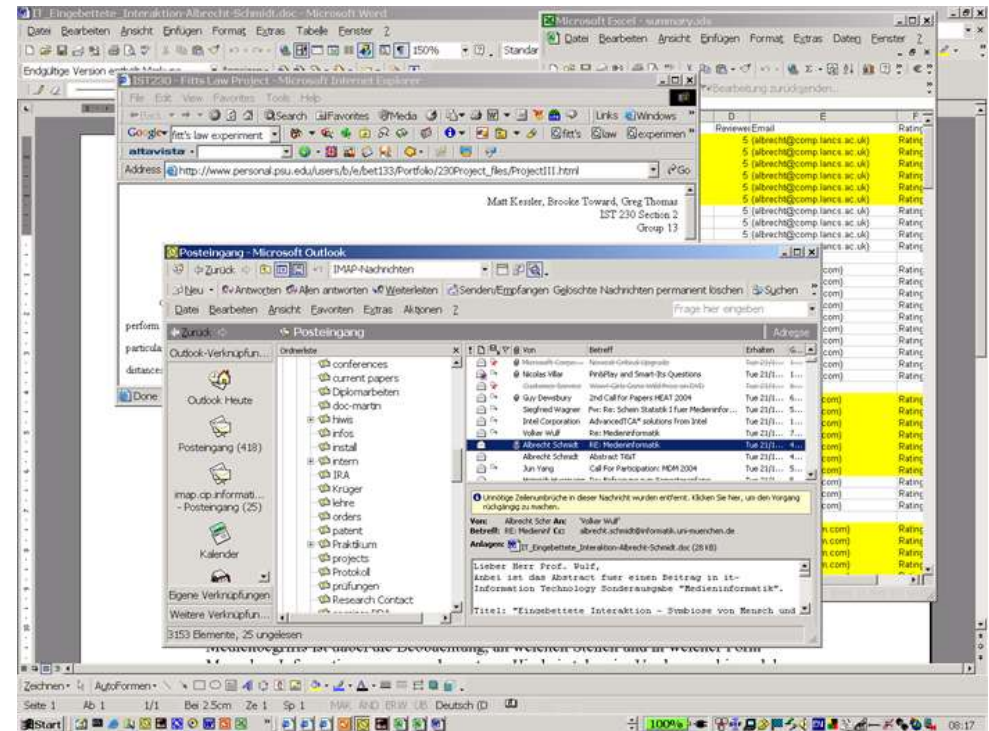
Perfect User's Answers

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



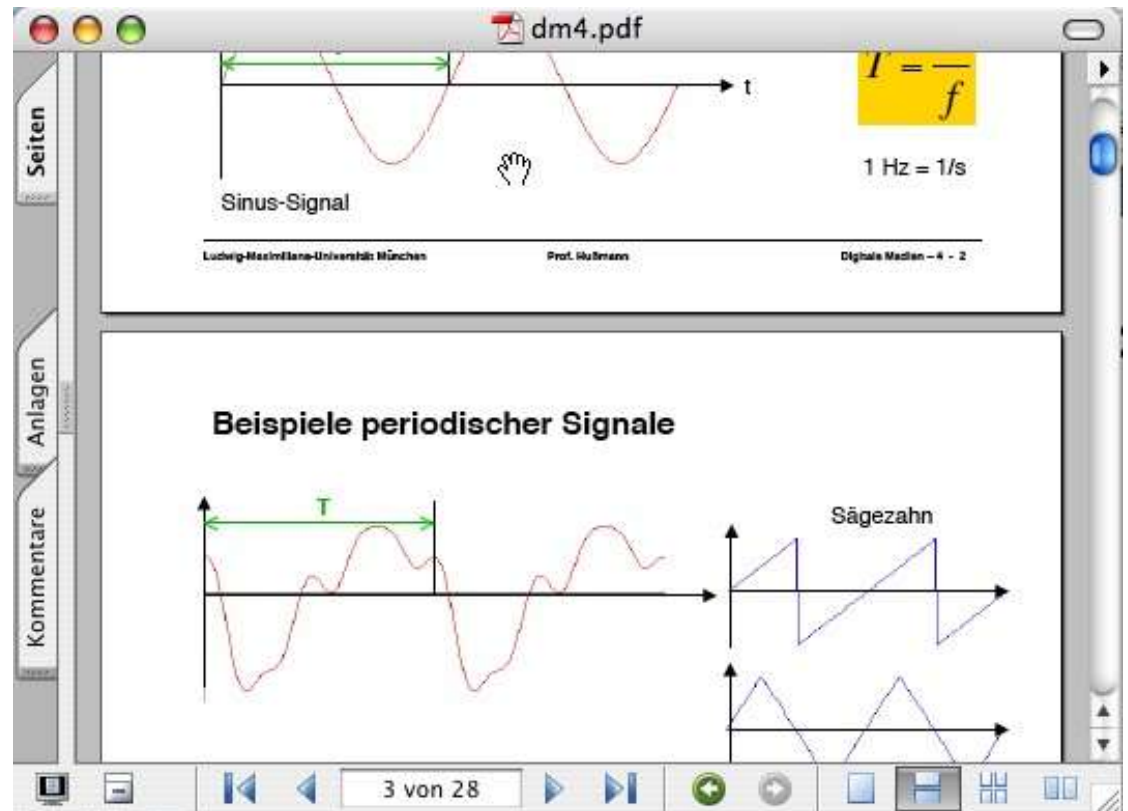
Metaphor Example 1 – Overlaying Windows

- 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...



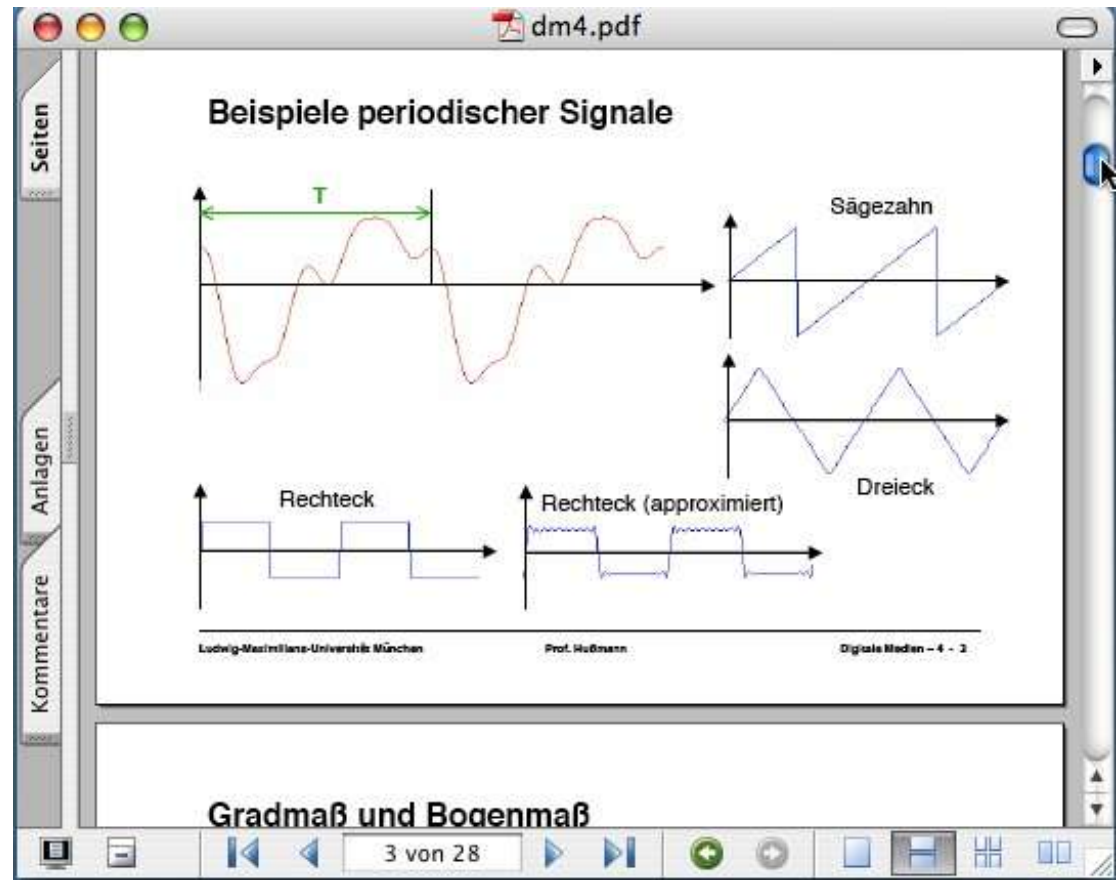
Metaphor Example 2 – Scrollbar vs. Hand

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



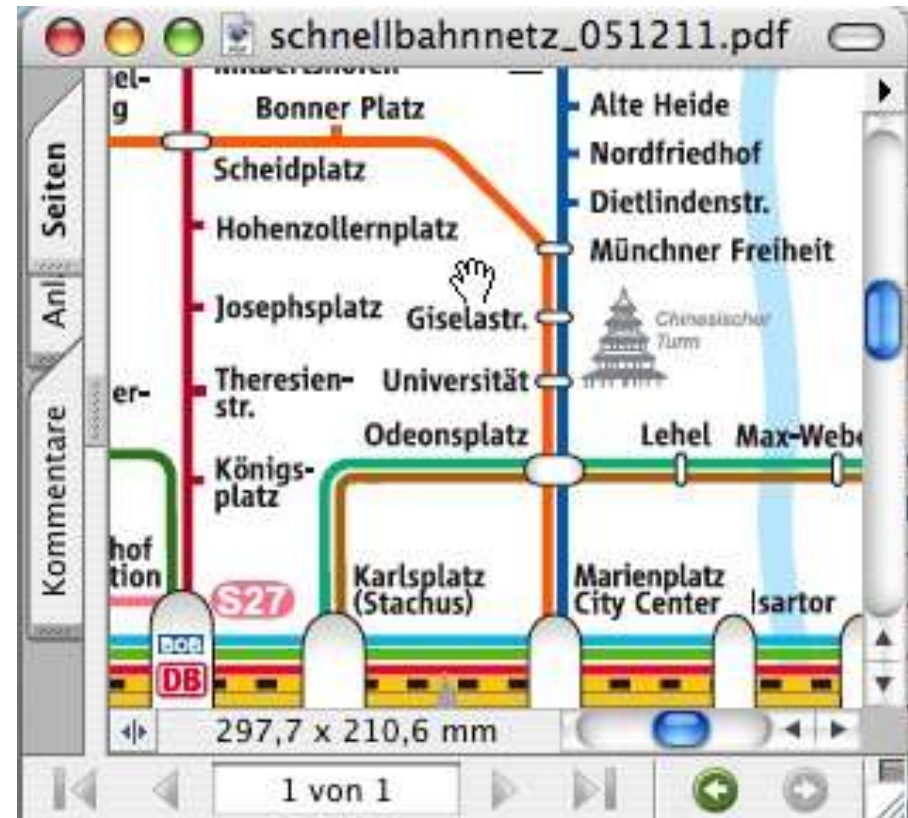
Metaphor Example 2 – Scrollbar vs. Hand

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



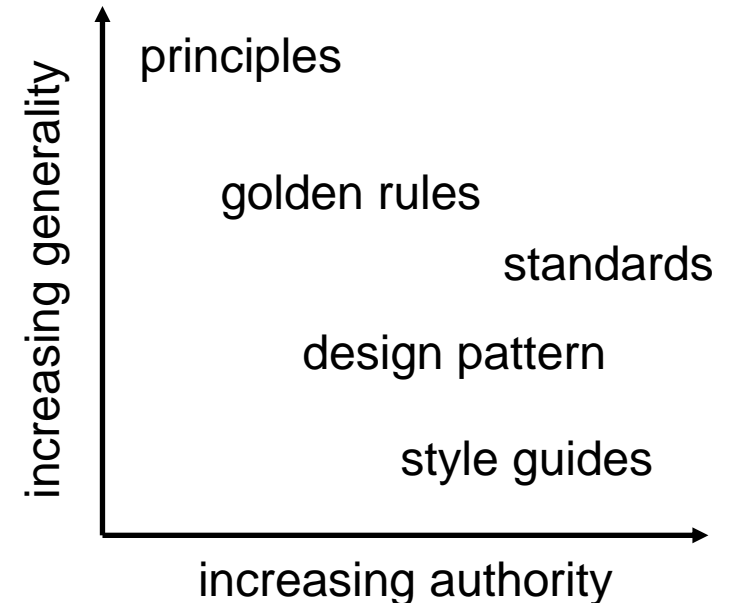
Metaphor Example 2 - Scrollbar vs. Hand

- 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 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?

3 Basic HCI Principles and Models

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Principles to Support Usability

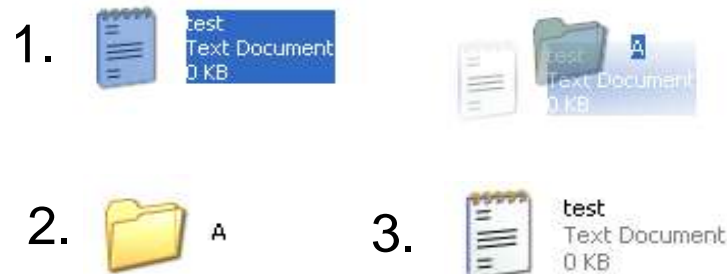
- Learnability
 - the ease with which new users can begin effective interaction and achieve maximal performance
- Flexibility
 - the multiplicity of ways the user and system exchange information
- Robustness
 - the level of support provided to the user in determining successful achievement and assessment of goal-directed behavior

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

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

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



```
CA 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

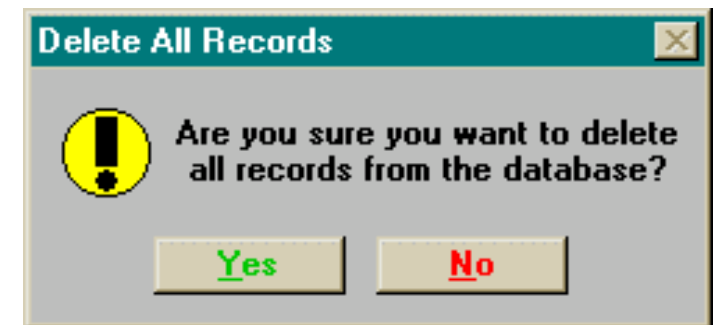
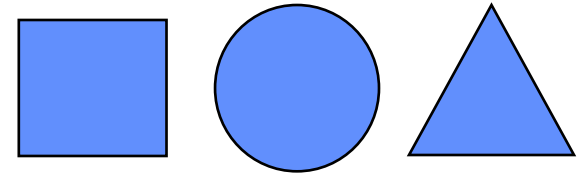
C:\>cd test
C:\test>dir *.txt
Volume in drive C has no label.
Volume Serial Number is FCB2-566A

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

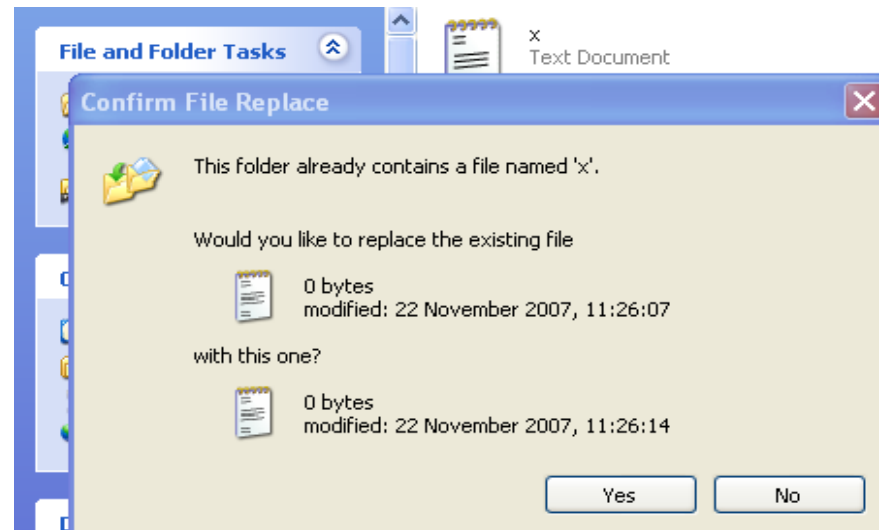


Principles of Flexibility (1 / 6)

- 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



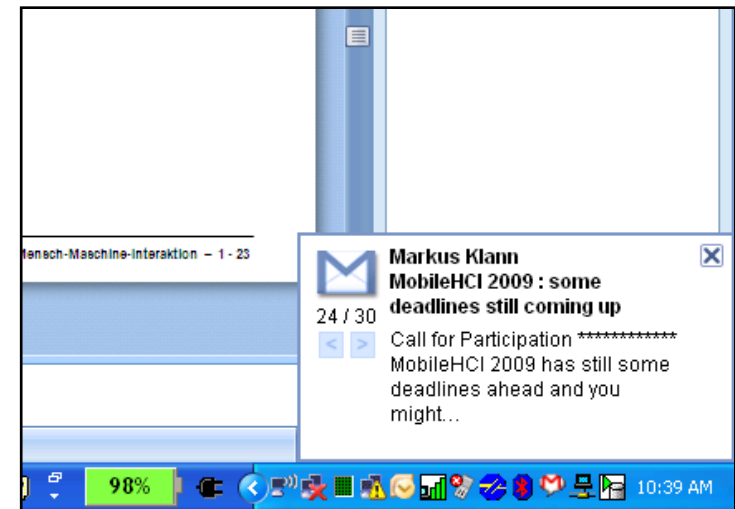
user preemptiveness



system preemptiveness

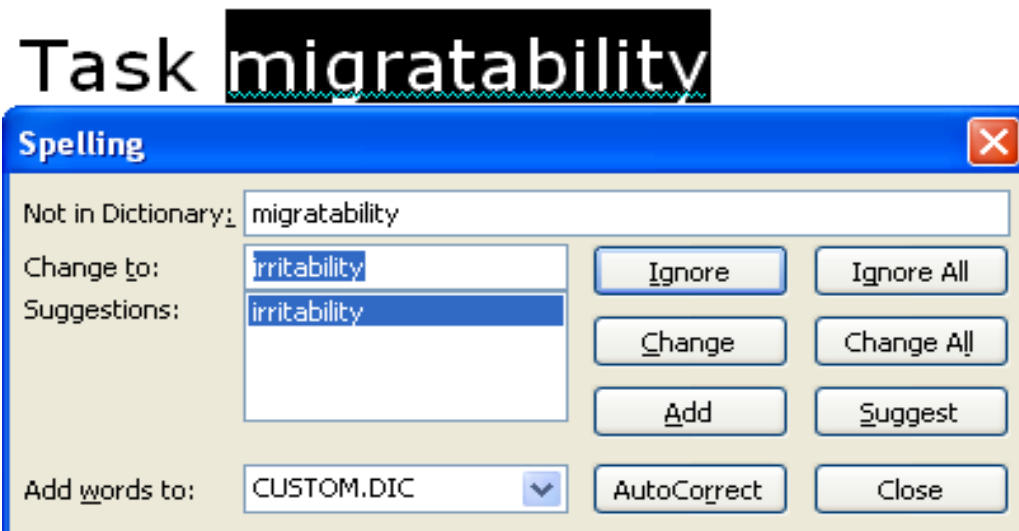
Principles of Flexibility (2 / 6)

- 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



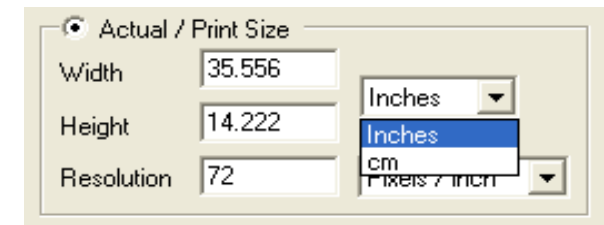
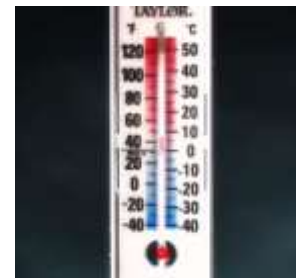
Principles of Flexibility (3 / 6)

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

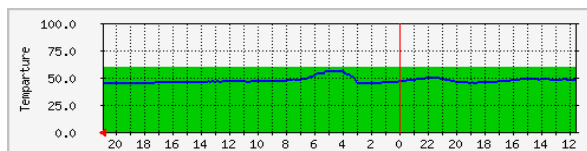


Principles of Flexibility (4 / 6)

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



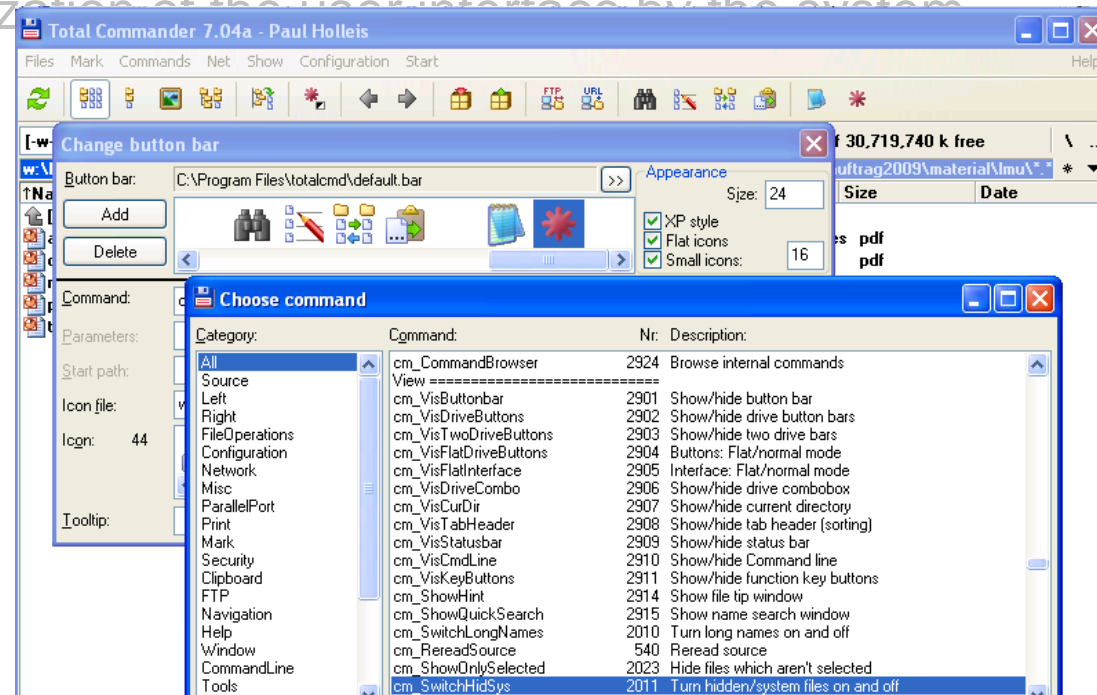
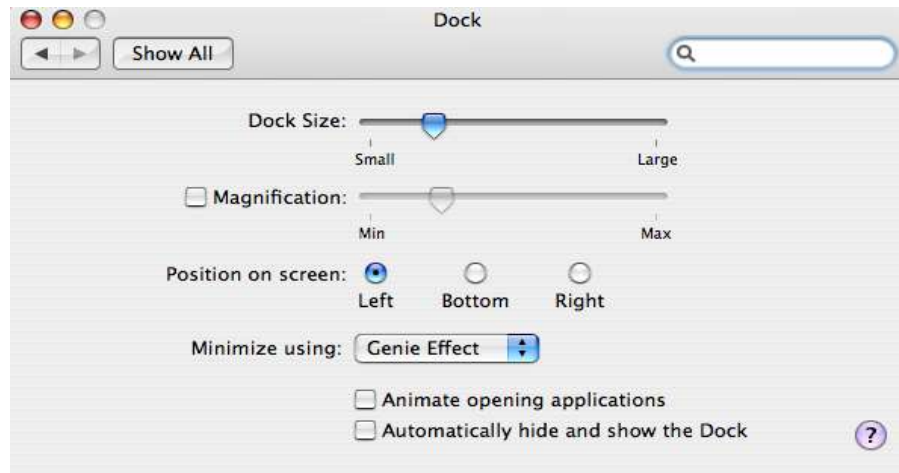
- equal opportunity: blurs the distinction between input and output



	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

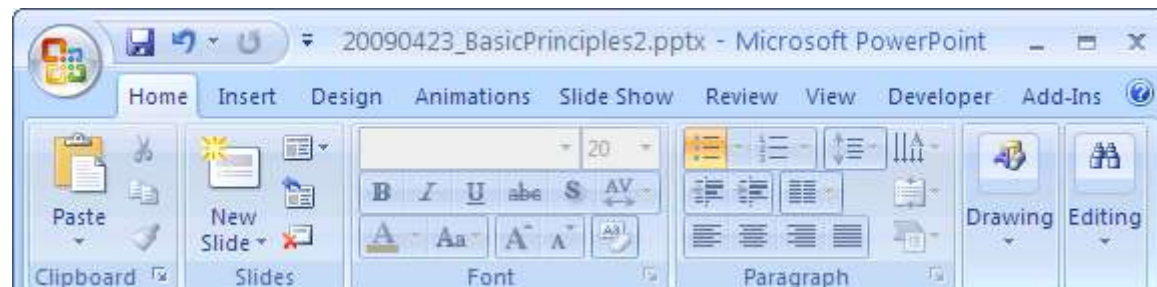
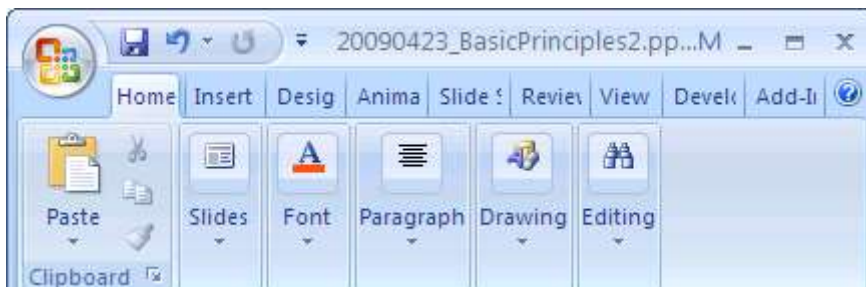
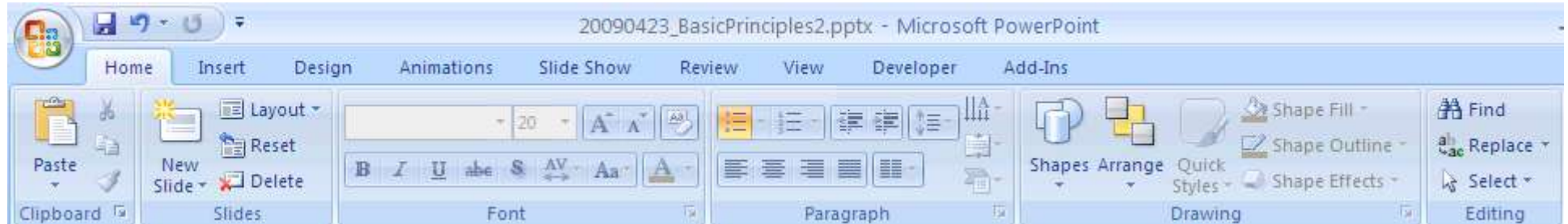
Principles of Flexibility (5 / 6)

- 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
 - 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)

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

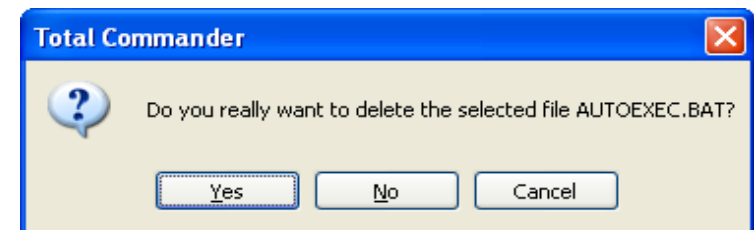


- ability of the user to evaluate the internal state of the system from its perceivable representation

- Recoverability

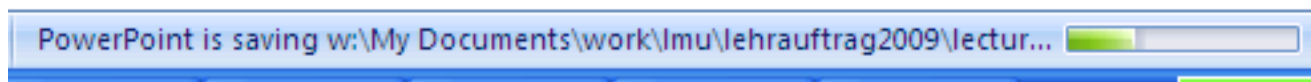


- ability of the user to correct a recognized error
- reachability (states): forward (redo) / backward (undo) recovery
- commensurate effort (more effort / steps for deleting a file than for moving it)



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 ($< 100\text{ms}$)
 - stability and indication of response time



Letterboxing: Please wait.
This may take a while.

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”]

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