3 Basic HCI Principles and Models

Principles for User Interface (UI) design

- Implementation and technology independent principles
  - Provide a rough guideline for design
  - To be supplemented by more detailed analyses (see later)
- Ben Shneiderman's list of principles
  - **Principle 1 : Recognize User Diversity**
  - **Principle 2 : Follow the 8 Golden Rules**
  - **Principle 3 : Prevent Errors**

http://media.pearsoncmg.com/aw/aw_shneiderma_dtui_4/chapter2.pdf

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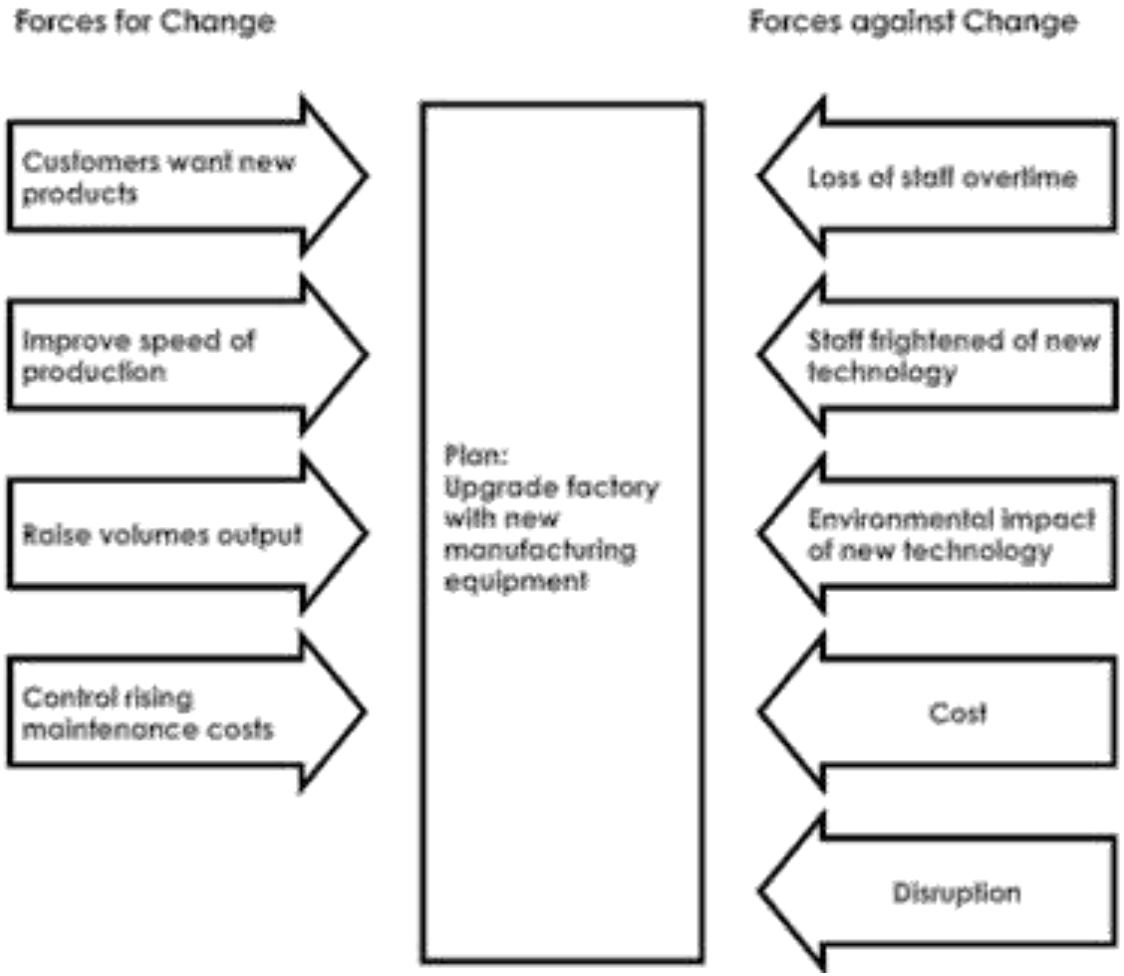
Principle 1: Recognize User Diversity

- Obvious and simple (?) - nevertheless in reality extremely difficult
- To be done *before* the design
- Basic concepts to structure the problem
  - Usage profiles
    - » Different types of users
    - » Different types of usage scenarios
    - » Dependent on the situation of the user
  - Task profiles
    - » What is the goal of the user?
    - » How does the user want to achieve the goal?

Usage Profiles – Stakeholders

- Possible stakeholders
  - Shareholders
  - Government
  - Senior executives
  - Your coworkers
  - Suppliers
  - The press
  - Interest groups
  - Customers
  - Analysts
  - The public
  - The community
  - Your family

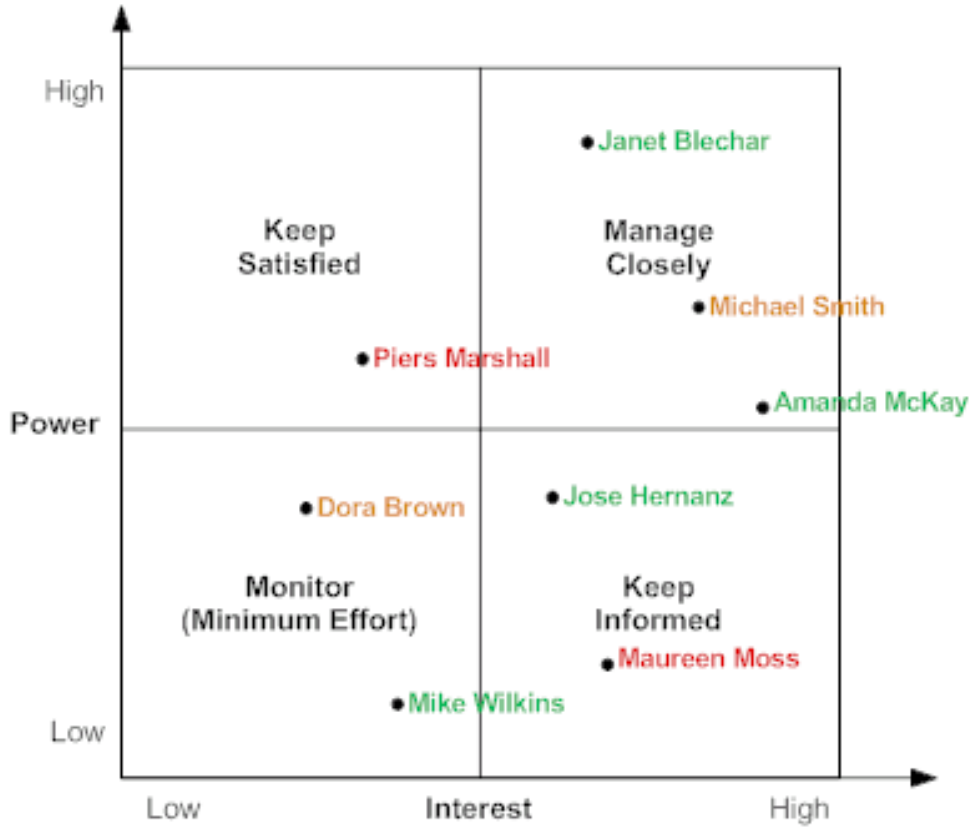


Force-field Analysis

http://www.mindtools.com

Usage Profiles – Approach

- Identify stakeholders
  - Brainstorming
  - Review past projects
  - Interviews
- Categorise stakeholders
  - Amount of interest
  - Amount of influence
  - Positive / negative attitude
  - Reasons for attitude
- Draw a force-field analysis and keep it in mind throughout the project



Power vs. interest grid

http://www.mindtools.com

Usage Profiles – More than the People

- “Know thy user”
  (Wilfred J. Hansen, User Engineering Principles for Interactive Systems, 1971)
- Starting point for design: what is the background of the user?
  - Different people have different requirements for their interaction
- Complex multi-dimensional classification problem!
- Issues to be taken into account
  - Goals, motivation, personality
  - Education, cultural background, training
  - Age, gender, physical abilities, …
  - Multiple user communities, various combinations of background
- Well-known and frequently used classification
  - Novice users
  - Knowledgeable intermittent users
  - Expert frequent users

Task Profiles

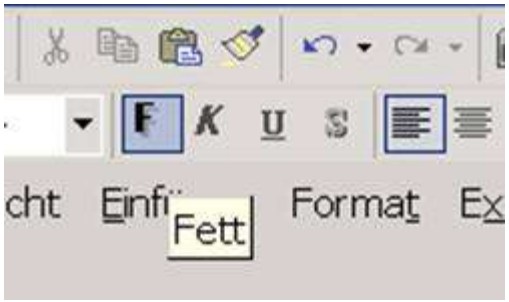
- The goal: find out what the user is trying to do!
  - Needs of users, goals and resulting tasks
- Supported tasks should be determined before the design starts
  - Determine granularity of atomic tasks: flexibility vs. ease of use
- Functionality should *only* be added if identified to help solving tasks
  - Temptation: ~~add unneeded functionality only because it is "cheap" to achieve~~!
- Frequency of actions (relative to user profiles) leads to design choices
  - The more frequent an action, the easier its invocation
  - Example:
    - » very frequent actions invoked by special keys (e.g. DEL)
    - » intermediately frequent actions invoked by keyboard shortcut, special button, …
    - » infrequent actions invoked through menu selections, form fillings, …

Hypothetical Frequency of Tasks
(Example: a travel booking system)

Task / *Position*	Group reservation	Change of itinerary	Booking child care	Comparing sales agent performance
Sales agent	0.2	0.1	0.1	0
Manager	0	0	0	0.3
Family	0.05	0.05	0.3	0
Business traveler	0.01	0.2	0.01	0

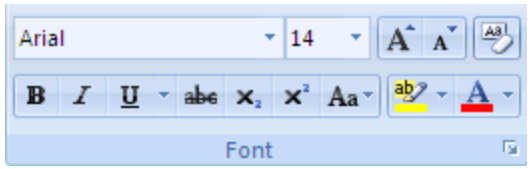
Task Frequency – Examples

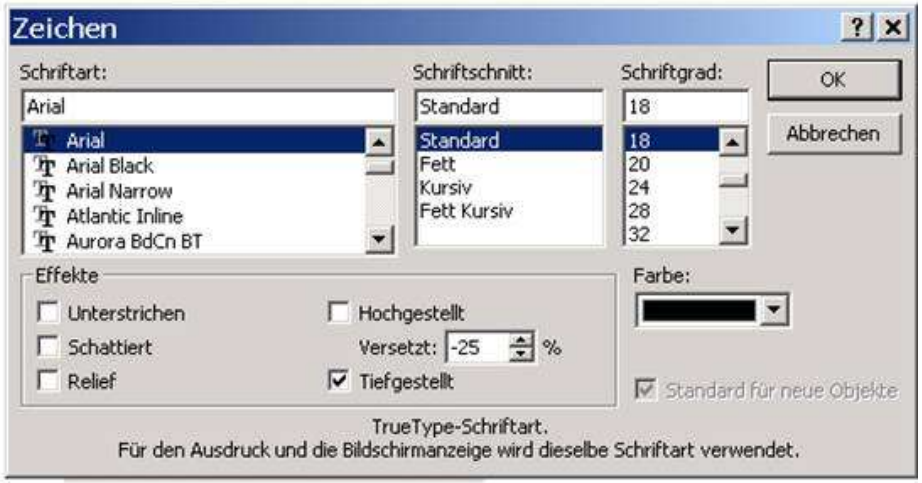
Word 2003



Powerpoint 2007

Word 2007





- *Bold* format is available in the toolbar
- *Subscript* requires menu and dialog
- Assumption for the standard UI is that user needs more often bold than subscript
- For users with different needs customization is possible

Task Frequency: Trade-off between Quick Access and Over-crowed Interface

- Example toolbar
  - More tasks directly available in the toolbar make it quicker to do these tasks
  - Increasing the number of options in the toolbar increase the time needed to locate them
  - Screen area that is used

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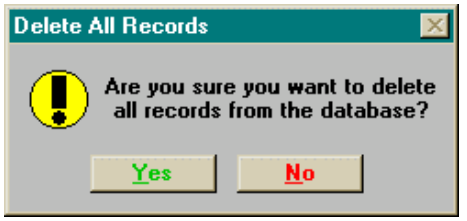
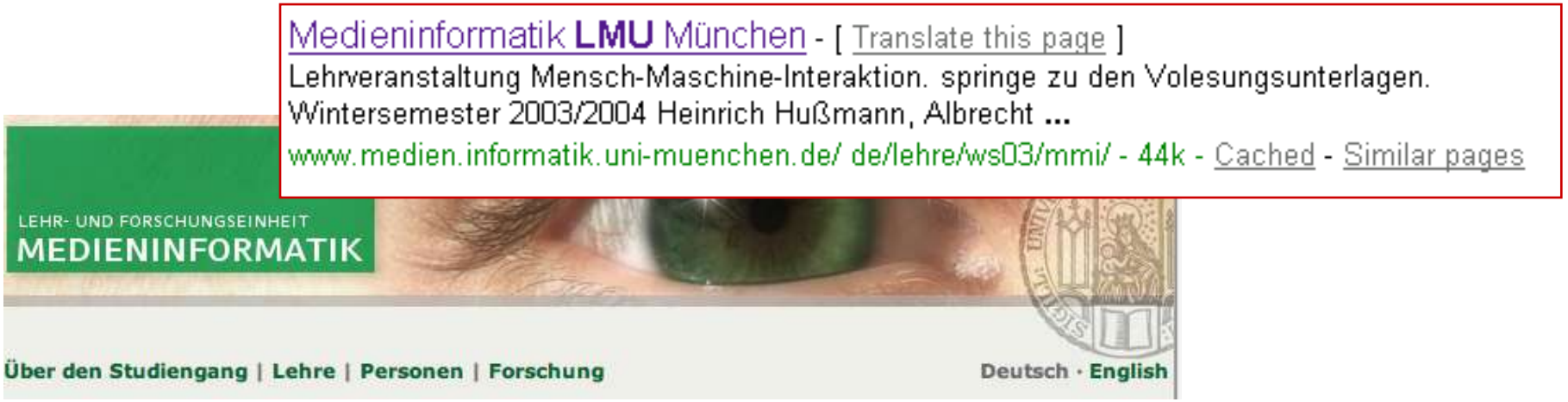
8 Golden Rules - Rule 1: Consistency



- Many forms of consistency:
  - Consistent sequences of actions in similar situations
  - Identical terminology used in prompts, menus, help screens
  - Consistent color, capitalization, layout, fonts etc.
- Bad example: WWW
  - No real guidelines and no authority
    - » How are links represented?
    - » Where is the navigation?
  - Styles and “fashion” change quickly..



Consistency: Levels

- Consistency levels
  - lexical
  - syntactic
  - semantic

- **Consistent**
  - Delete/insert character
  - Delete/insert word
  - Delete/insert line
  - Delete/insert paragraph

- **Inconsistent** – variant 1
  - Delete/insert character
  - Delete/insert word
  - Remove/insert line
  - Delete/insert paragraph

- **Inconsistent** - variant 2
  - Take-away/insert character
  - Delete/add word
  - remove/put-in line
  - eliminate/create paragraph

- **Inconsistent** - variant 3
  - Character deletion/insertion
  - Delete/insert word
  - Line deletion/insertion
  - Delete/insert paragraph

Lexical / Syntactic Consistency

- Lexical Consistency
  - Coding consistent with common usage, e.g.
    - » red = bad, green = good
    - » left = less, right = more
  - Consistent abbreviation rules
  - Equal length or first set of unambiguous chars
  - Devices used same way in all phrases
  - Character delete key is always the same
- Syntactic Consistency
  - Error messages placed at same (logical) place
  - Always give command first - or last
  - Apply selection consistently, e.g. select text then apply tool or select tool and then apply to a text
  - Menu items always at same place in menu (muscle memory)

Semantic Consistency

- Global commands that are always available
  - Help
  - Abort (command underway)
  - Undo (completed command)
- Operations valid on all reasonable objects
  - if object of class “X” can be deleted, so can object of class “Y”
- Applicability
  - to command line user interfaces
  - to keyboard short cuts
  - to speech interfaces
  - to tool bars
  - to menus
  - to selection operation
  - to gestures
  - …

Consistency: Capture through Grammars

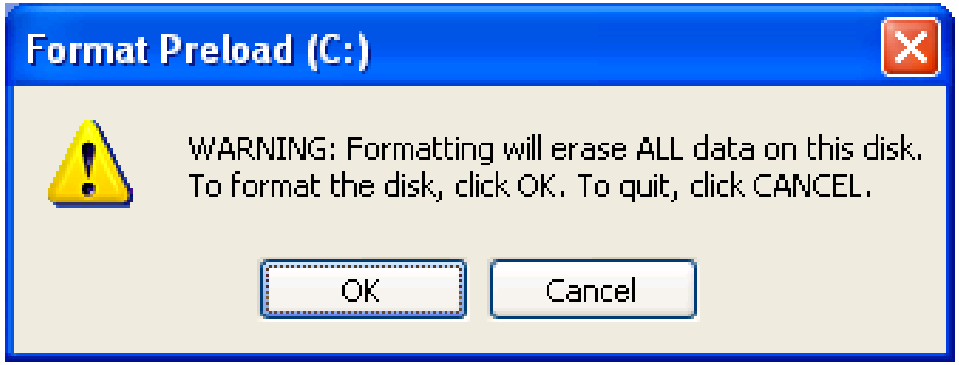
- Task-Action-Grammar (TAG), Reisner 1981
  - Task[direction,unit] → symbol[direction] + letter[unit]
  - Symbol[direction=forward] → ”CTRL”
  - Symbol[direction=backward] → ”ALT”
  - Letter[unit=word] → ”W”
  - Letter[unit=paragraph] → ”P”

- Example - Commands
  - Move cursor on word forward: CTRL-W
  - Move cursor on word backward: ALT-W
  - Move cursor on paragraph forward: CTRL-P
  - Move cursor on paragraph forward: ALT-P

Inconsistencies

- Dragging file operations?
  - folder on same disk vs. folder on different disk
  - file to trash can vs. disk to trash can
- Fitts' Law suggests bigger buttons for more often used operations

- Sometimes inconsistency is wanted
  - E.g. Getting attention for a dangerous operation
  - Consistency on semantic level may cause inconsistency on syntactic level
  - Example:
    - » Confirmation of operation is default option
    - » Confirmation of reformat command?

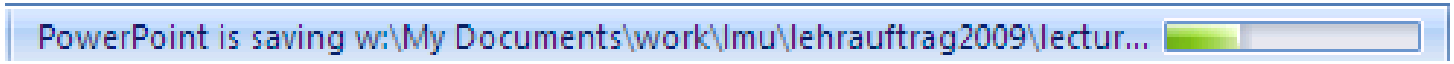


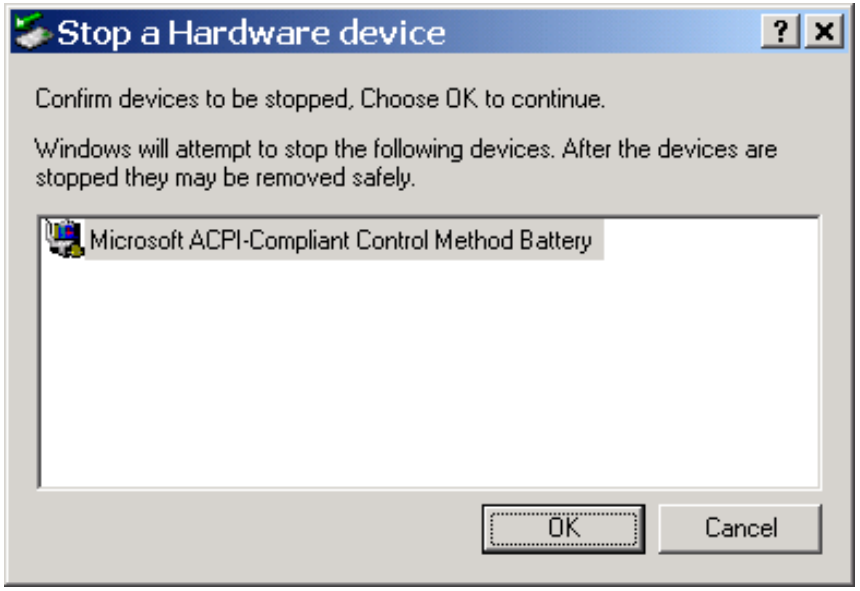
8 Golden Rules - Rule 2: Shortcuts

- Enable shortcuts: Improves speed for experienced users
- Shortcuts on different levels
  - Access to single commands, e.g. keyboard shortcuts (CTRL+S) or toolbar
  - Customizing of commands and environments, e.g. printer preset (duplex, A4, …)
  - Reusing actions performed, e.g. history in command lines, macro functionality
- Shortcuts to single commands are related to consistency
  - CTRL+X, CTRL+C, CTRL+V in Microsoft & Apple applications for cut, copy and paste
  - However CTRL+S (saving a document) is only implemented in some applications…
  - Apple applications are more consistent in shortcuts (e.g. CTRL-S) due to early guidelines/toolkits for developers

8 Golden Rules - Rule 3: Feedback

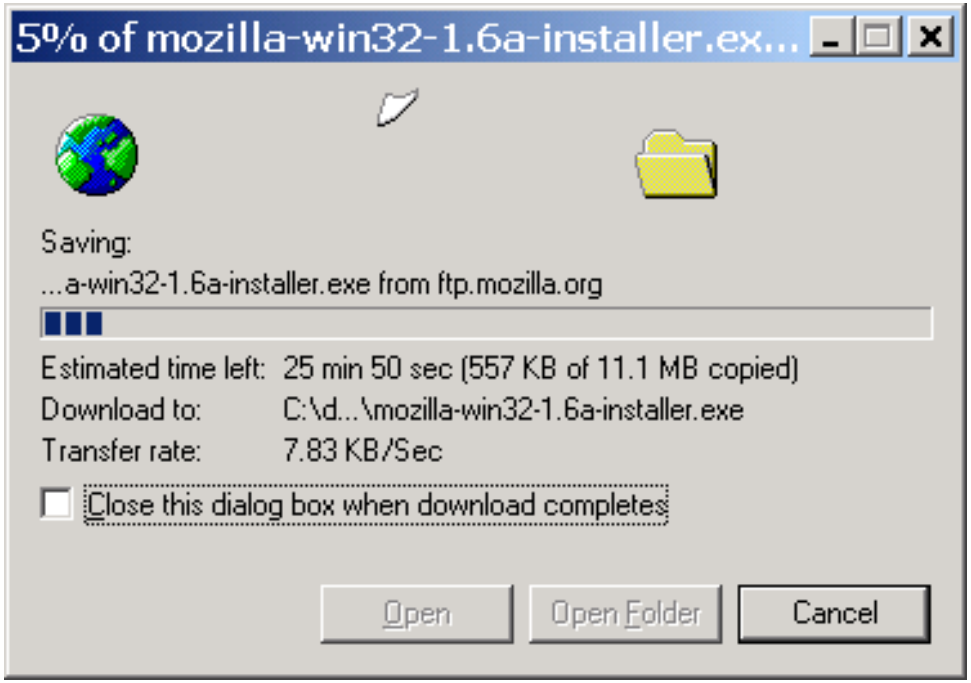
- For **any** action performed the user should have appropriate and informative feedback
- For frequent actions it should be modest, peripheral
- For infrequent actions it should be more substantial





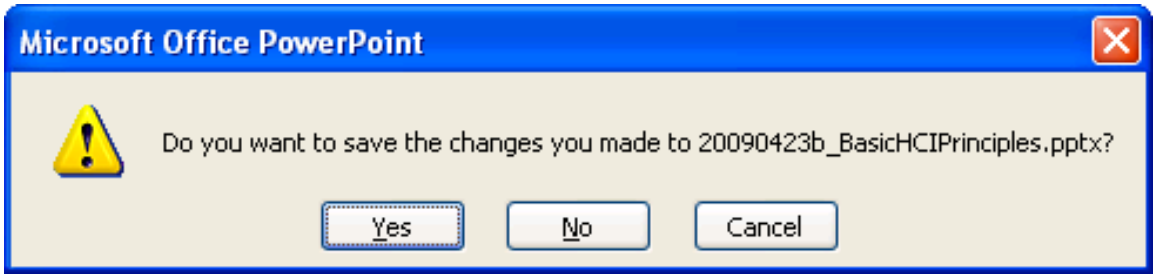
8 Golden Rules - Rule 4: Closure

- Sequences of actions should have a beginning, middle, and end.
  - Satisfaction of accomplishment = relief
- On different levels –
  - E.g. in the large: Web shop - it should be clear when I am in the shop, and when I have successfully check-out
  - E.g. in the small: a progress bar



8 Golden Rules - Rule 5: Prevent Errors

- Create UIs that make it hard to make errors
  - Examples:
    - » Menus instead of commands
    - » Options instead of alphanumeric field (only certain values allowed)
- Detect errors or possible errors
  - Examples
    - » Leaving an editor without saving
    - » Writing to a file that already exists



- Provides safety for the user
- Different options for handling:
  - Involve the user (current practice)
  - Prevent the error or its consequences on system level (e.g. create backups/versions when a file is overwritten)

8 Golden Rules - Rule 6: Easy Reversal of Actions

- As a basic rule – all actions should be reversible
  - Relieves anxiety of users, encourages exploration of unfamiliar options
- Providing UNDO functions (possibly with infinite depth)
- Allow undo of groups of actions
- Undo is not trivial if user is not working sequentially
  - E.g. write a text, copy it into the clipboard, undo the writing
    → the text is still in the clipboard!
- Reversal of action becomes a usage concept
  - Browser back-button is used for navigation (for the user a conceptual reversal of action)
  - Formatting of documents – e.g. “lets see how this looks, … don’t like it, … go back to the old state”

8 Golden Rules - Rule 7: Feeling in Control

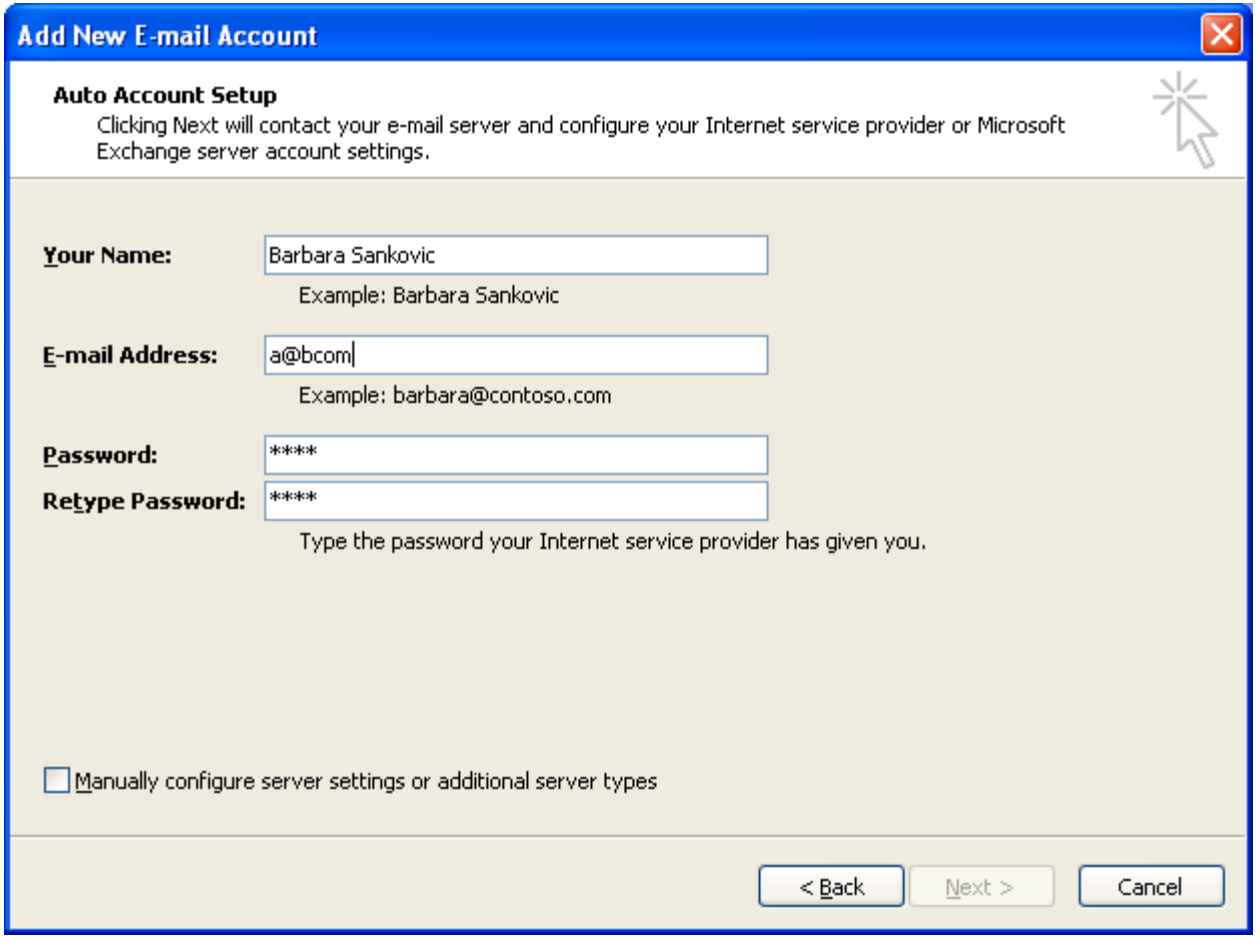
- Users (in particular experienced) like to feel to be in control of the system
- Gaines, 1981:
  - User should initiate actions (initiator instead of responder)
  - Avoid non-causality
- The system should be predictable
  - No surprising system actions, no tedious but unavoidable sequences of data entries, no unexpected silence or waiting state
  - Otherwise anxiety and dissatisfaction rise
- Note: some current developments are in contrast, e.g.:
  - Proactive computing
  - Intelligent agents
- General trade-off between transparency and intelligence of system

8 Golden Rules - Rule 8: Reduce Short-term Memory Load

- The system should remember, not the user
  - George A. Miller, 1956: The magical number Seven, Plus or Minus Two
  - Humans can recall 7 +/- 2 chunks of information for a short time
- Interface designs have to be simple to comply with human memory
- Examples that create problems
  - Multi-page forms where the user has to know at form N what she filled in in form N-1
  - Abbreviations introduced in one step and used in the following (e.g. user selects a destination – as the name of a city – and the system does the following steps by showing the airport code)
- Helpful:
  - Keep dialogues compact (avoid splitting of pages)
  - Use memory aids (visual or audio) for mnemonics
- Apply the rule with care!
  - Sometimes complex menu structures are unavoidable
  - With sufficient training and support, also cryptic mnemonics are acceptable for frequent users

Summary – 8 Golden Rules

- Consistency
- Shortcuts
- Feedback
- Closure
- Prevent Errors
- Reversal
- Control
- Memory Load



1) Does not show there is a (potential) error in the email address – just greys out the 'Next' button.
2) When passwords do not match, it allows 'Next' but gives a detailed error message.

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Principle 3: Prevent Errors - Classical Techniques

(Note: golden rule number 5 discusses the same topic on higher level…)

A few classical “tricks” to prevent errors (Source: Shneiderman)

- Correct matching pairs
  - Examples: { } in program text, <B>**bold**</B> in HTML
  - Prevention: insert both brackets in one action; or remind of missing bracket
- Complete sequences
  - Assistance to complete a sequence of actions to perform a task
    - » For advanced users: planning and editing the sequence
  - Examples: log-on sequences, wizards, scripts
- Command correction
  - Aim: Trying to prevent users entering incorrect commands
    - » Examples: file completion on Unix / helpful error messages / menus instead of commands

What is an “error” after all?