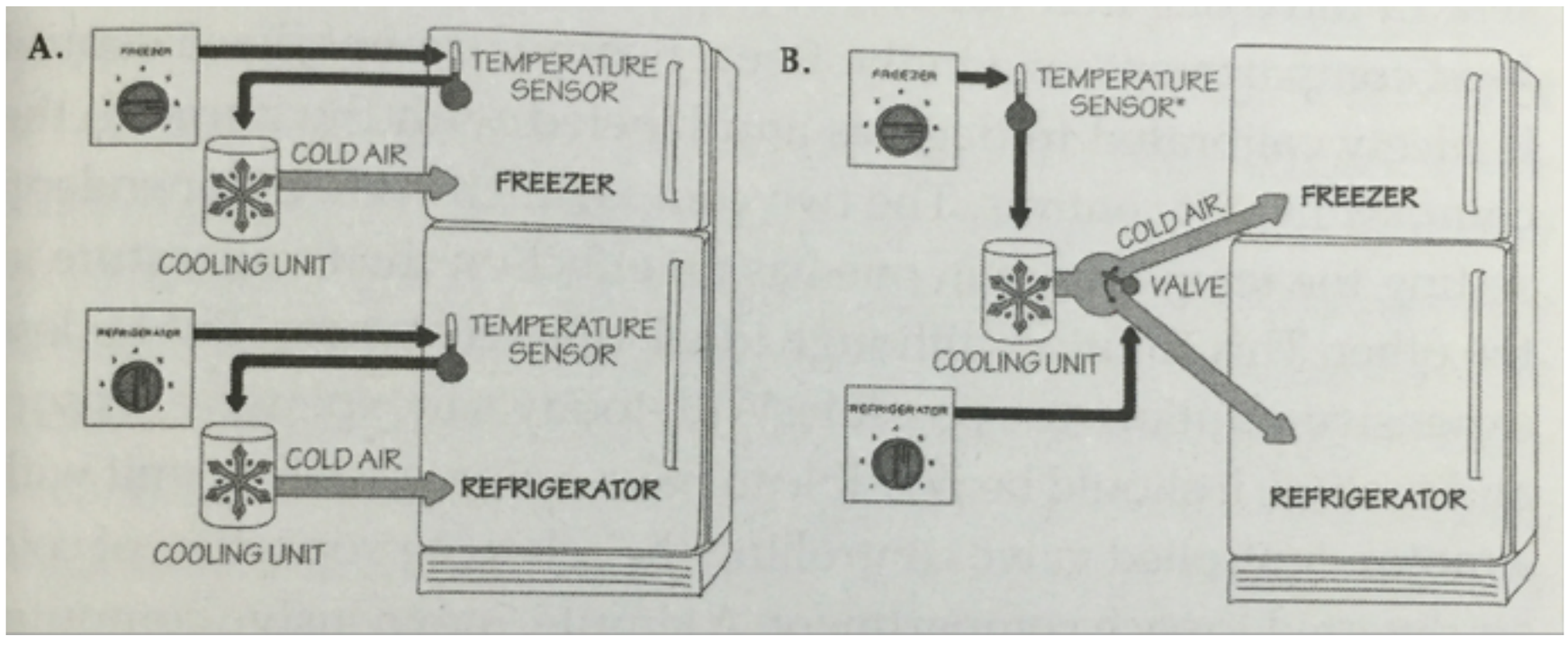
Usability & User Centered Design

SWE 432, Fall 2018

Design and Implementation of Software for the Web

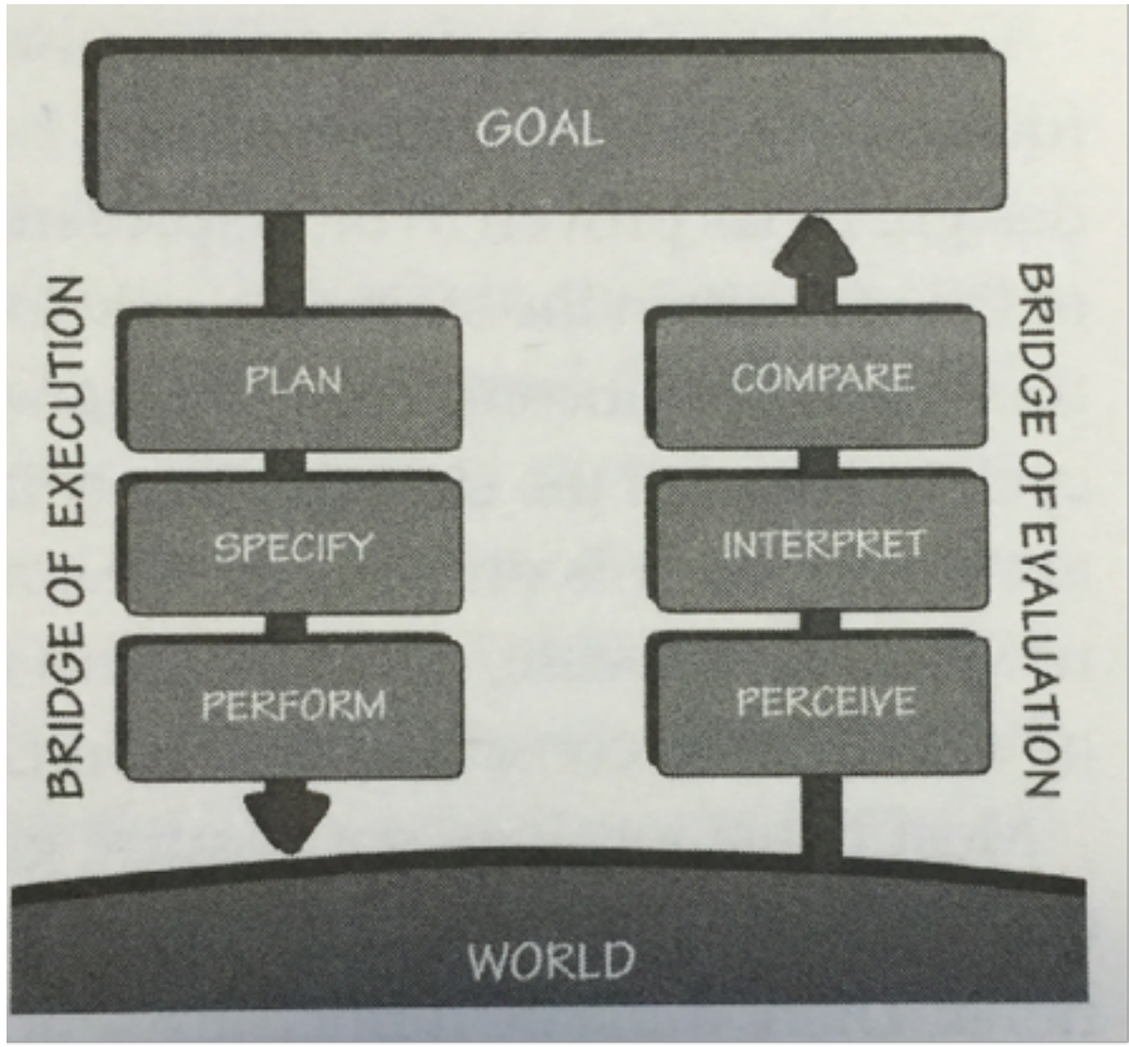
Review: Mental models

- Only single temperature sensor.
- Controls not independent, need to adjust both.
- (also delayed feedback)

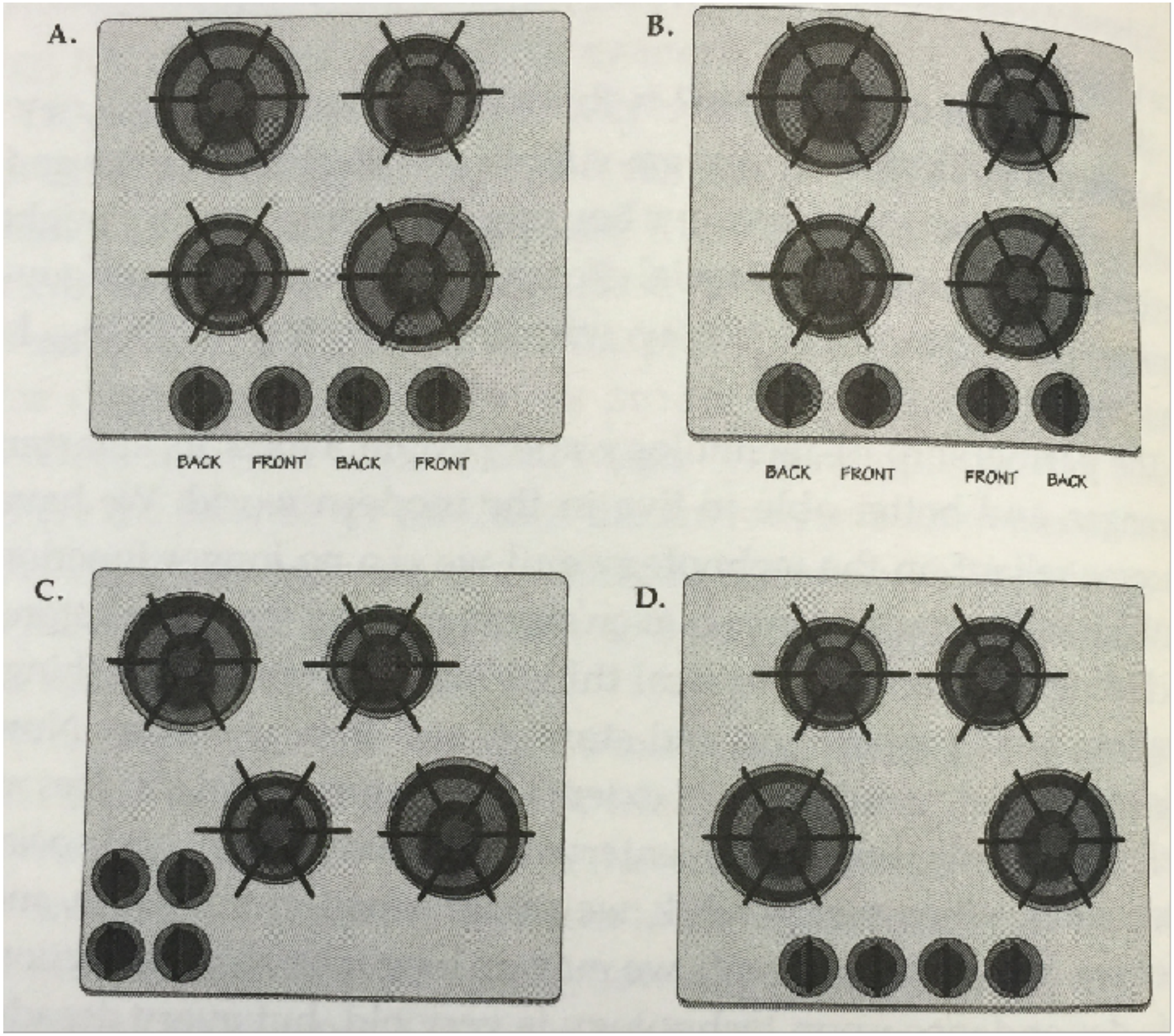


Review: Norman's 7 stages of action

1. Goal (form the goal)
2. Plan (the action)
3. Specify (action sequence)
4. Perform (action sequence)
5. Perceive (the state of the world)
6. Interpret (the perception)
7. Compare (outcome w/ goal)



Review: Example - burners



Today

- What is user centered design?
- What does it mean to be usable?
- How can one evaluate usability?
  - Heuristic evaluations

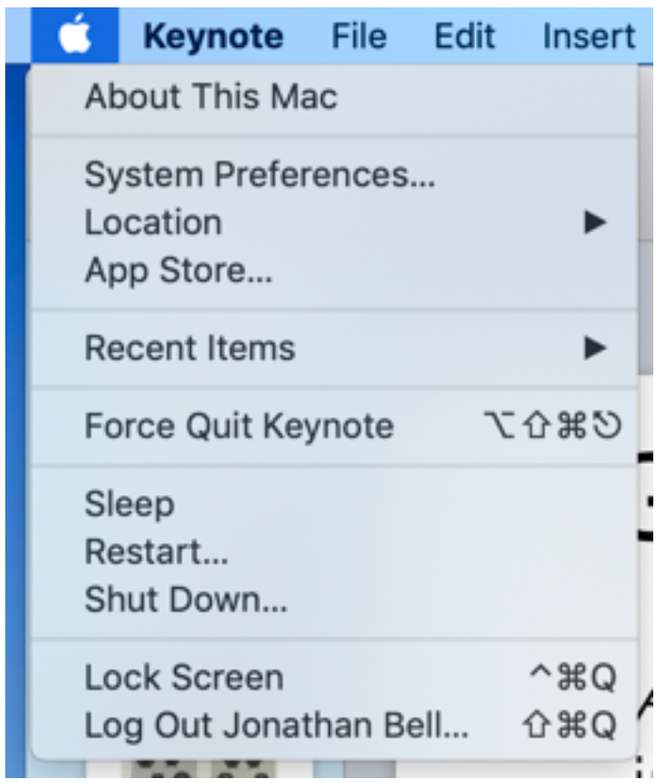
For further reading:
https://www.nngroup.com/articles/how-to-conduct-a-heuristic-evaluation/
https://www.nngroup.com/articles/ten-usability-heuristics/
http://designingwebinterfaces.com/6-tips-for-a-great-flex-ux-part-5

Characteristics of usability

- ease of use
- productivity
- efficiency
- effectiveness
- learnability
- retainability
- user satisfaction

Ground rules - terminology

- *Affordances* allow a user to interact with an object in **specific** ways (e.g. the sort buttons on wikipedia tables)
- *Constraints* restrict interactions and are often physical (e.g. can't move cursor outside of the screen)
- *Conventions* are usually cultural constraints (e.g. reading left-to-right), or the meaning of the "apple" menu



Affordances, Constraints, Conventions

Usable or unusable?

Usable or unusable?

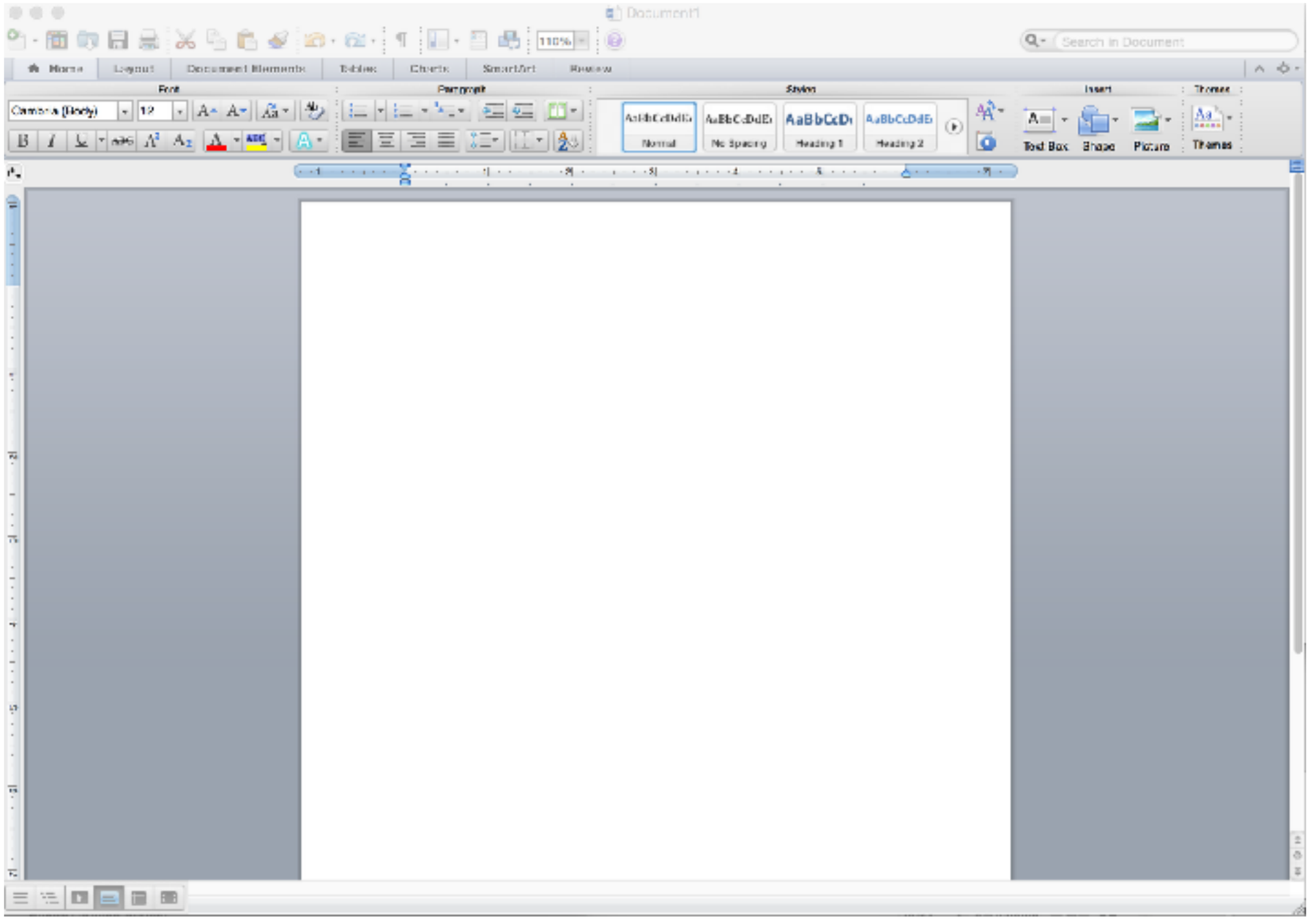
Usable or unusable?

A teapot

From Don Norman, Emotional Design

Usable or unusable?

A word processor



Usability

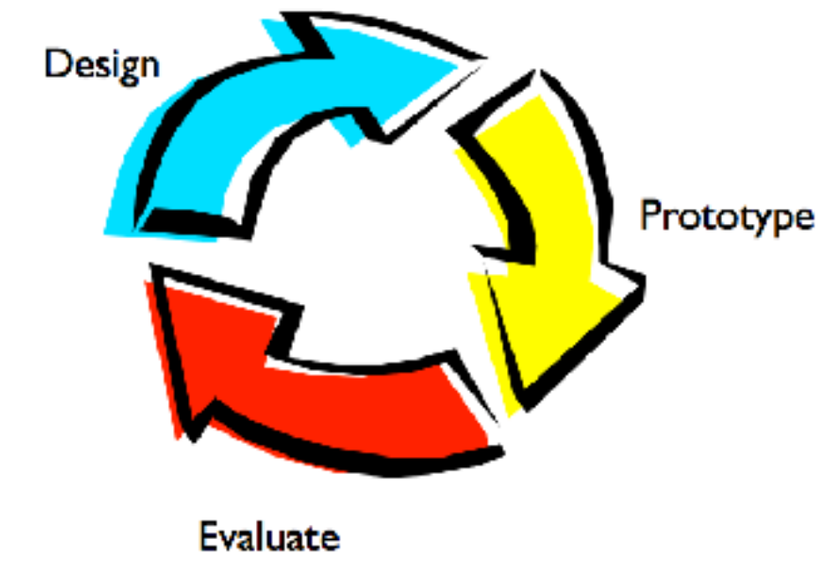
- A property of the relationship between
  - humans with goal-driven tasks
  - an artifact
  - The speed and success with which the goals can be accomplished (task **performance**)

User-centered design

- Given humans with goals and tasks, design an **artifact** that helps to accomplish these tasks

Iterative User-centered design

- Given humans with goals and tasks, **re**design an **existing** artifact that helps to accomplish these tasks **faster** and **more successfully**

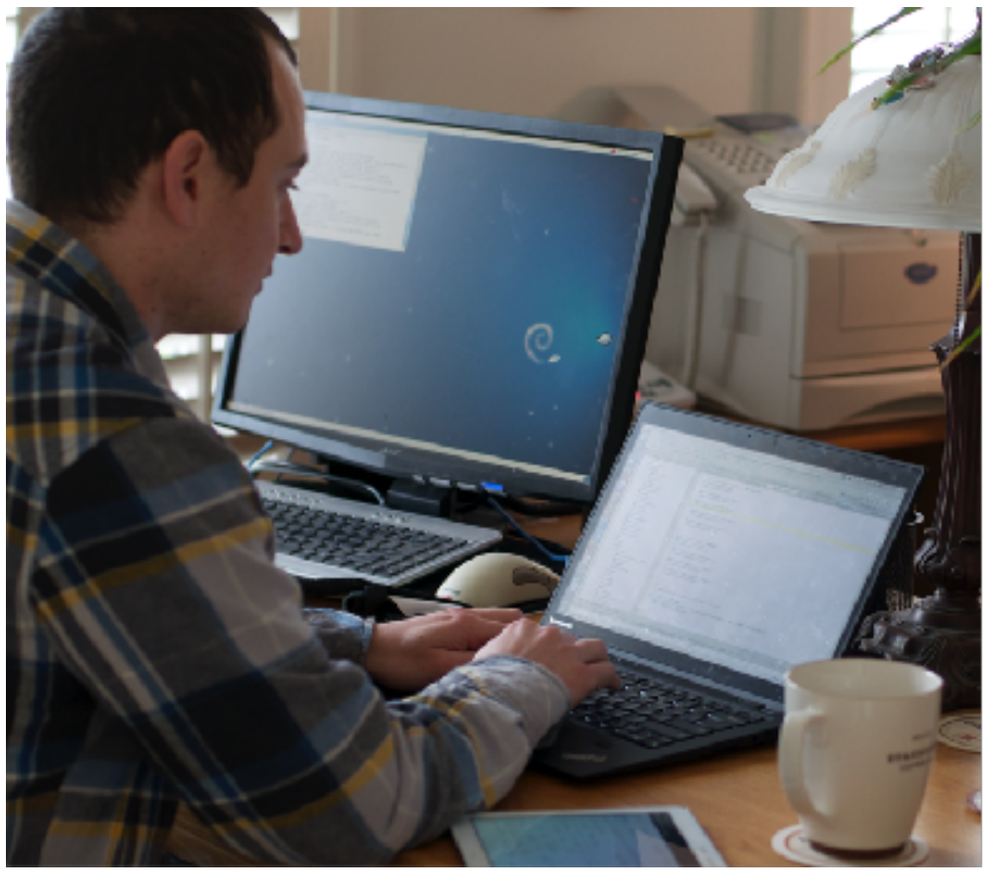


Usability evaluation

- Given humans with goals and tasks and a new artifact, identify usability **issues** that decrease task performance

Empirical: Usability evaluation **study**

- Given humans with goals and tasks and an artifact, **observe humans to** identify usability issues that decrease task performance
- Offers ground truth (subject to measurement error and sampling bias)



Analytical: Usability **principles**

- Given humans with goals and tasks and an artifact, **assess for conformance to UI principles to** identify usability issues that decrease task performance
- Enables ground truth to be roughly approximated using lightweight evaluation method

Why study usability?

Adapted from Maneesh Agrawala & Bjoern Hartmann

Life-Threatening Errors

- 1995 American Airlines jet **crashed** into canyon wall, killing all aboard
- On approach to Rozo airport in Colombia
- Pilot skipped some of the approach procedures
- Pilot typed in “R” and system **completed** full name of airport to Romeo
- Guidance system executed turn at low altitude to head for Romeo airport
- 9 seconds later plane struck canyon wall
- Is the pilot to blame?
- http://en.wikipedia.org/wiki/American_Airlines_Flight_965

What usability is not

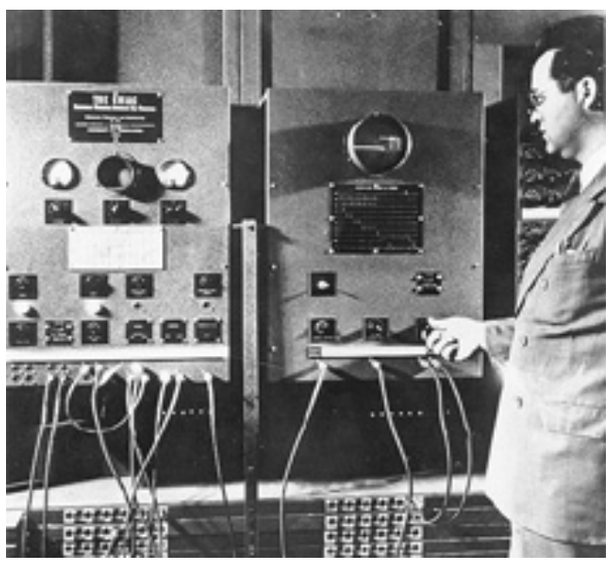
- Not “dummy proofing”
- Not being “user-friendly”
- Not just “usability testing”
- Not just making software pretty

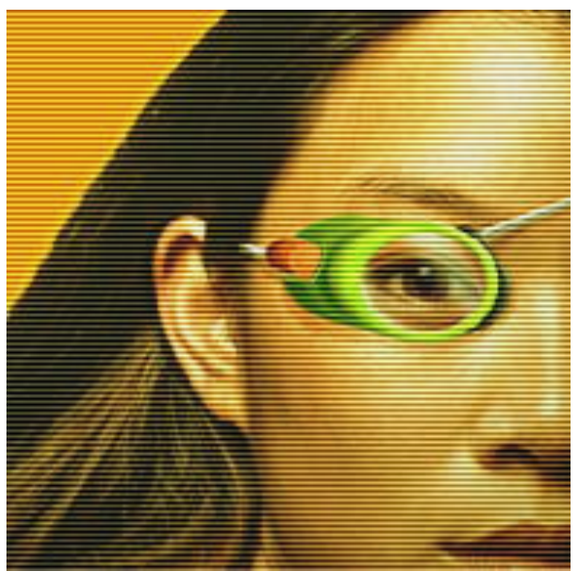
The user is NOT like me

- Understanding user needs, tasks, goals

Human-Computer Interaction

"a discipline concerned with the design, evaluation, and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them."
ACM SIGCHI Curriculum Development Group Report, 1992





Heuristic evaluation

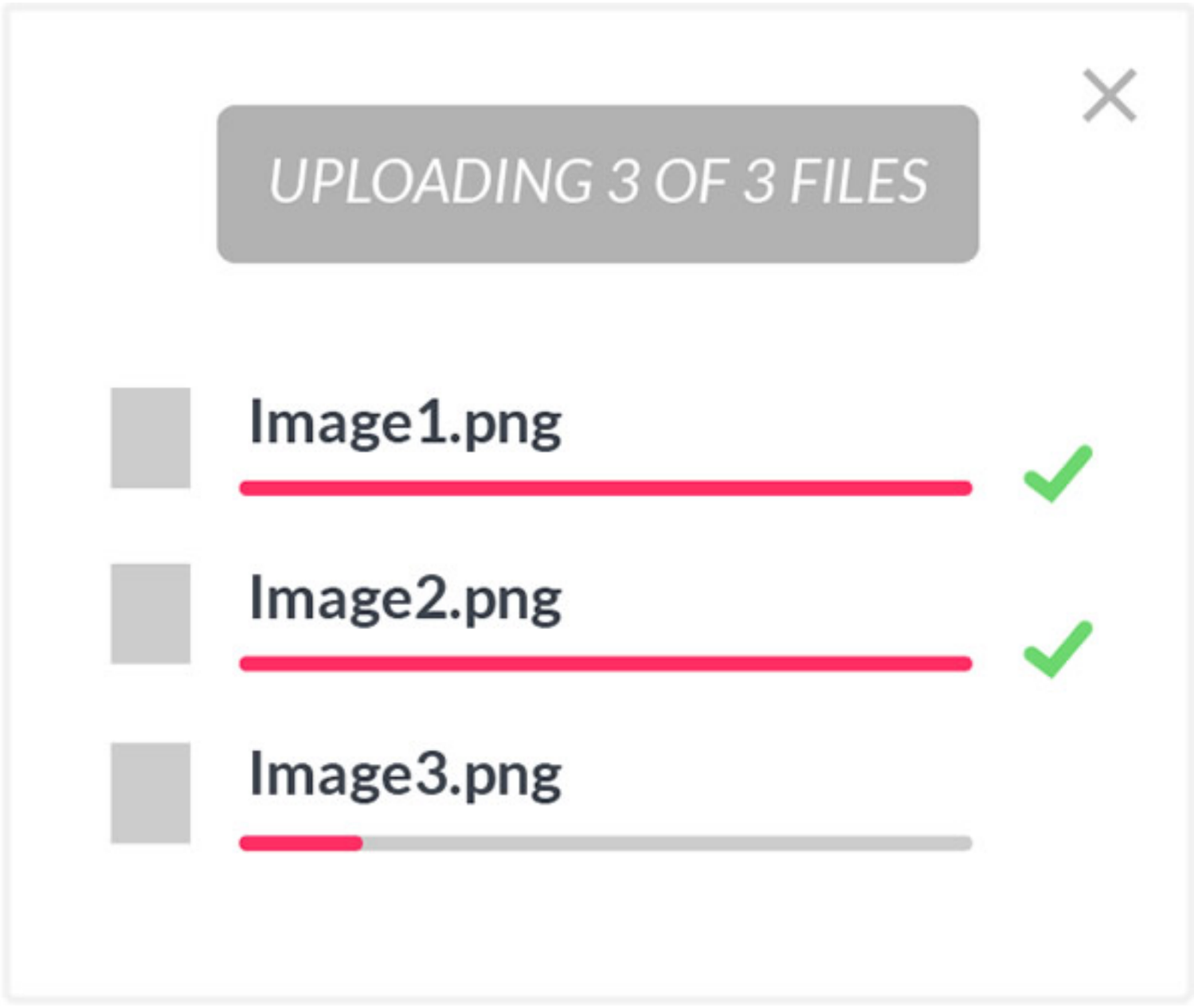
- "**Discount** usability engineering methods"
  - Pioneered by Jakob Nielsen in the 1990s
- Involves a small team of evaluators to evaluate an interface based on recognized usability principles
- Heuristics–"rules of thumb"

Adapted from slides by Bonnie John and Jennifer Mankoff

Heuristics

1. Visibility of system status
2. Match between system and the real world
3. User control and freedom
4. Consistency and standards
5. Error prevention
6. Recognition vs. recall
7. Flexibility and efficiency of use
8. Aesthetic and minimalist design
9. Help users recognize, diagnose, and recover from errors
10. Help and documentation

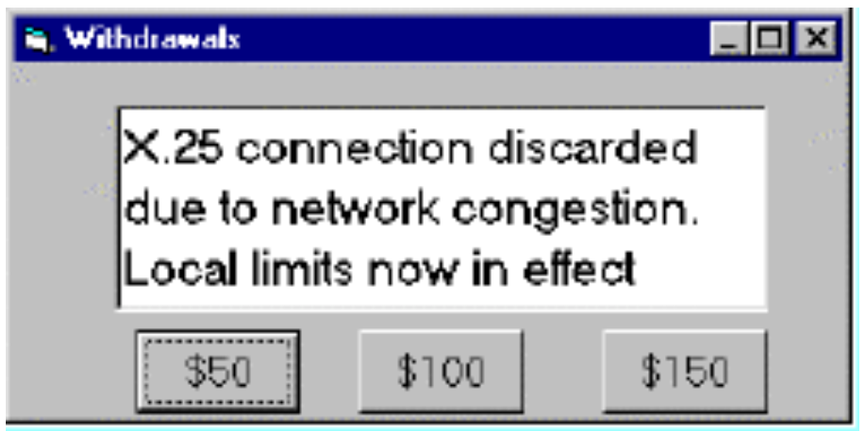
H1: Visibility of System Status

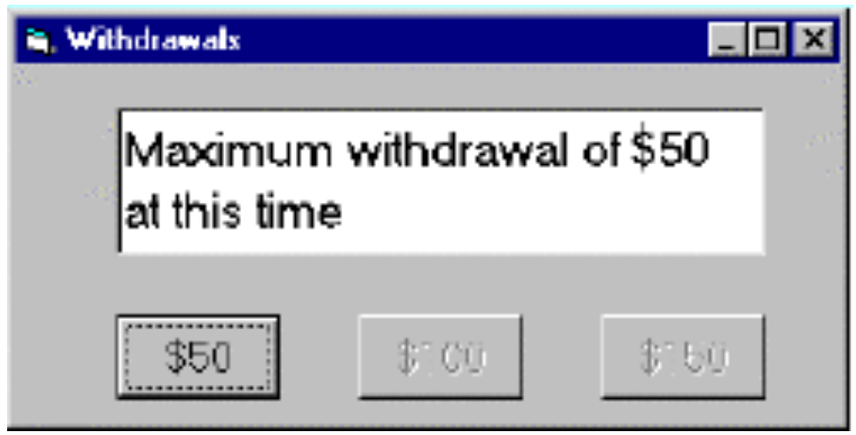


H1: Visibility of System Status

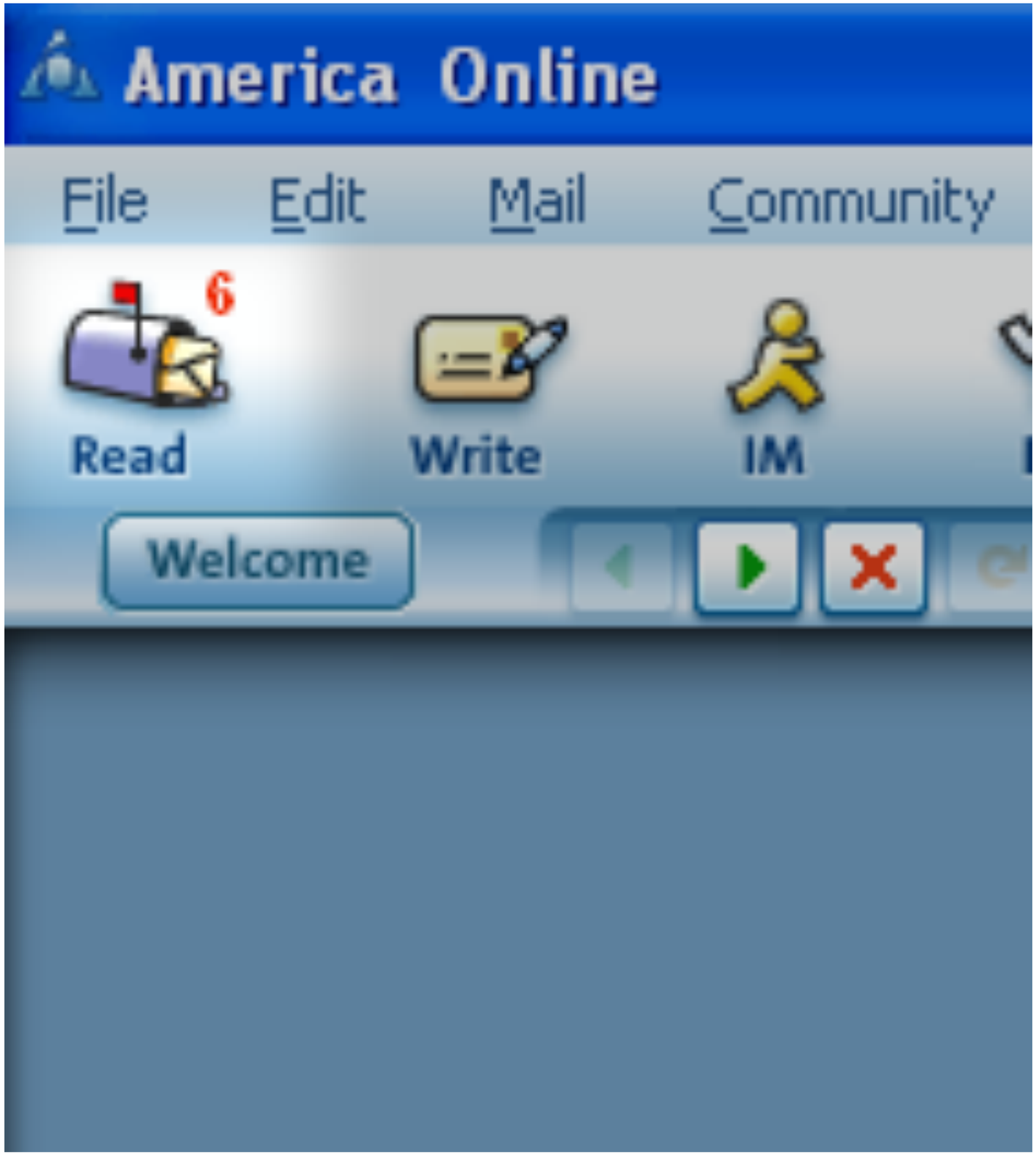
- What input has been received--Does the interface above say what the search input was?
- What processing it is currently doing--Does it say what it is currently doing?
- What the results of processing are--Does it give the results of processing?
- Feedback allows user to monitor progress towards solution of their task, allows the closure of tasks and reduces user anxiety (Lavery et al)

H2: Match between system and the real world





- Speak the users' language
- Follow real world conventions


America Online
File
Edit
Mail
Community
6
Read
Write
IM
Welcome


Transfer Disk
Trash


Thu 3:52:04 PM
Macintosh HD
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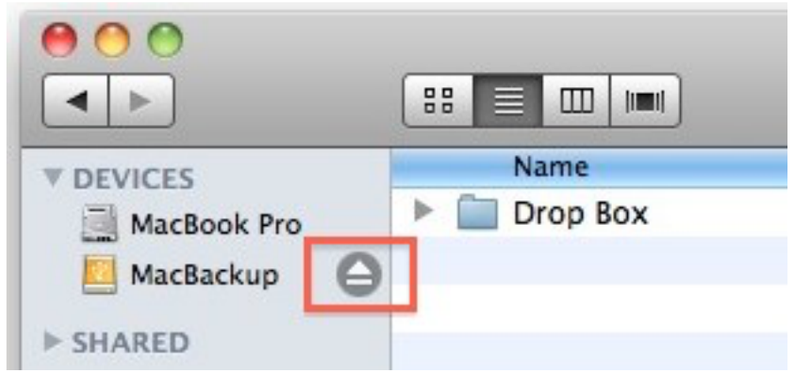
DEVICES
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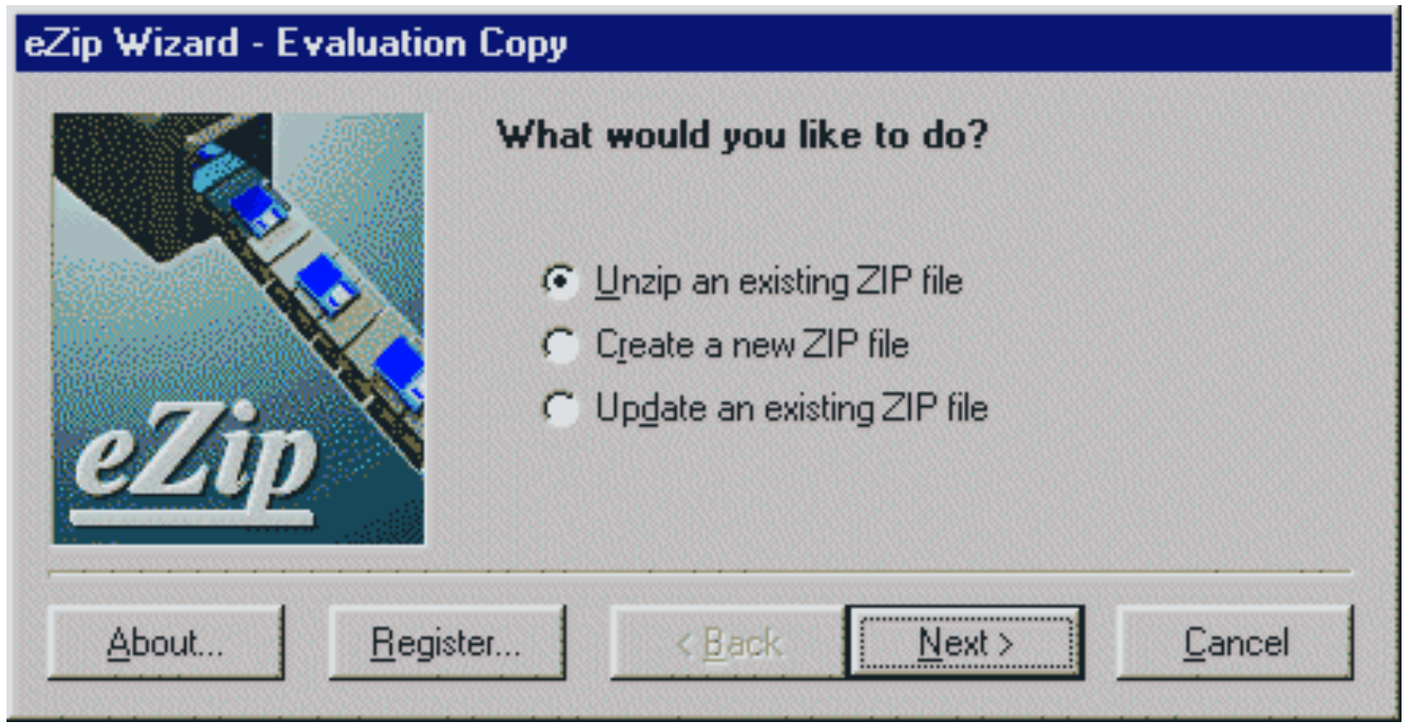
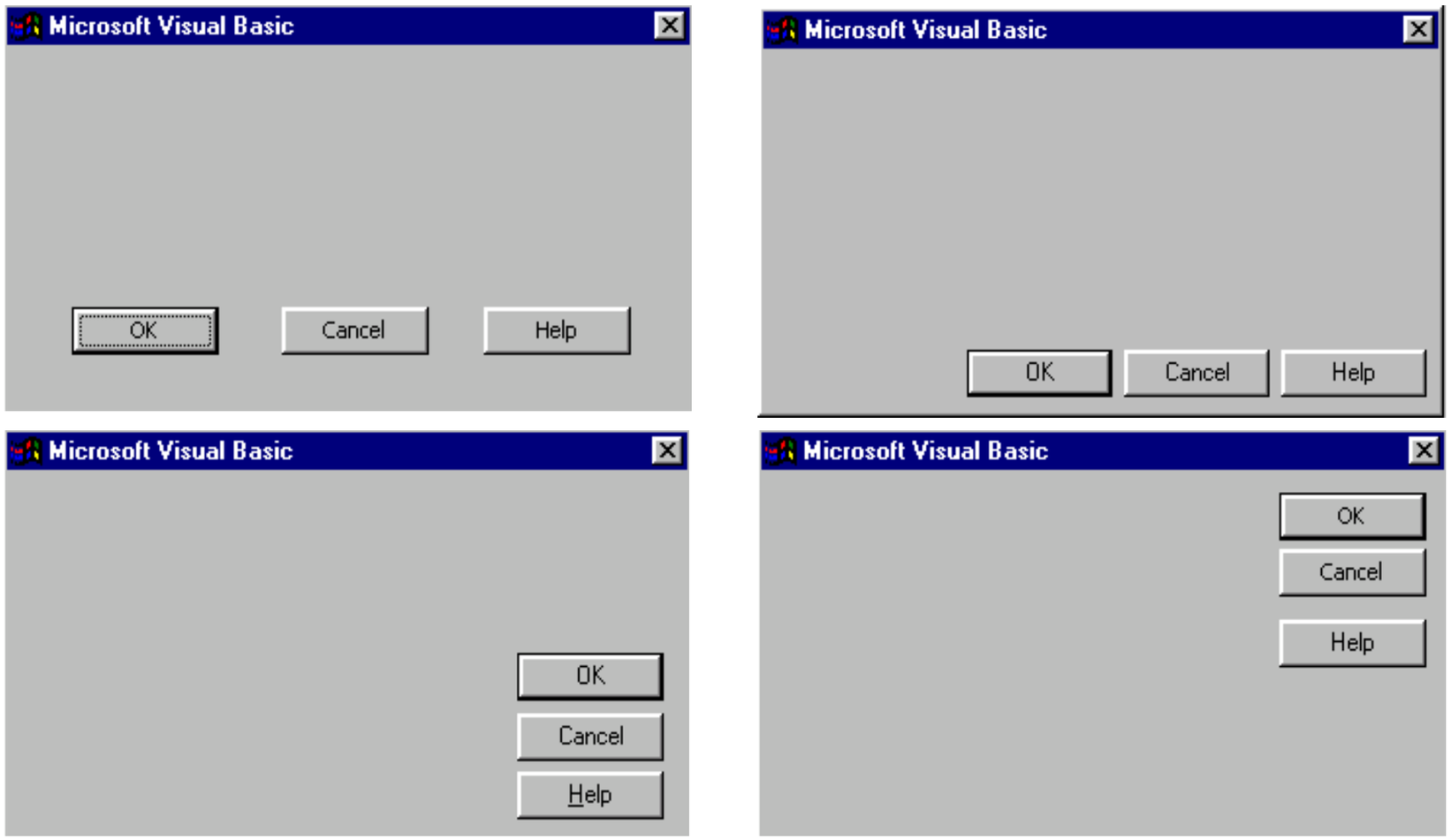
MacBackup
SHARED
Name
Drop Box

H3: User Control and Freedom



- "Exits" for mistaken choices, undo, redo
- Don't force down fixed paths

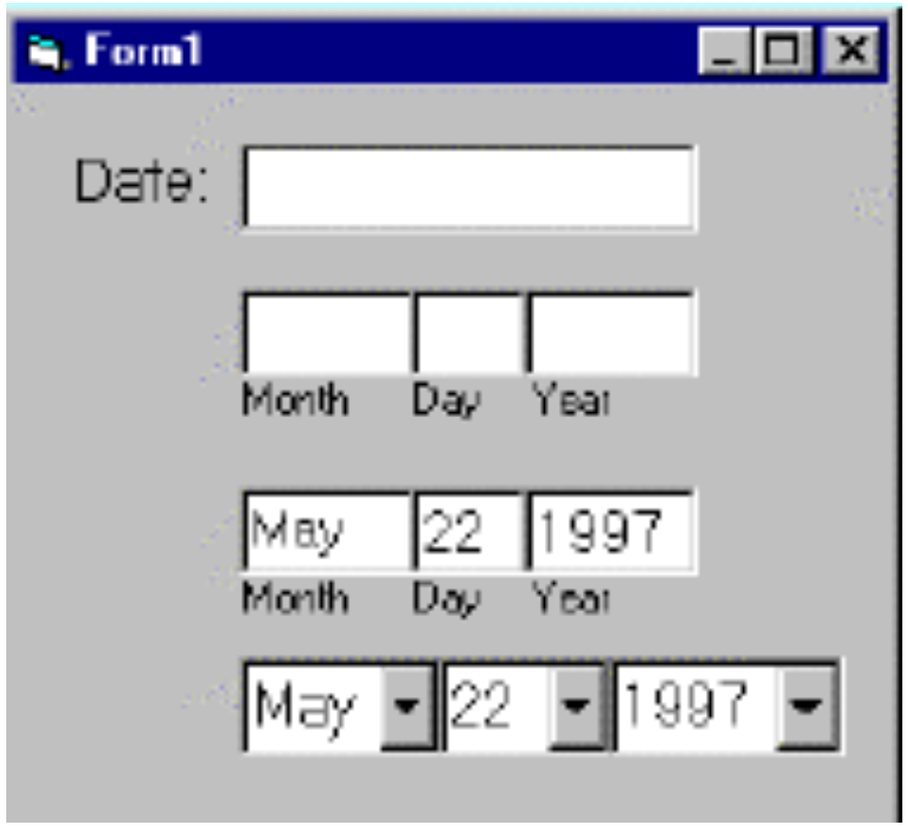
H4: Consistency and Standards

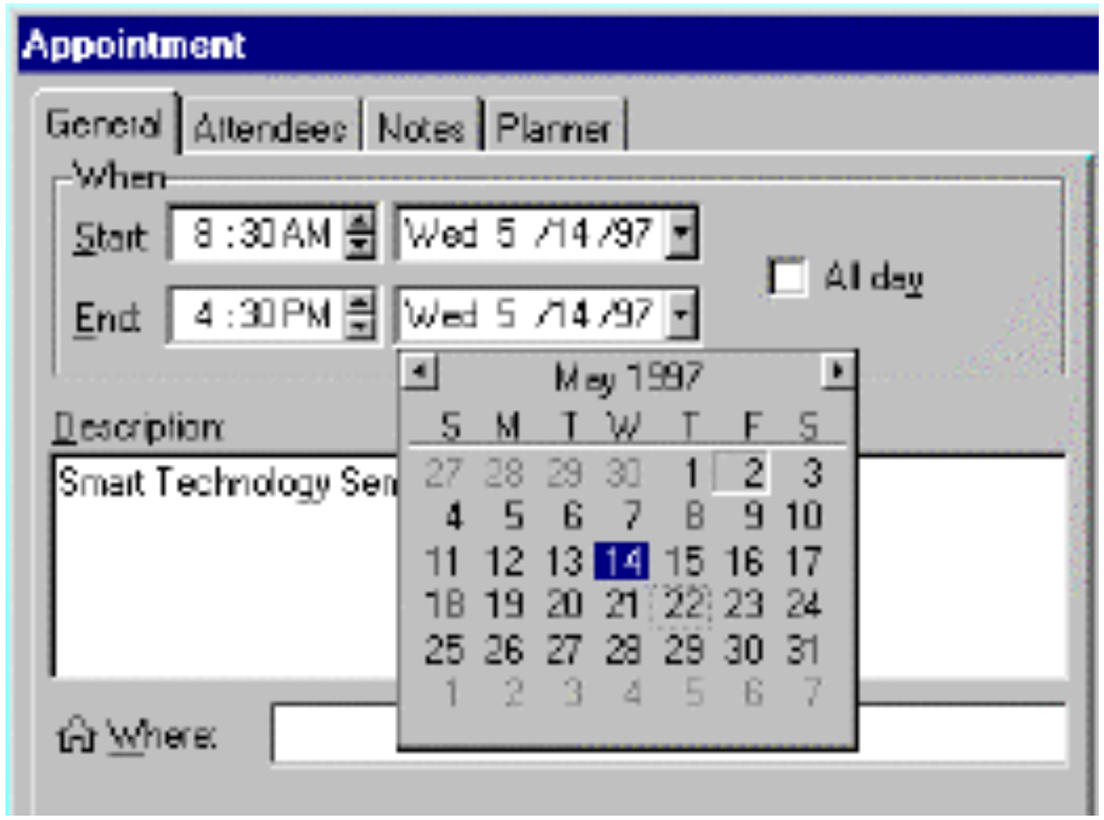


- Same words, situations, actions, should mean the same thing in **similar** situations; same things look the same, be located in the same place.
- Different things should be different


PNC BANK
Please Insert Your Check Face Up With The
Top Of The Check To The Right.
PNC BANK
MEMBER FDIC pnc.com

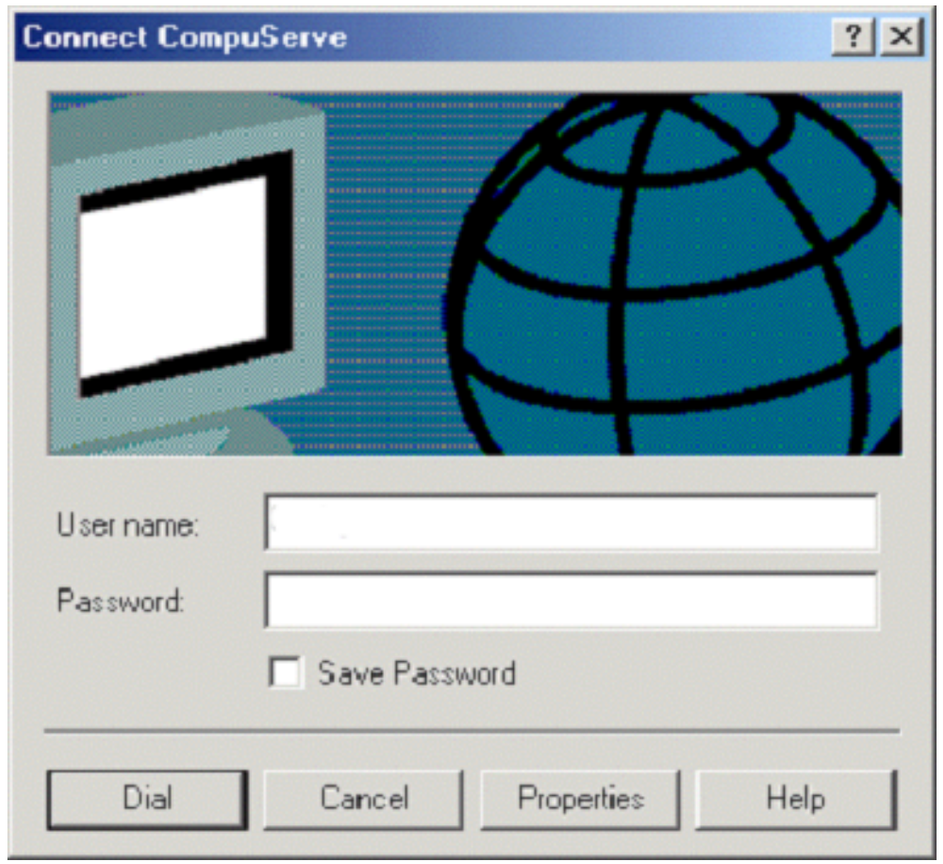
H5: Error prevention





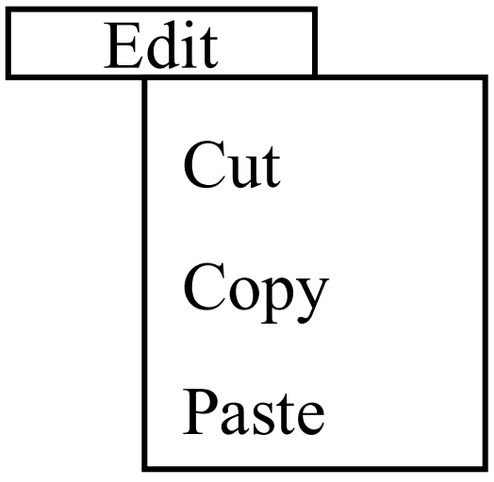
- Careful design which prevents a problem from occurring in the first place

H6: Recognition rather than recall



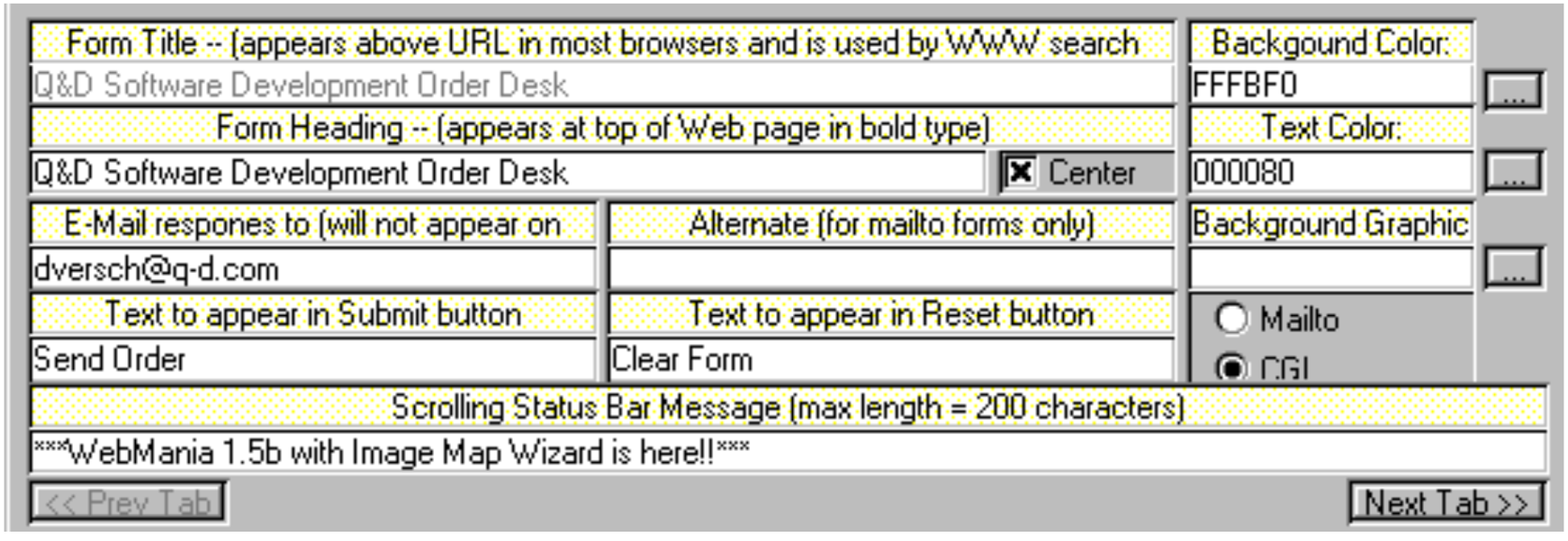
- Make objects, actions and options visible or easily retrievable

H7: Flexibility and Efficiency of Use



- Accelerators for experts (e.g., gestures, kb shortcuts)
- Allow users to tailor frequent actions (e.g., macros)

H8: Aesthetic and Minimalist design

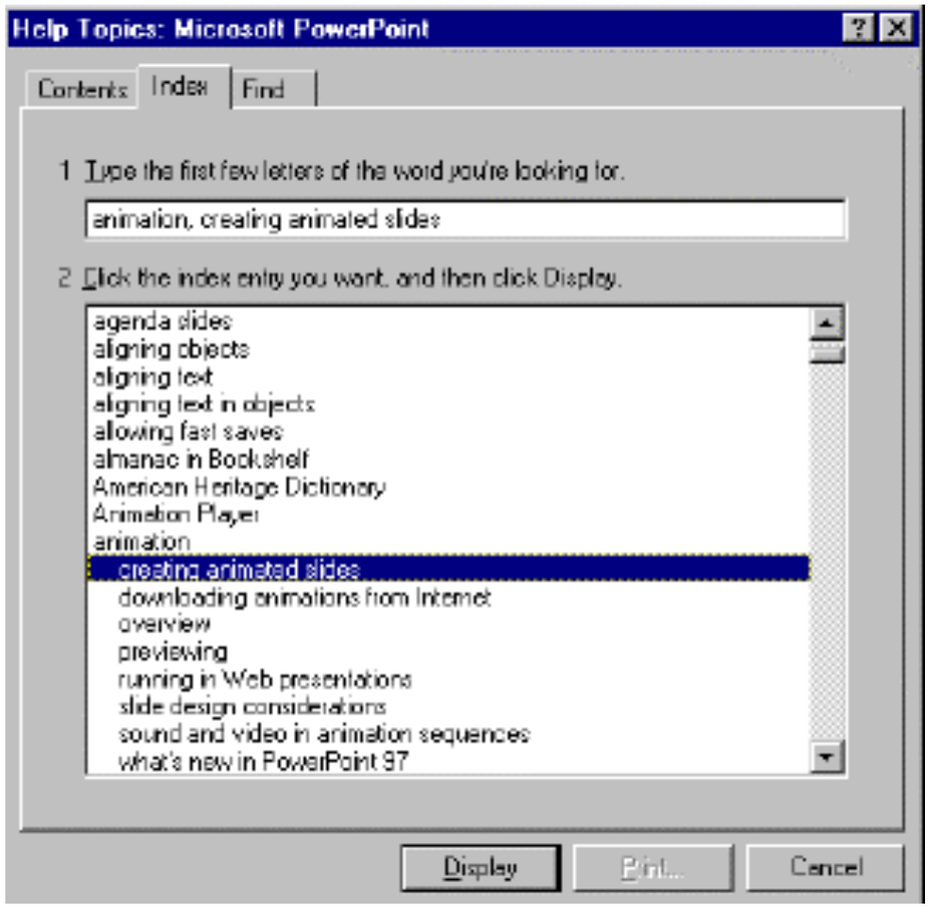


- Interfaces should not contain irrelevant or rarely needed information

H9: Help users recognize, diagnose, and recover from errors

- Error messages in language user will understand
- Precisely indicate the problem
- Constructively suggest a solution

H10: Help and documentation



- Easy to search
- Focused on the user's task
- List concrete steps to carry out
- Always available

Example

1. Visibility of system status
2. Match between system and the real world
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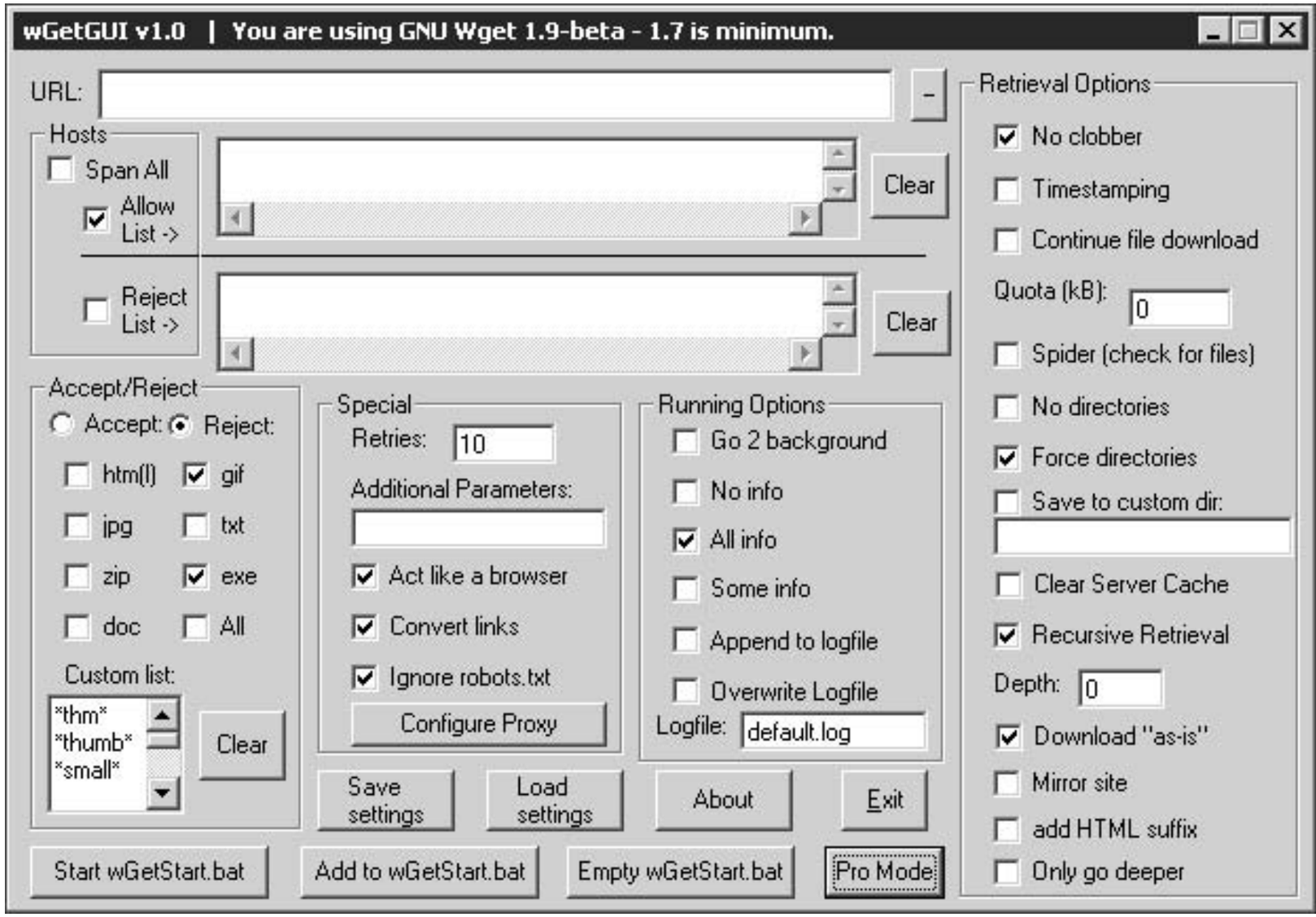

Example

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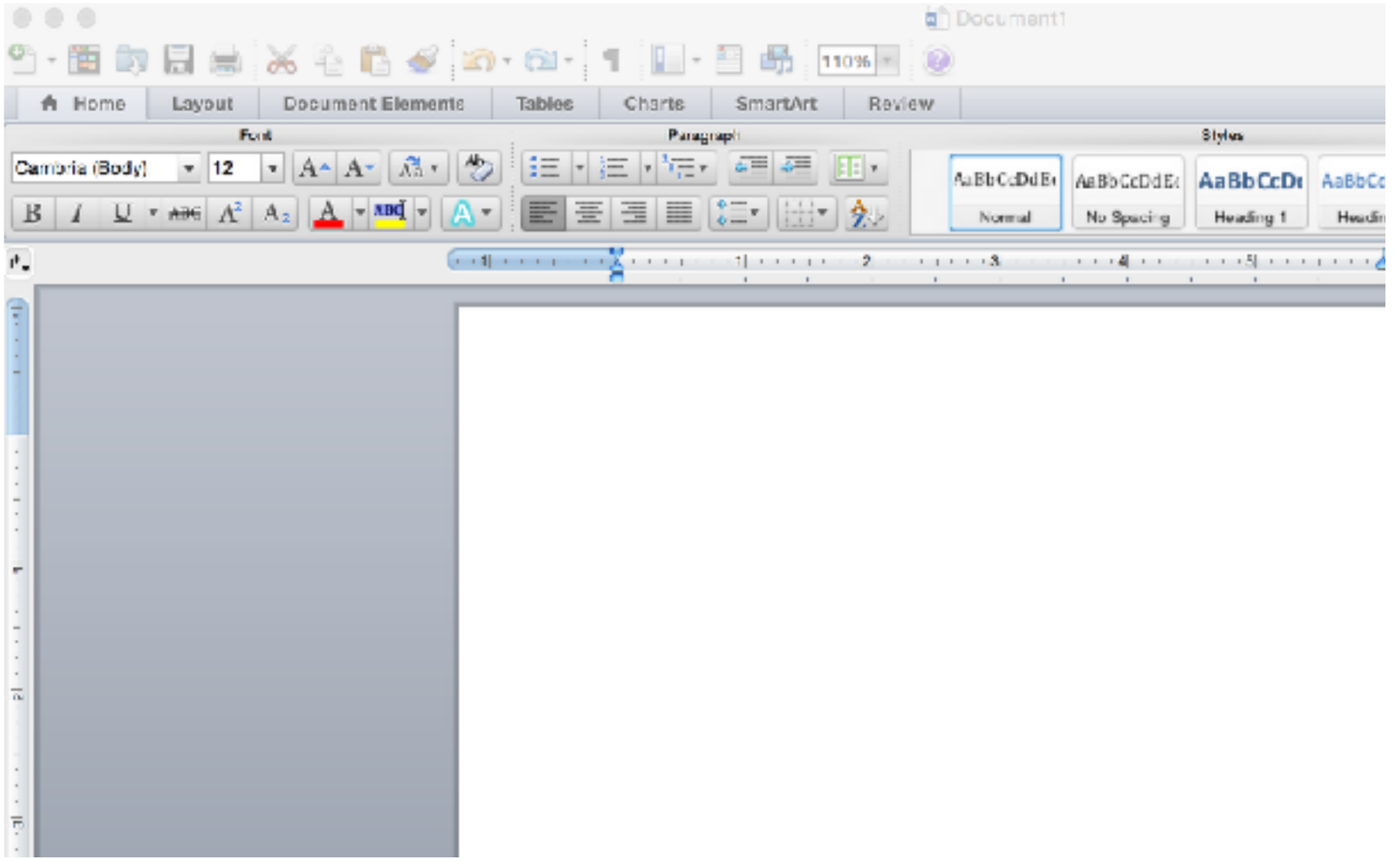

Using heuristic evaluation

- Can be used informally to identify issues in a website
- Can be used as a more formal usability inspection method
  - Evaluators each first separately identify issues
  - Issues then combined from each evaluator

Heuristic evaluation in groups

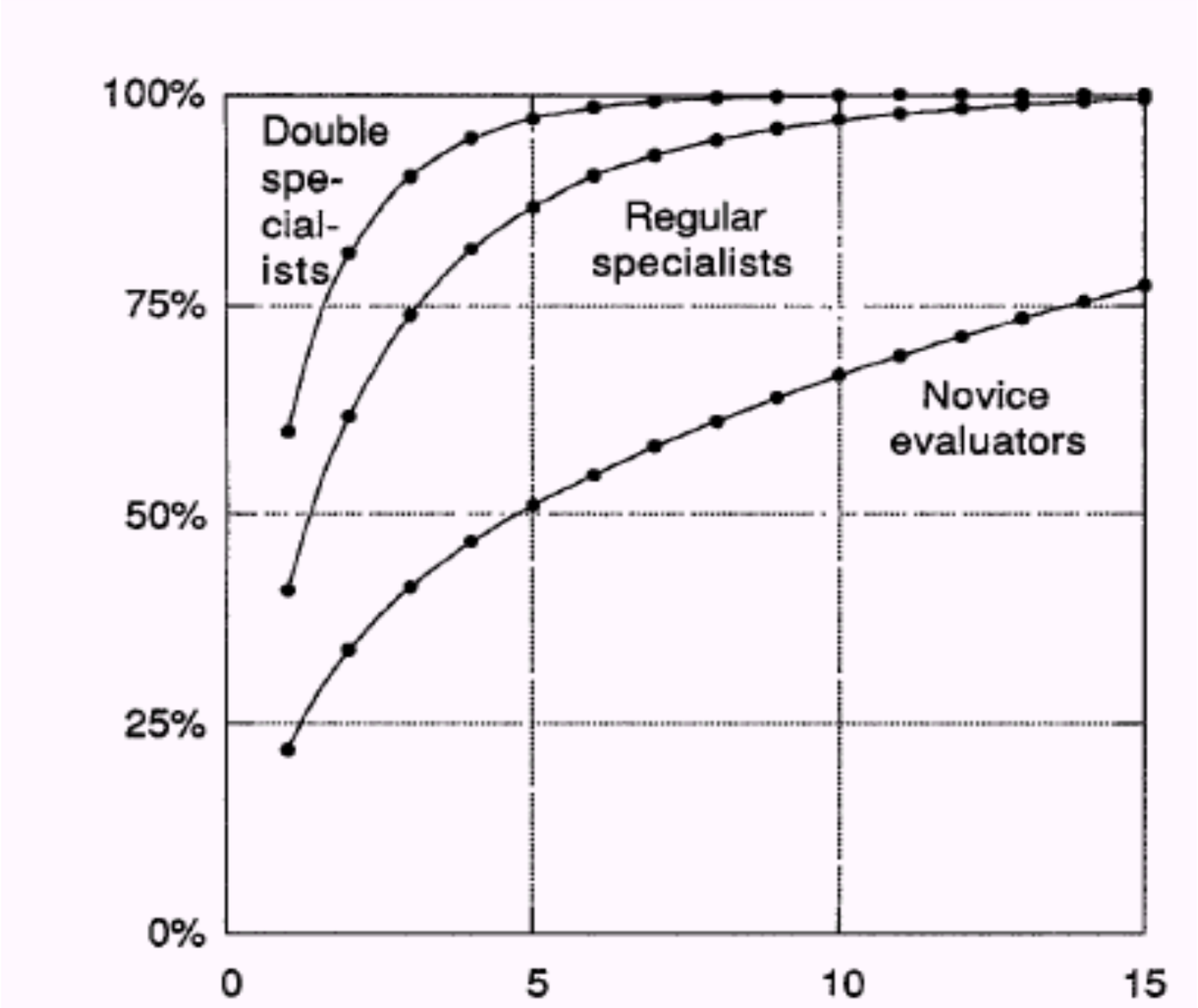

Figure 2 *Average proportion of usability problems found as a function of number of evaluators in a group performing the heuristic evaluation.*

Advantages of HE

- “Discount usability engineering” - Intimidation low
- Don’t need to identify tasks, activities
- Can identify some fairly obvious fixes
- Can expose problems user testing doesn’t expose
- Provides a language for justifying usability recommendations

Disadvantages of HE

- Un-validated
- Do not employ real users
- Can be error prone
- Better to use usability experts
- Problems unconnected with tasks
- Heuristics may be hard to apply to new technology

Ways to use HE

- Early in design process to catch major issues
- When time or resources are not available for empirical usability evaluation

In class activity

- Form groups of 3 or 4
- Together select an application or website (e.g., Word, Twitter)
- Work individually identify at least 1 usability issue
- For each issue, identify the heuristic, identify the functionality in the application, and summarize how the heuristic is violated in a few sentences