CS 4530: Fundamentals of Software Engineering

Lesson 6.1 UI Design / User-Centered Design

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Learning Objectives for this Lesson

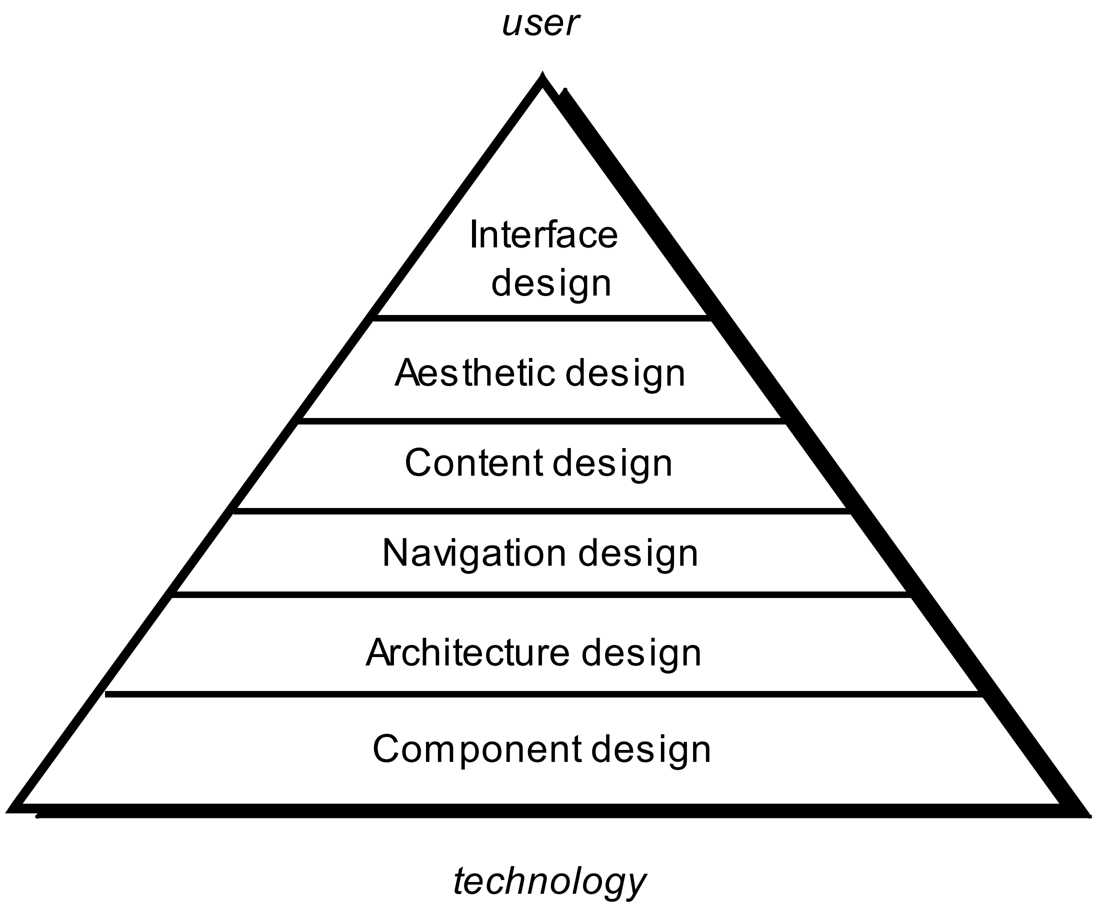
- By the end of this lesson, you should be able to:
  - Describe the major aspects of usability;
  - Articulate the process of user-centered design;
  - Explain several heuristics for good user interaction.

Goal: Build the Right Product

- If the product doesn’t do what the users want…
    - … we’ve wasted time and money.
- If the product is not usable by the users…
    - … we will need to invest time/money to make it usable.
- Users are often not sure exactly what they want,
    - … so we iterate the requirements process.
- We shift development “to the left” (closer to user)
    - We correct mistakes
        - Before design, or else
        - Before coding, or else
        - Before debugging, or else
        - Before deployment.

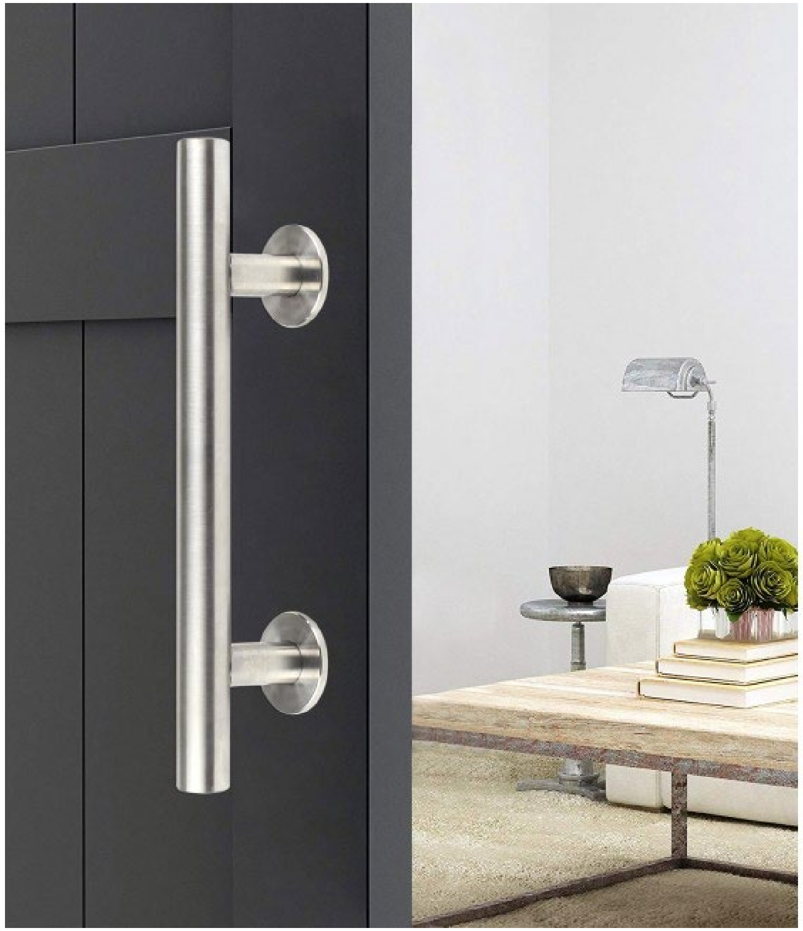
The earlier,
The better!

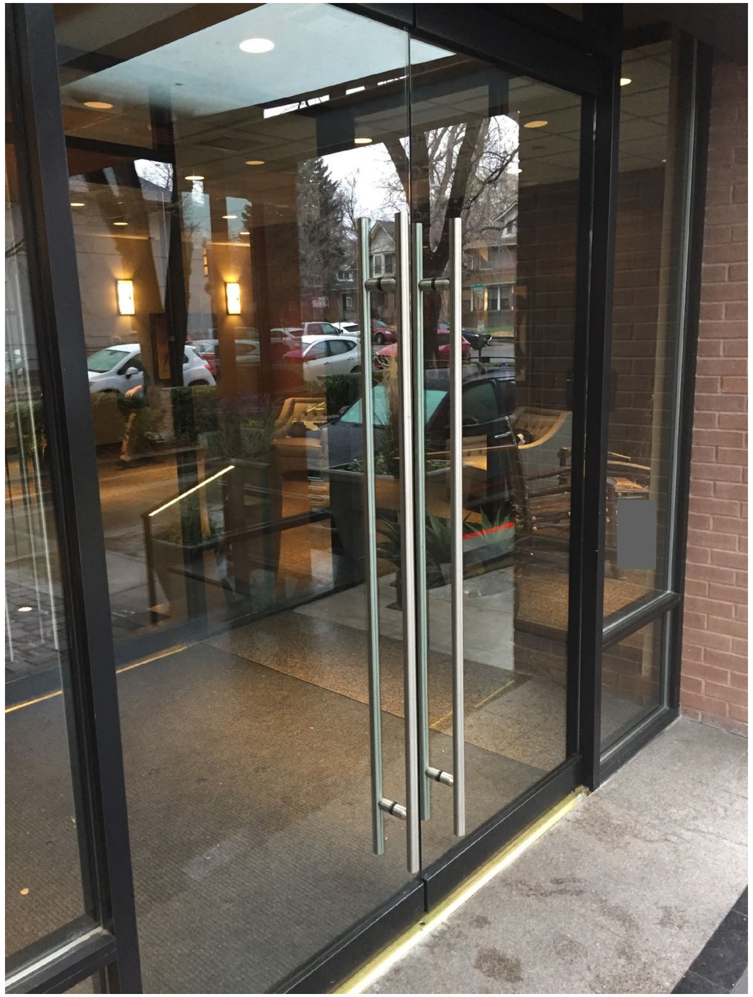
UI Design is important part of the link between user and technology



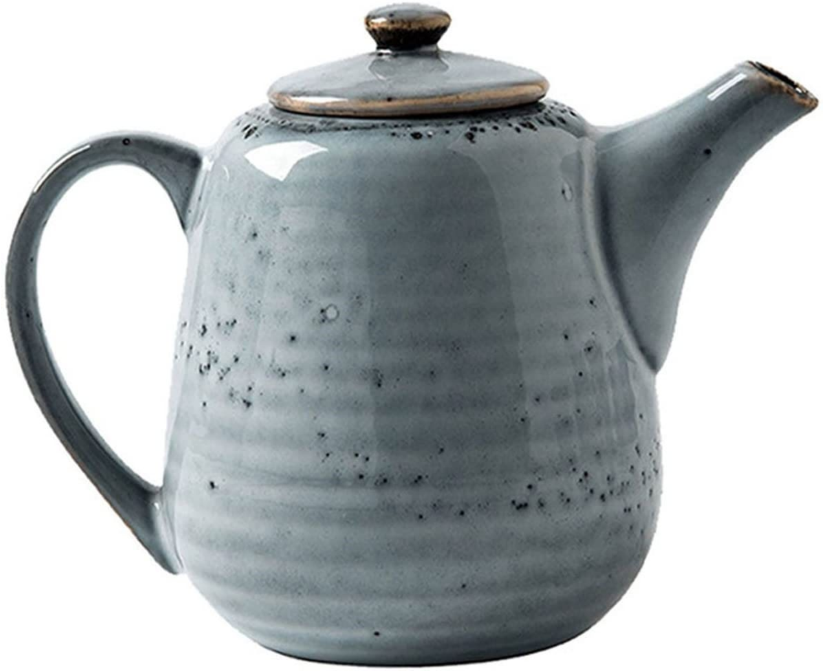
- Software Design includes a lot more than just designing components and architecture
- Important to design:
  - User Interfaces
  - Contents
  - Navigation
- We want “Usable” software

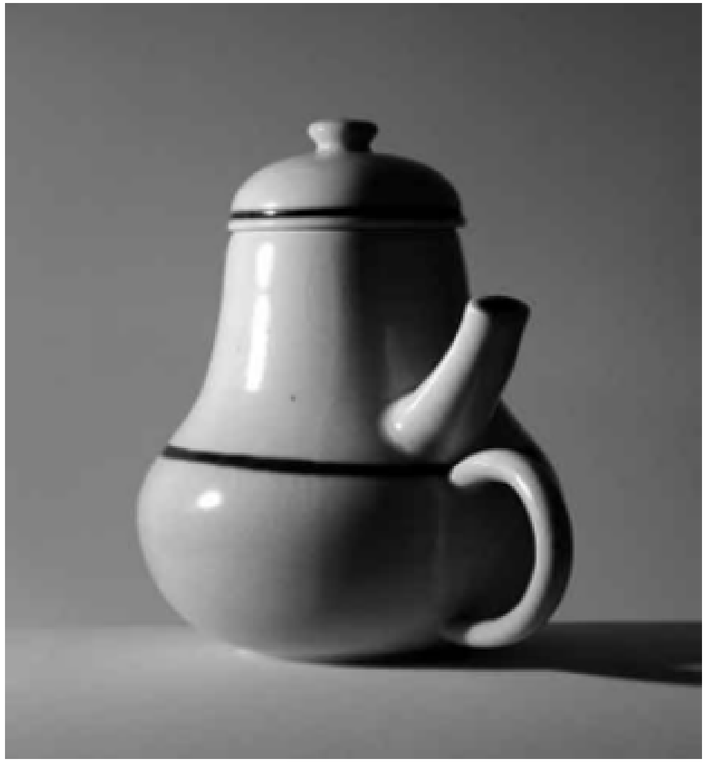
Usable or Unusable?





Usable or Unusable?





From Don Norman, Psychology of Everyday Things (c 1988)

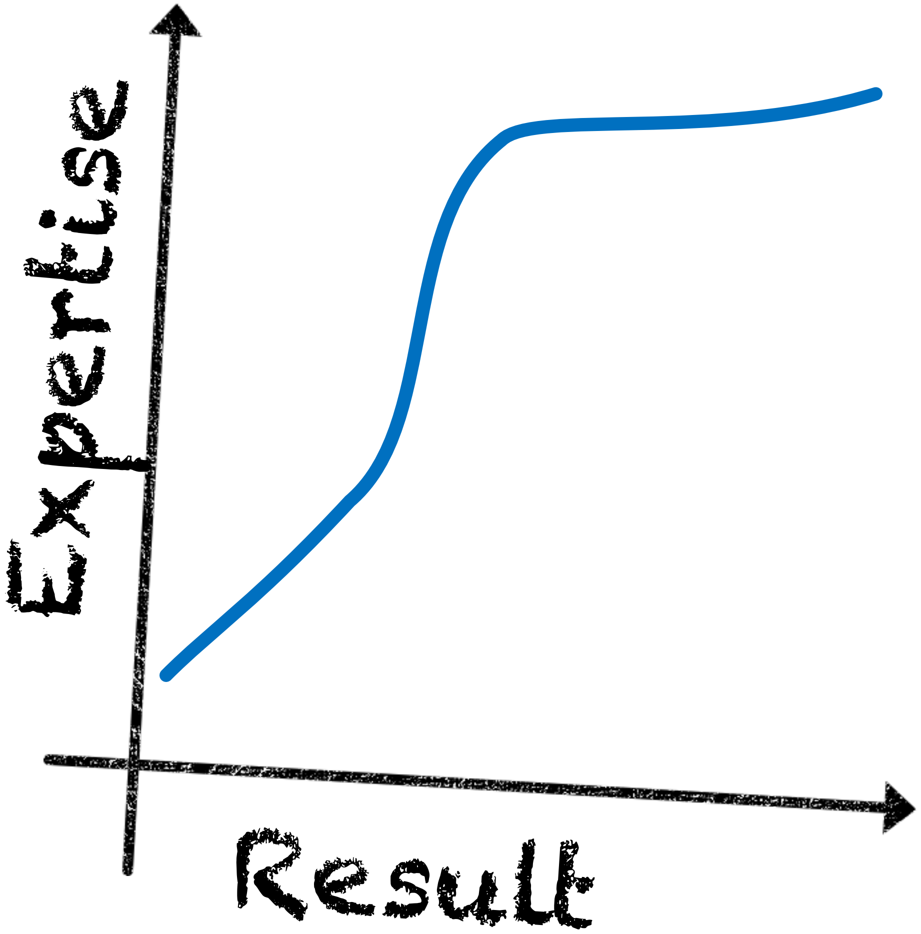
“Usability”: a Definition

- *Usability* is …
- … a measure of how …
  - … an artifact …
  - … impacts …
  - … a human …
    - … with particular goals.

For us:
a software artifact

The goals are key!

Usability Characteristics (1 of 5): Learnability

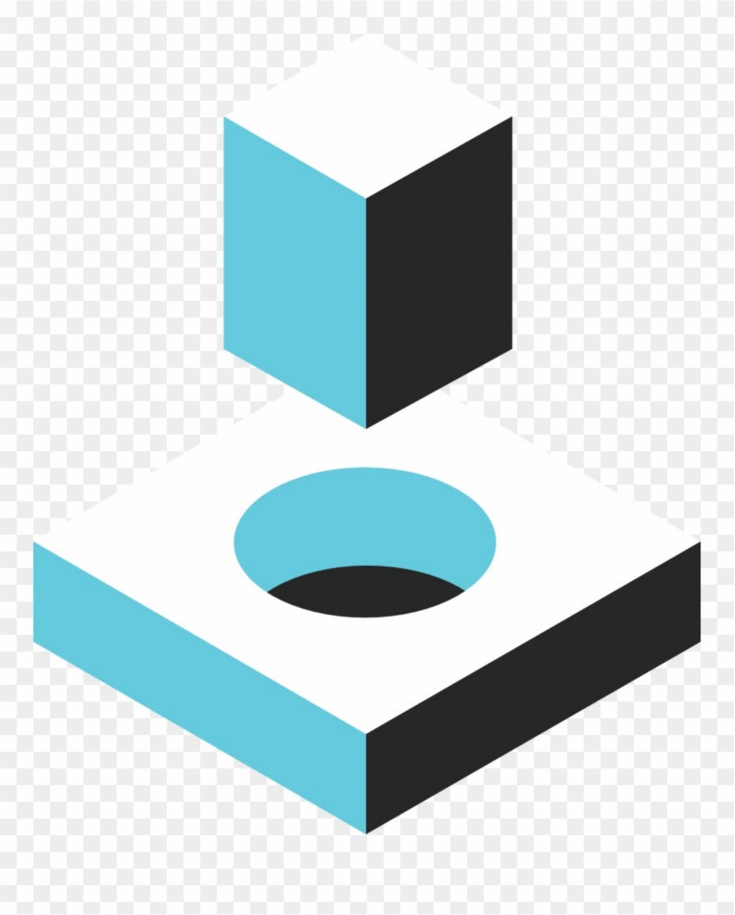


- How easy is it to learn to use the artifact to accomplish a goal?

- A “steep” learning curve requires a lot of expertise before one can achieve results.

Usability Characteristics (2 of 5): Effectiveness

- How often does the use lead to completion of a goal?
- Is the artifact “fit for purpose”?

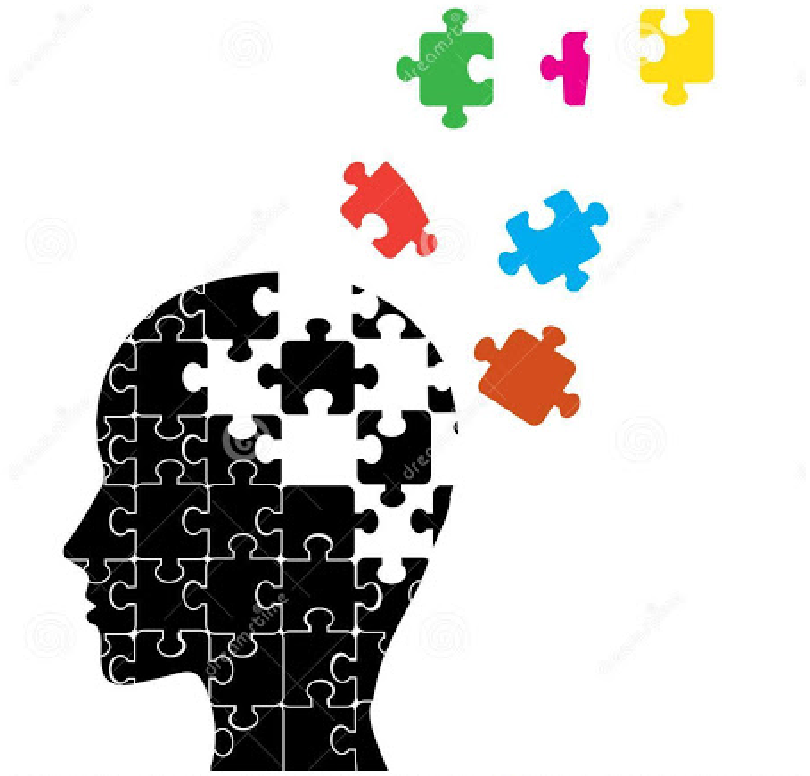


Usability Characteristics (3 of 5): Productivity

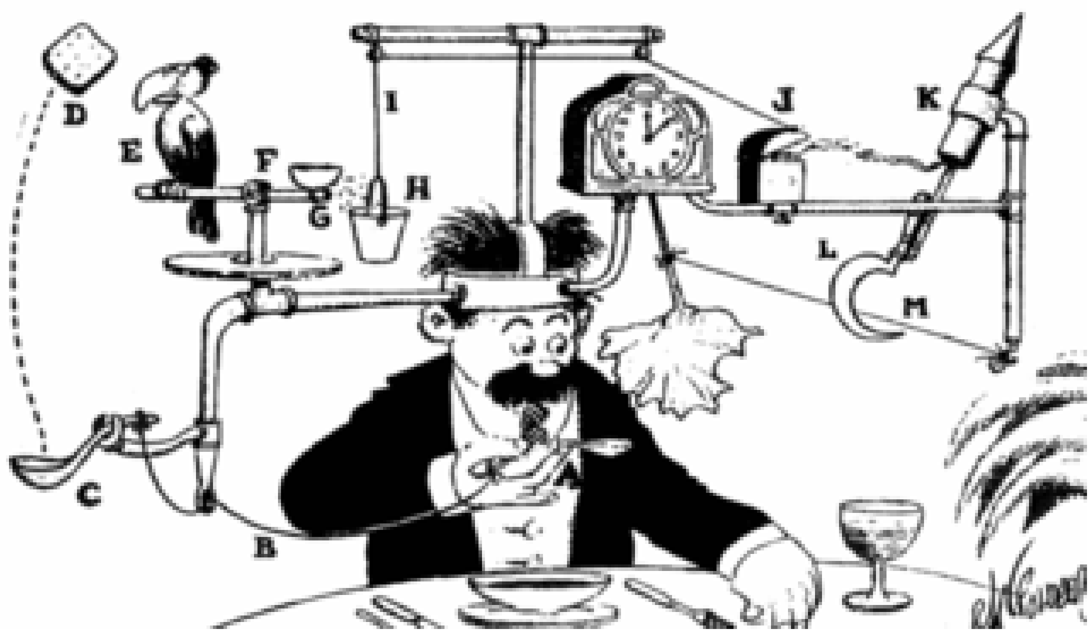
- How large a multiplier of human effort does this artifact give?
- Does it make hard things easy? (or the reverse!)

Usability Characteristics (4 of 5): Retainability

- How long is the ability to use the artifact retained between uses?
- Inner consistency can help mitigate a steep learning curve.



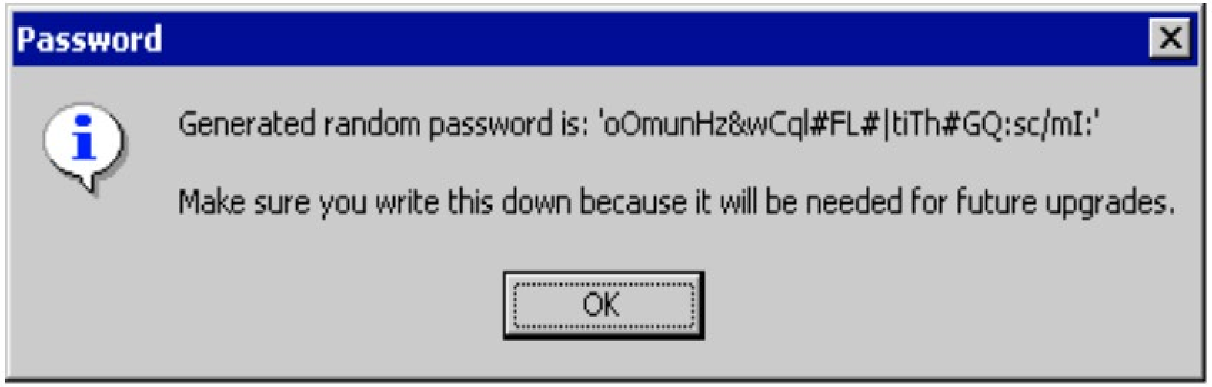
Usability Characteristics (5 of 5): Satisfiability



- How pleasant is the artifact to use?
- Is it elegant and simple?

Why study Usability?

- It is crucial for user satisfaction



Generated random password is: 'oOmunHz&wCql#FL#|tiTh#GQ:sc/mI:'

Make sure you write this down because it will be needed for future upgrades.

Adapted from Maneesh Agrawala & Bjoern Hartmann

Crash of AA Flight 965

http://en.wikipedia.org/wiki/American_Airlines_Flight_965

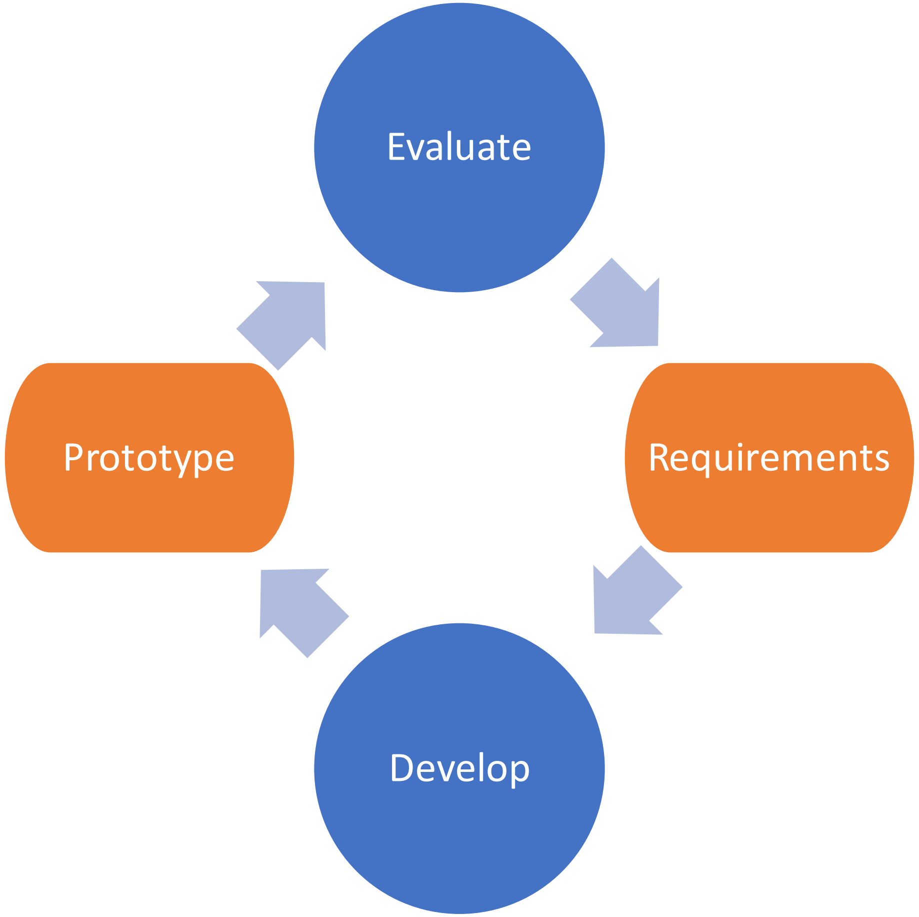
Airbus A350 Cupholders

“Usability

- **Not…**
  - “dummy proofing”
  - being “user-friendly”
  - making software pretty
- **Usability IS:**
  - Recognize: “The user may not be like me”
  - Understanding **<u>user</u>** needs, tasks, goals
- **User’s mental model *matches with* designer’s mental model**

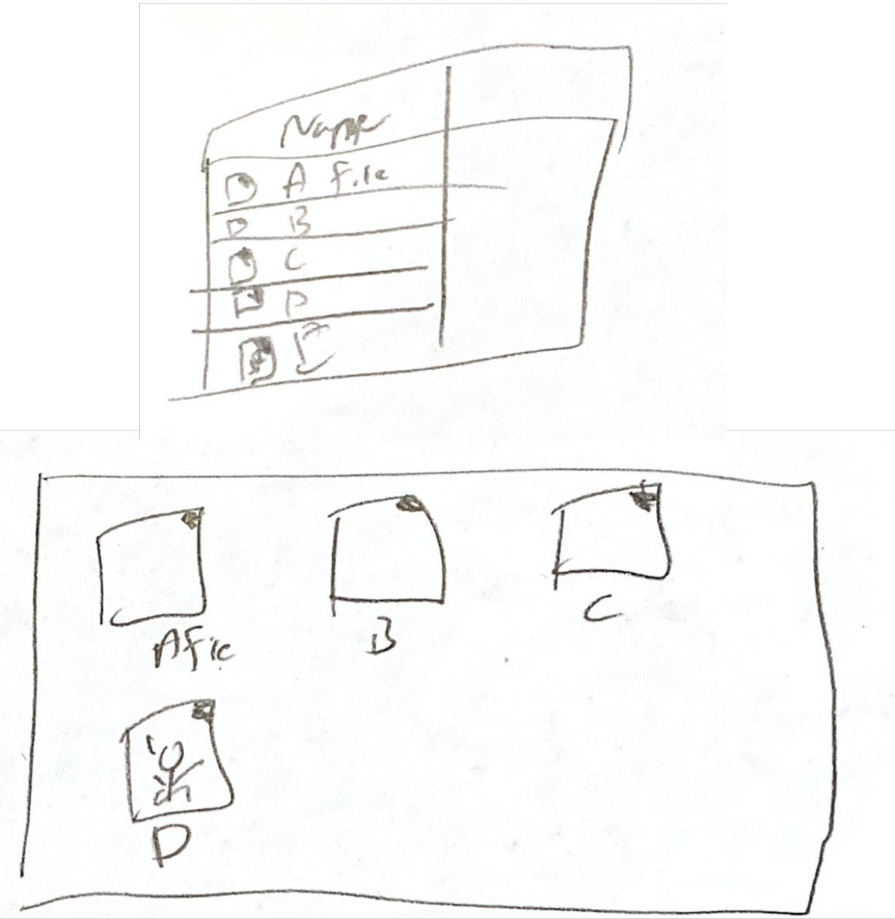
User-Centered Design

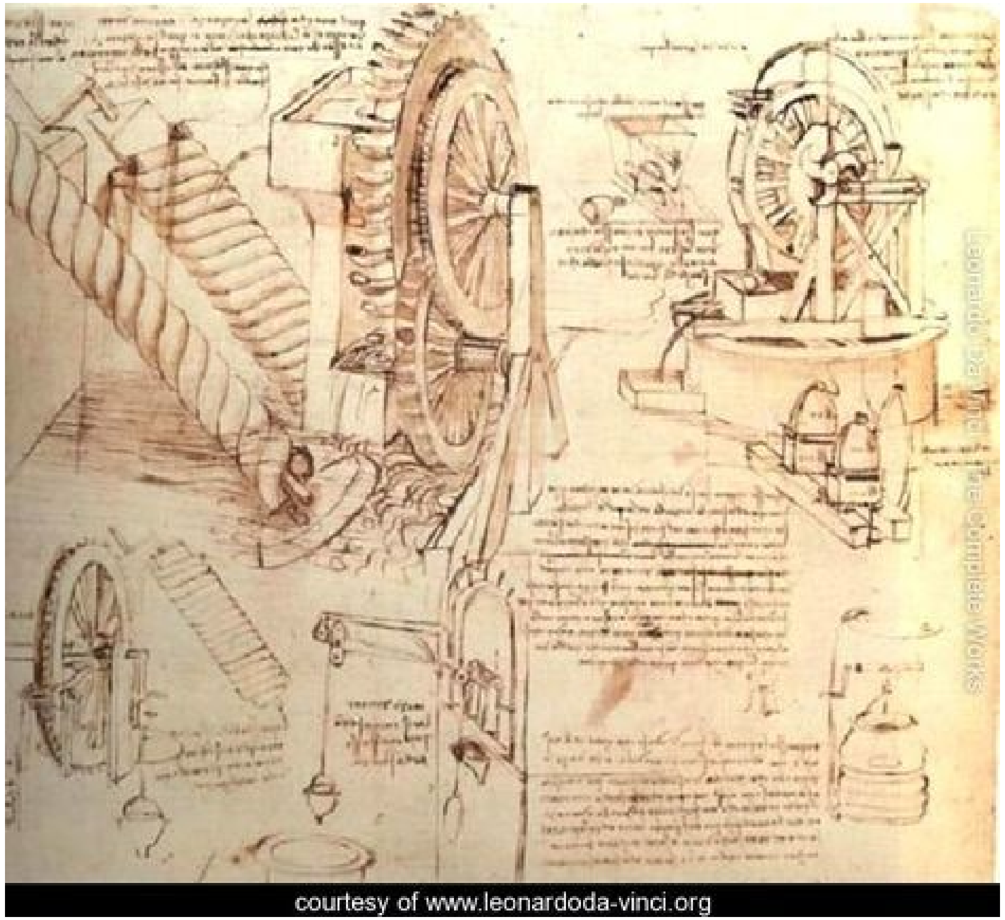
- A system is evaluated from the user viewpoint.
  - Ideally by the users!
- Tension: when do we evaluate?
  - An incomplete product may not be usable;
  - If a product is complete, using evaluation has cost.
- Resolution: evaluate *prototype*!



Key Idea: Design Alternatives

- Use sketches

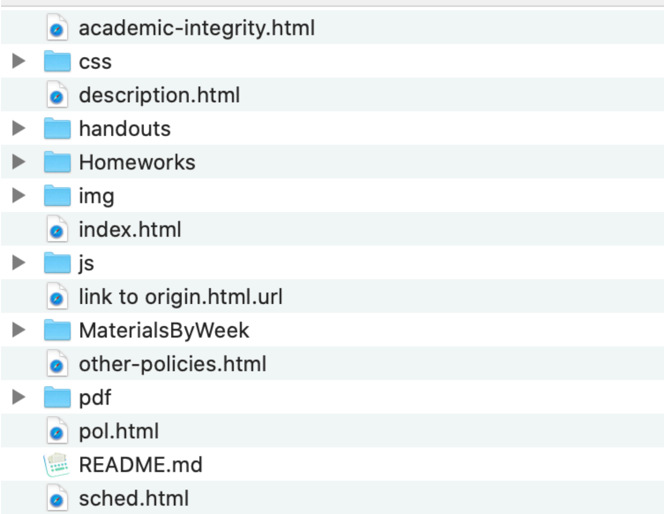




courtesy of www.leonardoda-vinci.org

Key Idea: Design Alternatives

- Think broadly with wide range of possible designs then choose "*one*"



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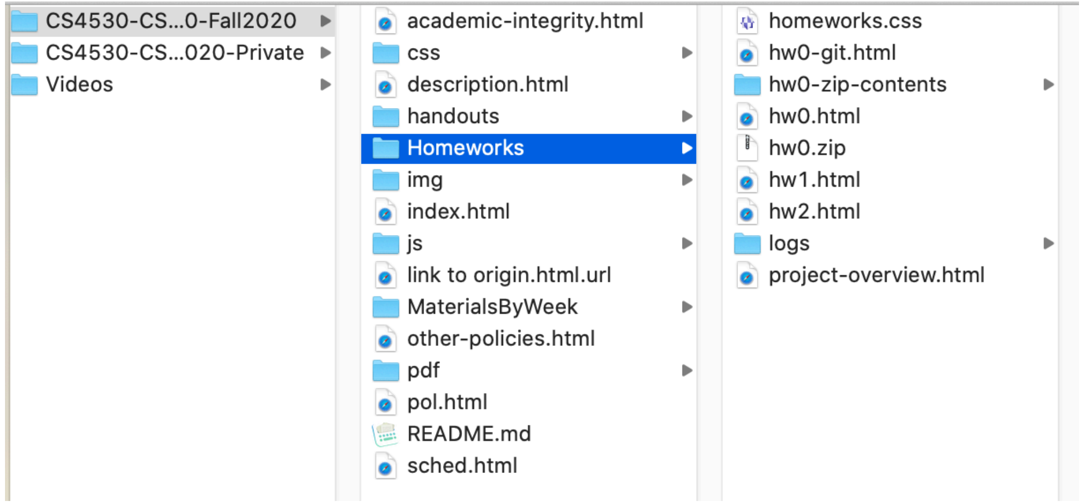

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CS4530-CS...020-Private
Videos

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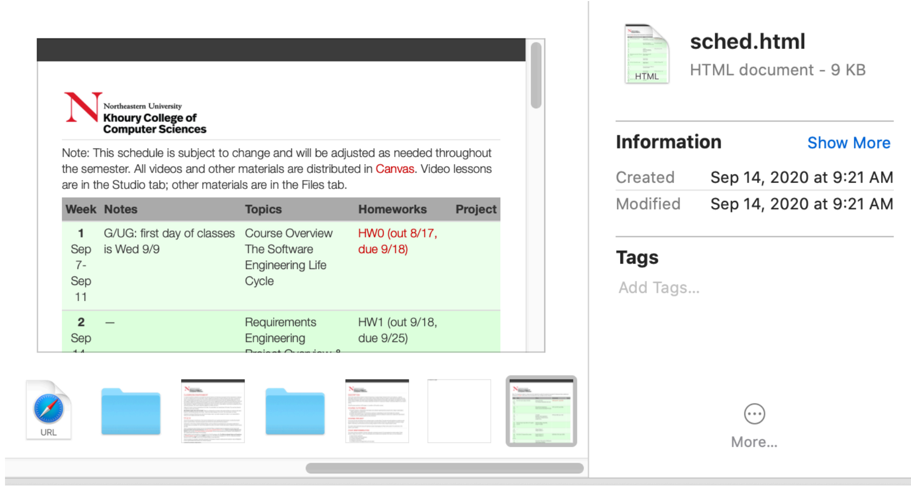

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Note: This schedule is subject to change and will be adjusted as needed throughout the semester. All videos and other materials are distributed in Canvas. Video lessons are in the Studio tab; other materials are in the Files tab.

Week	Notes	Topics	Homeworks	Project
1 Sep 7-Sep 11	G/UG: first day of classes is Wed 9/9	Course Overview The Software Engineering Life Cycle	HW0 (out 8/17, due 9/18)	
2 Sep	—	Requirements Engineering	HW1 (out 9/18, due 9/25)	

sched.html
HTML document - 9 KB

Information
Show More

Created Sep 14, 2020 at 9:21 AM
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Tags
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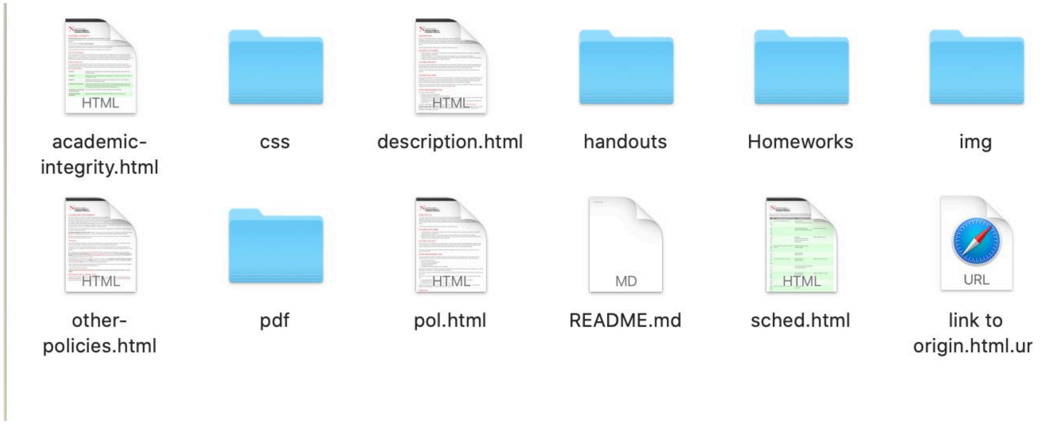

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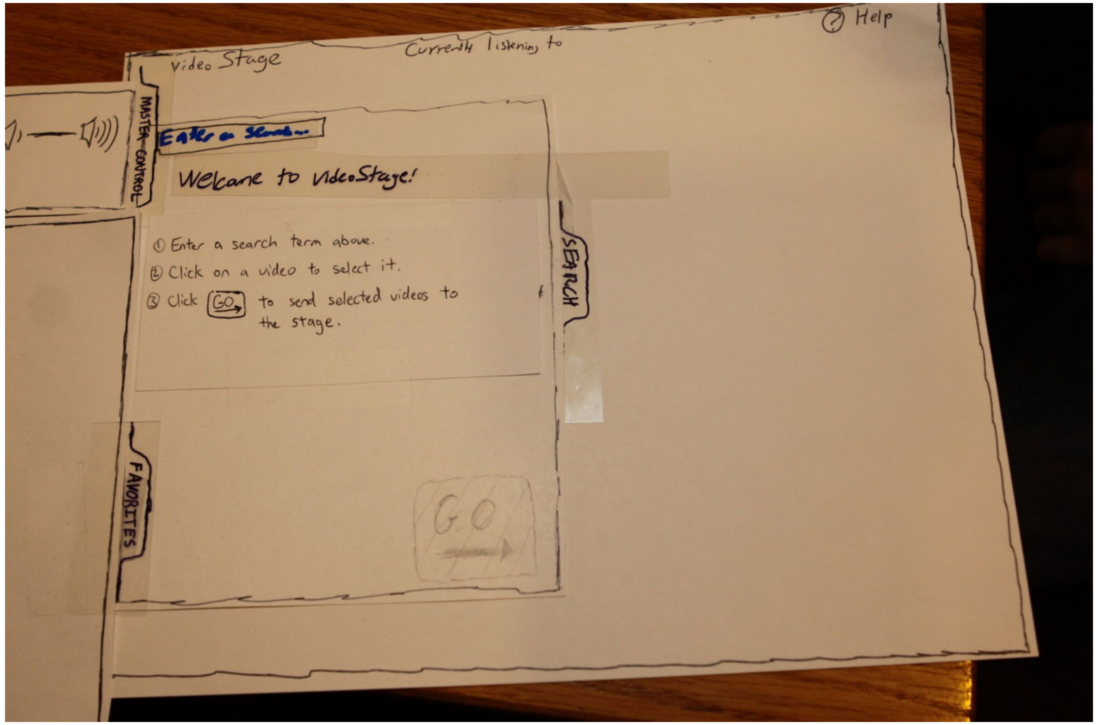
Prototype (1 of 3): Paper Simulation



① Enter a search term above.
② Click on a video to select it.
③ Click GO to send selected videos to the stage.

- Hand-drawn user interfaces:
  - on paper or card;
  - made on the spot.
- Developers animate:
  - Present to test user;
- Users act:
  - Indicate what they would do.
- Advantage: *fast turnaround, cost less, allow more iterations*

Prototype (2 of 3): Wizard-of-Oz

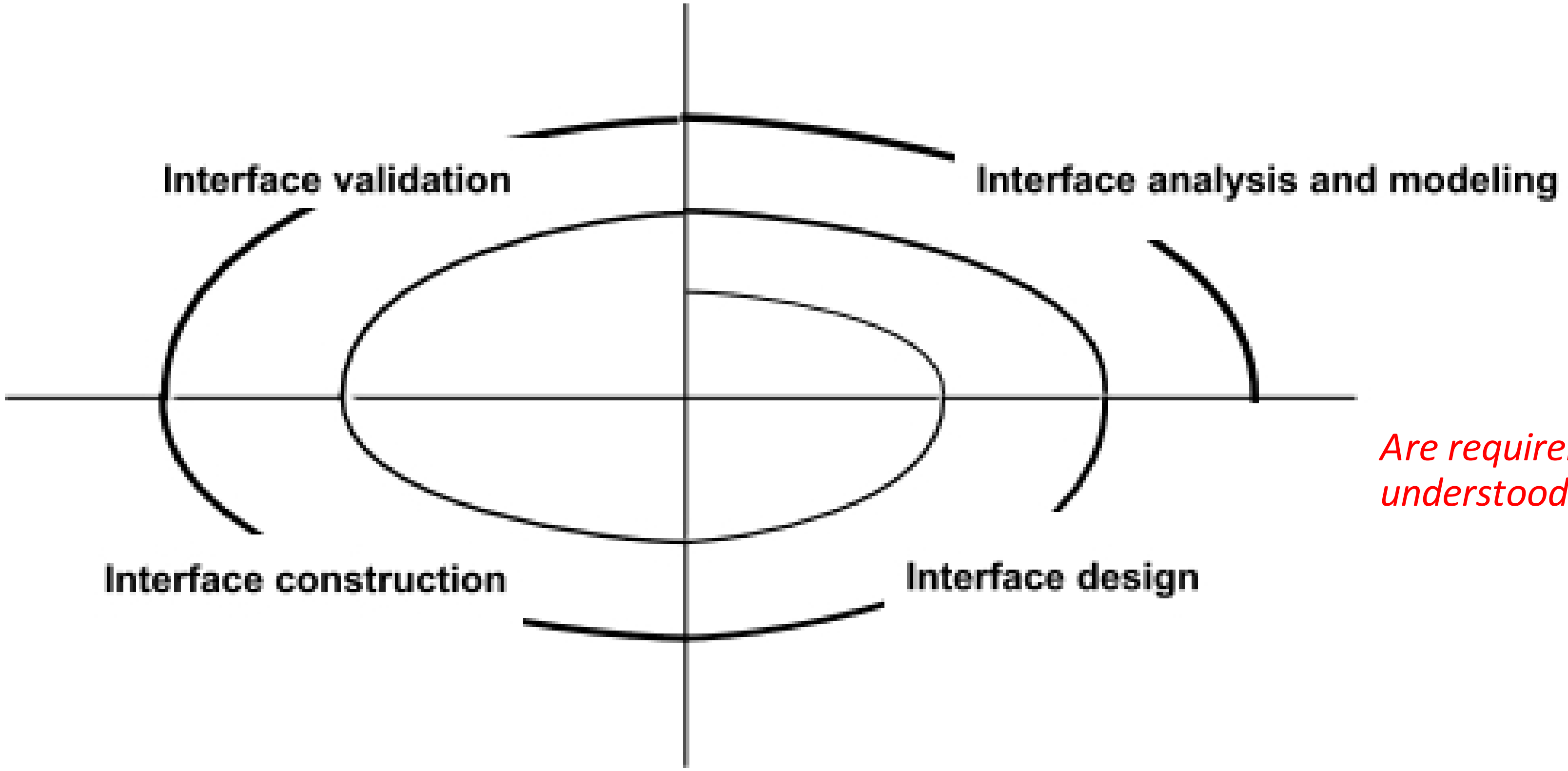
- Software has right “look”
  - But barely functional.
- Scripted interaction only
  - All responses are “canned.”
- Illusion is effective.

Prototype (3 of 3): Working Prototype

- The software system partly implemented:
  - User interface fully realized;
  - Functionality limited.
- Particularly for feature requests:
  - New feature can get quick-and-dirty implementation
  - Quickly get feedback if the right feature is implemented.
- Comparison of UCD with TDD:
  - In TDD: feature request is realized in a test;
  - In UCD: feature request is realized in a user-interface.

In both cases, we delay implementation
until more understanding gained:
Move decisions closer to customers.

User-Centered Design is *refined*



Are requirements fully understood ?

Tips for Aesthetic Design (UI Design)

- Don’t be afraid of white space.
- Emphasize content that meets user needs.
- Organize layout elements from top-left to bottom right.
- Group navigation, content, and function geographically within the page/screen.
- Don’t extend your real estate with the scrolling bar.
- Consider resolution and browser window size when designing layout.

https://blog.prototypr.io/ux-design-101-prototyping-rapidly-sketching-wireframes-65b7dfbabf52

Forms of User Evaluation

- Empirical evaluation study
    - “How many tasks accomplished in N minutes?”
- Qualitative evaluation
    - Observers find patterns in interaction;
    - Users give feedback after use.
- ”Dogfooding” (internal evaluation)
    - Developers use product as soon as feasible.
- Heuristic evaluation
    - Evaluate against best practices.

Best Practice Heuristics (Nielsen)

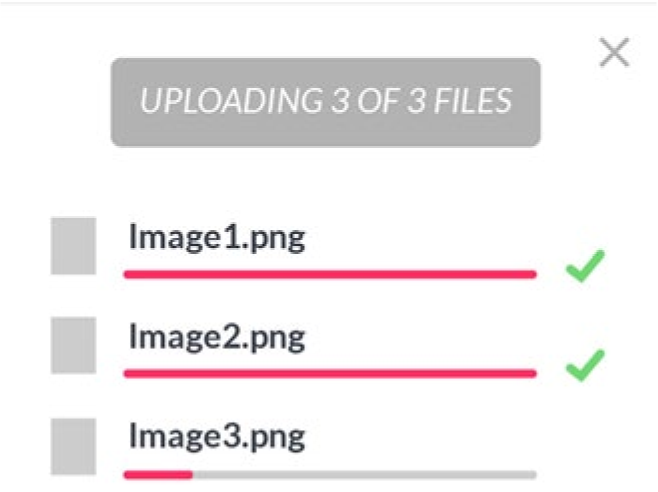
- “*Discount* ($) usability engineering methods”
  - Pioneered by Jakob Nielsen in the 1990s
- Involves a small team of evaluators to evaluate an interface based on recognized usability principles
- Heuristics–”rules of thumb”

Much cheaper than an evaluation with ”real” users!

(Adapted from slides by Bonnie John and Jennifer Mankoff)

H1: Visibility of System Status

- Interface should show:
  - What input has been received;
  - What processing is currently happening;
  - What results have already been completed.
- This feedback allows
  - user to monitor progress towards solution of their task;
  - allows the closure of tasks; and
  - reduces user anxiety (Lavery et al).
- Great podcast with interview with Brad Myers, creator/popularizer of progress bar in his 1985 PhD thesis ([99 Percent Invisible 9/3/19]())

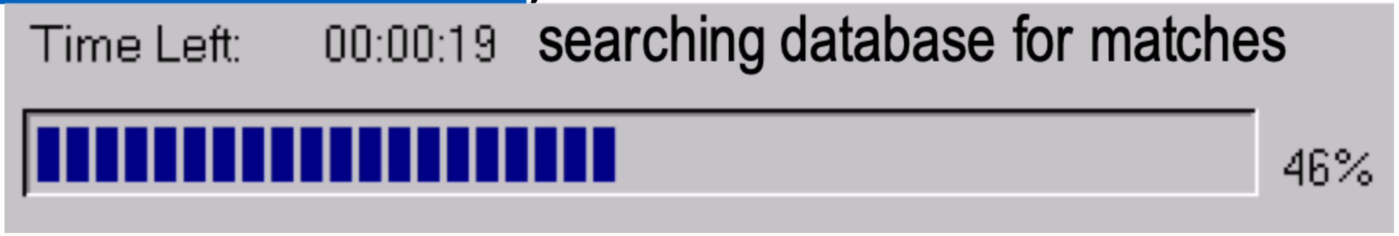


UPLOADING 3 OF 3 FILES

Image1.png ✓

Image2.png ✓

Image3.png



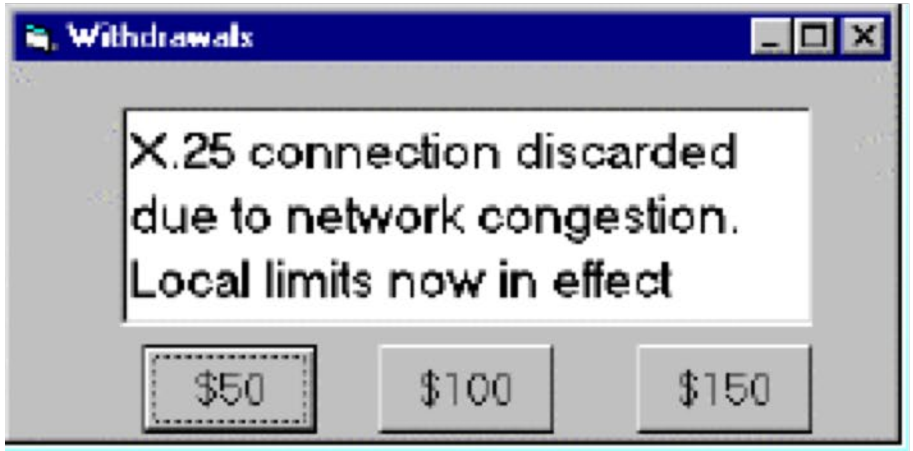
Time Left: 00:00:19 searching database for matches

46%

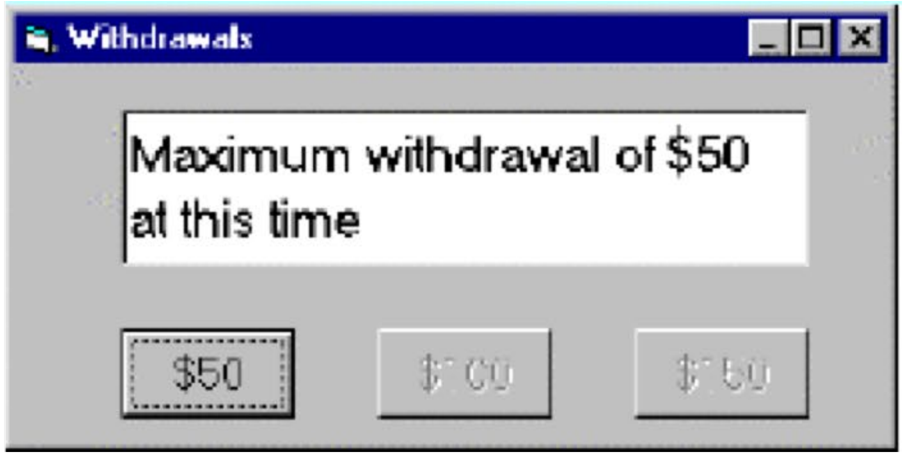
H2: Match Between System and Real World

- Speak the users’ language.
- Follow real world conventions.

- Don’t use internal jargon (“X.25 connection discarded”)
- “Gray out” illegal options.



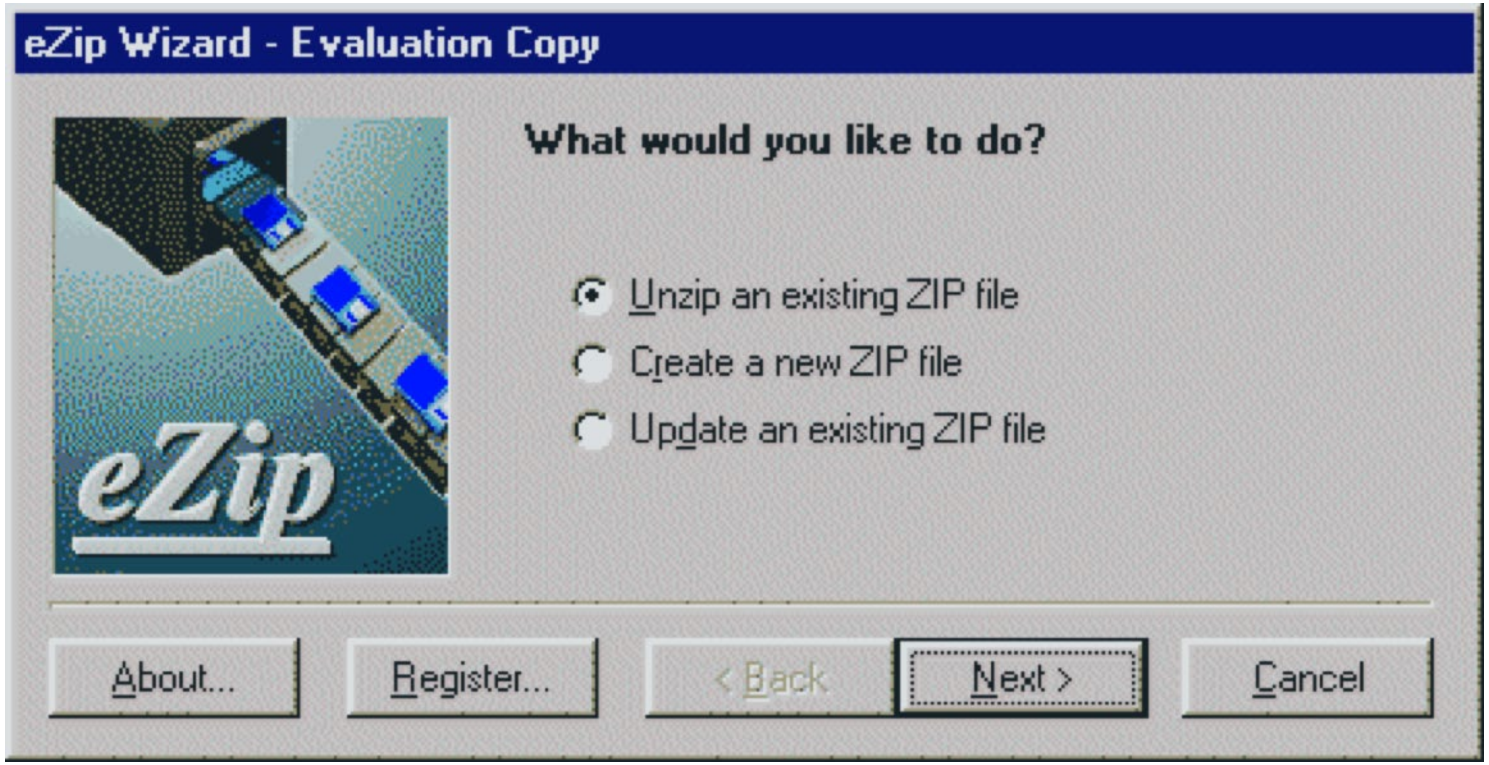
X.25 connection discarded due to network congestion. Local limits now in effect



Maximum withdrawal of $50 at this time

H3: User Control and Freedom

- “Exits” for mistaken choices: undo, redo, cancel
- Don’t force down fixed paths.

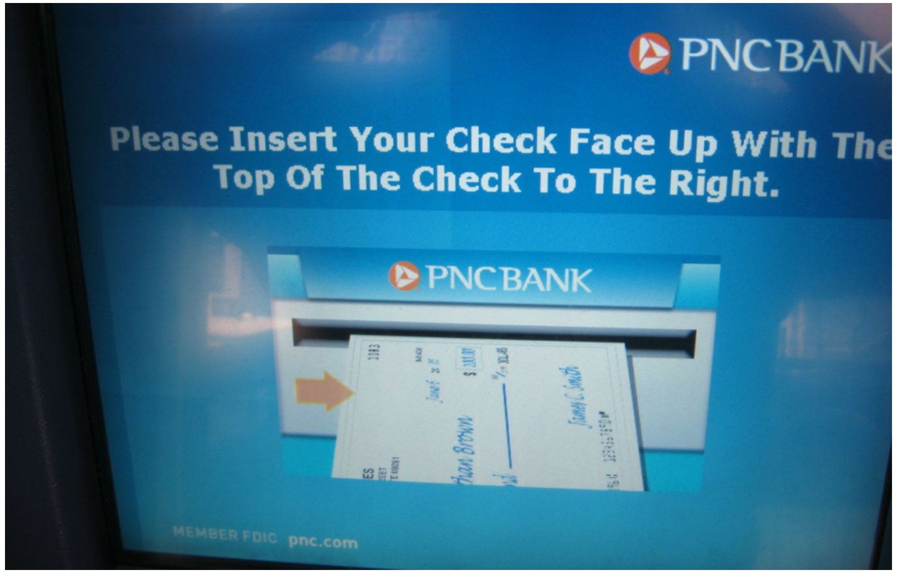


What would you like to do?

● Unzip an existing ZIP file
○ Create a new ZIP file
○ Update an existing ZIP file

H4: Consistency and Standards

- Same words, situations, actions, should mean the same thing in similar situations;
- Same things look the same and be located in the same place.
- Text consistent with figures.
- Different things should be different.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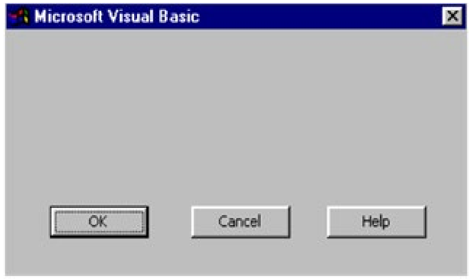
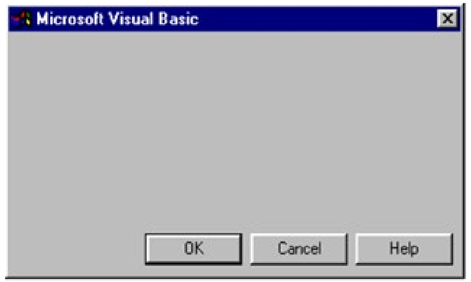
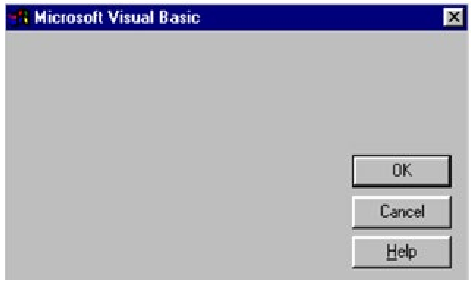
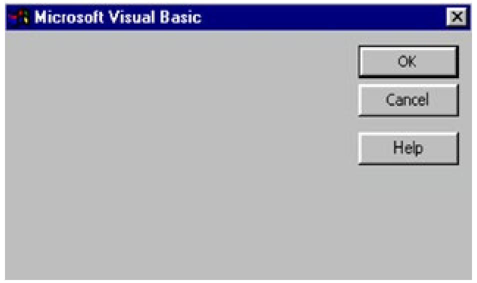
Top Of The Check To The Right.
PNCBANK
MEMBER FDIC pnc.com



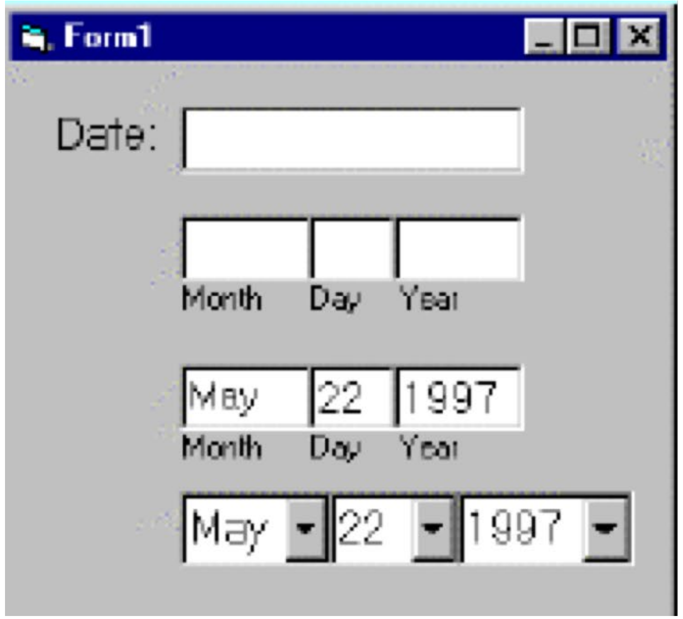






H5: Error Prevention

- Careful design can prevent a problem from occurring in the first place.
- It’s easier to point to a date on the calendar than to type it in the correct format.



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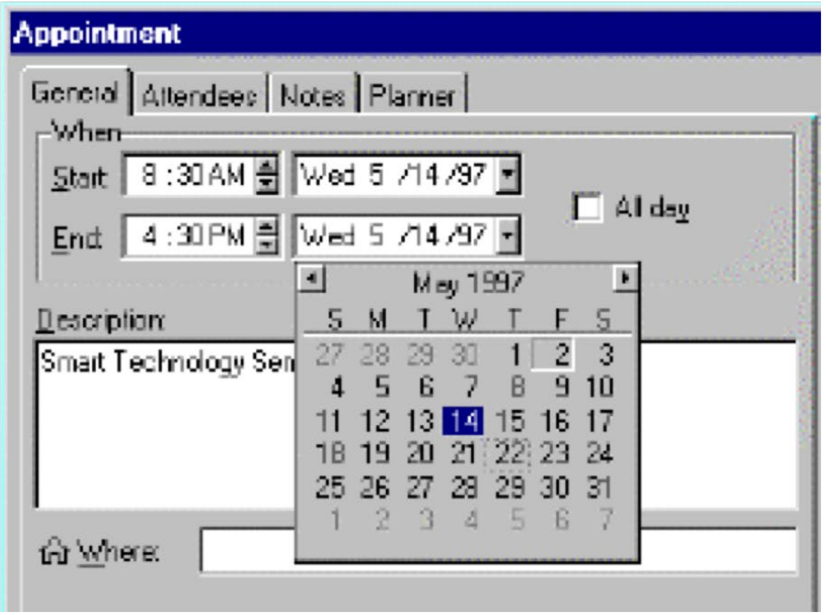


Start 8:30 AM Wed 5/14/97

End 4:30 PM Wed 5/14/97

☐ All day

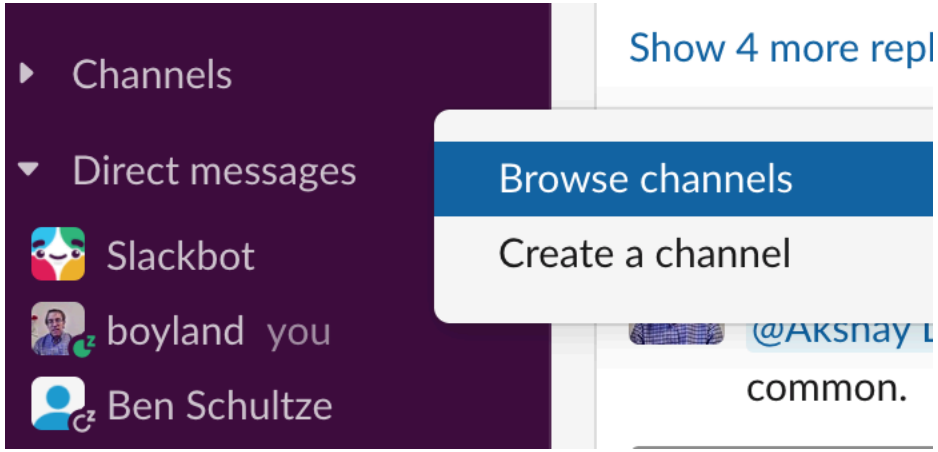
Description: Smart Technology Sem

May 1997

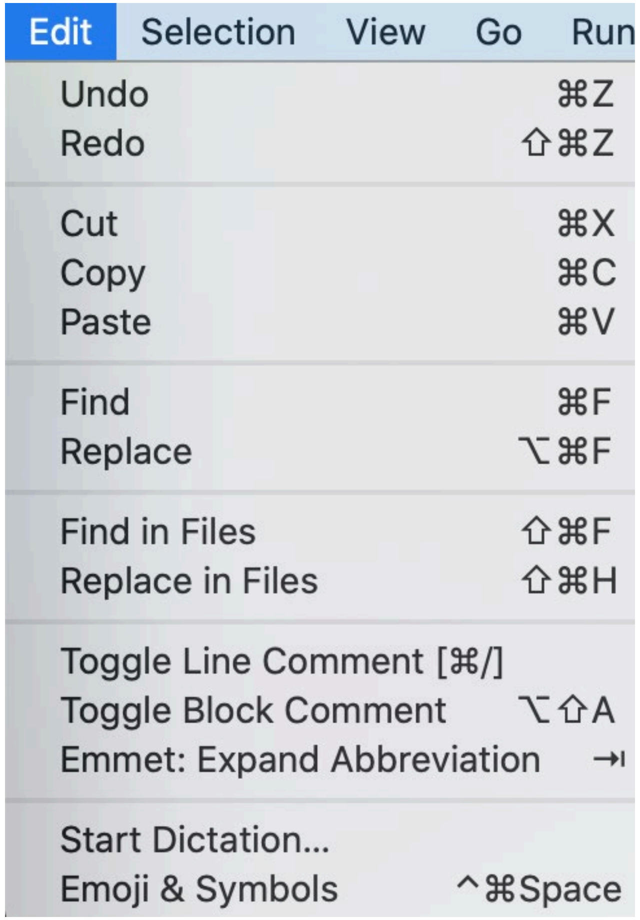
S	M	T	W	T	F	S
27	28	29	30	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31
1	2	3	4	5	6	7

H6: Recognition rather than Recall

- Make objects, actions and options visible or easily retrievable.
- It’s easier to pick out the channel we want to add than to enter the correct name.



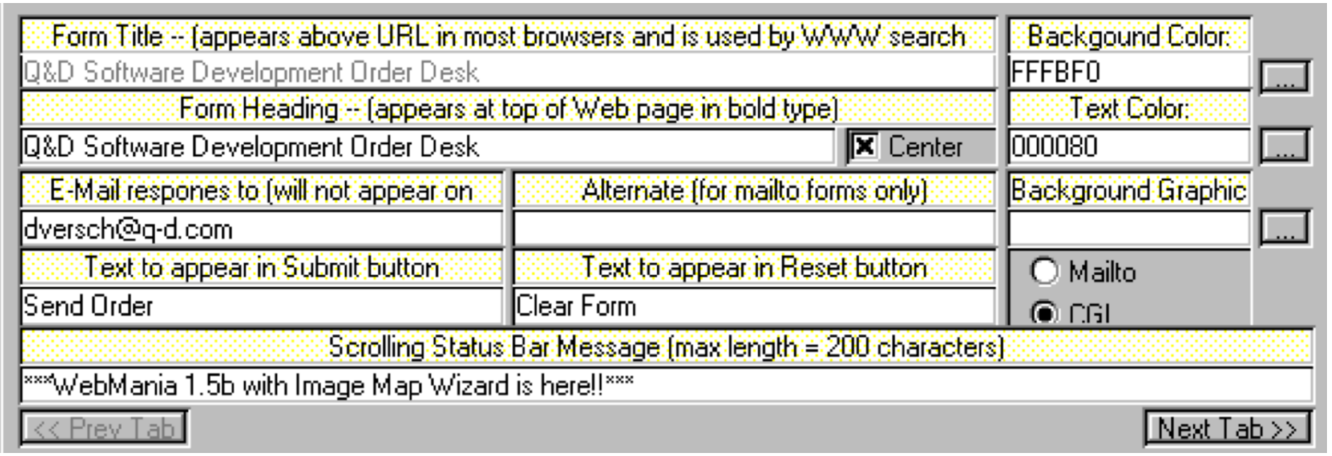
H7: Flexibility and Efficiency of Use



- 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.



Form Title -- (appears above URL in most browsers and is used by WWW search
Q&D Software Development Order Desk

Backgound Color:
FFFBF0

Form Heading -- (appears at top of Web page in bold type)
Q&D Software Development Order Desk ☒ Center

Text Color:
000080

E-Mail respones to (will not appear on
dversch@q-d.com

Alternate (for mailto forms only)

Background Graphic

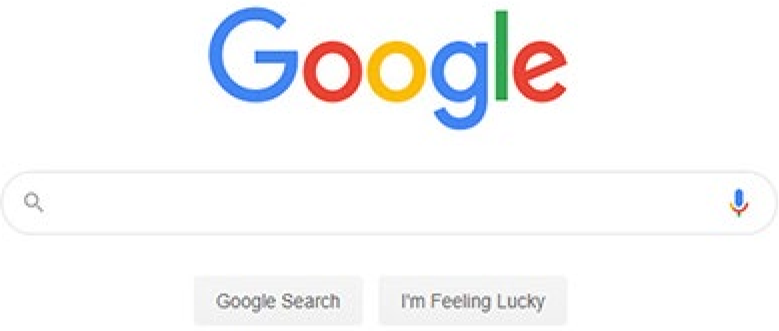
Text to appear in Submit button
Send Order

Text to appear in Reset button
Clear Form

○ Mailto
● CGI

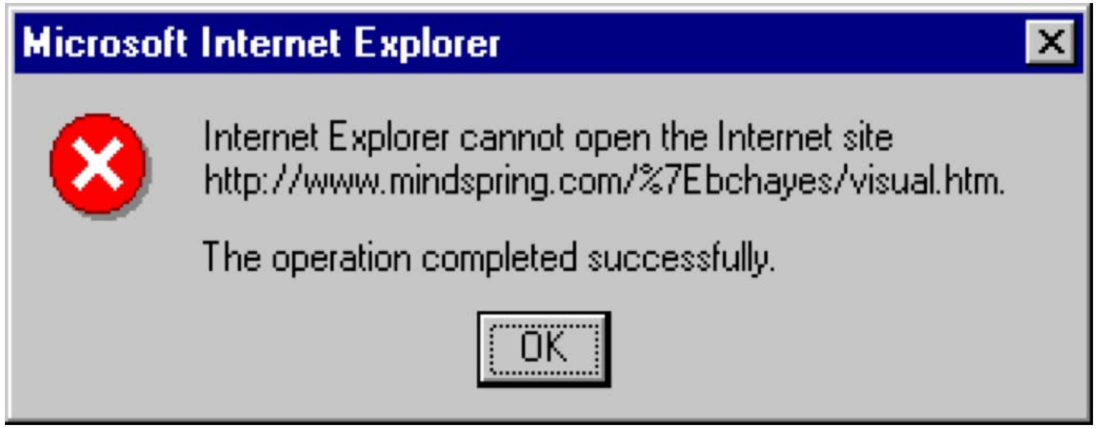
Scrolling Status Bar Message (max length = 200 characters)
WebMania 1.5b with Image Map Wizard is here!!

- Here is an example of minimalist design:



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

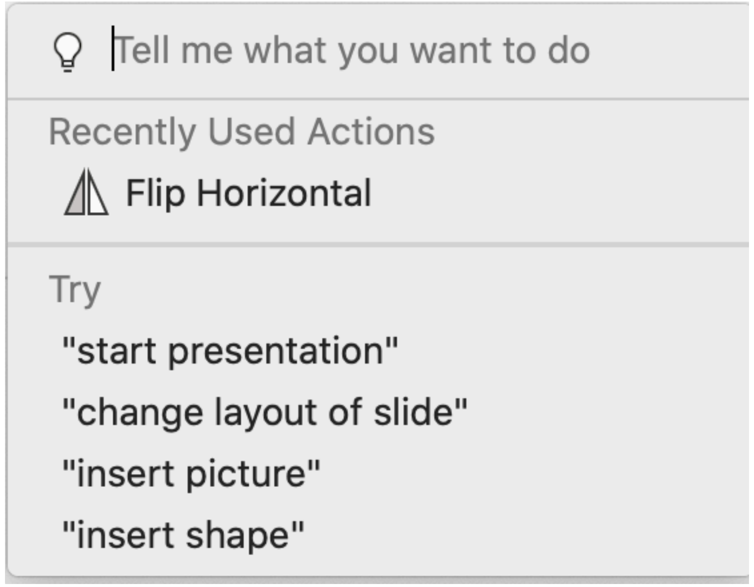
- Use standards to convey errors;
- Error messages should be in language user will understand;
- Precisely indicate the problem;
- Constructively suggest a solution.



Internet Explorer cannot open the Internet site http://www.mindspring.com/%7Ebchayes/visual.htm.

The operation completed successfully.

H10: Help and Documentation



- Should be
  - Easy to search;
  - Focused on the user’s task;
  - List concrete steps to carry out;
  - Always available.

Review: Learning Objectives for this Lesson

- you should now be able to:
  - Describe the major aspects of usability;
  - Articulate the process of user-centered design;
  - Explain several heuristics for good user interaction.