Usability

CSE 331

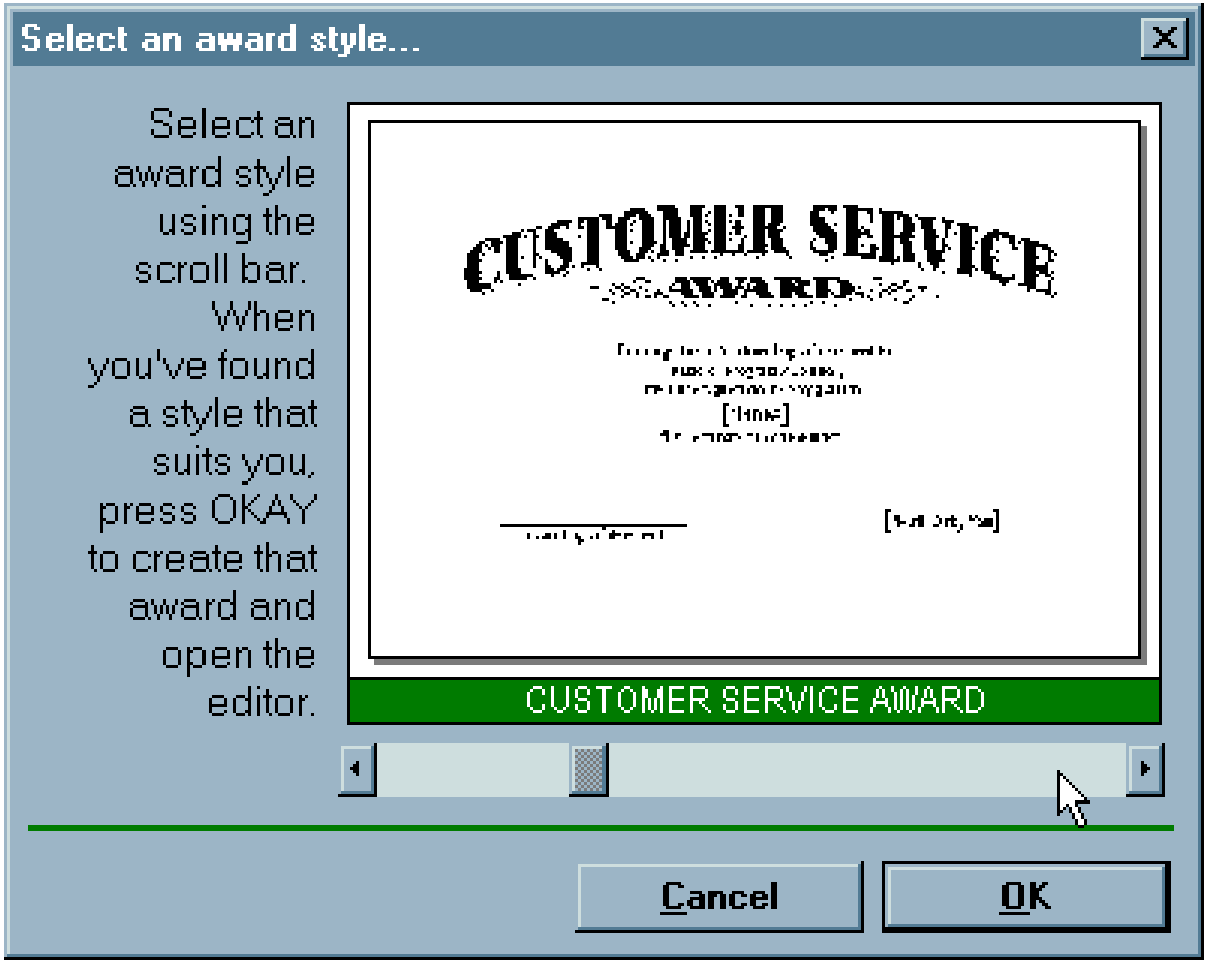
Spring 2010

Slides originally from Robert Miller

User Interface Hall of Shame

Source: Interface Hall of Shame

User Interface Hall of Shame



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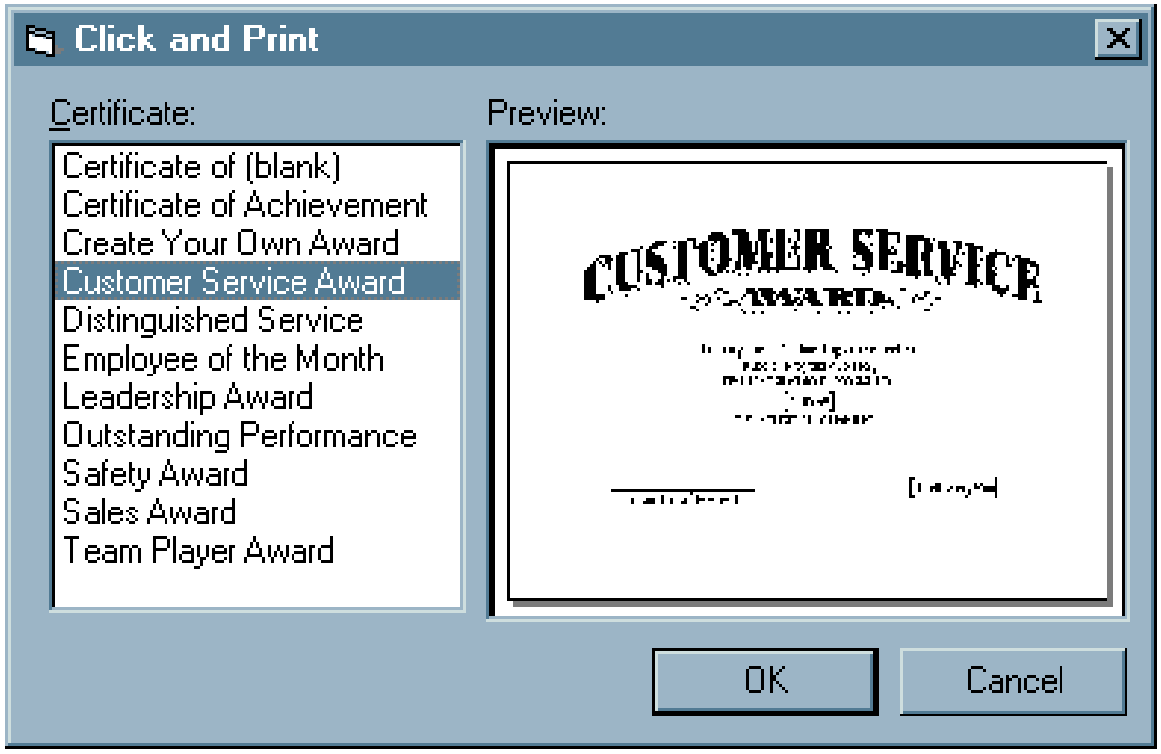
Redesigning the Interface



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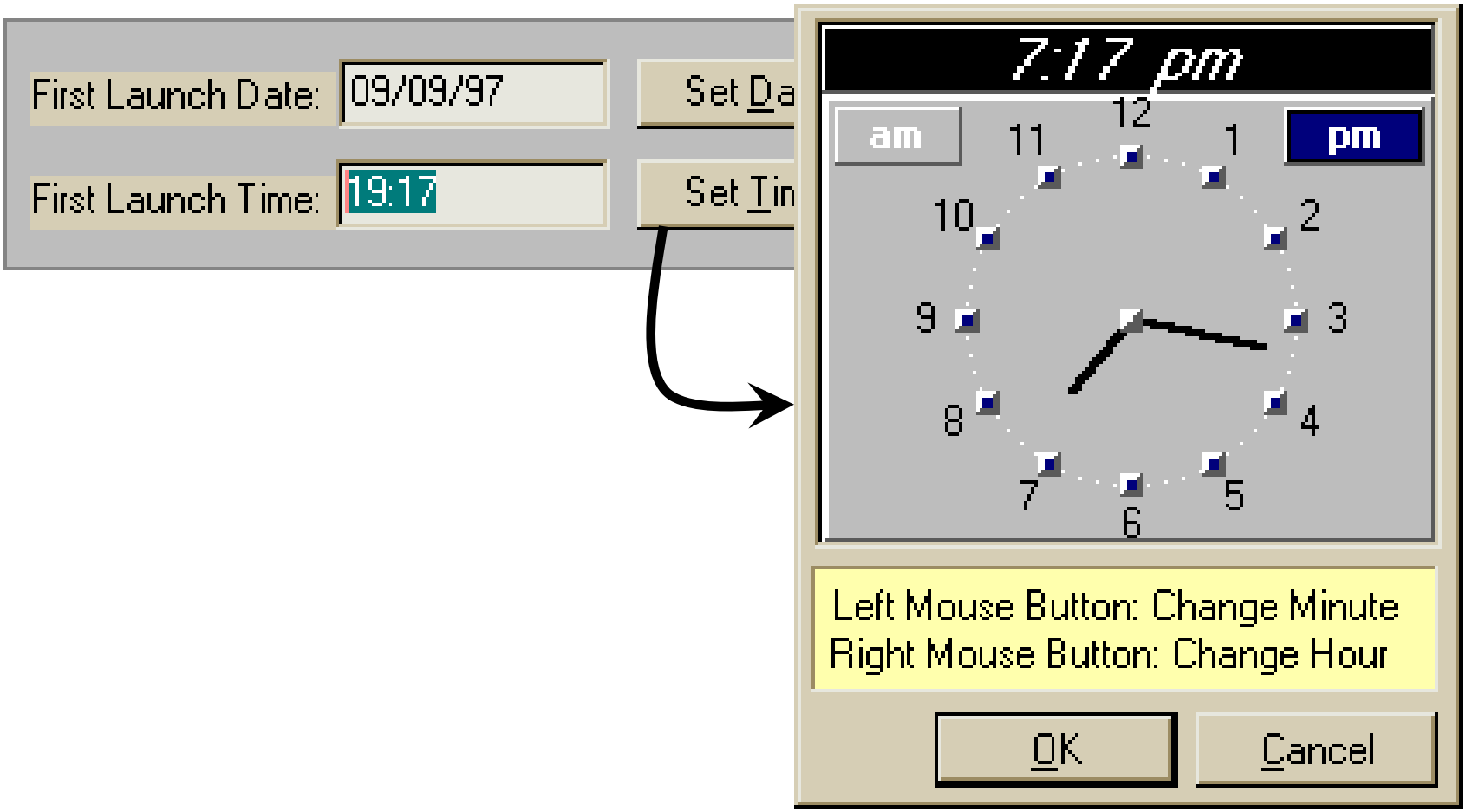
Another for the Hall of Shame



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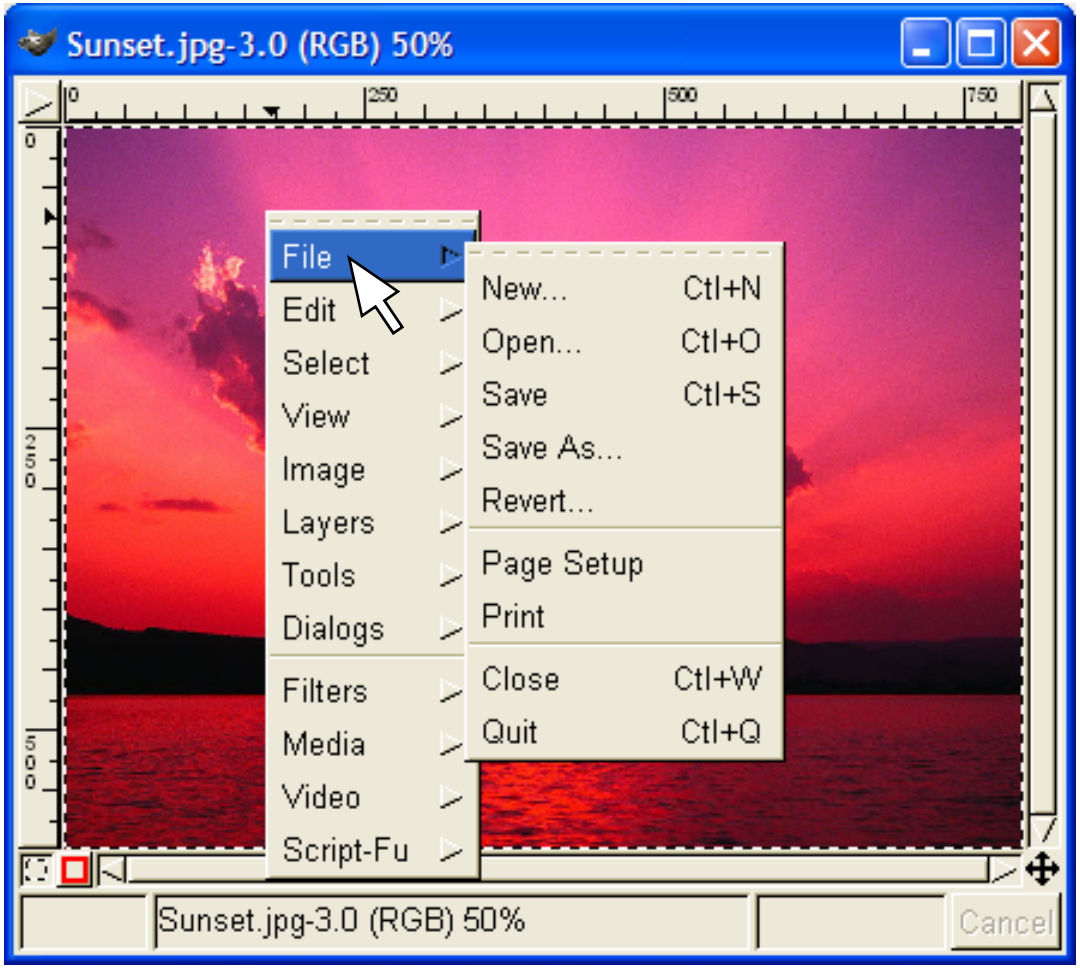
Hall of Fame or Hall of Shame?

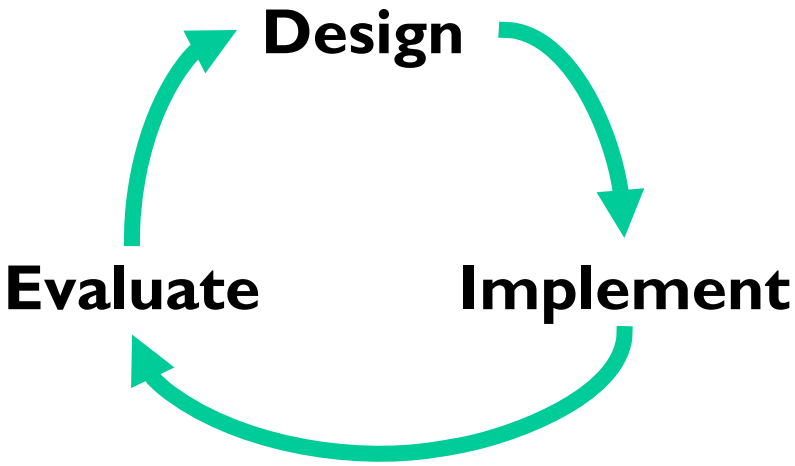


User Interfaces Are Hard to Design

- You are not the user
  - Most software engineering is about communicating with other programmers
  - UI is about communicating with users
- The user is always right
  - Consistent problems are the system's fault
- …but the user is not always right
  - Users aren't designers

Iterative Design

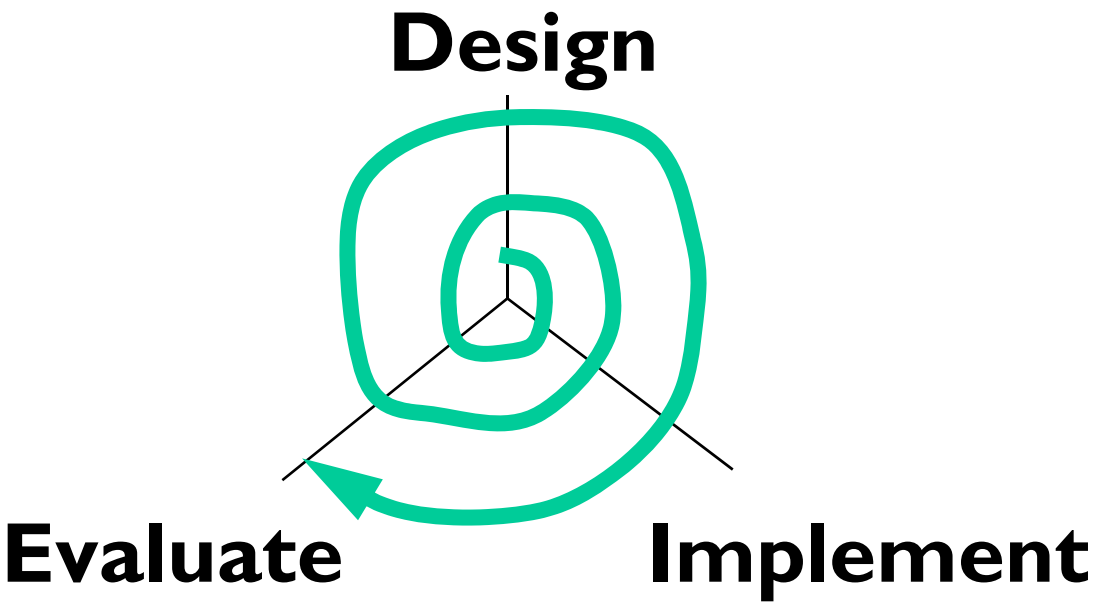
- UI development is an iterative process



- Iterations can be costly
  - If the design turns out to be bad, you may have to throw away most of your code

Spiral Model

- Use throw-away prototypes and cheap evaluation for early iterations

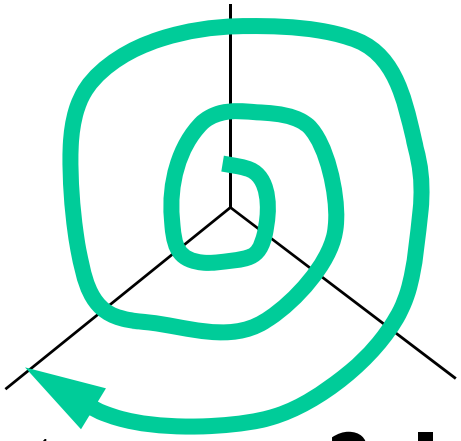


Usability Defined

- Usability: how well users can use the system's functionality
- Dimensions of usability
  - Learnability: is it easy to learn?
  - Efficiency: once learned, is it fast to use?
  - Memorability: is it easy to remember what you learned?
  - Errors: are errors few and recoverable?
  - Satisfaction: is it enjoyable to use?

Lecture Outline

1. Design
design principles



2. Implement
low-fidelity prototypes

3. Evaluate
user testing

Usability Goals

- Learnability
- Visibility
- Efficiency
- Error handling
- Simplicity

Learnability

Source: Interface Hall of Shame

Metaphorical Design

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People Don't Learn Instantly

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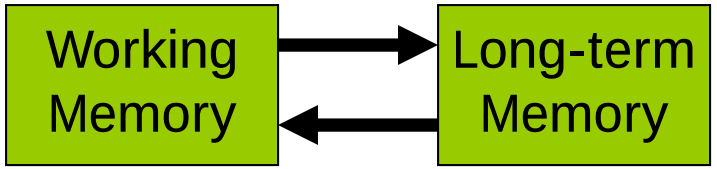
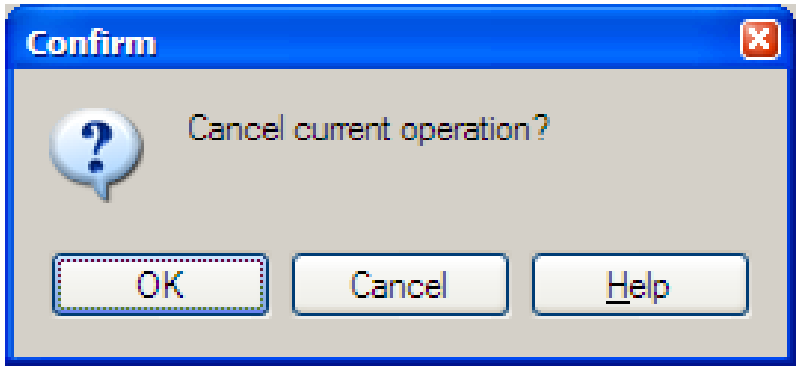
Some Facts About Memory & Learning



- Working memory
  - Small: 7 ± 2 "chunks"
  - Short-lived: gone in ~10 sec
  - **Maintenance rehearsal** is required to keep it from decaying (but costs attention)
- Long-term memory
  - Practically infinite in size and duration
  - **Elaborative rehearsal** transfers chunks to long-term memory

Design Principles for Learnability

- Consistency
  - Similar things look similar, different things different
  - Terminology, location, argument order, ...
  - Internal, external, metaphorical

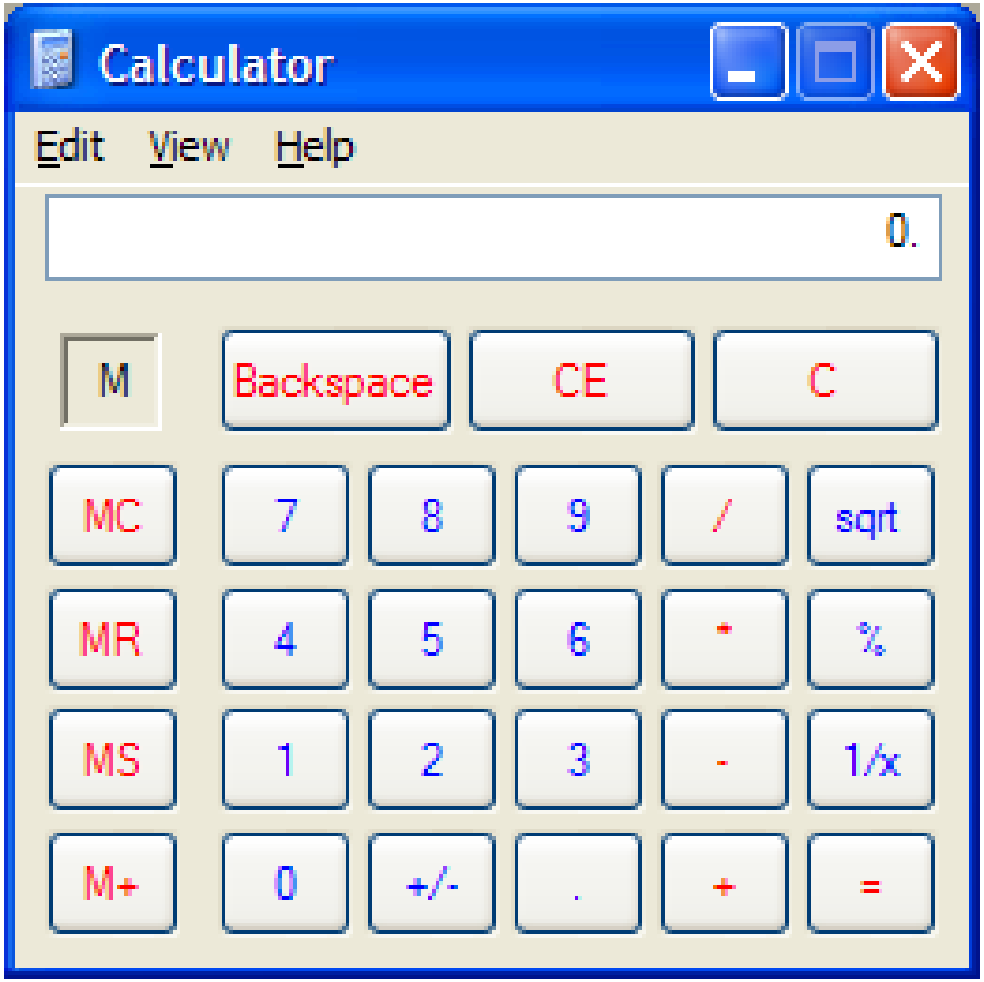


- Match the real world
  - Common words, not tech jargon

Source: Interface Hall of Shame

- Recognition, not recall
  - Labeled buttons are better than command languages
  - Combo boxes are better than text boxes

Visibility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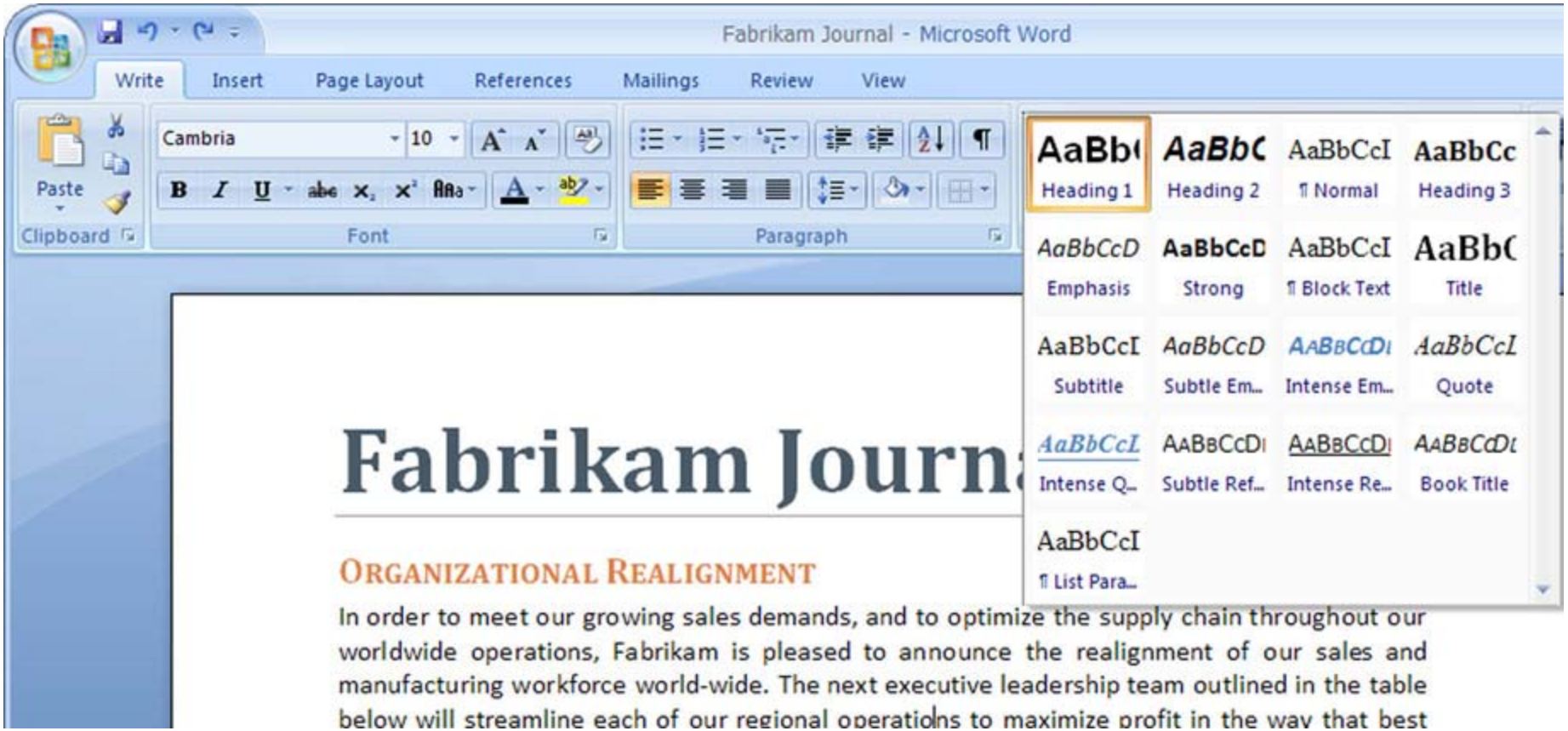
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Fabrikam Journa
ORGANIZATIONAL REALIGNMENT
In order to meet our growing sales demands, and to optimize the supply chain throughout our worldwide operations, Fabrikam is pleased to announce the realignment of our sales and manufacturing workforce world-wide. The next executive leadership team outlined in the table below will streamline each of our regional operations to maximize profit in the way that best

Some Facts About Human Perception

- **Perceptual fusion**: stimuli < 100ms apart appear fused to our perceptual systems
  - 10 frames/sec is enough to perceive a moving picture
  - Computer response < 100 ms feels instantaneous

- **Color blindness**: many users (~8% of all males) can't distinguish red from green

normal vision

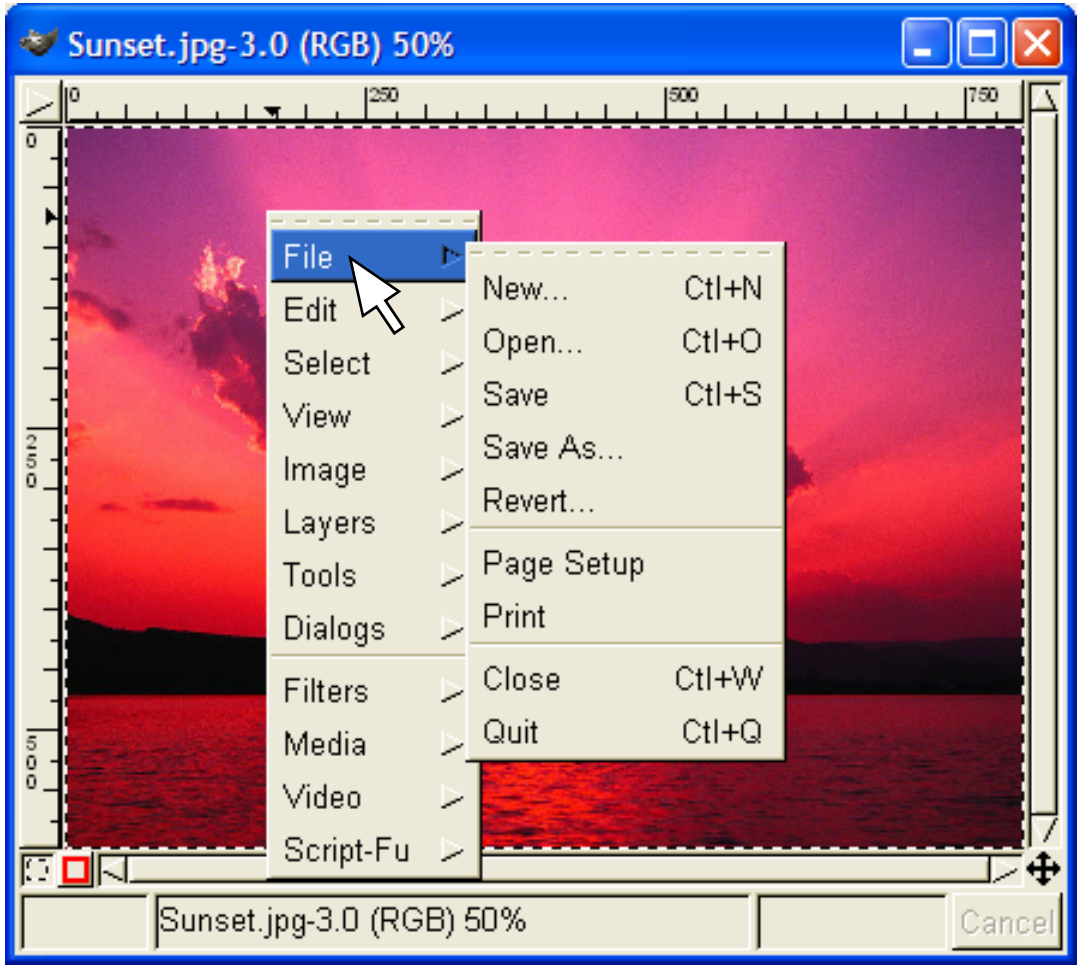
red-green deficient

Design Principles for Visibility

- Make system state visible: keep the user informed about what's going on
  - Mouse cursor, selection highlight, status bar
- Give prompt feedback
  - Response time rules-of-thumb

< 0.1 sec	seems instantaneous
0.1-1 sec	user notices, but no feedback needed
1-5 sec	display busy cursor
> 1-5 sec	display progress bar

Efficiency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Save As...
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Page Setup
Print
Close Ctl+W
Quit Ctl+Q
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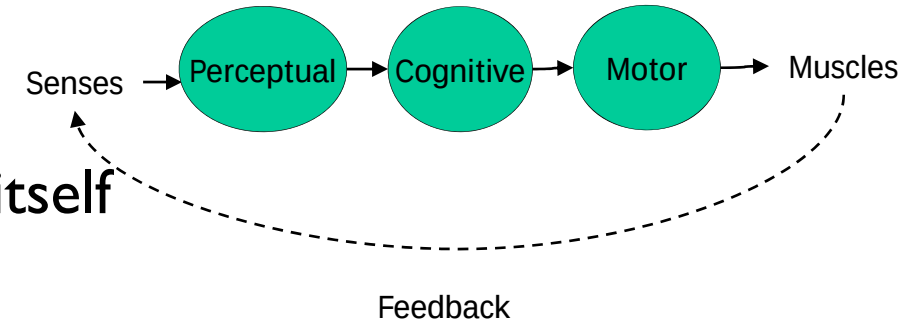
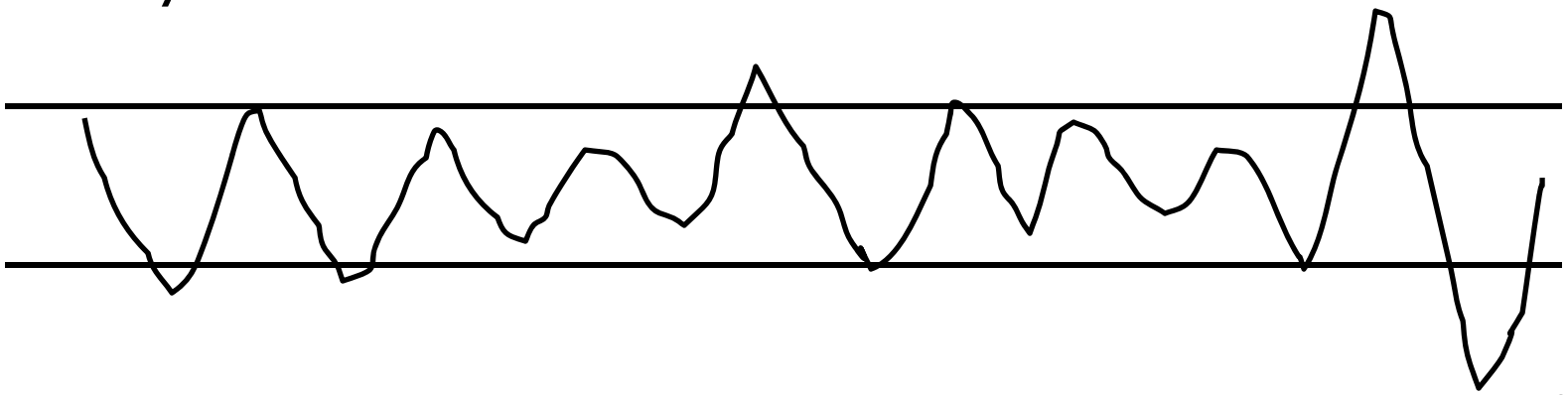
Some Facts About Motor Processing

- Open-loop control
  - Motor processor runs by itself
  - Cycle time is ~ 70 ms

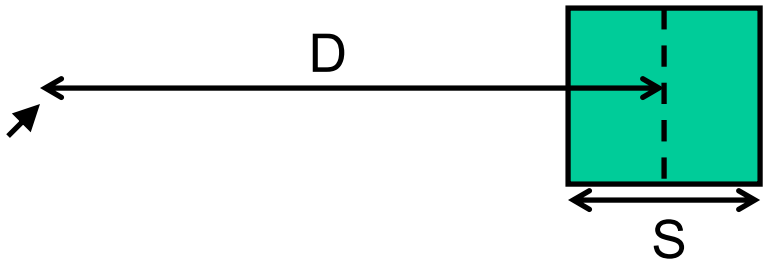


- Closed-loop control
  - Muscle movements (or their effect on the world) are perceived and compared with desired result
  - Cycle time is ~ 240 ms



Pointing Tasks: Fitts's Law

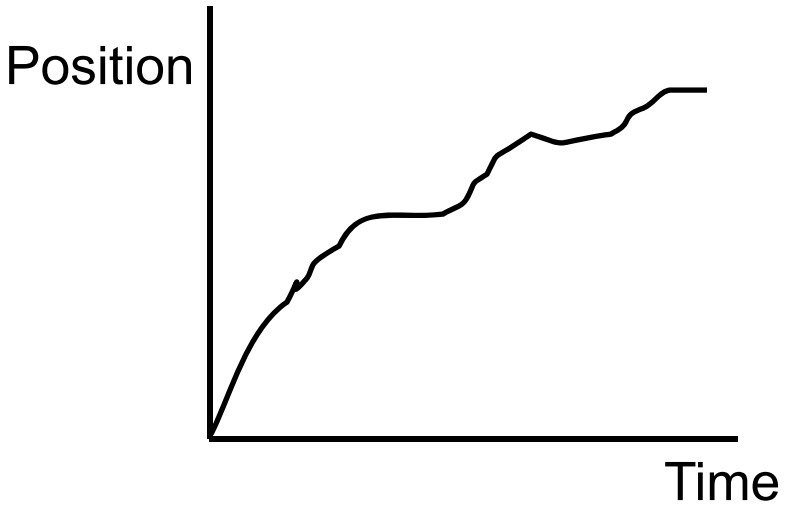
- How long does it take to reach a target?

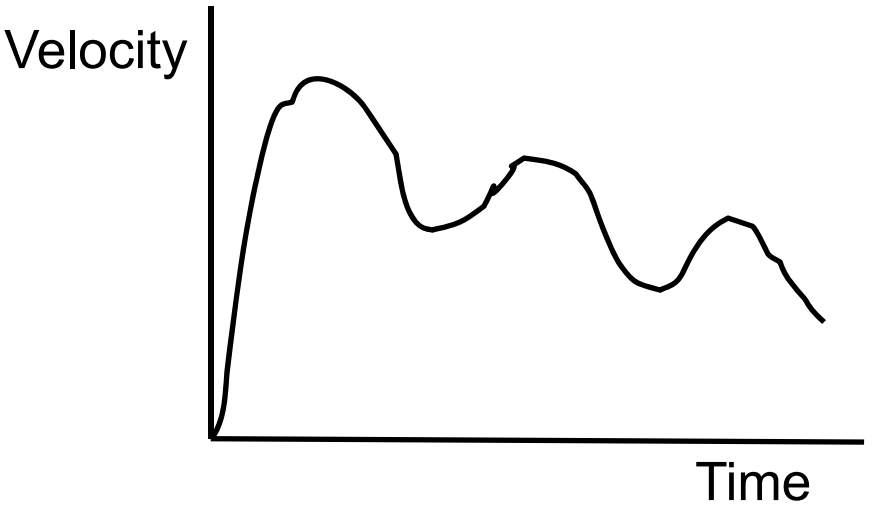


  - Moving mouse to target on screen
  - Moving finger to key on keyboard
  - Moving hand between keyboard and mouse

Analytical Derivation of Fitts's Law

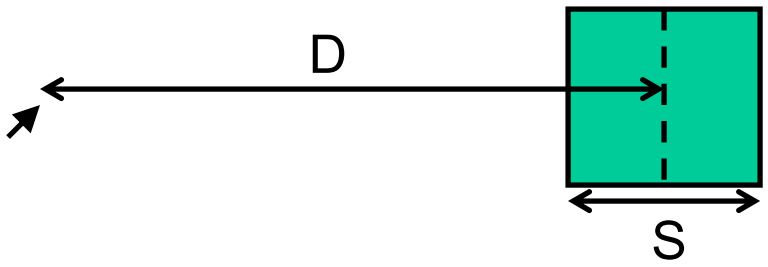
- Moving your hand to a target is closed-loop control
- Each cycle covers remaining distance D with error εD





Fitts's Law

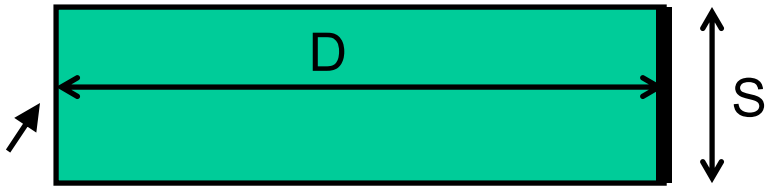
- T = RT + MT = a + b log (D/S)



- log(D/S) is the *index of difficulty* of the pointing task

Path Steering Tasks

- Fitts's Law applies only if path to target is **unconstrained**
- But the task is much harder if path is constrained to a tunnel



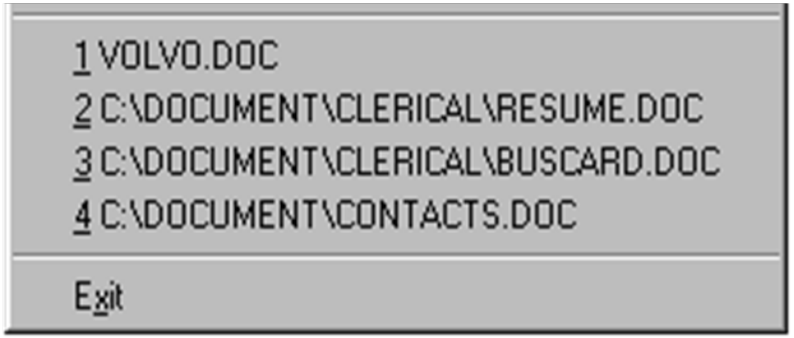
$$T = a + b\,(D/S)$$

- This is why cascading menus are slow!

Design Principles for Efficiency

- Fitts's Law and Steering Law
  - Make important targets big, nearby, or at screen edges
  - Avoid steering tasks

- Provide shortcuts
  - Keyboard accelerators
  - Styles
  - Bookmarks
  - History

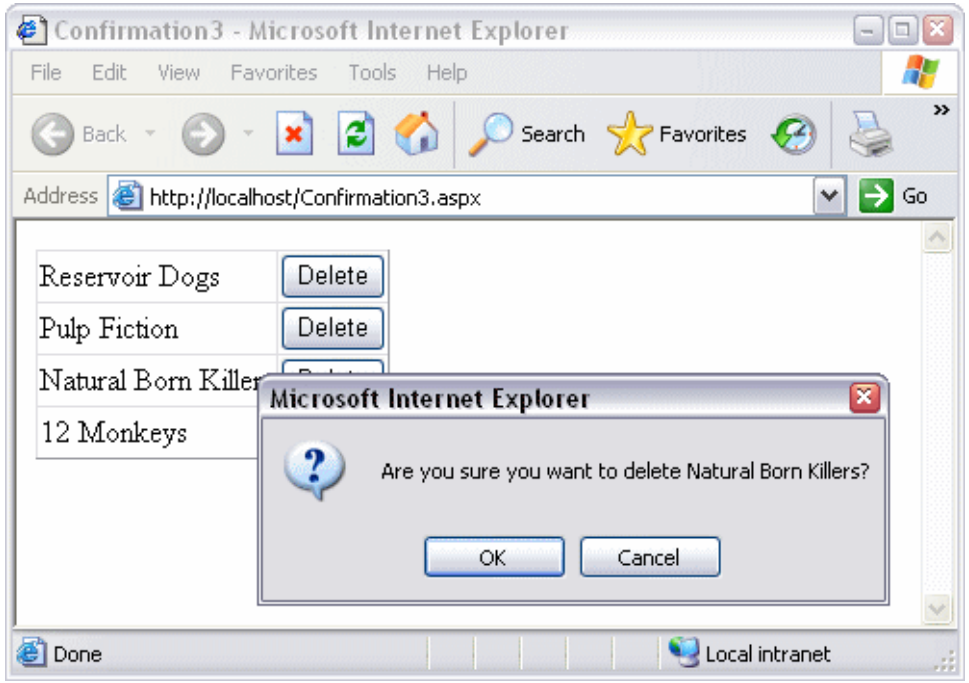


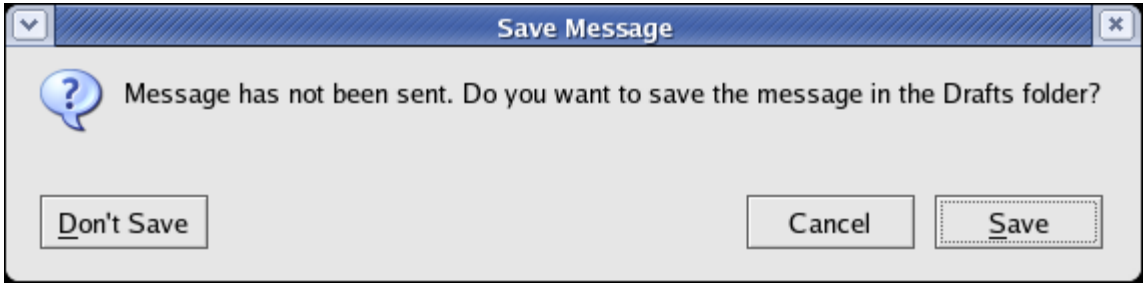
Source: Interface Hall of Shame

Mode Error

- Modes: states in which actions have different meanings
  - Vi's insert mode vs. command mode
  - Drawing palette
- Avoiding mode errors
  - Eliminate modes entirely
  - Visibility of mode
  - Spring-loaded or temporary modes
  - Disjoint action sets in different modes

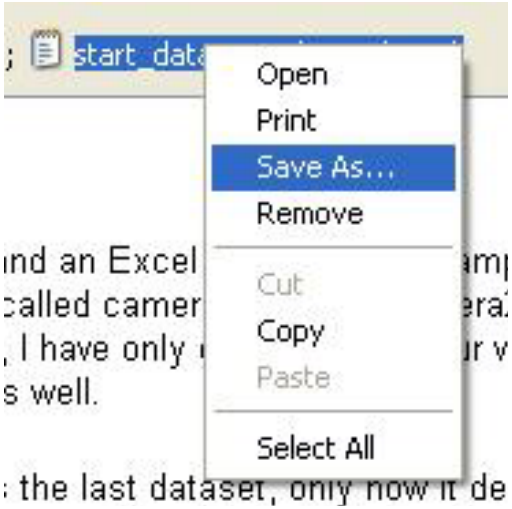
Confirmation Dialogs

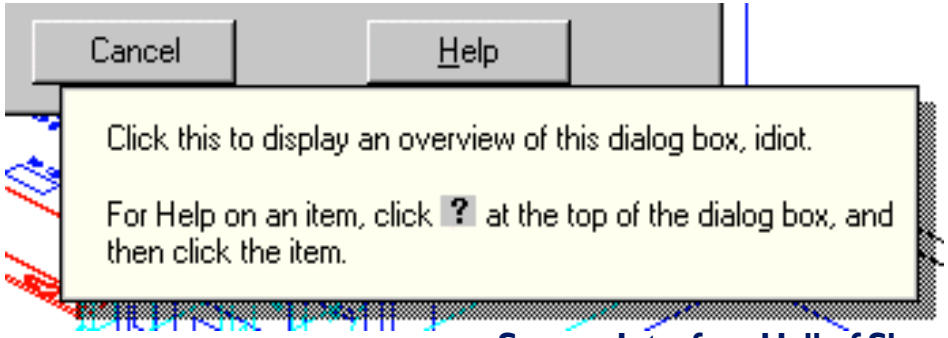




Design Principles for Error Handling

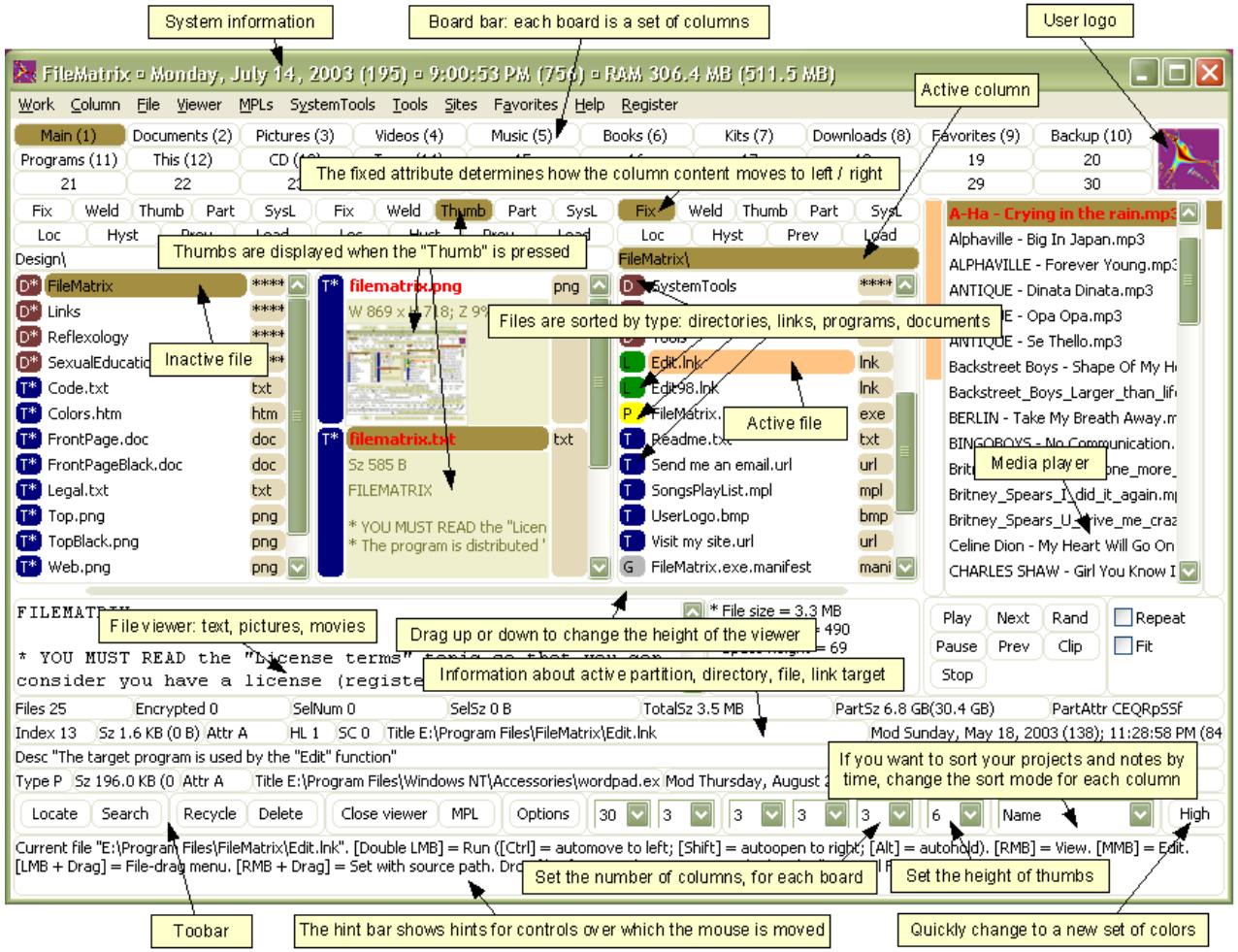
- Prevent errors as much as possible
  - Selection is better than typing
  - Avoid mode errors
  - Disable illegal commands
  - Separate risky commands from common ones
- Use confirmation dialogs sparingly
- Support undo
- Good error messages
  - Precise
  - Polite
  - Constructive help





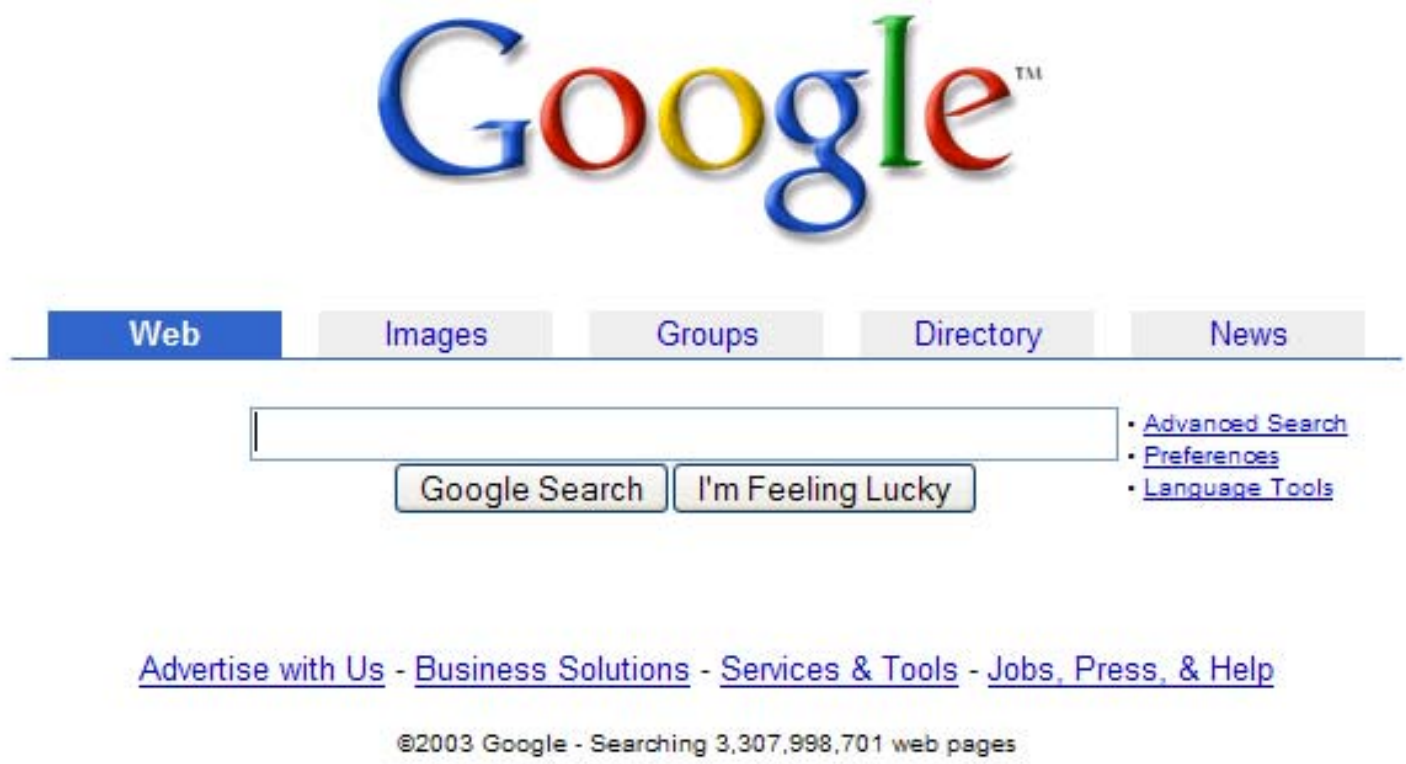
Source: Interface Hall of Shame

Simplicity



Source: Alex Papadimoulis

Simplicity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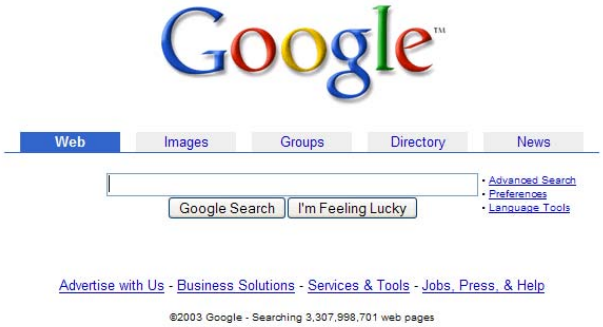
Design Principles for Simplicity

- "Less is More"
  - Omit extraneous information, graphics, features
- Good graphic design
  - Few, well-chosen colors and fonts
  - Group with whitespace
- Use concise language
  - Choose labels carefully

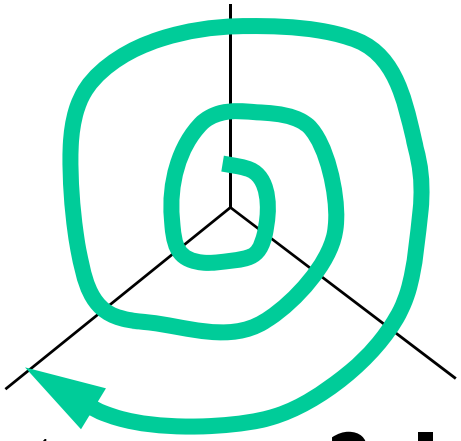


Document your system

- Write the user manual
  - Program and UI metaphors
  - Key functionality
  - Not: exhaustive list of all menus
- What is hard to describe?
- Who is your target user?
  - Power users *need* a manual
  - Casual users may not
  - Piecemeal online help is no substitute

Lecture Outline

1. Design
design principles



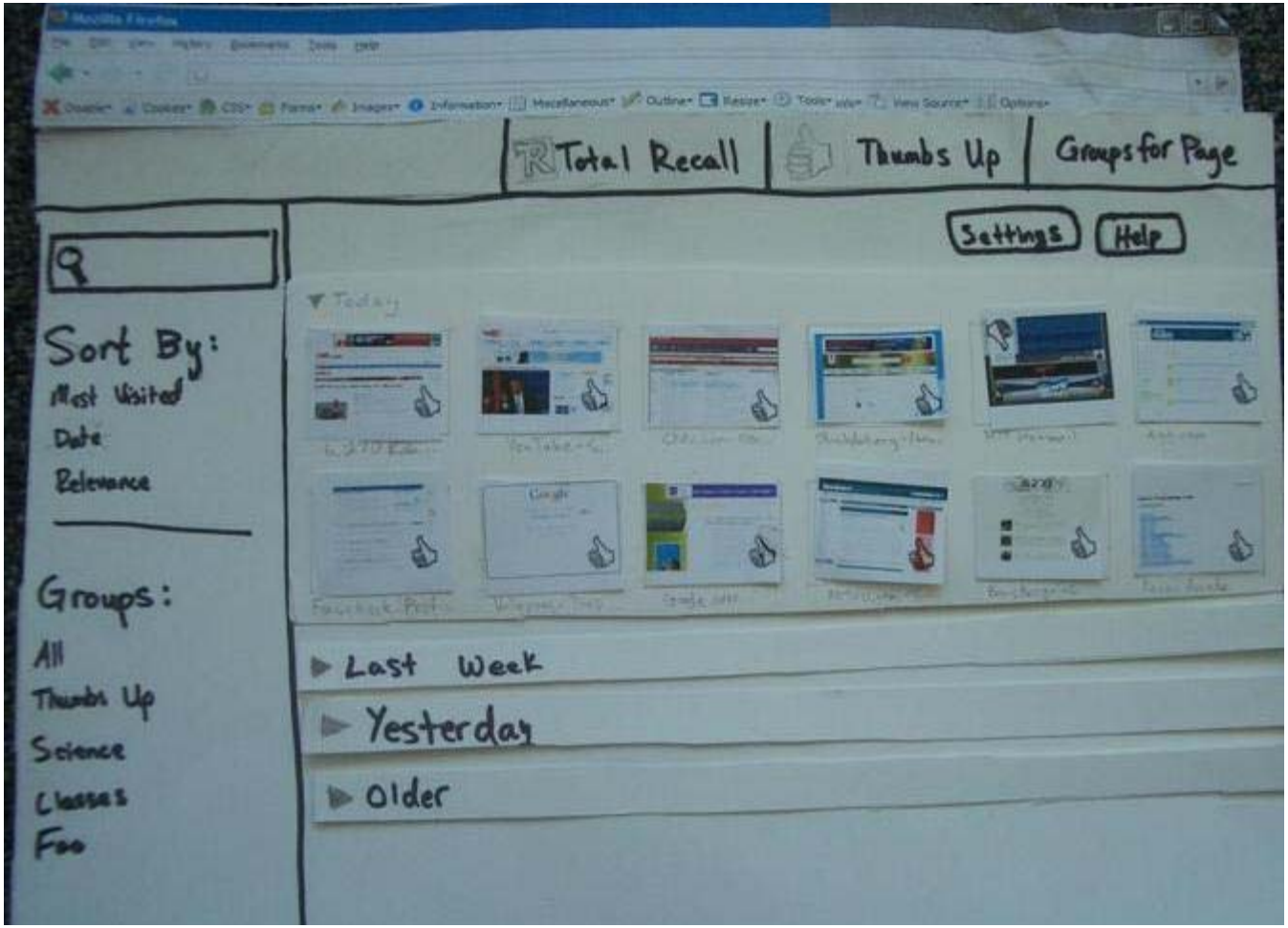
3. Evaluate
user testing

2. Implement
low-fidelity prototypes

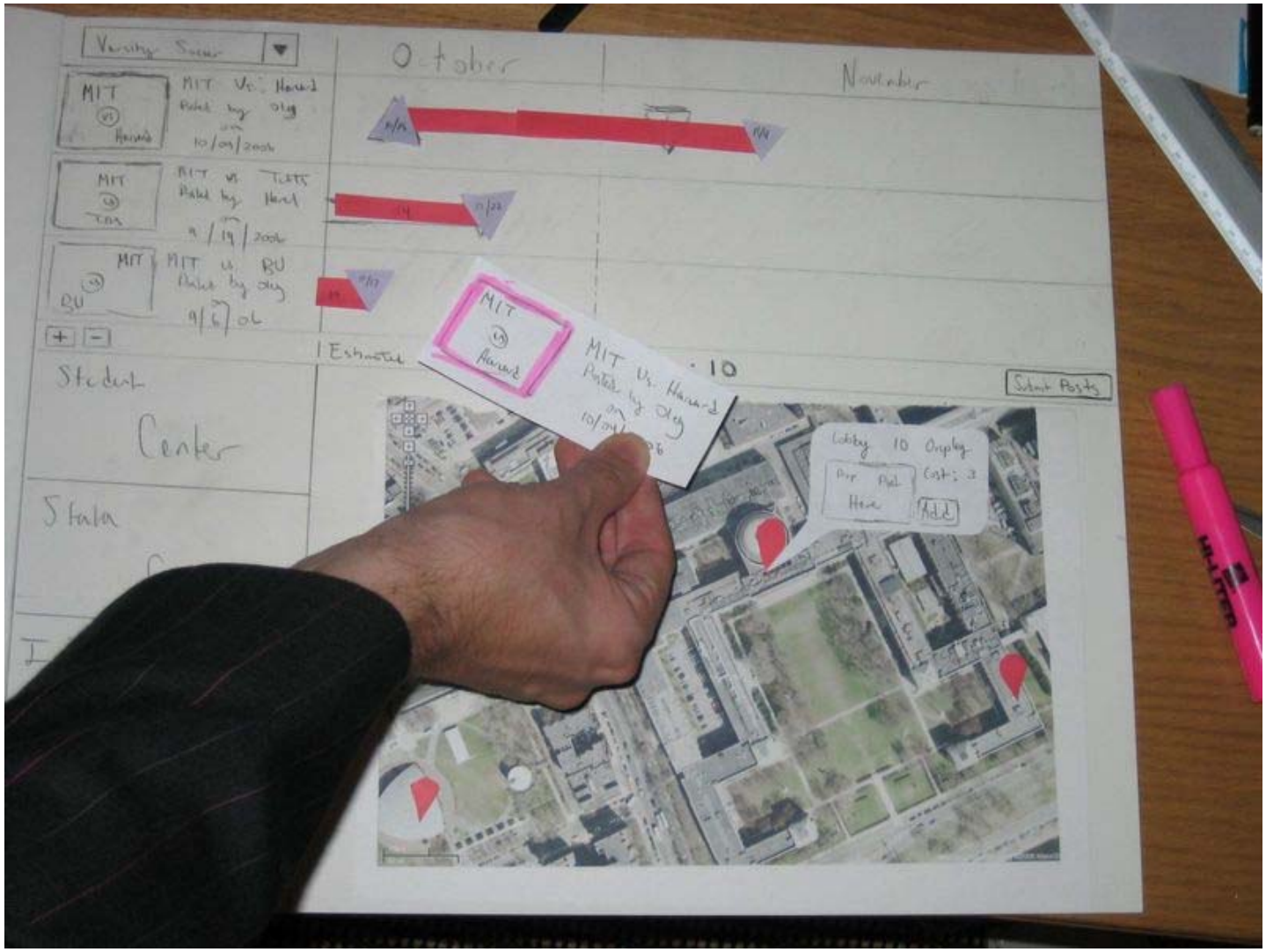
Low-fidelity Prototypes

- Paper is a very fast and effective prototyping tool
  - Sketch windows, menus, dialogs, widgets
  - Crank out lots of designs and evaluate them
- Hand-sketching is OK – even preferable
  - Focus on behavior & interaction, not fonts & colors
- Paper prototypes can even be executed
  - Use pieces to represent windows, dialogs, menus
  - Simulate the computer's responses by moving pieces around and writing on them

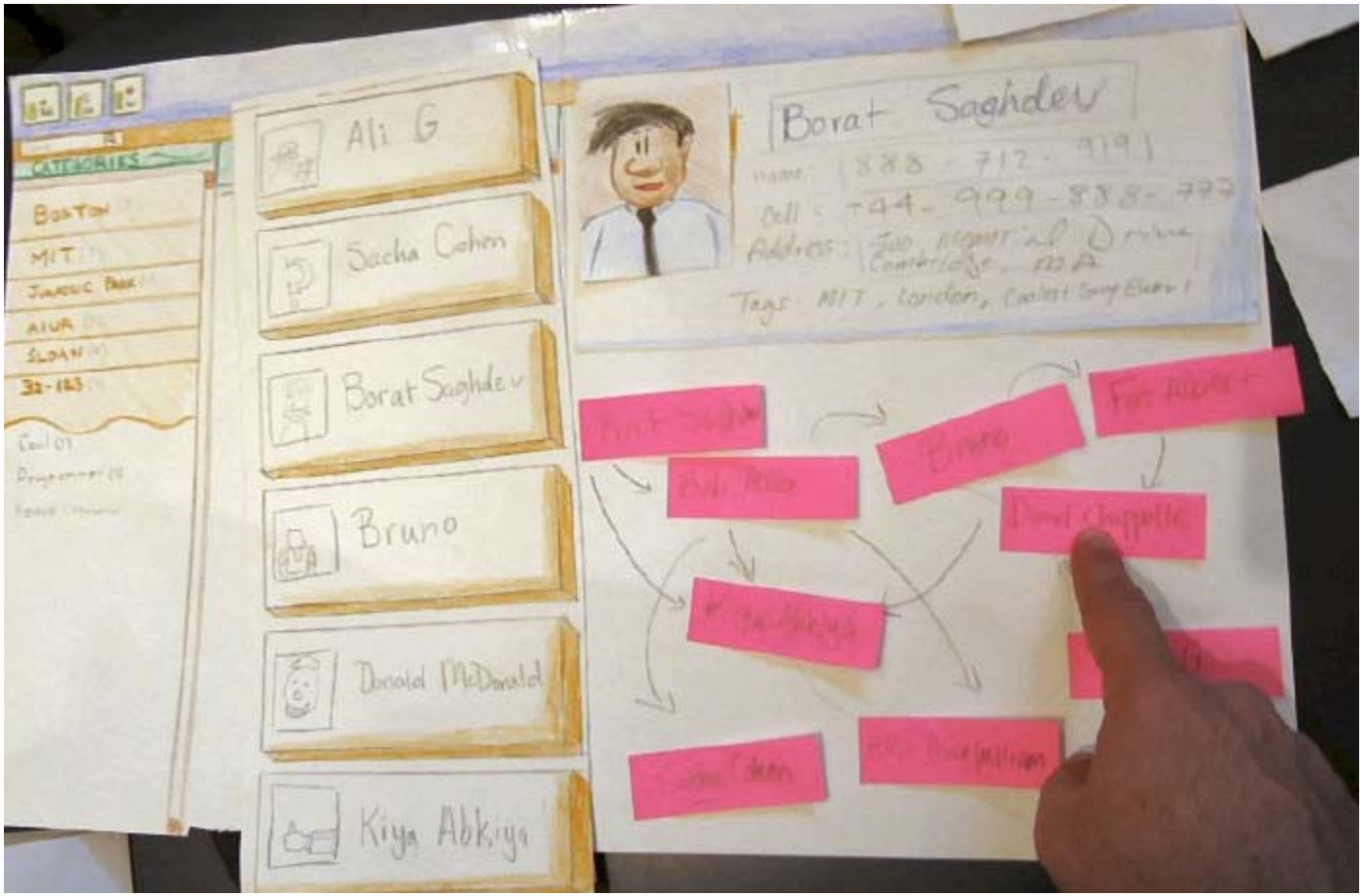
Paper Prototypes



Paper Prototypes



Paper Prototypes



User Testing

- Start with a prototype
- Write up a few representative tasks
  - Short, but not trivial
  - e.g.: "add this meeting to calendar",
    "type this letter and print it"
- Find a few representative users
  - 3 is often enough to find obvious problems
- Watch them do tasks with the prototype

How to Watch Users

- Brief the user first (being a test user is stressful)
  - "I'm testing the system, not testing you"
  - "If you have trouble, it's the system's fault"
  - "Feel free to quit at any time"
  - Ethical issues: informed consent
- Ask user to think aloud
- Be quiet!
  - Don't help, don't explain, don't point out mistakes
  - Sit on your hands if it helps
  - Two exceptions: prod user to think aloud ("what are you thinking now?"), and move on to next task when stuck
- Take lots of notes

Watch for Critical Incidents

- Critical incidents: events that strongly affect task performance or satisfaction
- Usually negative
  - Errors
  - Repeated attempts
  - Curses
- Can also be positive
  - "Cool!"
  - "Oh, now I see."

Summary

- You are not the user
- Keep human capabilities and design principles in mind
- Iterate over your design
- Make cheap, throw-away prototypes
- Evaluate them with users

Further Reading

- General books on usability
  - Johnson. *GUI Bloopers: Don'ts and Dos for Software Developers and Web Designers*, Morgan Kaufmann, 2000.
  - Jef Raskin, *The Humane Interface*, Addison-Wesley 2000.
  - Hix & Hartson, *Developing User Interfaces*, Wiley 1995.
- Low-fidelity prototyping
  - Rettig, "Prototyping for Tiny Fingers", CACM April 1994.
- Usability heuristics
  - Nielsen, "Heuristic Evaluation." http://www.useit.com/papers/heuristic/
  - Tognazzini, "First Principles." http://www.asktog.com/basics/firstPrinciples.html