CSE 331
Software Design & Implementation

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Winter 2012

Usability

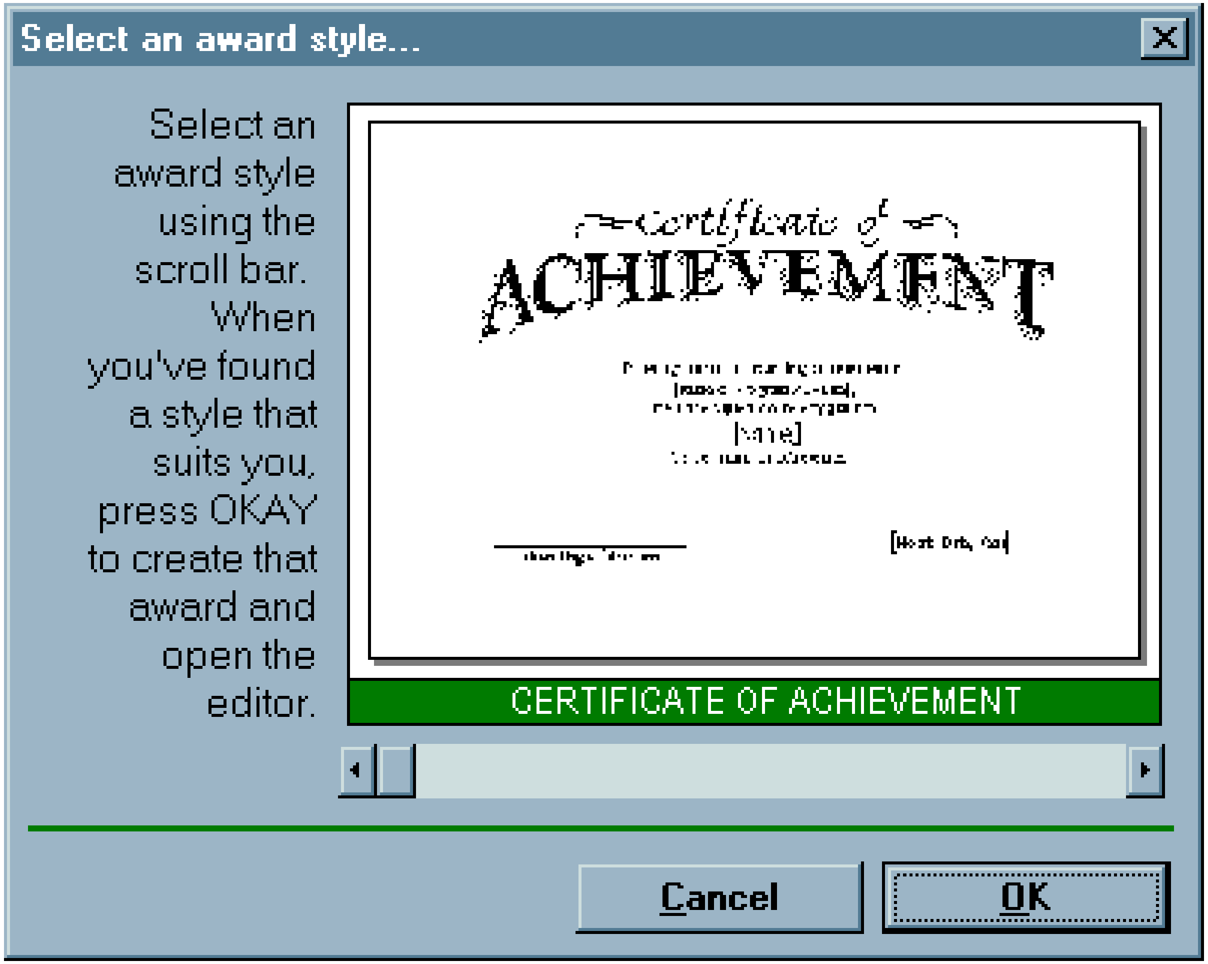
(Slides by David Notkin and Mike Ernst
based on slides due to Robin Miller)

Usability

A lecture on usability won’t make anyone an interface expert – any more than using LaTeX makes one a graphics designer. But it’s important to have some appreciation for the issues. And you’re designing a UI in hw6….

IF YOU REALLY HATE SOMEONE, TEACH THEM TO RECOGNIZE BAD KERNING.

User Interface Hall of Shame



Select an award style...

Select an award style using the scroll bar. When you've found a style that suits you, press OKAY to create that award and open the editor.

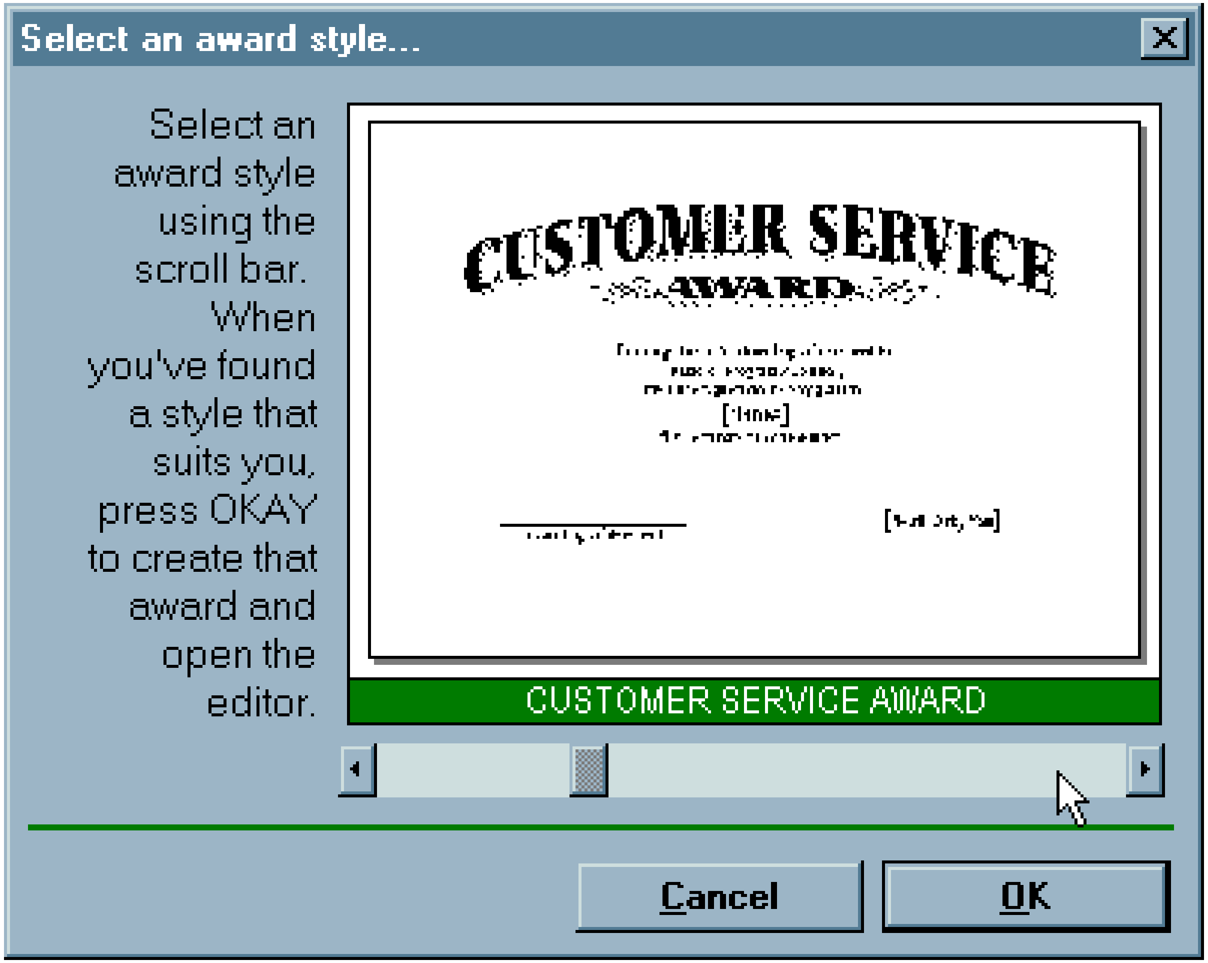
Source: Interface Hall of Shame

What’s wrong?

- Usability is about creating effective user interfaces
- The first slide shows a WYSIWYG GUI – but it still fails – why?
- The long help message is needed for a simple task because the interface is bizarre!
  - The scrollbar is used to select an award template
  - Each position on the scrollbar represents a template, and moving the scrollbar back and forth changes the template shown
  - Cute but bad use of a scrollbar
  - How many templates? No indication on scrollbar
  - How are the templates organized? No hint

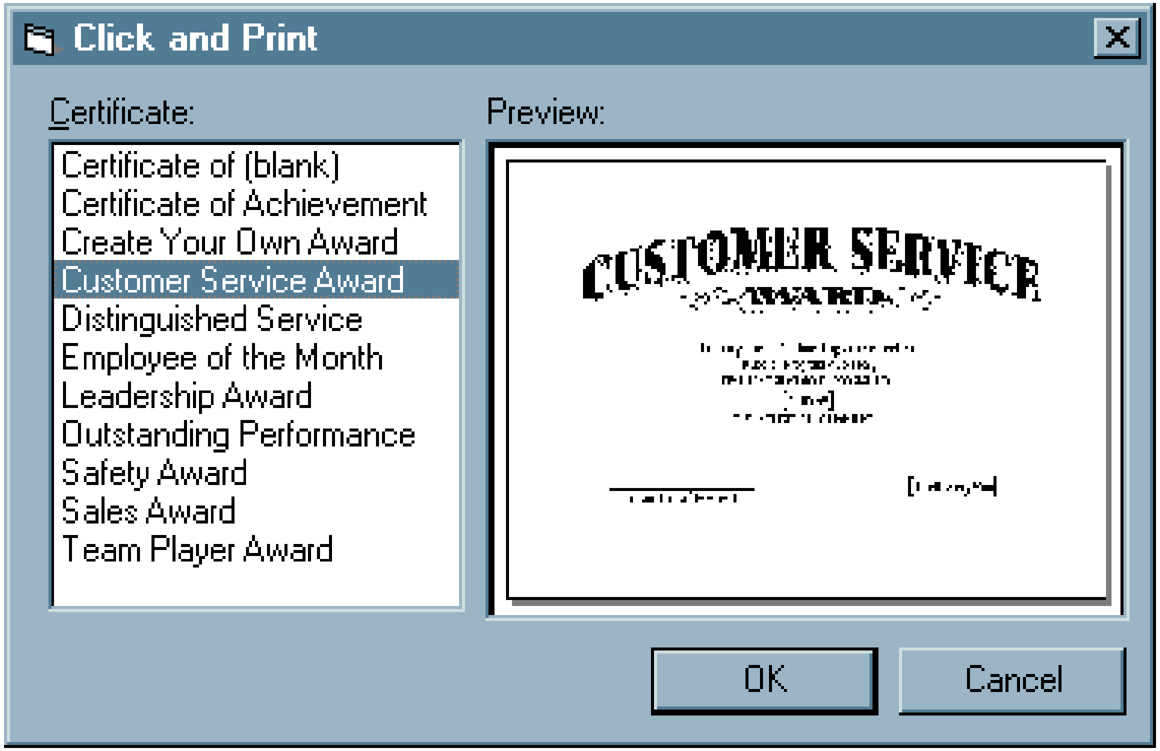
User Interface Hall of Shame

- Inconsistent with common usage of scrollbars – usually used for continuous scrolling, not discrete selection
- How does a frequent user find a template they've used before?



Select an award style using the scroll bar. When you've found a style that suits you, press OKAY to create that award and open the editor.

Redesigning the Interface



Click and Print

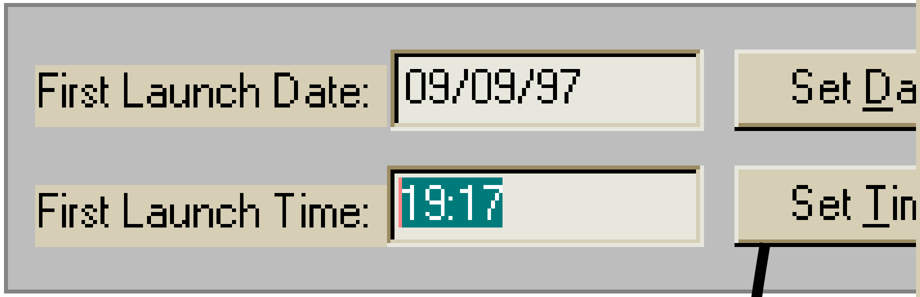
Certificate:

- Certificate of (blank)
- Certificate of Achievement
- Create Your Own Award
- Customer Service Award
- Distinguished Service
- Employee of the Month
- Leadership Award
- Outstanding Performance
- Safety Award
- Sales Award
- Team Player Award

Preview:

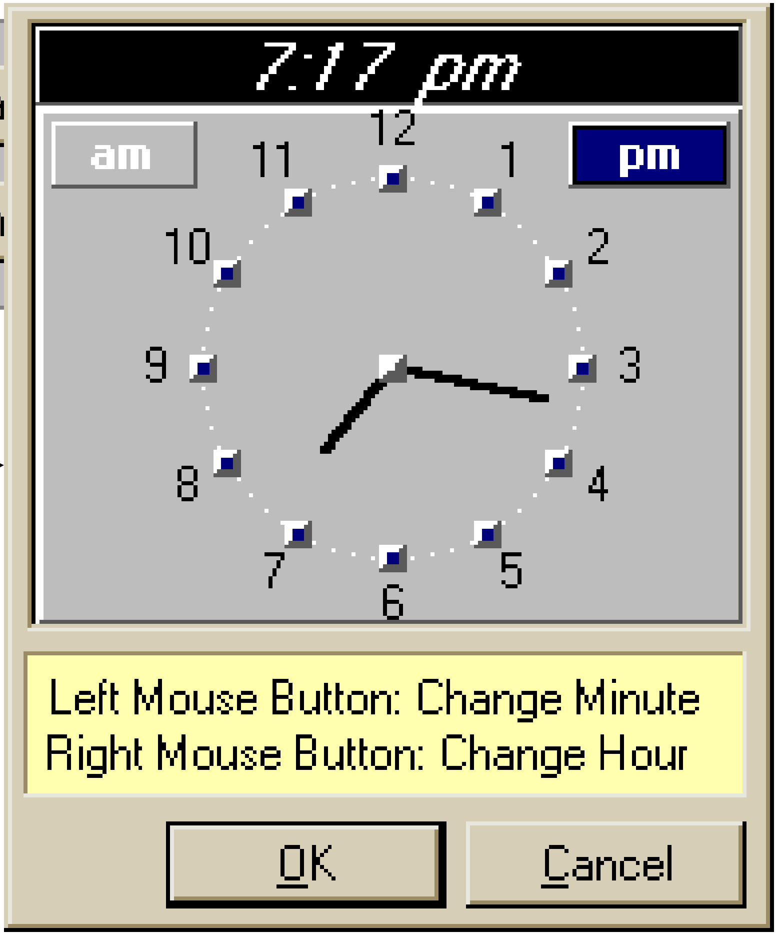
Source: Interface Hall of Shame

Another for the Hall of Shame



First Launch Date: 09/09/97

First Launch Time: 19:17



7:17 pm

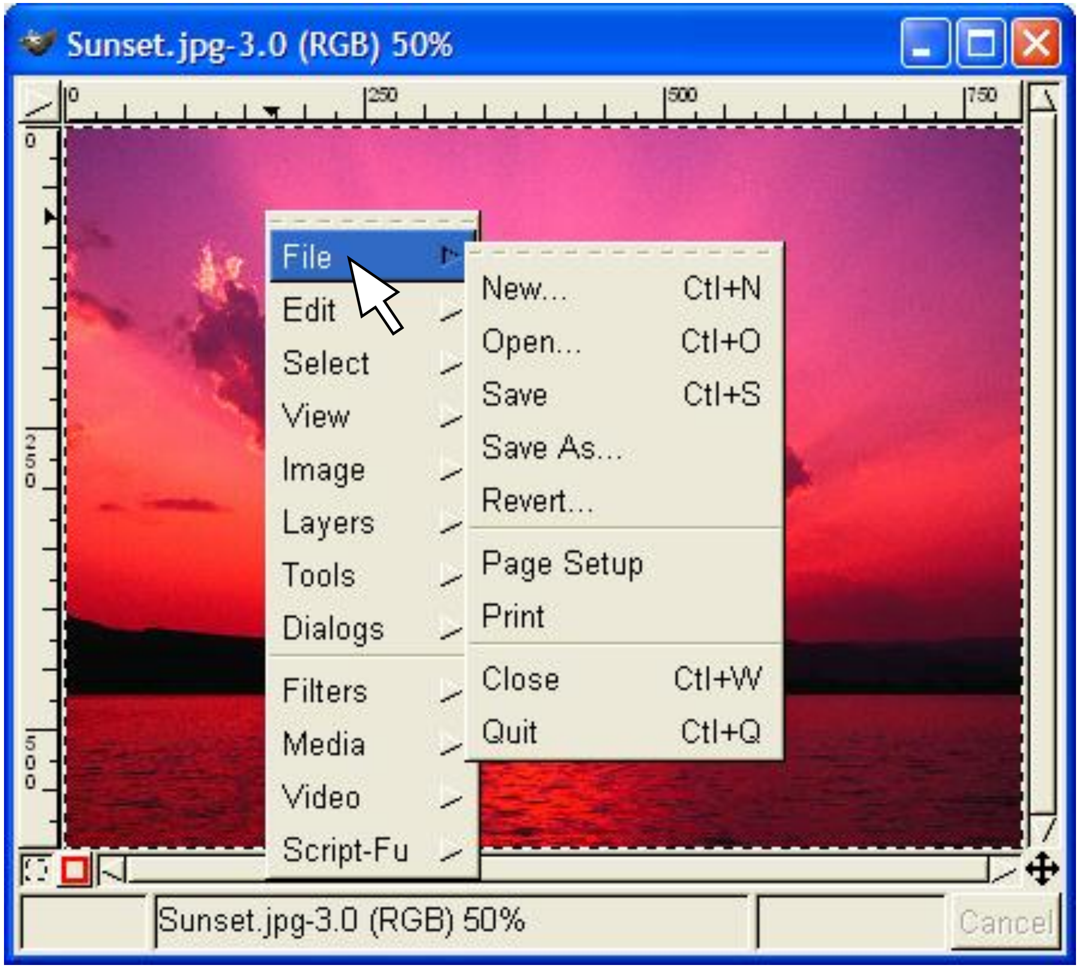
Left Mouse Button: Change Minute
Right Mouse Button: Change Hour

- The date and time *look* editable but aren’t – click “Set Time” for a dialog box instead
- Dialog box displays inconsistently with launch time – 12 vs. 24, analog vs. digital
- Click left [right] button to increase the minutes [hours] by 1 – makes a sophisticated GUI into a clock radio!

Source: Interface Hall of Shame

Hall of Fame or Hall of Shame?

Gimp windows have no menus – instead, right-click to get a popup menu and navigate further. Is this a fast way to select commands?

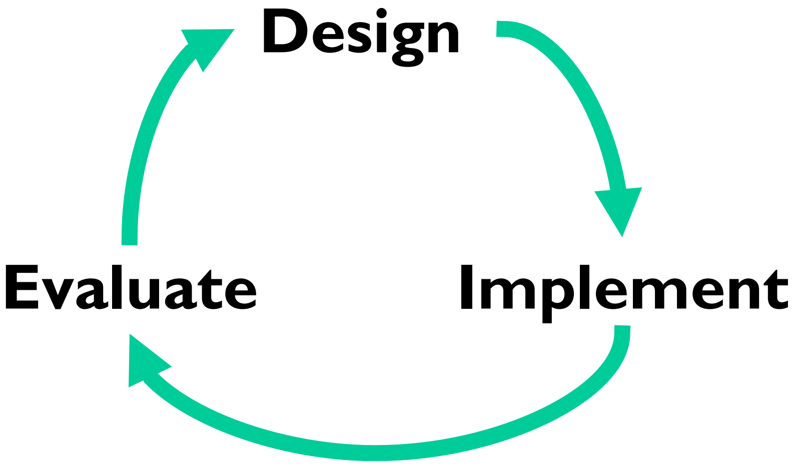


User Interfaces Are Hard to Design

- 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



Design

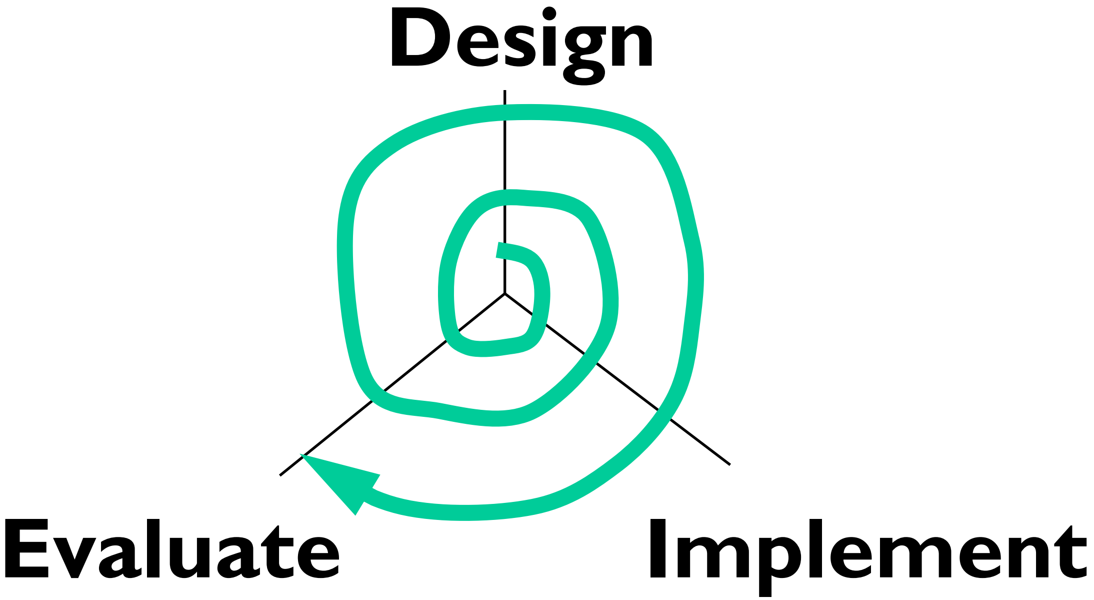
Evaluate

Implement

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

Spiral Model

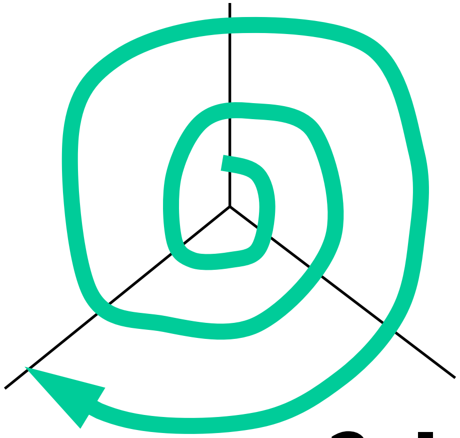
- Use throw-away prototypes and cheap evaluation for early iterations



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

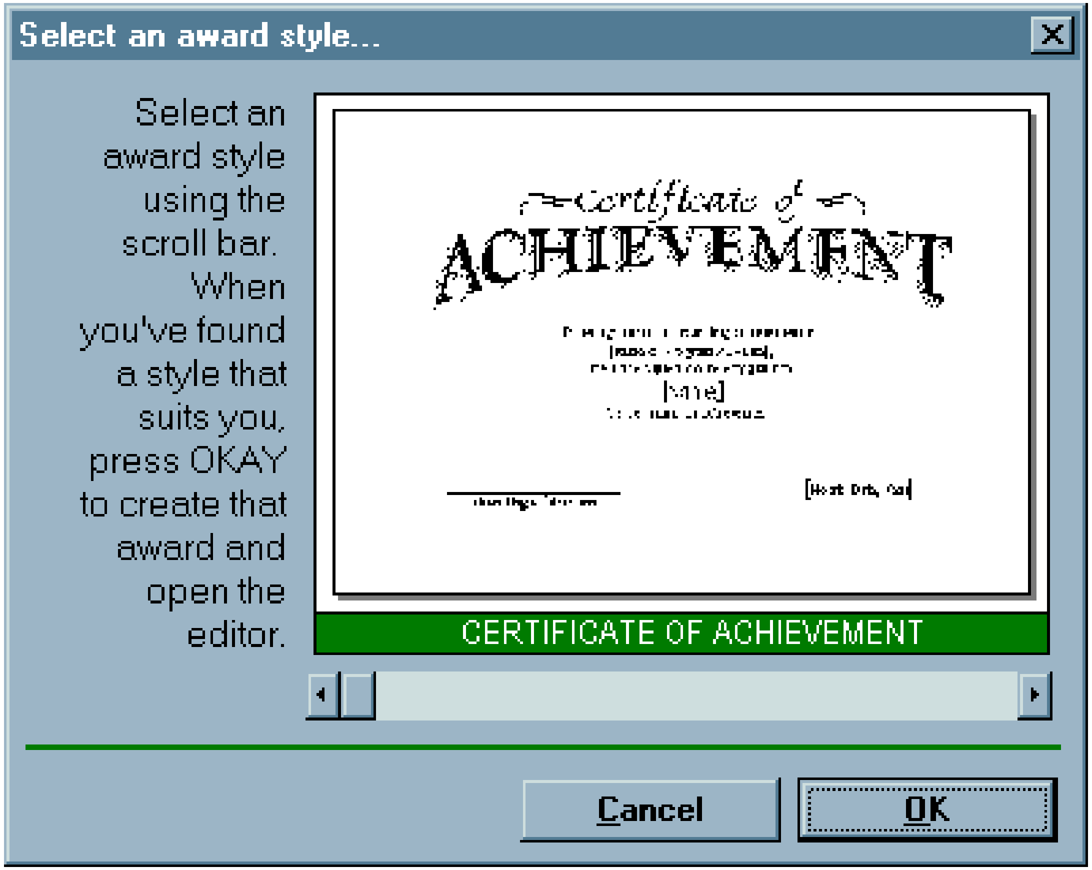
low-fidelity prototypes

3. Evaluate

user testing

Learnability

- Related to “intuitive” and “user-friendly”
- The first example had serious problems with learnability, especially with the scrollbar
  - Unfamiliar usage
  - Inconsistent usage
  - And outright inappropriate usage

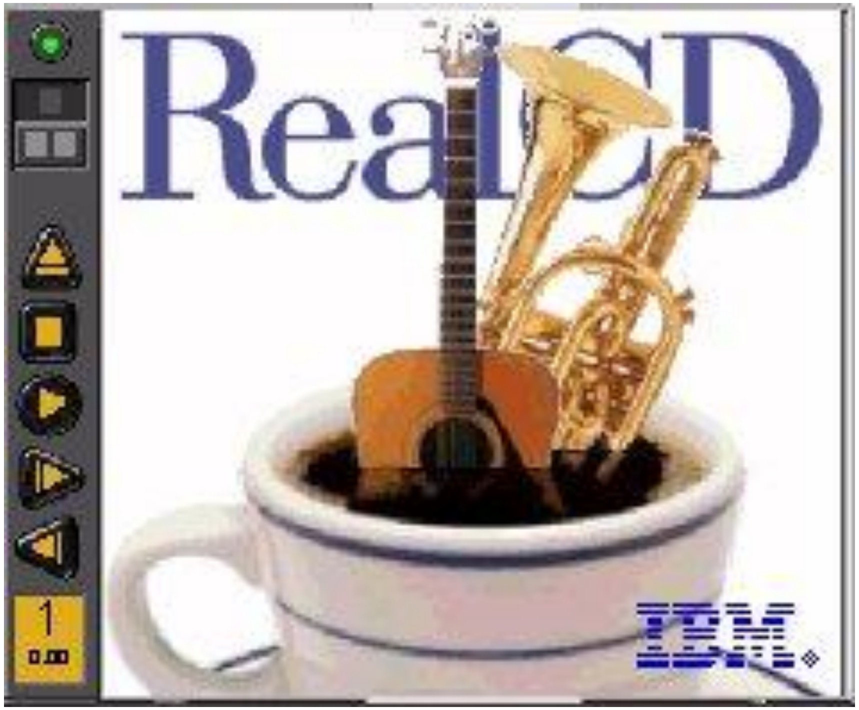


Select an award style using the scroll bar. When you've found a style that suits you, press OKAY to create that award and open the editor.

Source: Interface Hall of Shame

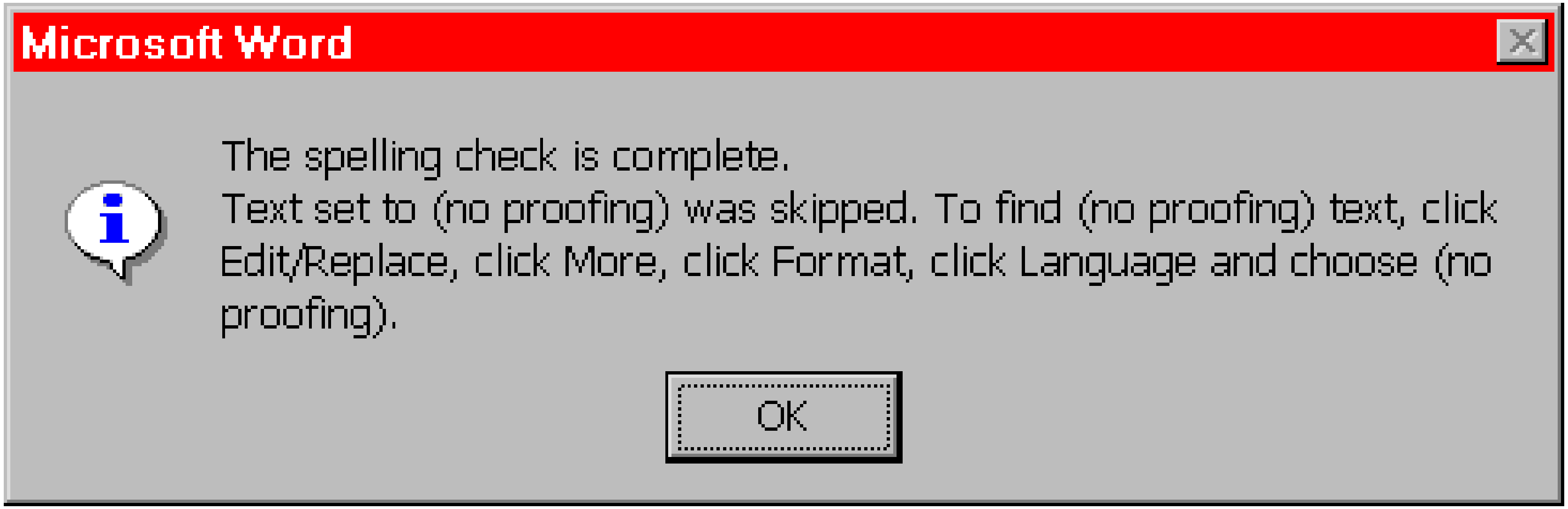
Metaphorical Design

- Designers based it on a real-world plastic CD case
- Metaphors are one way to make an interface “intuitive,” since users can make guesses about how it will work
- Dominated by static artwork – clicking it does nothing
- Why? A CD case doesn’t actually play CDs, so the designers had to find a place for the core player controls
- The metaphor is dictating control layout, against all other considerations
- Also disregards consistency with other desktop applications. Close box? Shut it down?



Source: Interface Hall of Shame

People Don't Learn Instantly

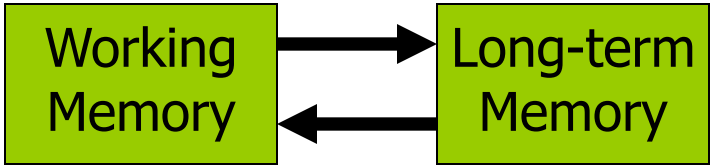


The spelling check is complete.
Text set to (no proofing) was skipped. To find (no proofing) text, click Edit/Replace, click More, click Format, click Language and choose (no proofing).

Source: Interface Hall of Shame

- To design for learnability it helps to know how people actually learn
- This example shows overreliance on the user's memory
  - It's a modal dialog box, so the user needs to click OK
  - But then the instructions vanish from the screen, and the user is left to struggle to remember them
  - Just because you've said it, doesn't mean they know it

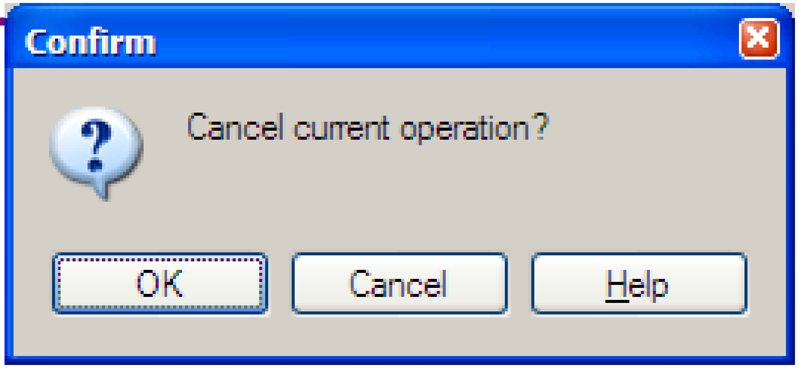
Some Facts About Memory & Learning



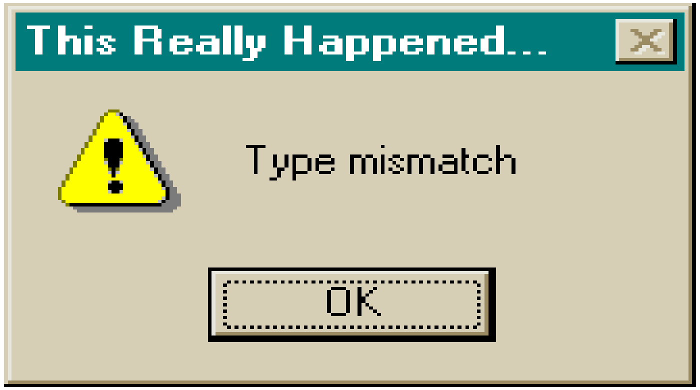
- Working memory
  - Small: 7 ± 2 “chunks”
  - Short-lived: gone in ~10 sec
  - Maintenance rehearsal is required to keep it from decaying (but costs attention)
- Long-term memory
  - Practically infinite in size and duration
  - Elaborative rehearsal transfers chunks to long-term memory

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



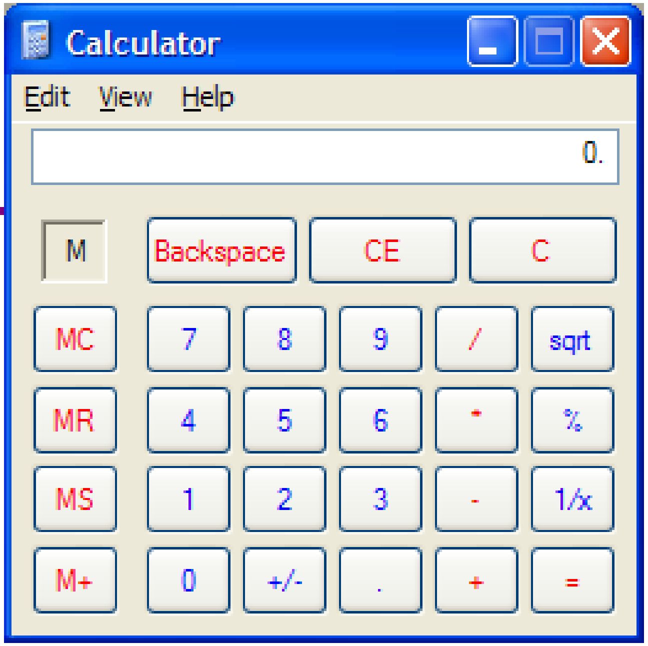
Cancel current operation?



Type mismatch

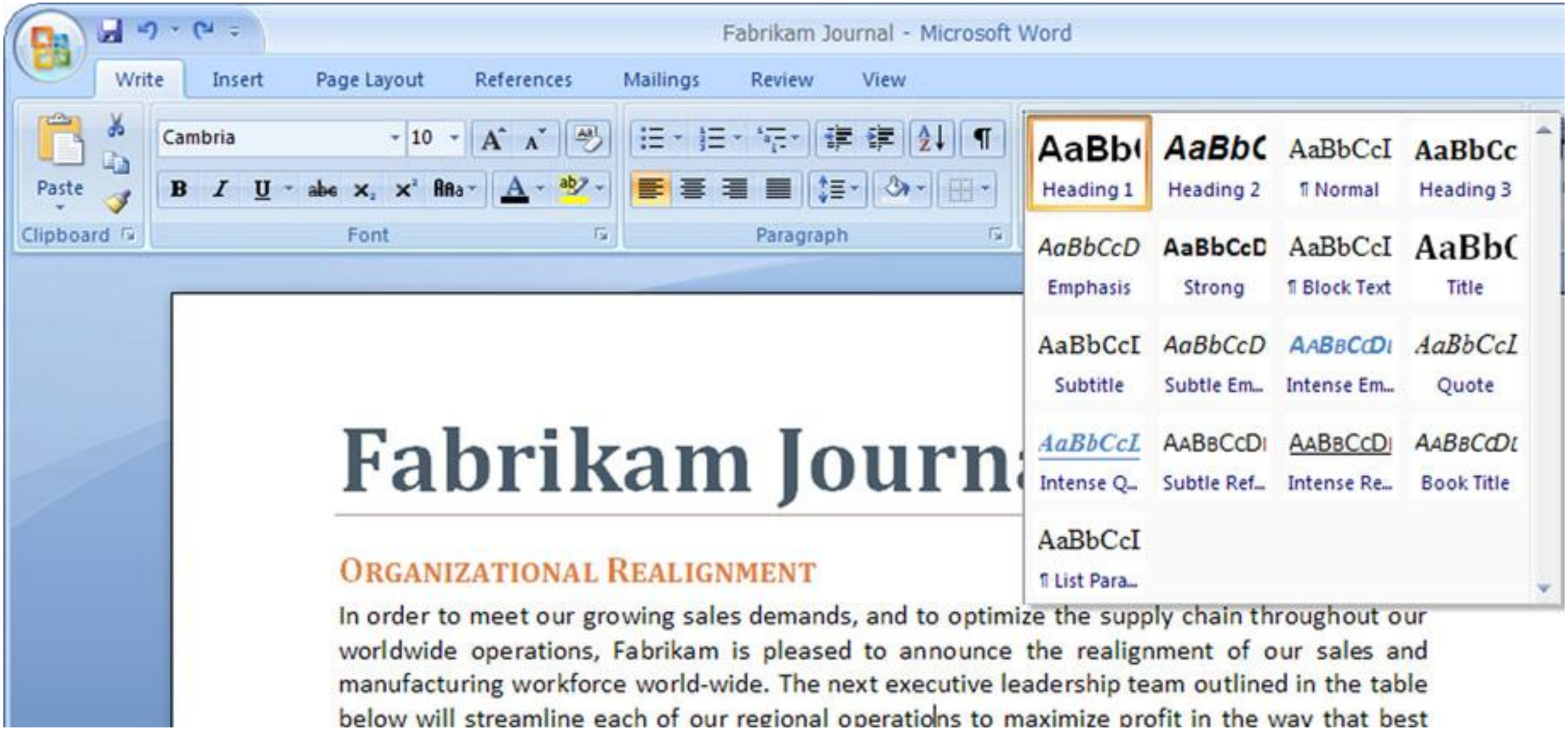
Source: Interface Hall of Shame

Visibility



- Familiar, easy to use
- But passes up some tremendous opportunities, including
  - Why only one line of display?
  - Why not a history?
  - Why only one memory slot? Why display “M” instead of the actual number stored in memory?
  - Visibility also compromised by invisible modes
    - When entering a number, pressing a digit appends it to the number; but after pressing an operator button, the next digit starts a new number – no visible feedback the low-level mode
    - It also lets you type numbers on the keyboard, but there is no hint about this

Feedback



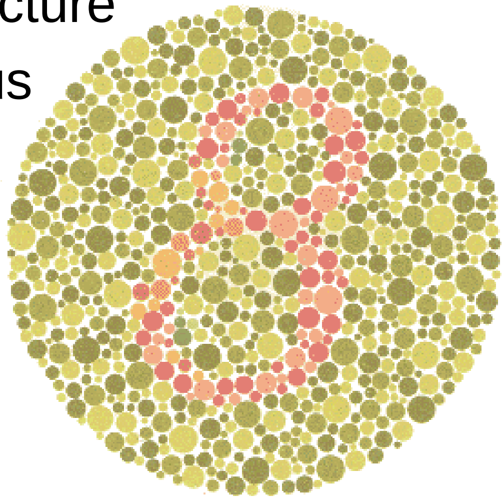
Fabrikam Journ

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

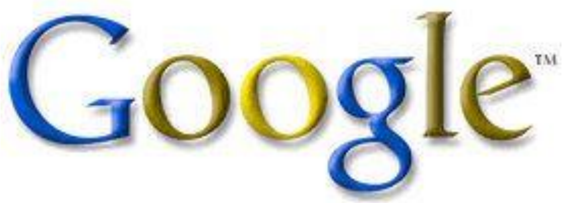
Facts About Human Perception

- **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

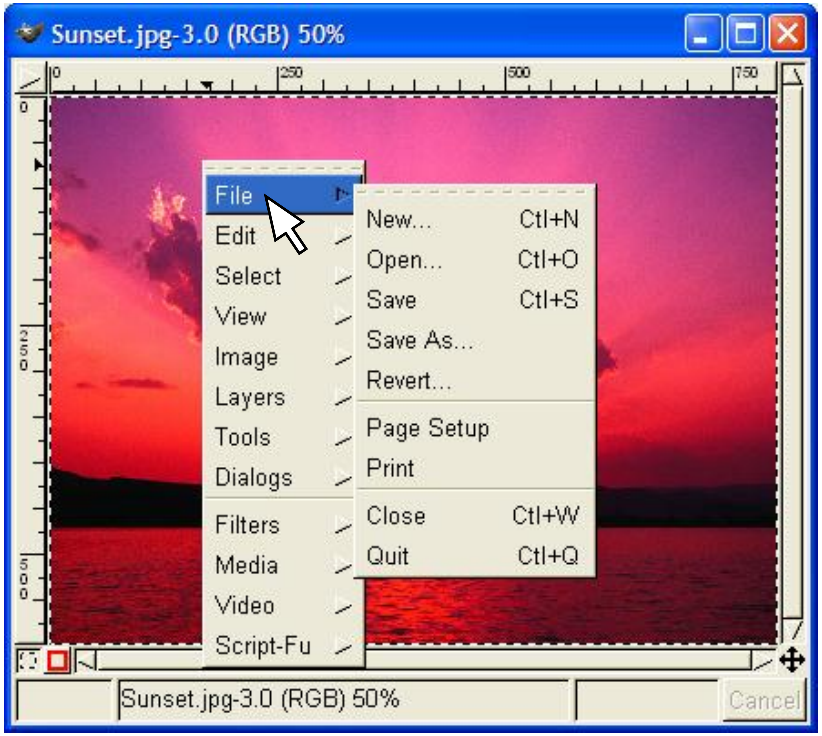
Progress bars…

I'M JUST OUTSIDE TOWN, SO I SHOULD BE THERE IN FIFTEEN MINUTES.
ACTUALLY, IT'S LOOKING MORE LIKE SIX DAYS.
NO, WAIT, THIRTY SECONDS.

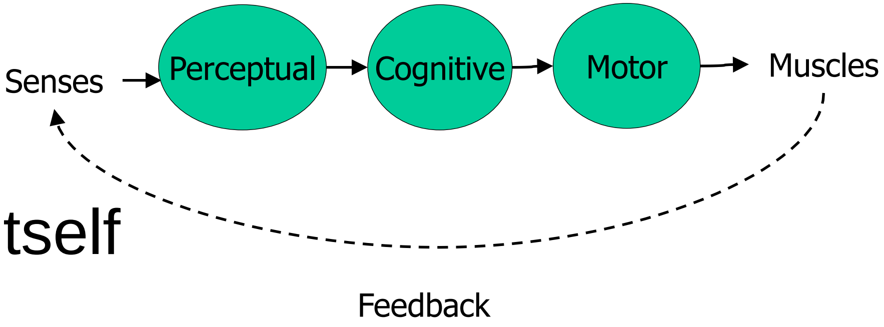
THE AUTHOR OF THE WINDOWS FILE COPY DIALOG VISITS SOME FRIENDS.

Efficiency

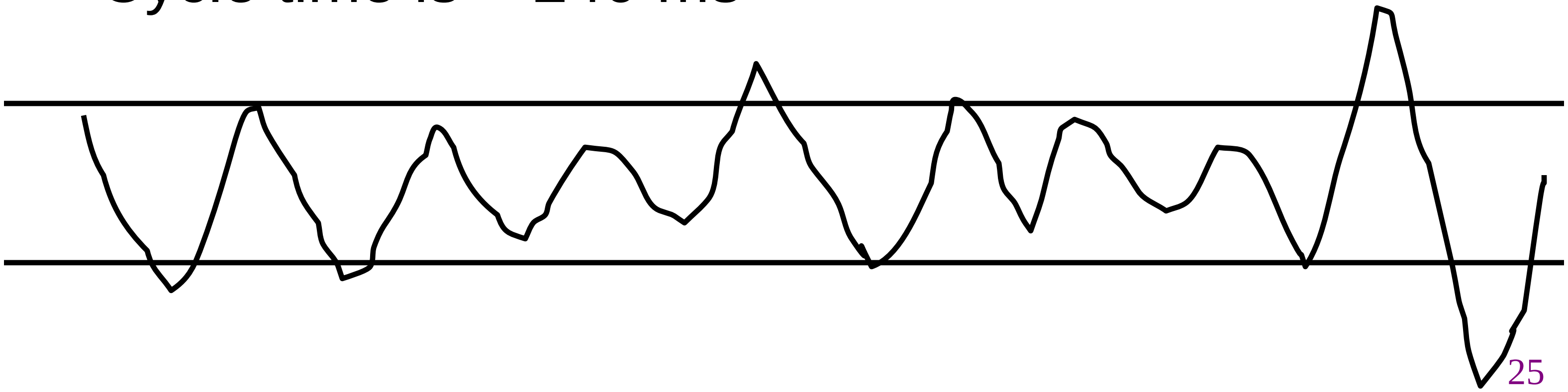
- How quickly can an expert operate the system – input, commands, perceiving and processing output
- About the performance of the I/O channel between the user and the program
- Fewer keystrokes to do a task is usually more efficient; but it's subtle
- The Gimp interface uses only contextual, cascading submenus – studies show it's actually slower to use than a menu bar



Some Facts About Motor Processing

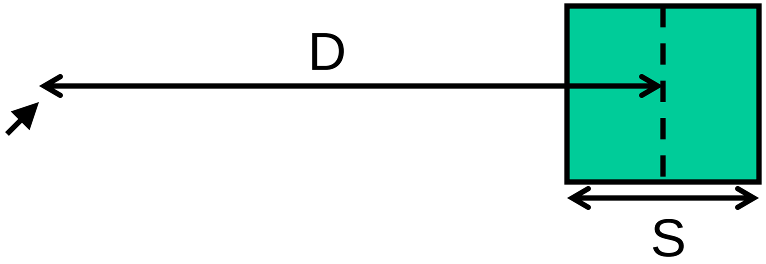


- Open-loop control
  - Motor processor runs by itself
  - Cycle time is ~ 70 ms
- Closed-loop control
  - Muscle movements (or their effect on the world) are perceived and compared with desired result
  - Cycle time is ~ 240 ms



Pointing Tasks: Fitts's Law

- How long does it take to reach a target?

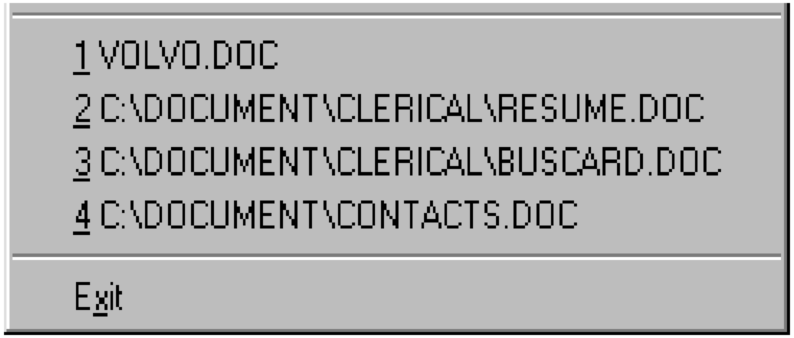


  - Moving mouse to target on screen
  - Moving finger to key on keyboard
  - Moving hand between keyboard and mouse

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

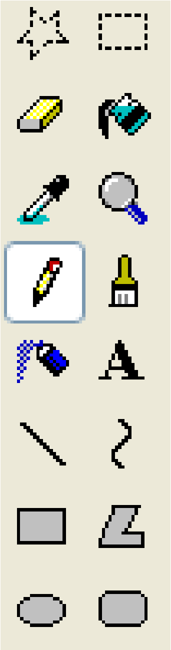


1 VOLVO.DOC
2 C:\DOCUMENT\CLERICAL\RESUME.DOC
3 C:\DOCUMENT\CLERICAL\BUSCARD.DOC
4 C:\DOCUMENT\CONTACTS.DOC
Exit

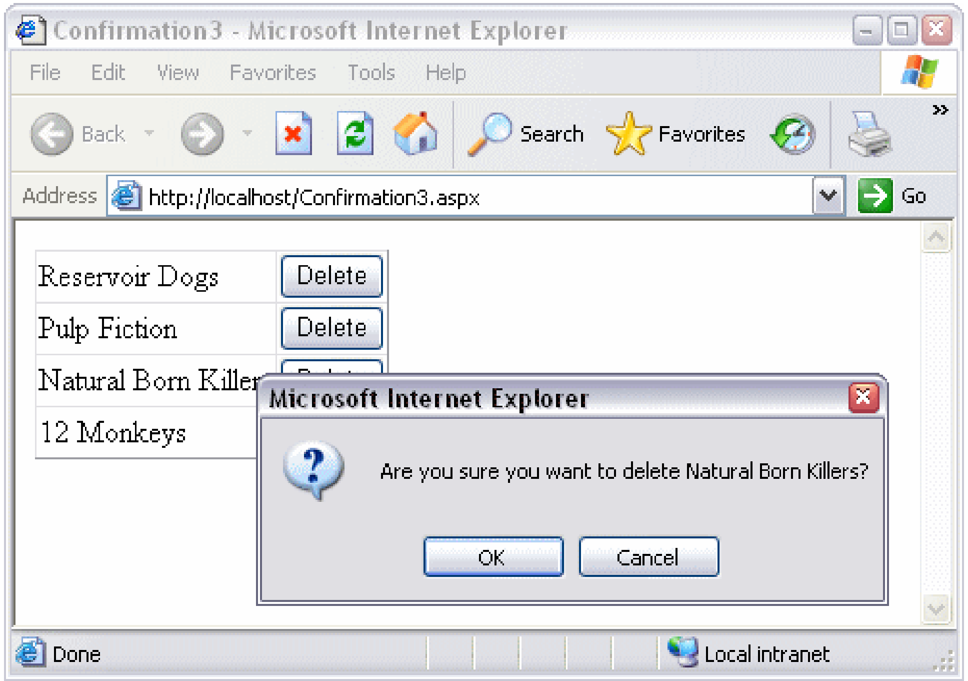
Source: Interface Hall of Shame

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

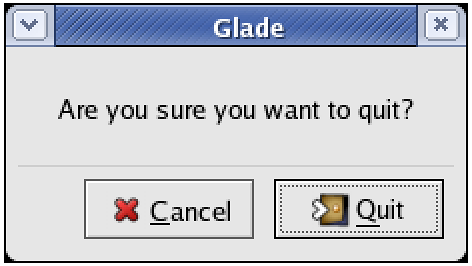


Confirmation Dialogs

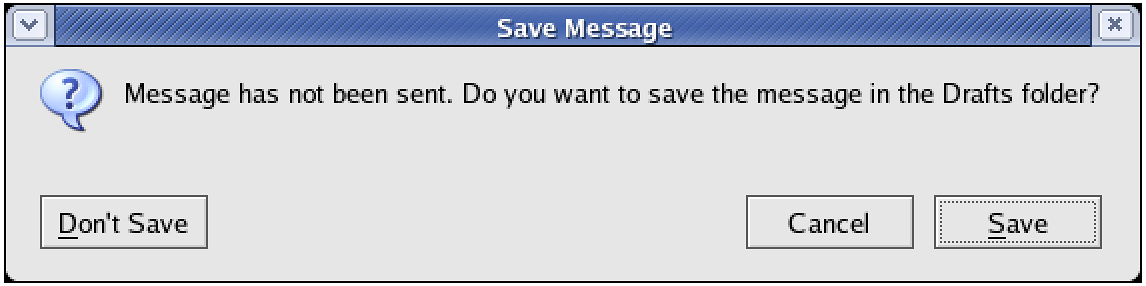


Are you sure you want to delete Natural Born Killers?

Confirmation3 - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back
Search
Favorites
Address
http://localhost/Confirmation3.aspx
Go
Reservoir Dogs
Delete
Pulp Fiction
Delete
Natural Born Killer
12 Monkeys
Microsoft Internet Explorer
OK
Cancel
Done
Local intranet



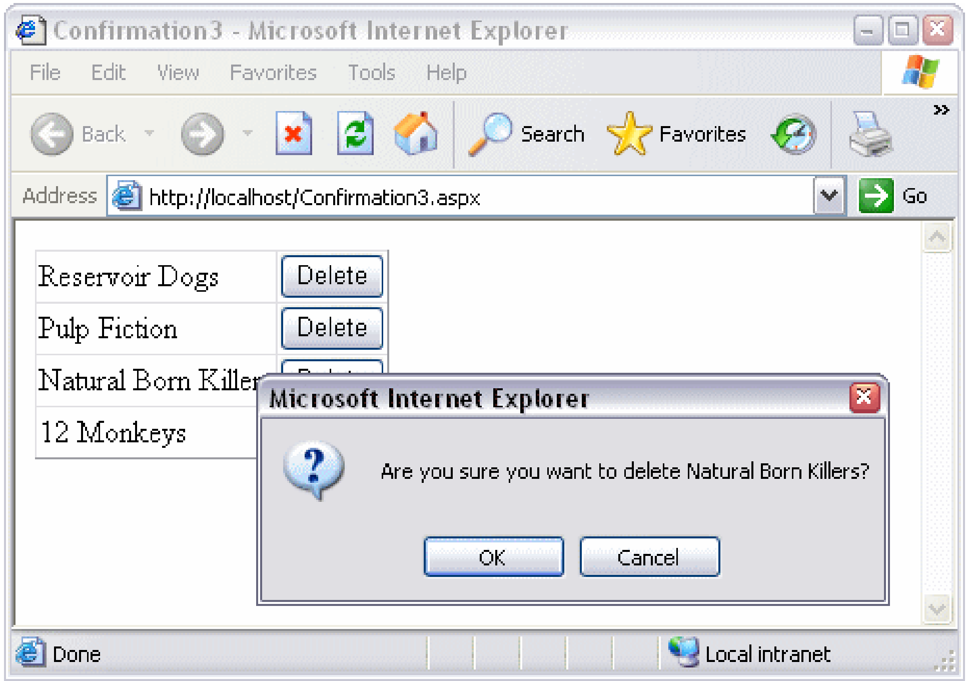
Are you sure you want to quit?



Message has not been sent. Do you want to save the message in the Drafts folder?

Confirmation Dialogs: “Are you sure?”

- They make common operations take two button presses rather than one
- Frequent confirmations dialogs lead to expert users chunking it as part of the operation
- Reversibility (i.e. undo) is a far better solution than confirmation – operations that are very hard to reverse may deserve confirmation, however



Confirmation3 - Microsoft Internet Explorer

Address: http://localhost/Confirmation3.aspx

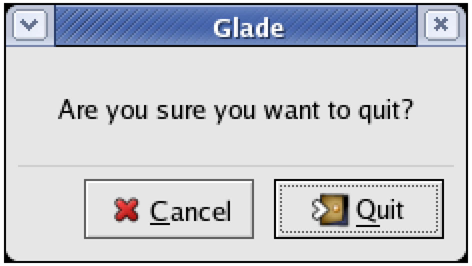
Reservoir Dogs	Delete
Pulp Fiction	Delete
Natural Born Killer	
12 Monkeys	

Microsoft Internet Explorer

Are you sure you want to delete Natural Born Killers?

Done

Local intranet

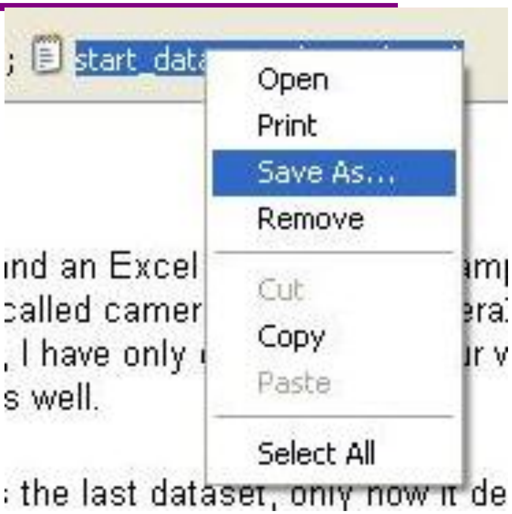


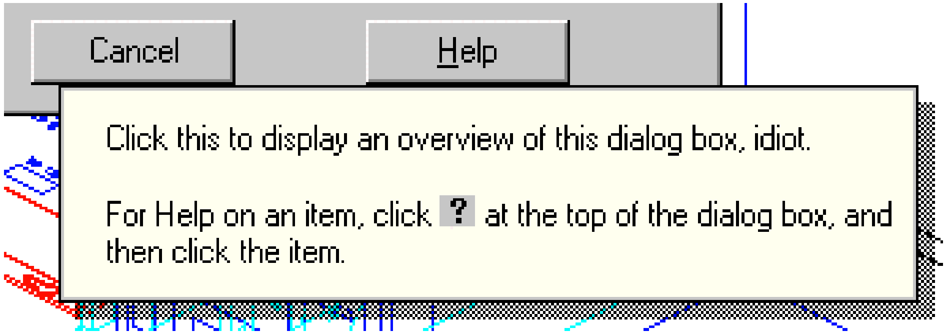
Glade

Are you sure you want to quit?

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
  - Speak the user’s language
  - Constructive help
  - Polite



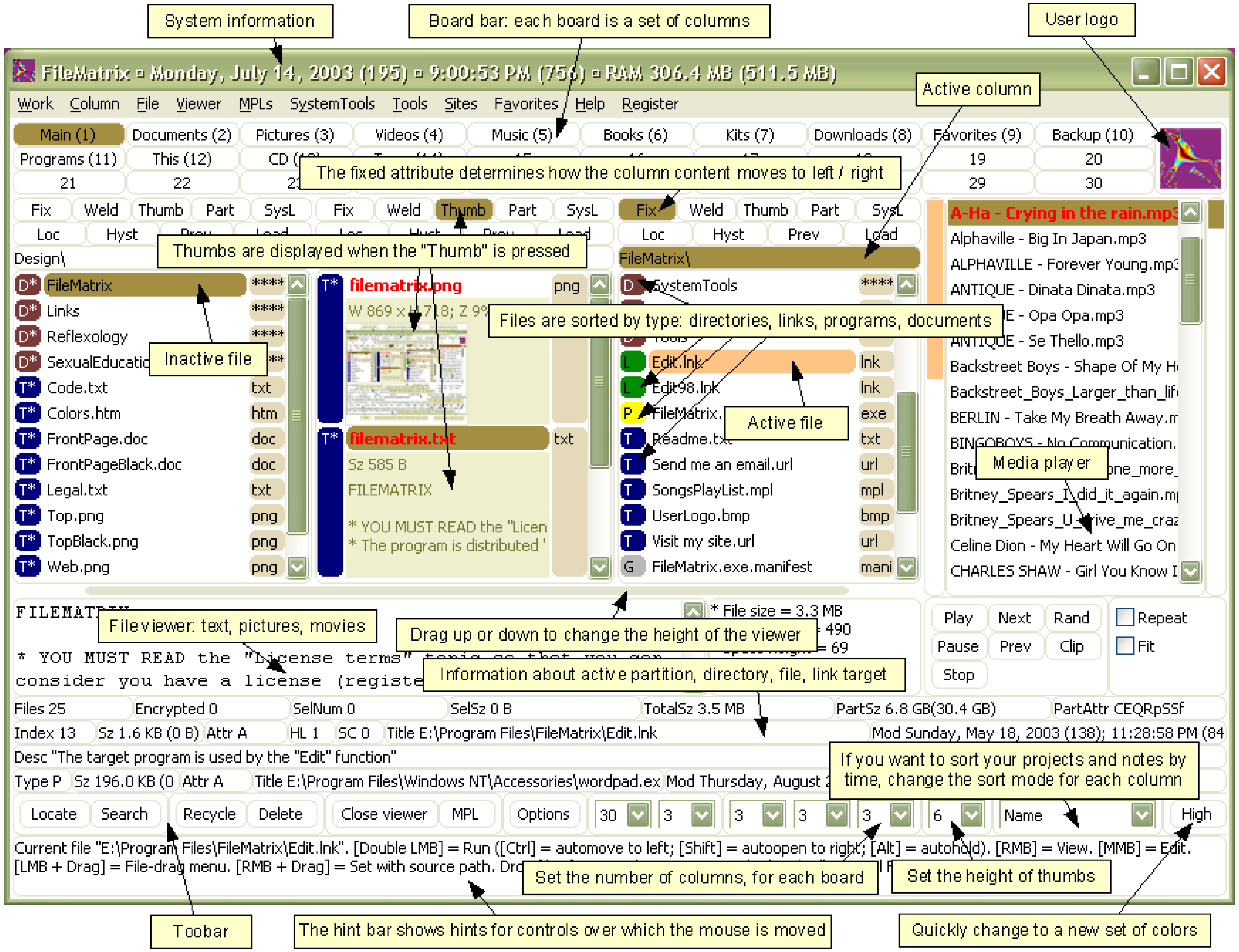


Click this to display an overview of this dialog box, idiot.

For Help on an item, click ? at the top of the dialog box, and then click the item.

Source: Interface Hall of Shame

Simplicity



System information

Board bar: each board is a set of columns

User logo

Active column

The fixed attribute determines how the column content moves to left / right

Thumbs are displayed when the "Thumb" is pressed

Files are sorted by type: directories, links, programs, documents

Inactive file

Active file

Media player

File viewer: text, pictures, movies

Drag up or down to change the height of the viewer

Information about active partition, directory, file, link target

If you want to sort your projects and notes by time, change the sort mode for each column

Set the number of columns, for each board

Set the height of thumbs

Toobar

The hint bar shows hints for controls over which the mouse is moved

Quickly change to a new set of colors

FileMatrix ¤ Monday, July 14, 2003 (195) ¤ 9:00:53 PM (756) ¤ RAM 306.4 MB (511.5 MB)

Files 25 | Encrypted 0 | SelNum 0 | SelSz 0 B | TotalSz 3.5 MB | PartSz 6.8 GB(30.4 GB) | PartAttr CEQRpSSf

Index 13 | Sz 1.6 KB (0 B) Attr A | HL 1 | SC 0 | Title E:\Program Files\FileMatrix\Edit.lnk | Mod Sunday, May 18, 2003 (138); 11:28:58 PM (84

Desc "The target program is used by the "Edit" function"

Type P | Sz 196.0 KB (0 | Attr A | Title E:\Program Files\Windows NT\Accessories\wordpad.ex | Mod Thursday, August 2

Current file "E:\Program Files\FileMatrix\Edit.lnk". [Double LMB] = Run ([Ctrl] = automove to left; [Shift] = autoopen to right; [Alt] = autohold). [RMB] = View. [MMB] = Edit. [LMB + Drag] = File-drag menu. [RMB + Drag] = Set with source path. Dro

FILEMATRIX

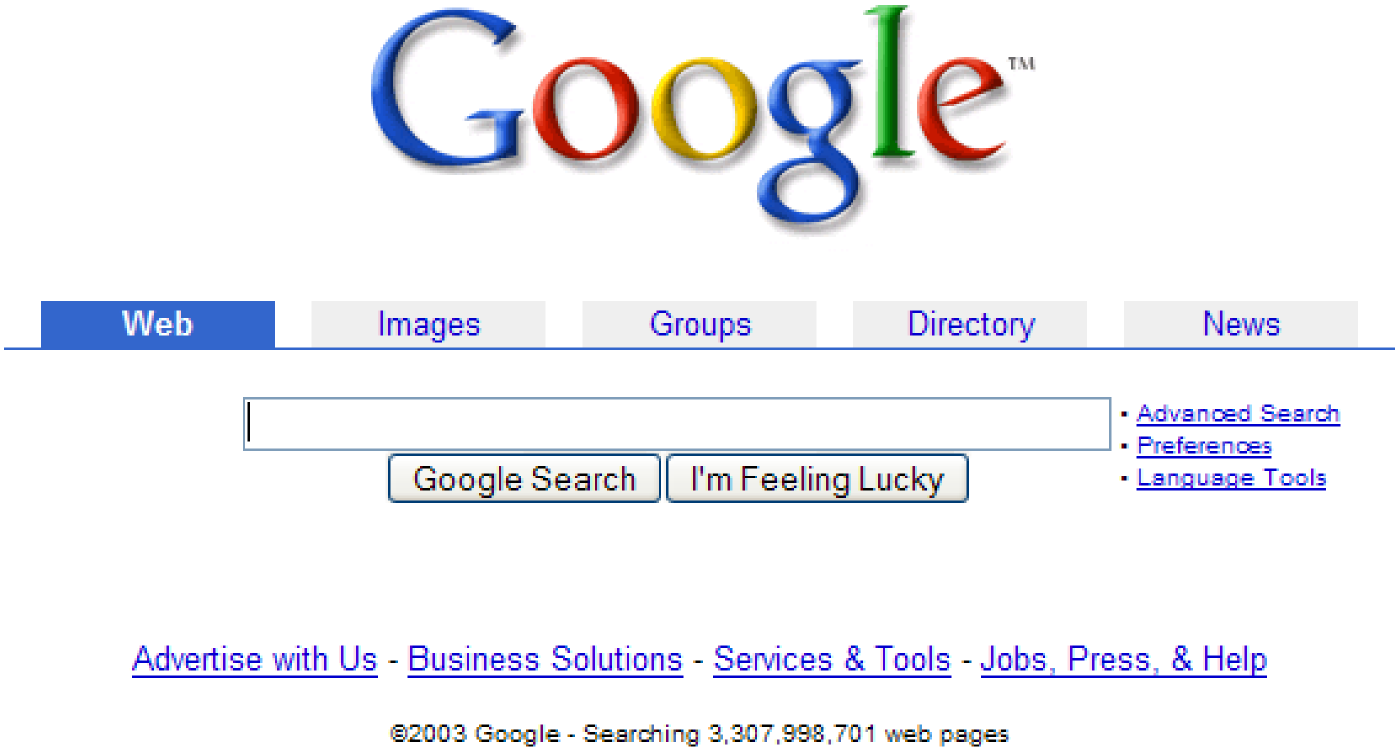
* YOU MUST READ the "License terms" topic so that you con consider you have a license (registe

* File size = 3.3 MB

Work Column File Viewer MPLs SystemTools Tools Sites Favorites Help Register
Main (1) Documents (2) Pictures (3) Videos (4) Music (5) Books (6) Kits (7) Downloads (8) Favorites (9) Backup (10)
Programs (11) This (12) CD (13) 19 20
21 22 29 30
Fix Weld Thumb Part SysL
Loc Hyst Prev Load
Design\
FileMatrix\
FileMatrix
Links
Reflexology
SexualEducatio
Code.txt txt
Colors.htm htm
FrontPage.doc doc
FrontPageBlack.doc doc
Legal.txt txt
Top.png png
TopBlack.png png
Web.png png
filematrix.png png
W 869 x H 718; Z 99
filematrix.txt txt
Sz 585 B
FILEMATRIX
* YOU MUST READ the "Licen
* The program is distributed "
SystemTools
Edit.lnk lnk
Edit98.lnk lnk
FileMatrix. exe
Readme.txt txt
Send me an email.url url
SongsPlayList.mpl mpl
UserLogo.bmp bmp
Visit my site.url url
FileMatrix.exe.manifest mani
A-Ha - Crying in the rain.mp3
Alphaville - Big In Japan.mp3
ALPHAVILLE - Forever Young.mp3
ANTIQUE - Dinata Dinata.mp3
ANTIQUE - Opa Opa.mp3
ANTIQUE - Se Thello.mp3
Backstreet Boys - Shape Of My H
Backstreet_Boys_Larger_than_life
BERLIN - Take My Breath Away.m
BINGOBOYS - No Communication.
Britney_Spears_One_more_
Britney_Spears_I_did_it_again.mp
Britney_Spears_U_drive_me_craz
Celine Dion - My Heart Will Go On
CHARLES SHAW - Girl You Know I
Play Next Rand
Pause Prev Clip
Stop
□ Repeat
□ Fit
490
69
Locate Search Recycle Delete Close viewer MPL Options 30 3 3 3 3 6 Name High

Source: Alex Papadimoulis

Simplicity



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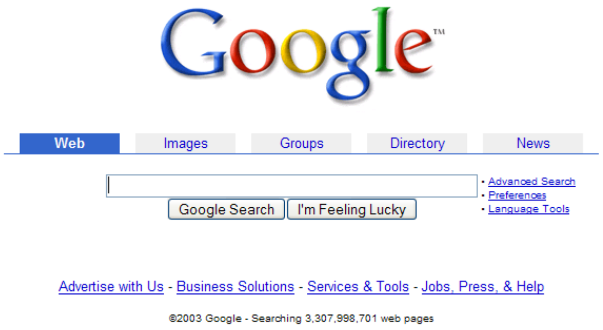
Design Principles for Simplicity

- “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



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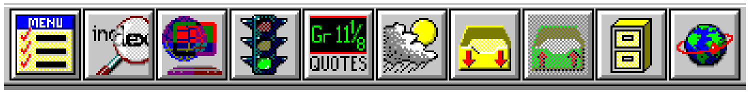
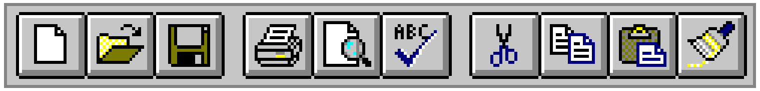
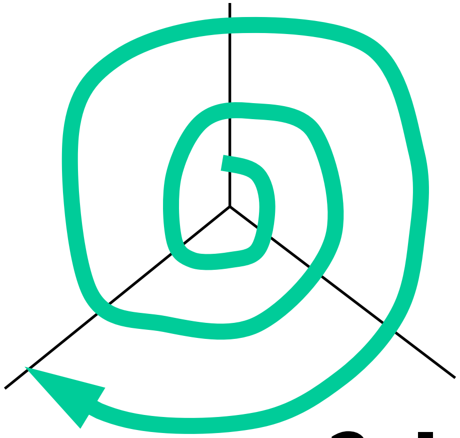




Document your system

- 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 might not
  - Piecemeal online help is no substitute

Lecture Outline



1. Design

design principles

3. Evaluate

user testing

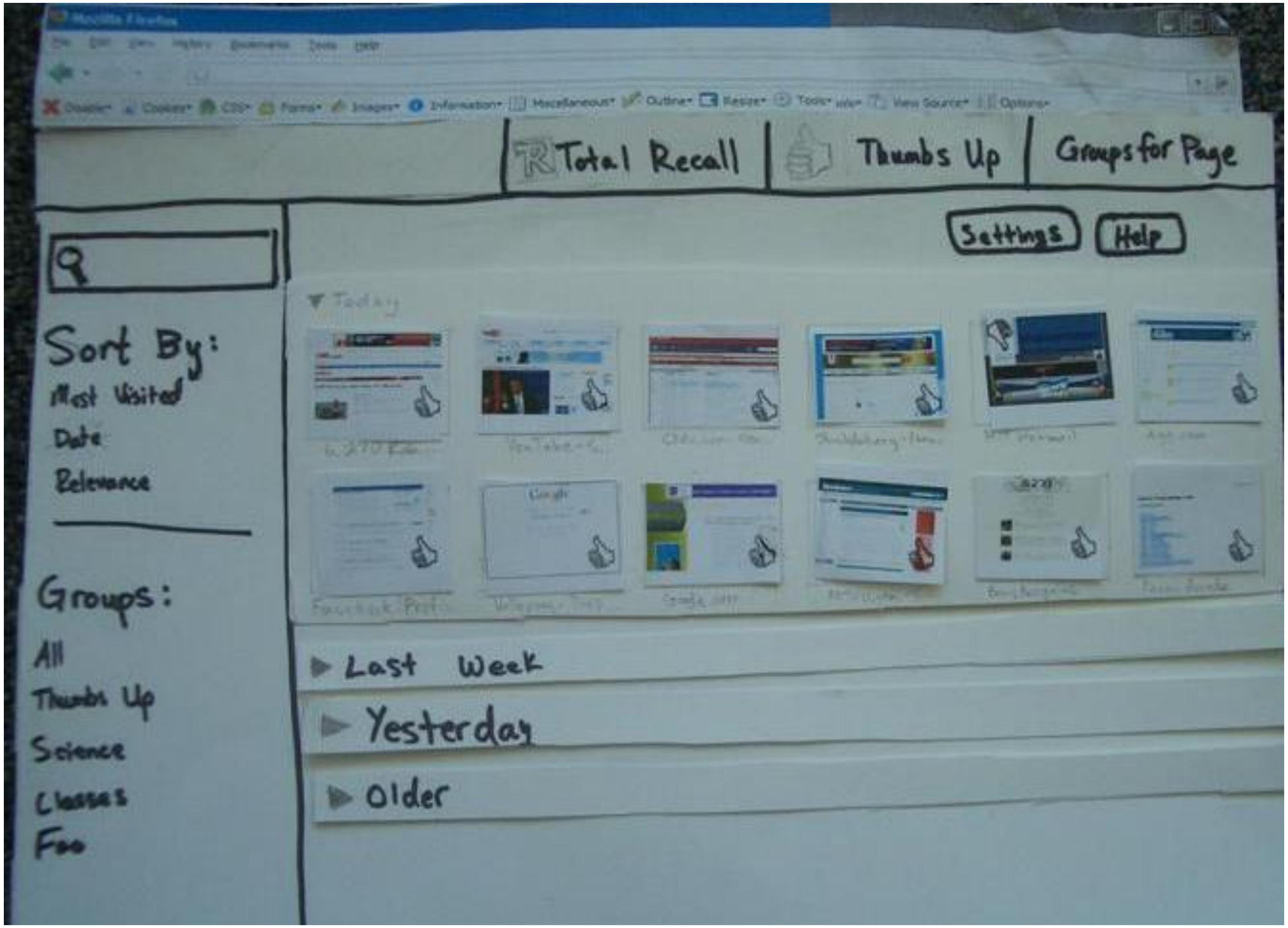
2. Implement

low-fidelity prototypes

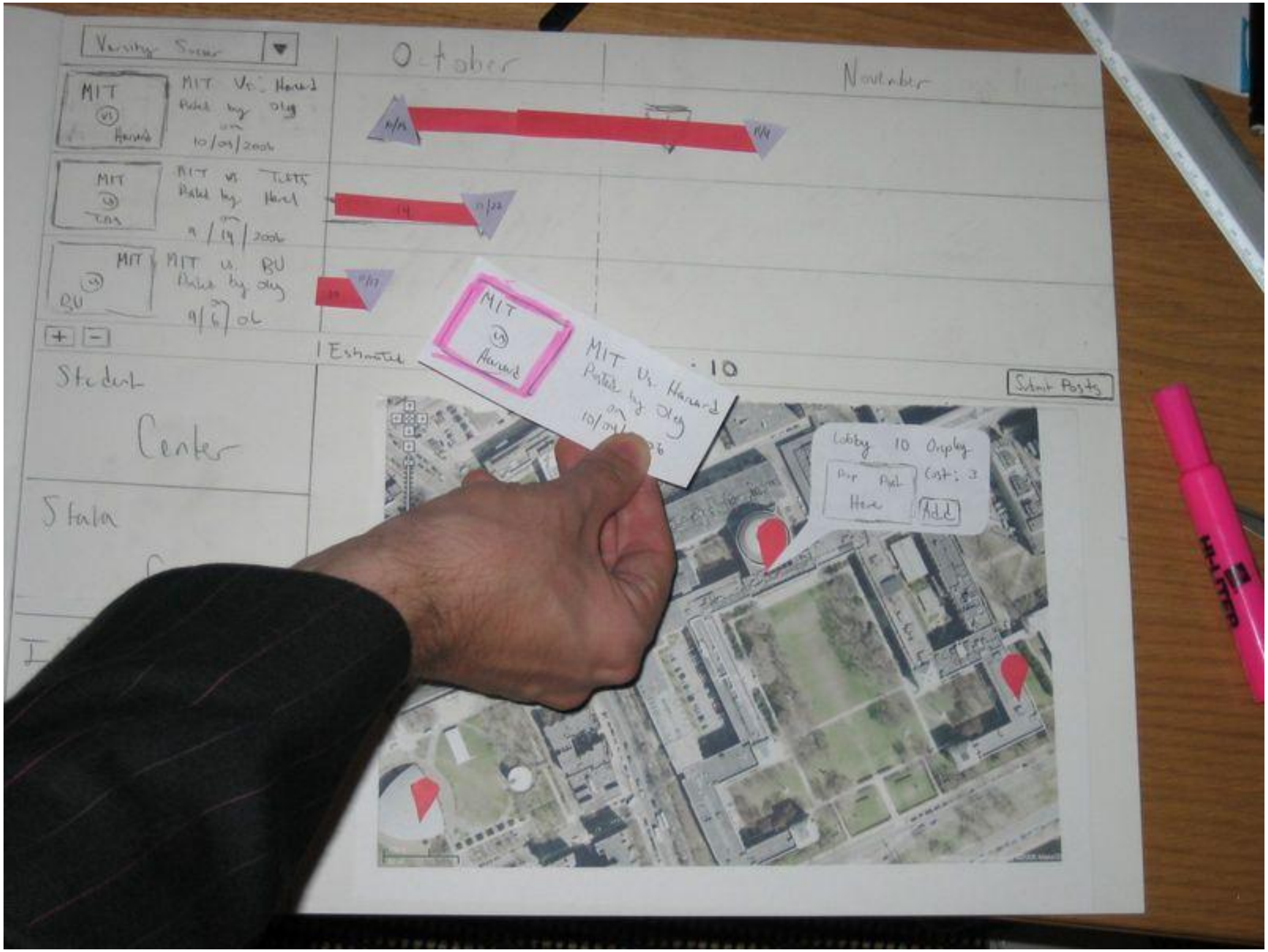
Low-fidelity Prototypes

- 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
  - Similar to design of your data structures & algorithms
- 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

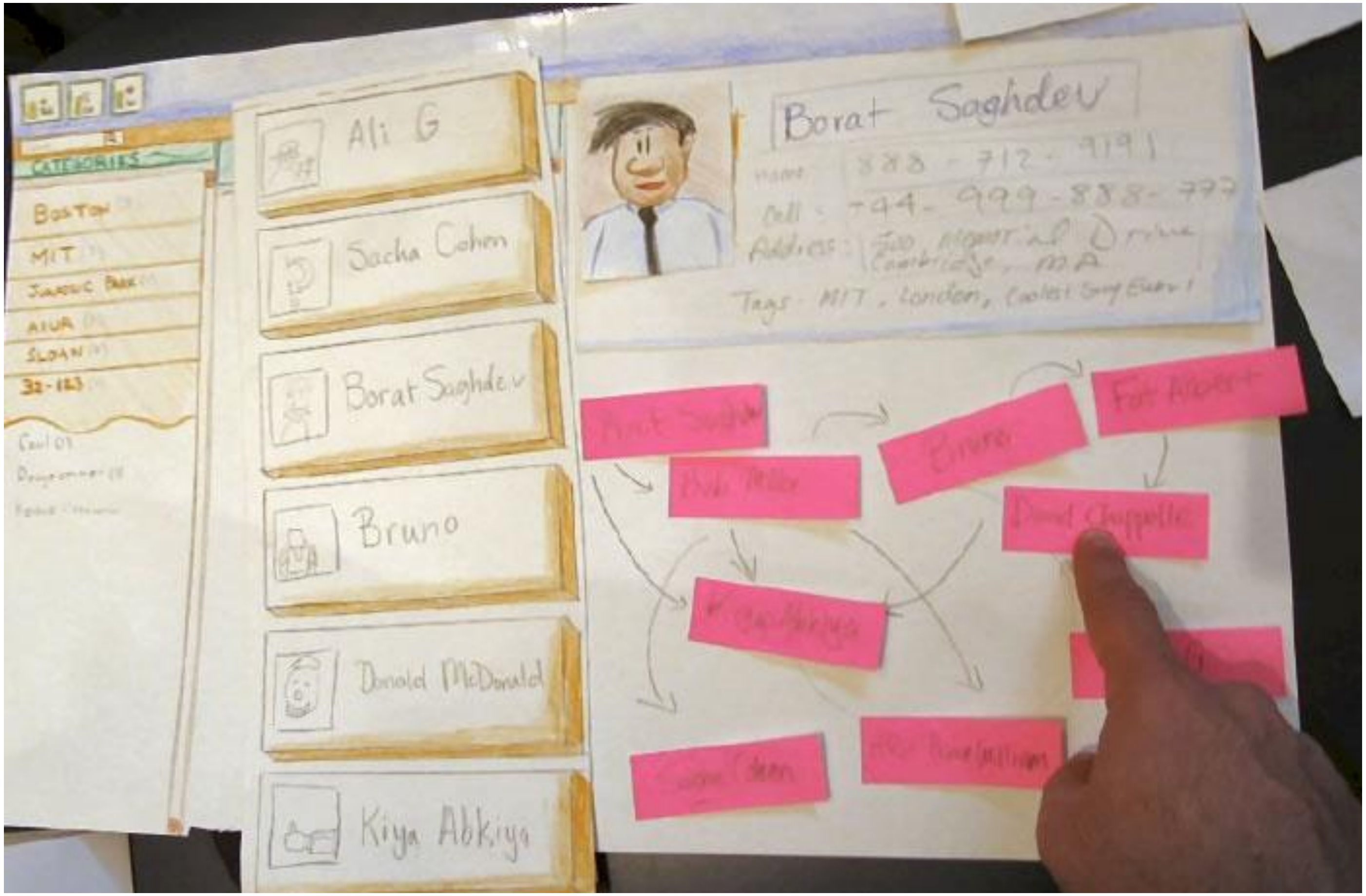
Paper Prototypes



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
- Write documentation
- 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