CPSC 310 – Software Engineering

Lecture 14 – User Interface Design

Credits: Fritz, Maclean, Rahul Premraj, Wolfman, Shepherd, Notkin, Razmov

Overview

- Introduction to design
- User-centered design and human capabilities
- Usability and how to achieve it
- Usability principles

Learning Goals

- Explain why designing interfaces is hard
- Understand why designers need to consider human abilities (memory, visual perception, …)
- Explain why usability is important and how it can be achieved
- Analyze a GUI for problems using Nielsen's 10 usability heuristics and suggest aspects of the GUI that could be improved
- Given a scenario, design a UI using the most appropriate UI components

Hmm…

- What is the most important consideration in developing a new software product?

A. Slick interface and design

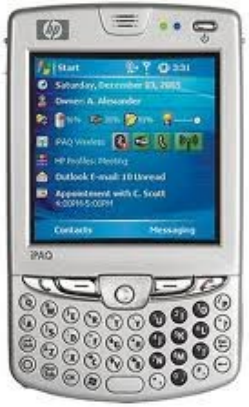
B. Reliable and secure

C. Fills a user need

D. Efficient and scalably coded

Designing interfaces is hard

- How many of you can program or use all aspects of your
  - digital watch?
  - cell phone?
  - DVD player?
  - microwave?
  - sewing machine?
  - washer and dryer?
  - stereo system (home or car)?
  - unfamiliar water faucets?



What causes these problems?

Now, to actually set the time, one does:

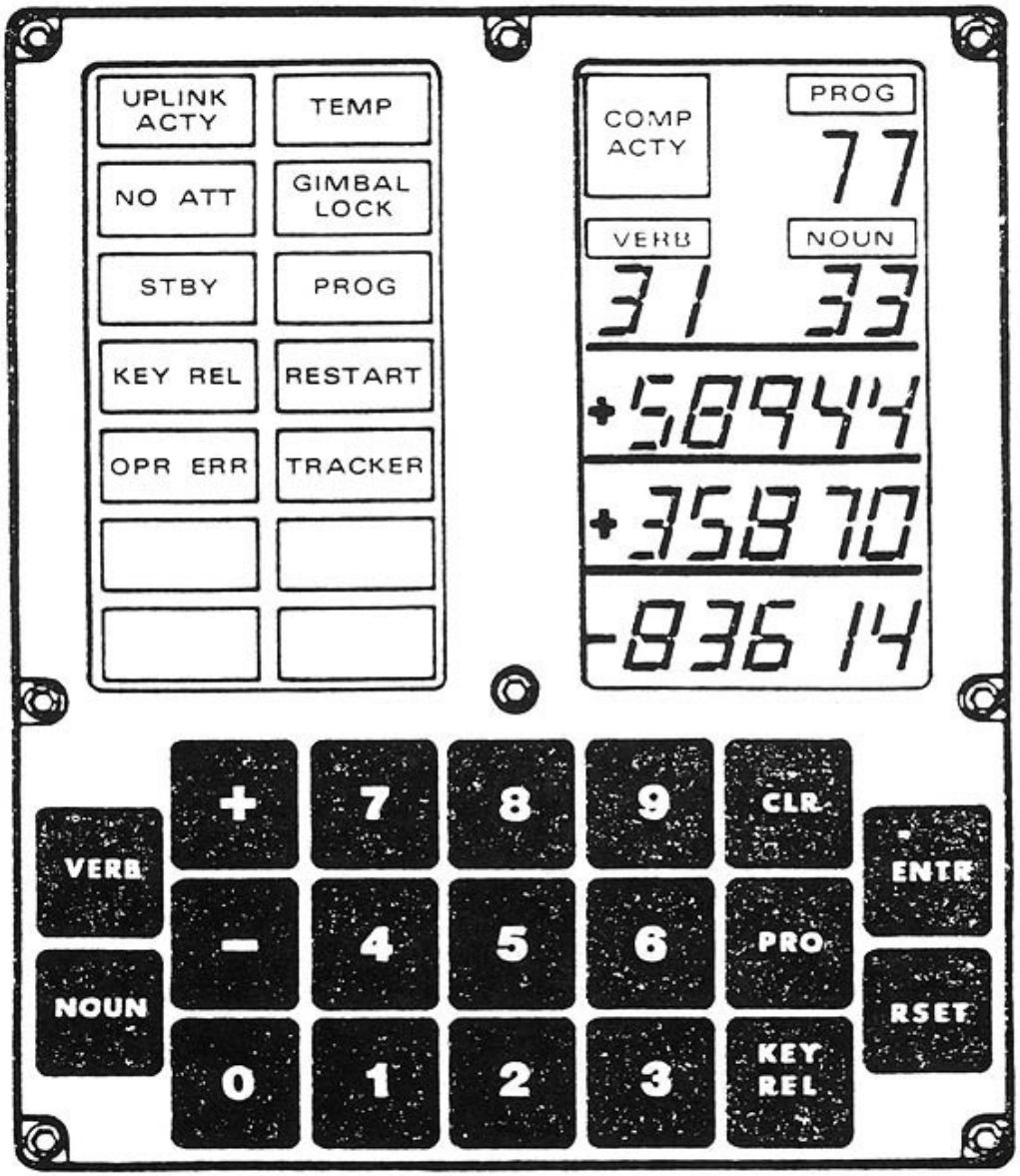
- Press and hold SET. (1 key press)
- Press MODE to select the hours place. (1 key press)
- Press SPLIT/RESET to advance hours. (6 key presses on average)
- Press MODE to select the minutes place. (1 key press)
- Press SPLIT/RESET to advance minutes. (30 key presses on average).
- Press SET when done. (1 key press)

Symbolic issues…

- What does this mean?

What does this mean?

What do these symbols mean?



video: http://www.youtube.com/watch?v=EXT96N1YfbQ

http://history.nasa.gov/computers/Ch2-7.html

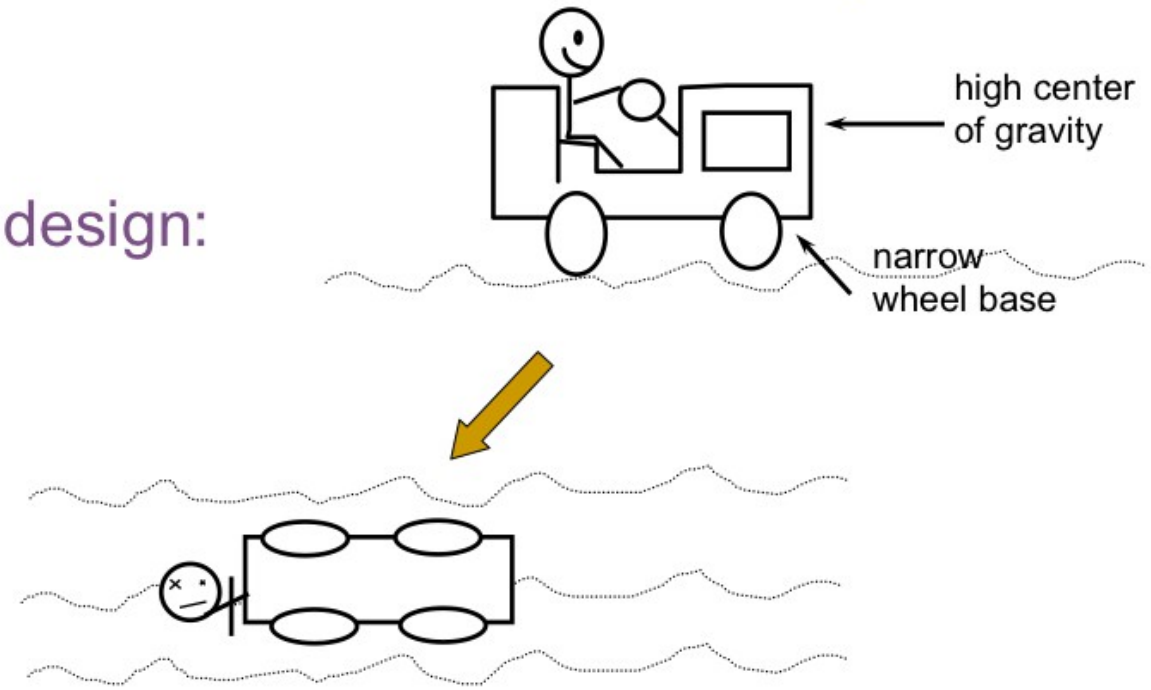
http://upload.wikimedia.org/wikipedia/commons/a/a4/Airbus_A380_cockpit.jpg

In the past…

typical terrain:
un-surfaced
rough
hilly

original design:

early tractors



used to be called "Driver's Error" …

but, accidents became infrequent when designs changed to low center of gravity & wider wheel bases

Our approach now…

- Make the tractors hard to tip…
- (make the interface easy to use and understand)

(UI) Design is important

- Many so-called human errors and "machine misuse" are actually errors in design.
- Designers help things work by providing a good conceptual model.
- Designers decide on a range of users as the design audience.
- But, design is difficult for a variety of reasons that go beyond design.

Good design avoids wasting the time of the users.

User-centered vs activity-centered

- Design for an activity: coordinated set of tasks.
- Does technology adapt to people? Or vice-versa?
- Consider a kitchen.

What is?

- Interface
- Design

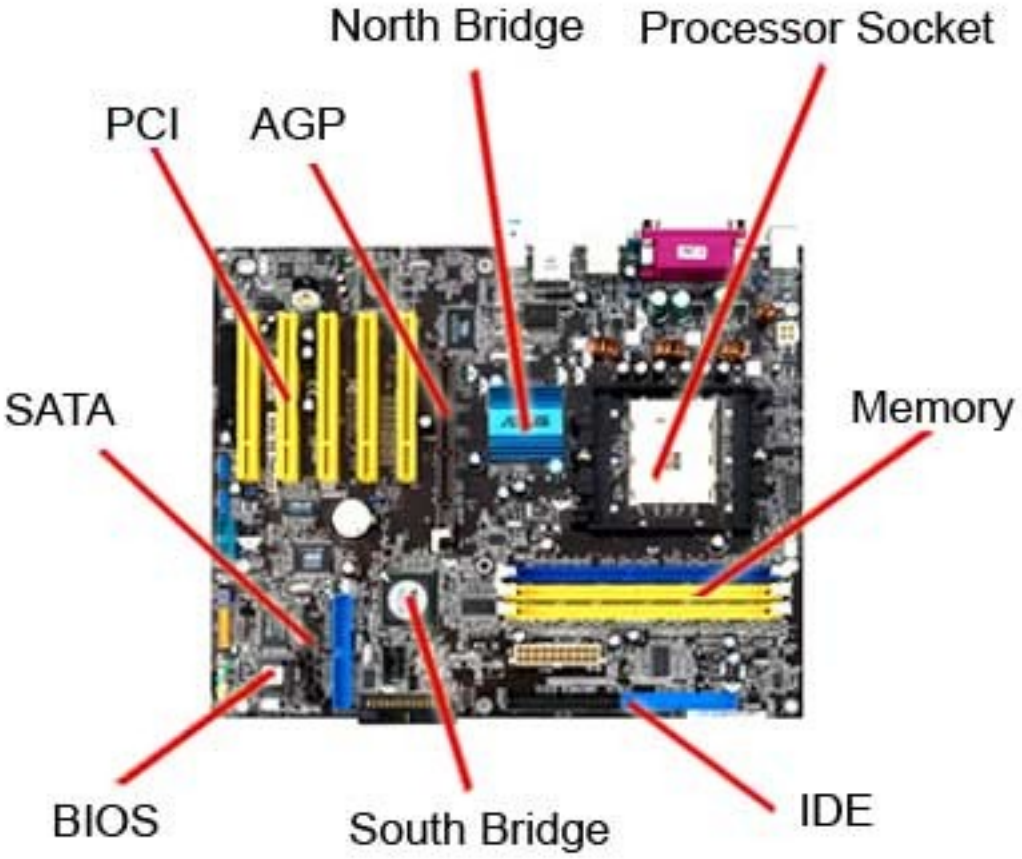
Interface - visual

Interface – physical

Design

2007
Balenciaga Collection

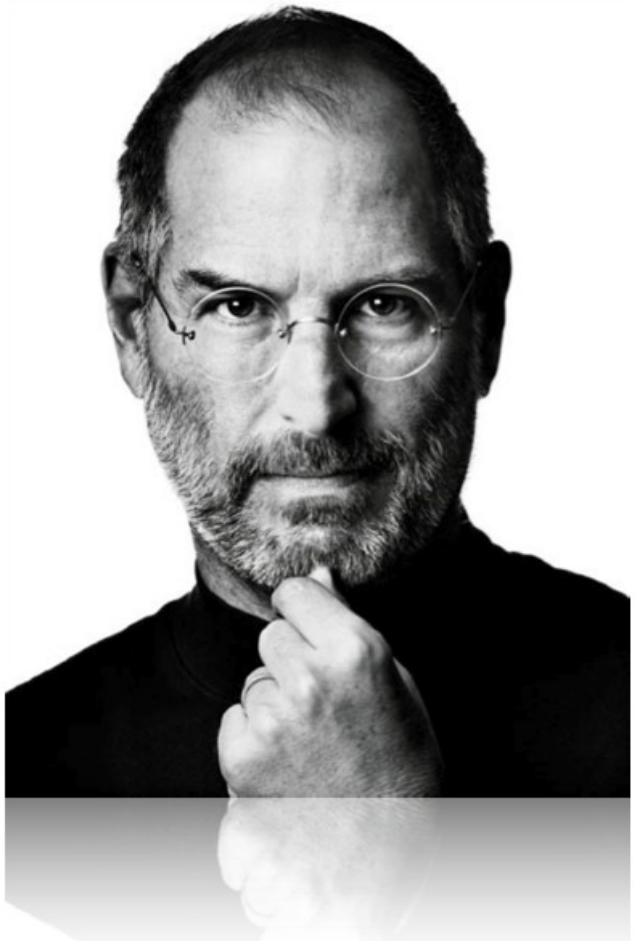
Design


North Bridge
Processor Socket
PCI
AGP
SATA
Memory
BIOS
South Bridge
IDE

Design


Now Playing
1 of 14
Dani California
3:27
iPod
Music
Photos
Extras
Settings
Shuffle Songs
MENU

What is design?



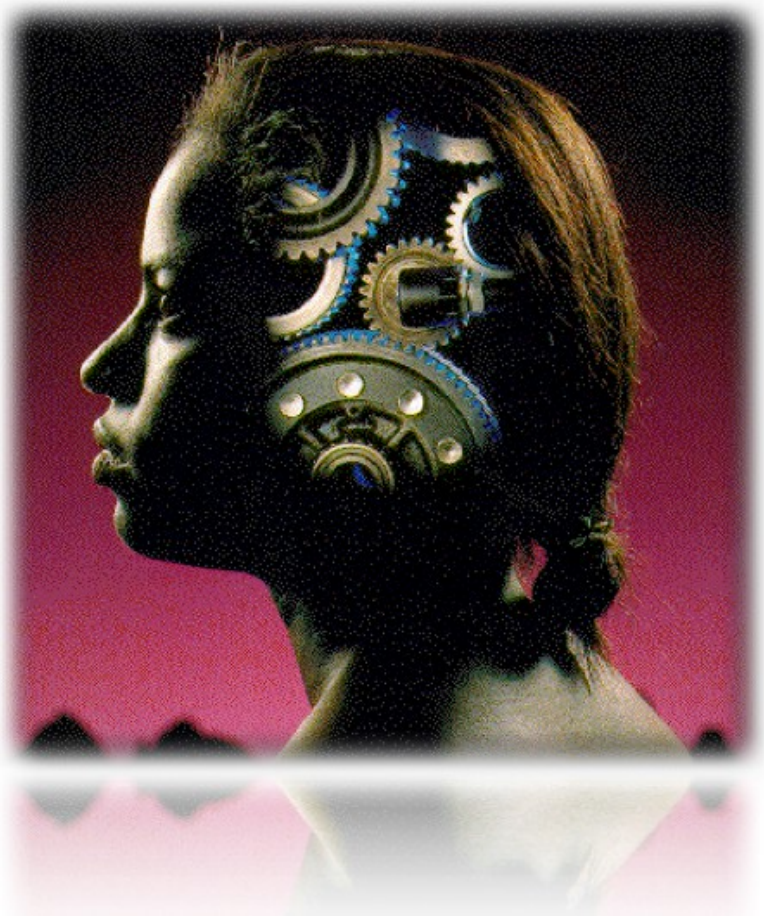
Design is not just what it looks like and feels like.

Design is how it works.

Why User-Centered Design?

- Why?
  - Cost saving
  - Competitive market
  - User expectations
- What? Consider users' abilities such as
  - Memory
  - Abilities
  - Color
  - Ergonomics

Human Capabilities



Some facts on memory

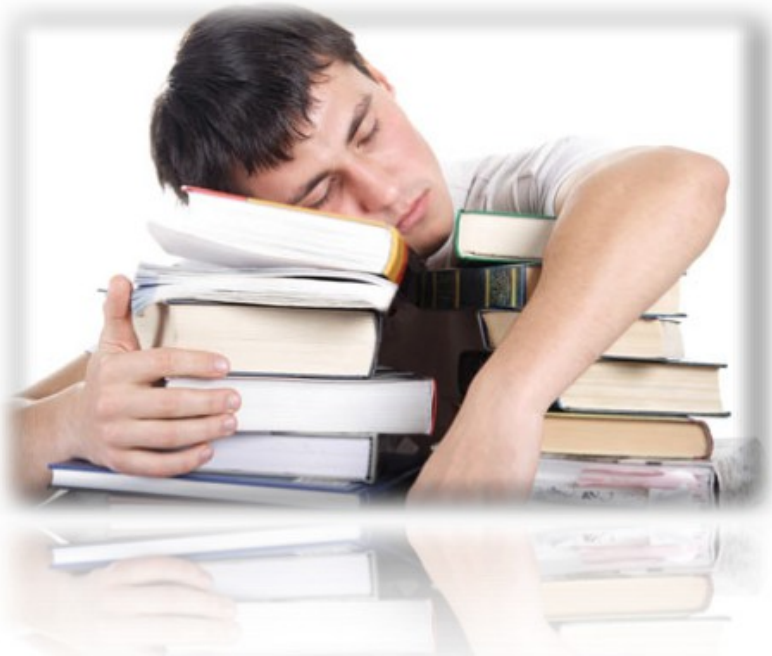
- Associations are built by repetition.
- Scaffold model (more likely to remember items that have many associations).
- Recognition is easier than recall.
- Working memory has small capacity.
- Long-term memory has large capacity.

Human Capabilities

Visual Perception

- We excel at pattern recognition.
- We automatically try to organize visual displays and look for cues.
- Motion, grouping, contrast, color can make different parts of a display more or less salient.

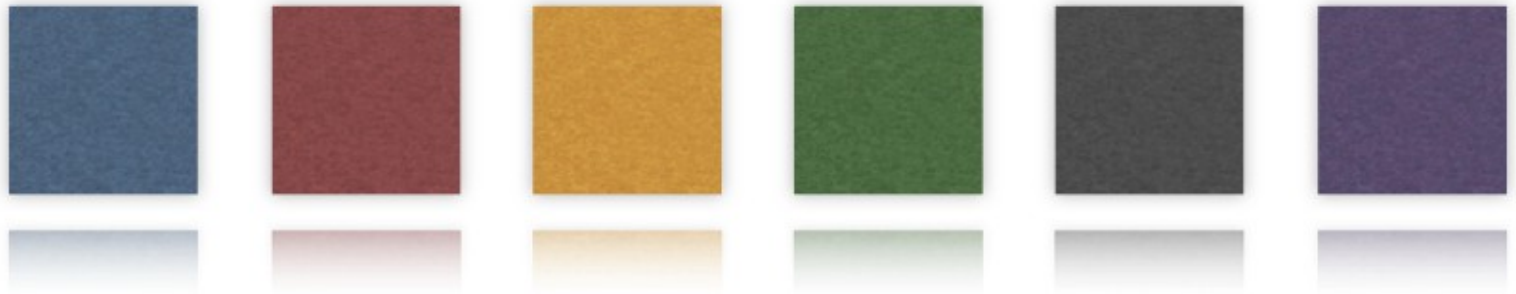
Human Capabilities



Learning

- Incrementally presented information accelerates learning.
- Some users like to explore systems to learn; others will not.
- Workers focus on accomplishing tasks, not learning software.

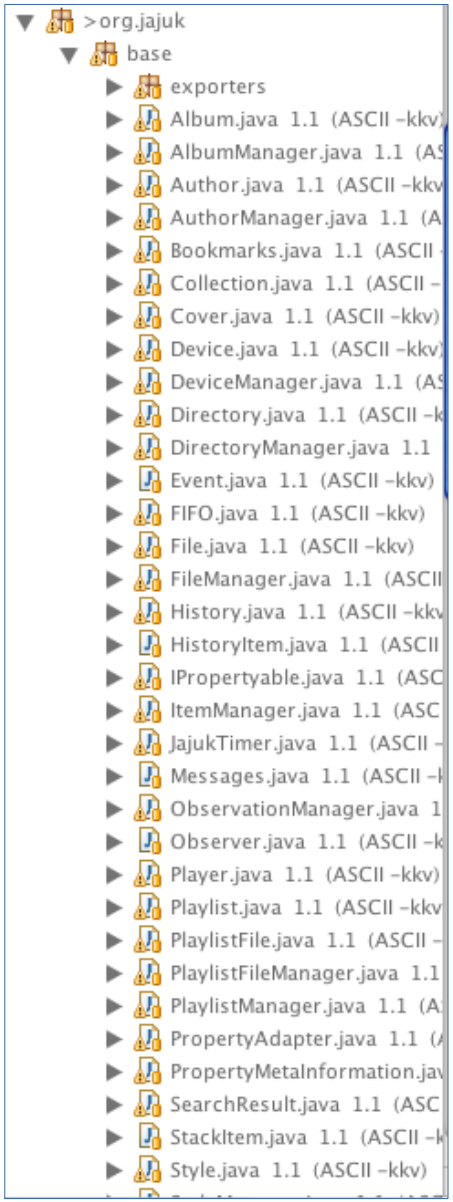
Human Limitations

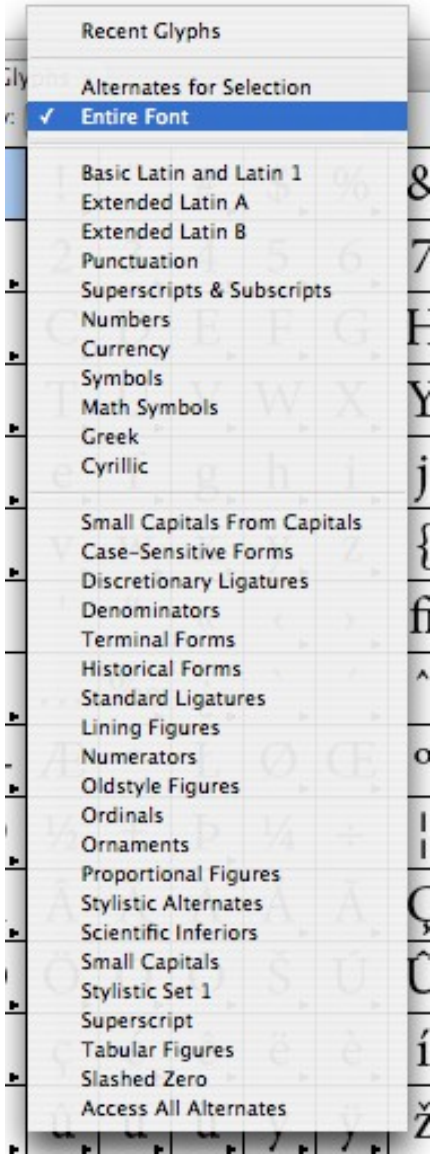


- Red-green color blindness (protonopia & deuteranopia)
  - 8% of males
  - 0.4% of females
- Blue-yellow color blindness (tritanopia)
  - Far more rare
- Guideline: don't depend solely on color distinctions
  - use redundant signals: brightness, location, shape

Human Limitation

- Information overload





Class activity

- Why is this street hard to shop on?
  - e.g., If you're trying to find a certain shop
  - How could you make it better?

Usability and Software Design

- usability: the effectiveness with which users can achieve tasks in one software environment
  - Studying and improving usability is part of Human-Computer Interaction (HCI) - CS 344

- usability and good UI design are closely related
- a bad UI can have unfortunate results…

Usability Principles

- Nielsen's 10 Principles of UI Design (Jakob Nielsen)
- Shneiderman's 8 Golden Rules
  - https://www.cs.umd.edu/users/ben/goldenrules.html
- Tog's 16 Principles
  - http://faculty.kutztown.edu/rieksts/385/topics/hci/tog-summary.html

Nielsen's Principles - #1

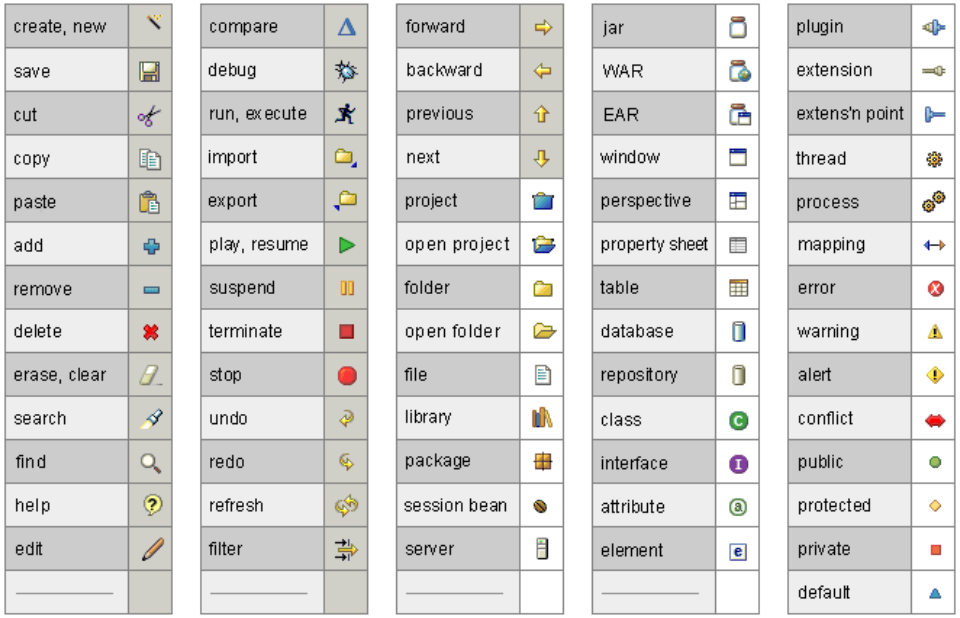
Match the Real World

- System should speak the users' language, with words, phrases and concepts familiar to the user, rather than system-oriented terms
- Follow real-world conventions
- Make information appear in natural and logical order
- Examples:
  - Files and folders on a desktop

Nielsen's Principles - #2

- Consistency and Standards

- Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.

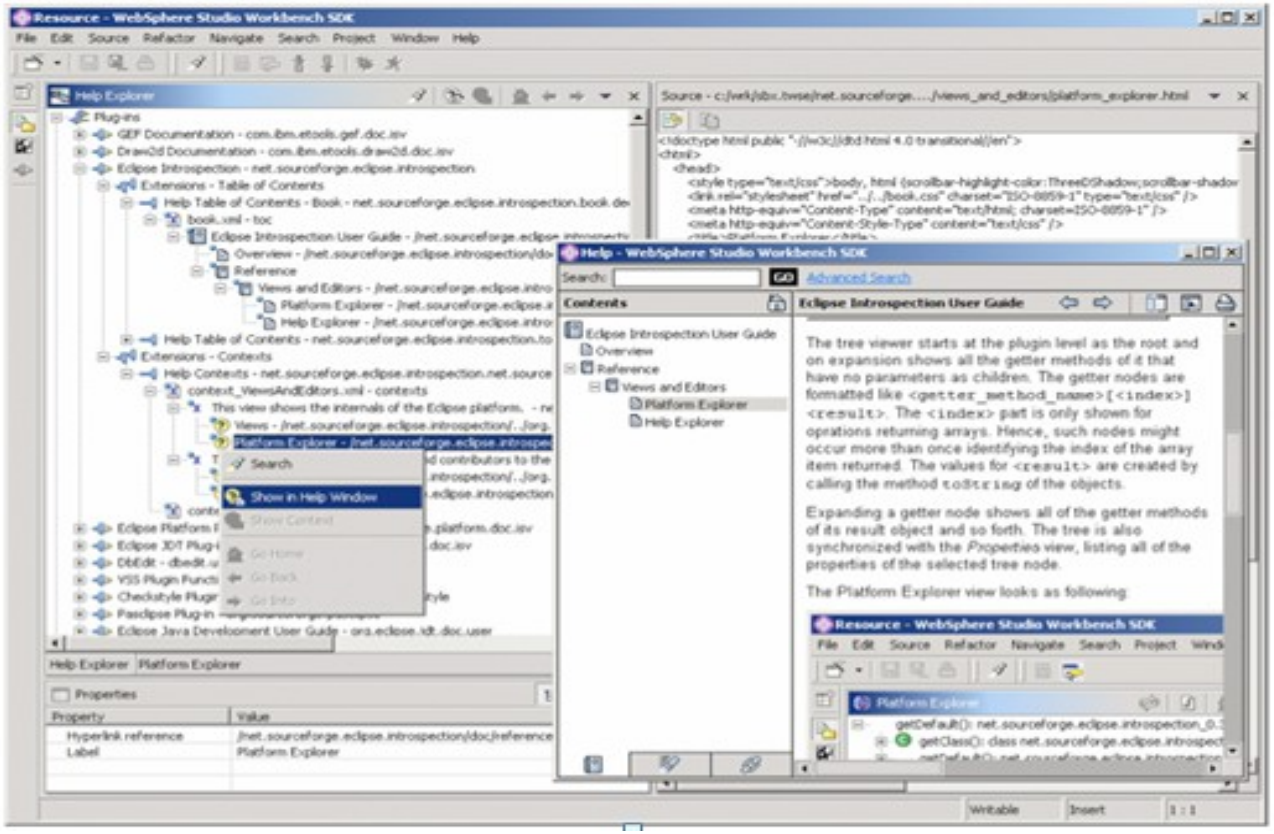


- Eclipse's icons guidelines
- Mac, Windows, Gnome and KDE guidelines

Nielsen's Principles - #3

- Help and Documentation

- Help should be searchable, focused on user's task, concrete and short.

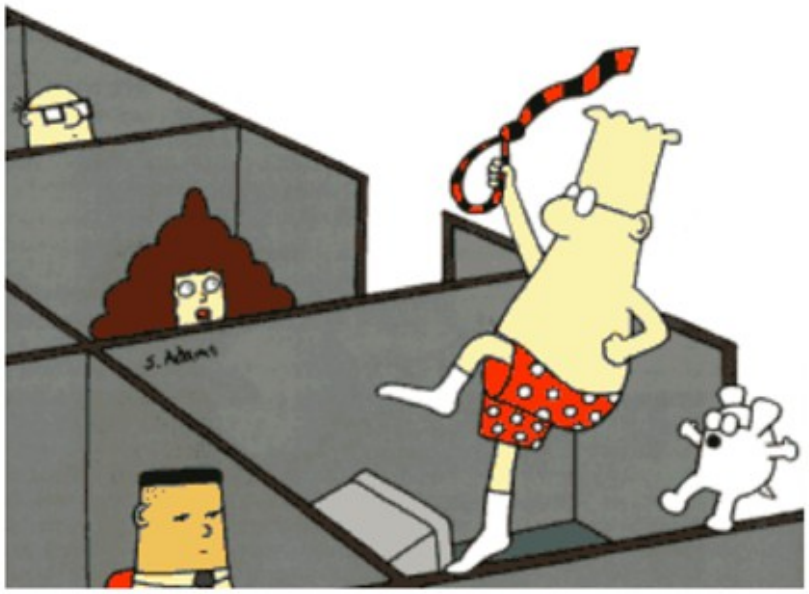


Nielsen's Principles - #4

- User Control and Freedom

- Provide "emergency exit" without having to go through extended dialogue

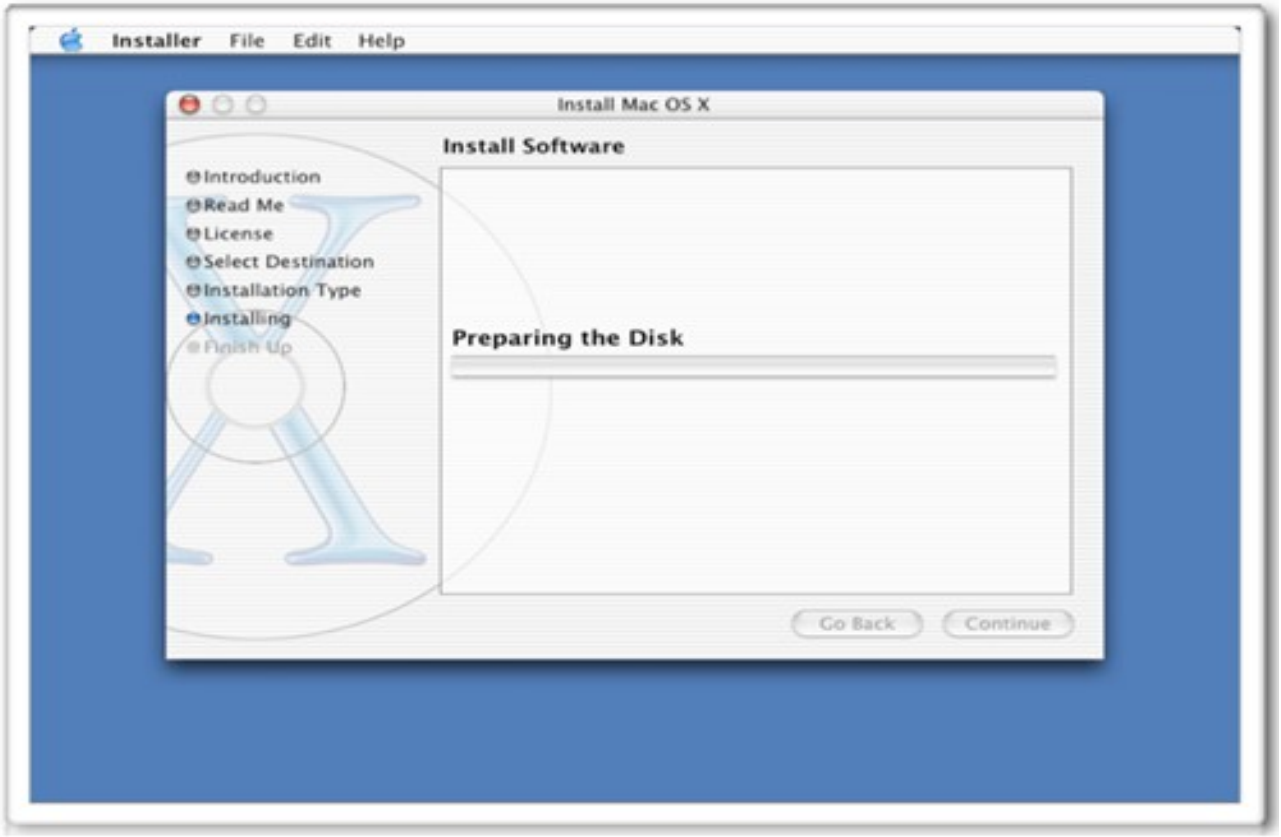
- Support undo and redo



Nielsen's Principles - #5

- Visibility of System Status

keep users informed about what is going on, through appropriate feedback within reasonable time



Nielsen's Principles - #6

- Flexibility and efficiency of use

- Accelerators – unseen by the novice user – may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.

Keyboard shortcuts

Print

Keyboard shortcuts help you save time by allowing you to never take your hands off the keyboard to use the mouse. *You'll need a Standard 101/102-Key or Natural PS/2 Keyboard to use the shortcuts.*

To turn these case-sensitive shortcuts on or off, click **Settings**, and then pick an option next to **Keyboard shortcuts**.

Shortcut Key	Definition	Action
c	Compose	Allows you to compose a new message. **<Shift> + c** allows you to compose a message in a new window.
/	Search	Puts your cursor in the search box.
k	Move to newer conversation	Opens or moves your cursor to a more recent conversation. You can hit **<Enter>** to expand a conversation.
j	Move to older conversation	Opens or moves your cursor to the next oldest conversation. You can hit **<Enter>** to expand a conversation.

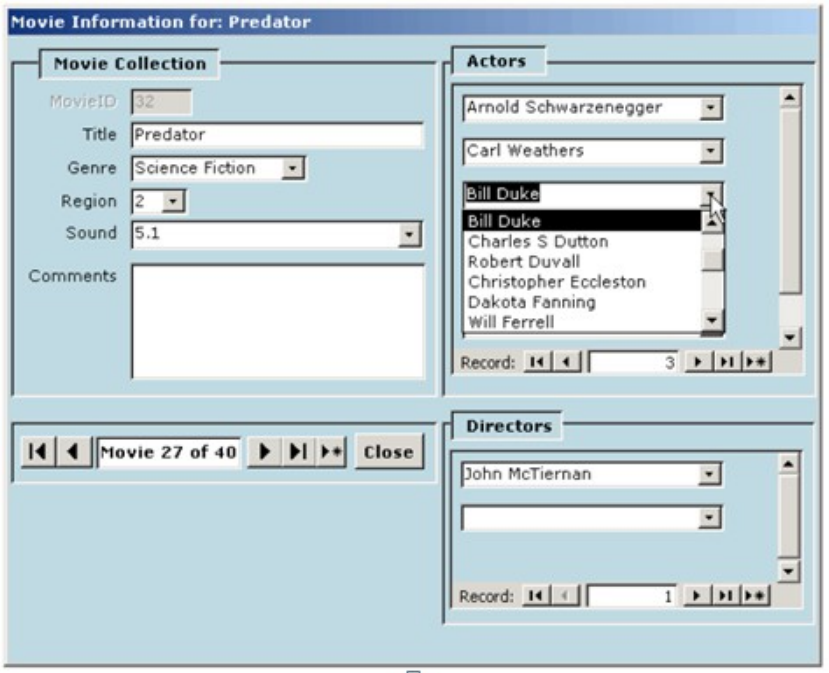
- e.g. gmail shortcuts

Nielsen's Principles - #7

- Error Prevention

- preventing errors is better than good error message

- eliminate error-prone conditions or check and present users with confirmation option



Nielsen's Principles - #8

- Recognition rather than recall

- Minimize user's memory load by making objects, actions, and options visible.

Nielsen's Principles - #9

- Help users recognize, diagnose, and recover from errors

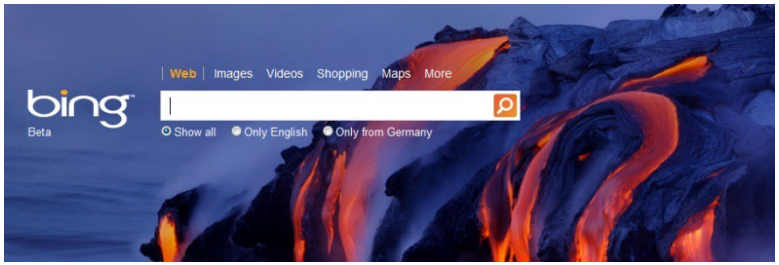
- Error messages in plain language (no codes), precise, and constructive

This example violates this principle!

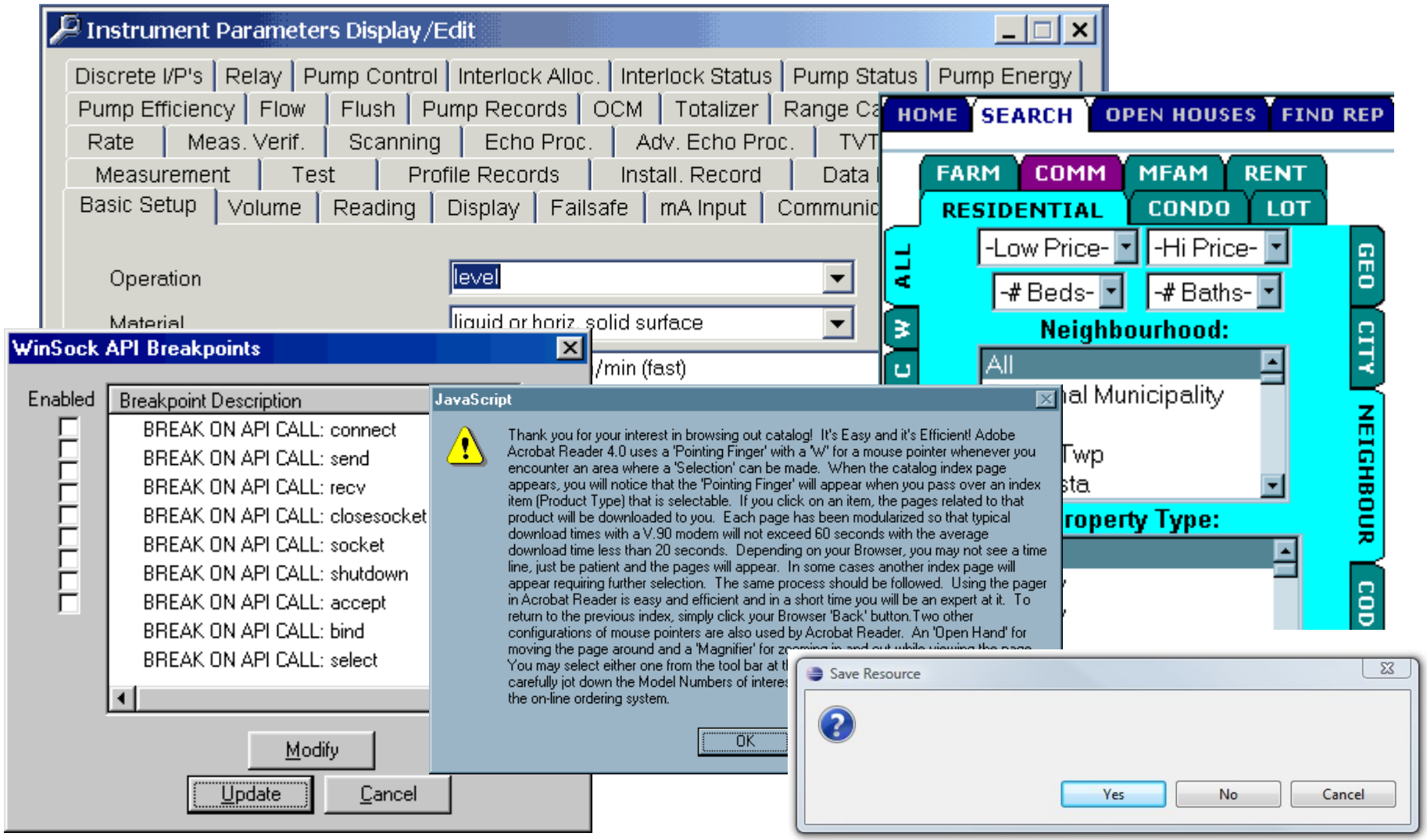
Nielsen's Principles - #10

- Aesthetic and Minimalist Design

- Dialogues should not contain information which is irrelevant or rarely needed



UI Hall of Shame



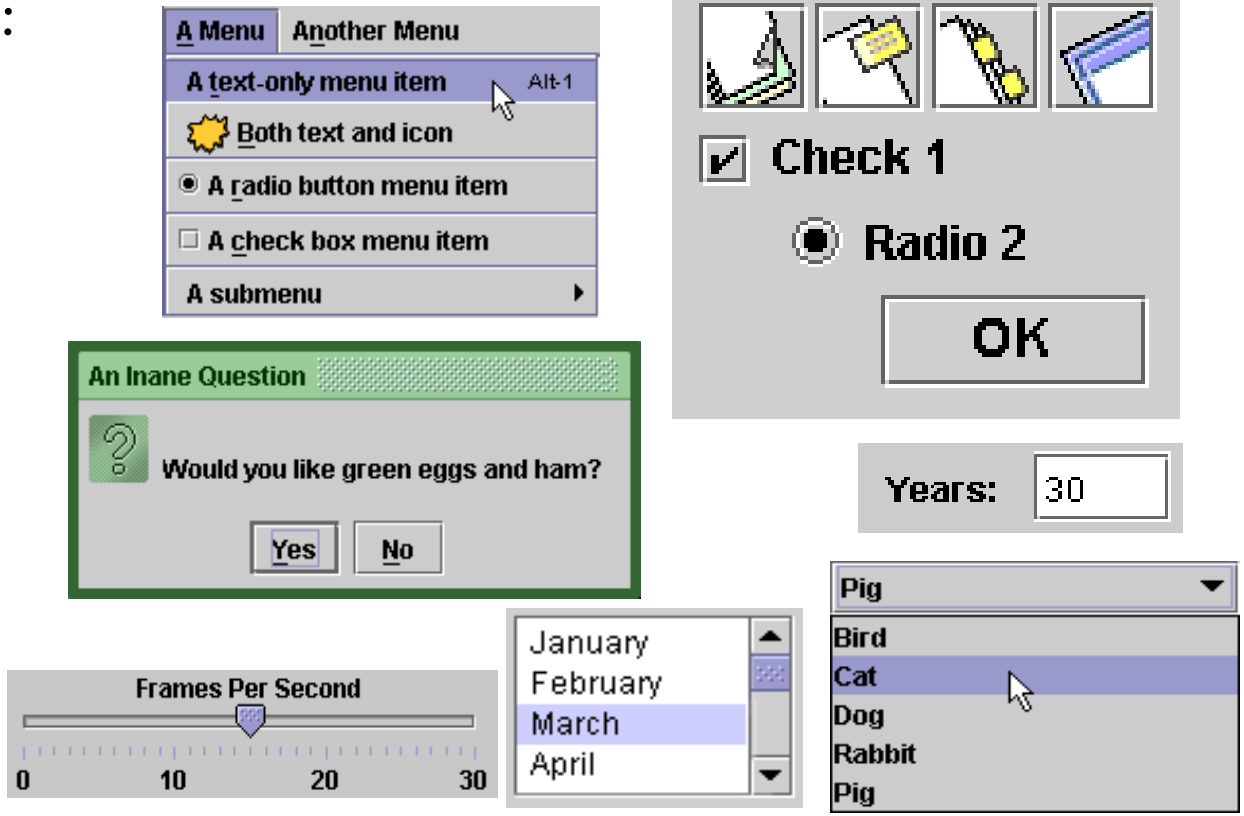
http://interfacehallofshame.eu/www.iarchitect.com/shame.htm

Achieving Usability

- Some methods to achieve good usability:
  - User testing / field studies – having users use the product and gathering data
  - Evaluations and reviews by UI experts
  - Prototyping
    - Paper prototyping
    - Code prototyping
- Good UI design focuses on the user – not on the developer or on the system environment

UI Design – Components

- When should we use:
  - A button?
  - A check box?
  - A radio button?
  - A text field?
  - A list?
  - A combo box?
  - A menu?
  - A dialog box?
  - Other..?

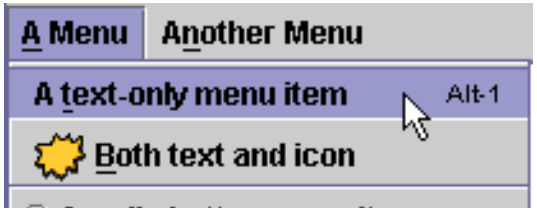


From Razmov, Notkin

UI Design – buttons, menus

- Use buttons for single independent actions that are relevant to the current screen.
  - Try to use button text with verb phrases such as "Save" or "Cancel", not generic: "OK", "Yes", "No"

- Use toolbars for common actions.

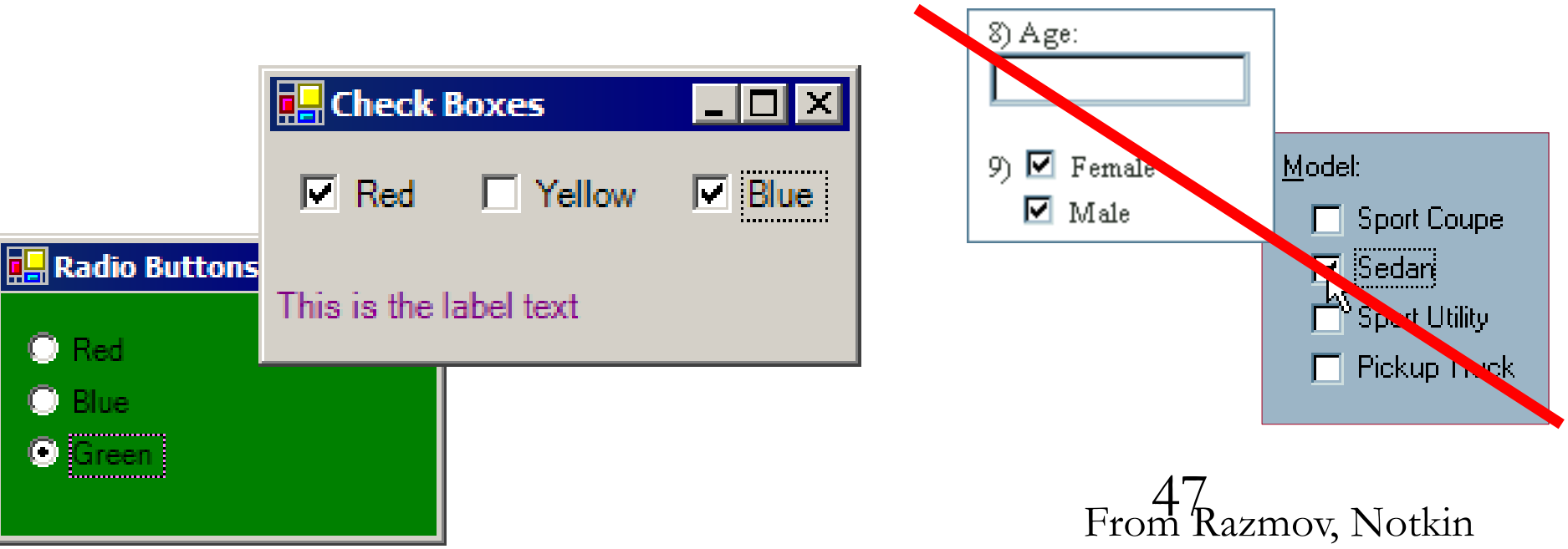


- Use menus for infrequent actions that may be applicable to many or all screens.

UI Design – checkboxes, radio buttons

- Use check boxes for on/off switches, when any one switch can be toggled irrespective of the others (often correspond to boolean values).

- Use radio buttons for related choices, when only one choice can be activated at a time (often corresponds to enum / constant values).

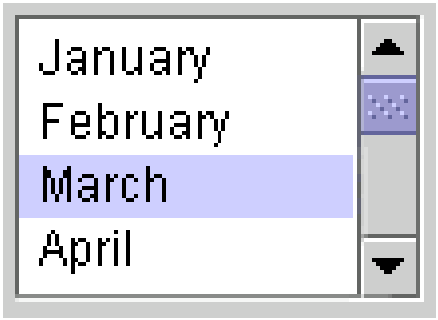


From Razmov, Notkin

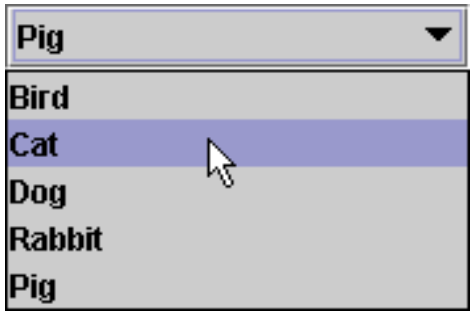
UI Design – lists, combo boxes

- use text fields (usually with a label) when the user may type in anything they want

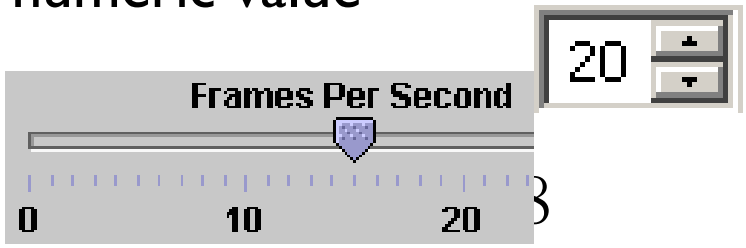
- use lists when there are many fixed choices (too many for radio buttons to be practical) and you want all choices visible on screen at once



- use combo boxes when there are many fixed choices, but you don't want to take up screen real estate by showing them all at once



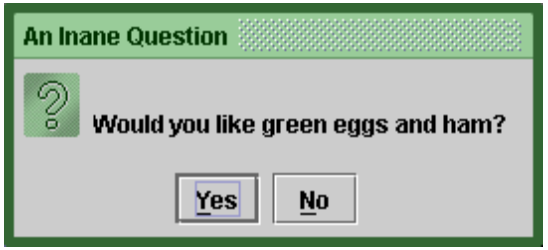
- use a slider or spinner for a numeric value



From Razmov, Notkin

UI Design – multiple screens

- use a tabbed pane when there are many screens that the user may want to switch between at any moment

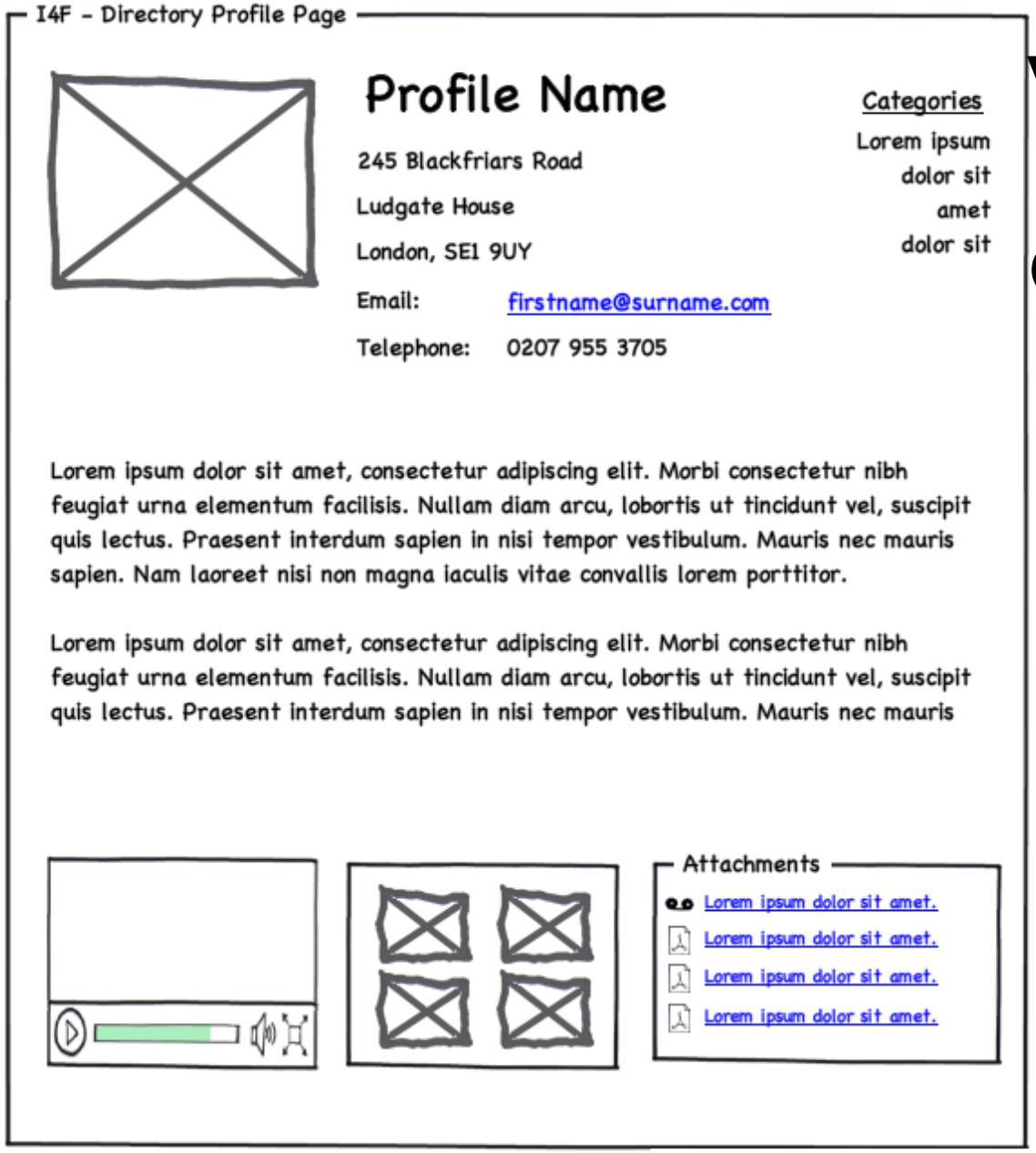


- use dialog boxes or option panes to present temporary screens or options

Prototyping

- Creating a scaled-down or incomplete version of a system to demonstrate or test aspects of it
- Reasons to do prototyping:
  - aids UI design
  - provides basis for testing
  - team-building
  - allows interaction with user to ensure satisfaction

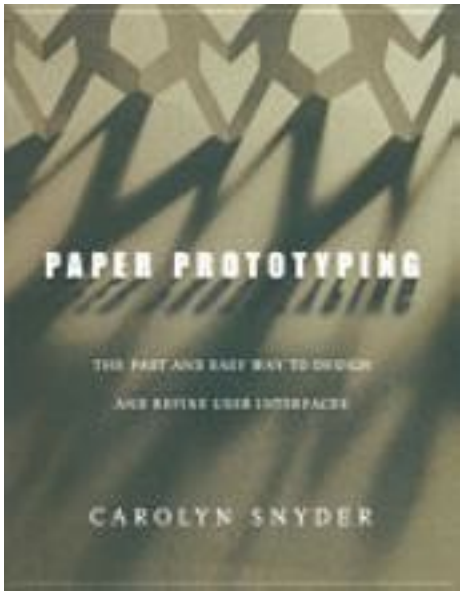
Wireframes or mockups



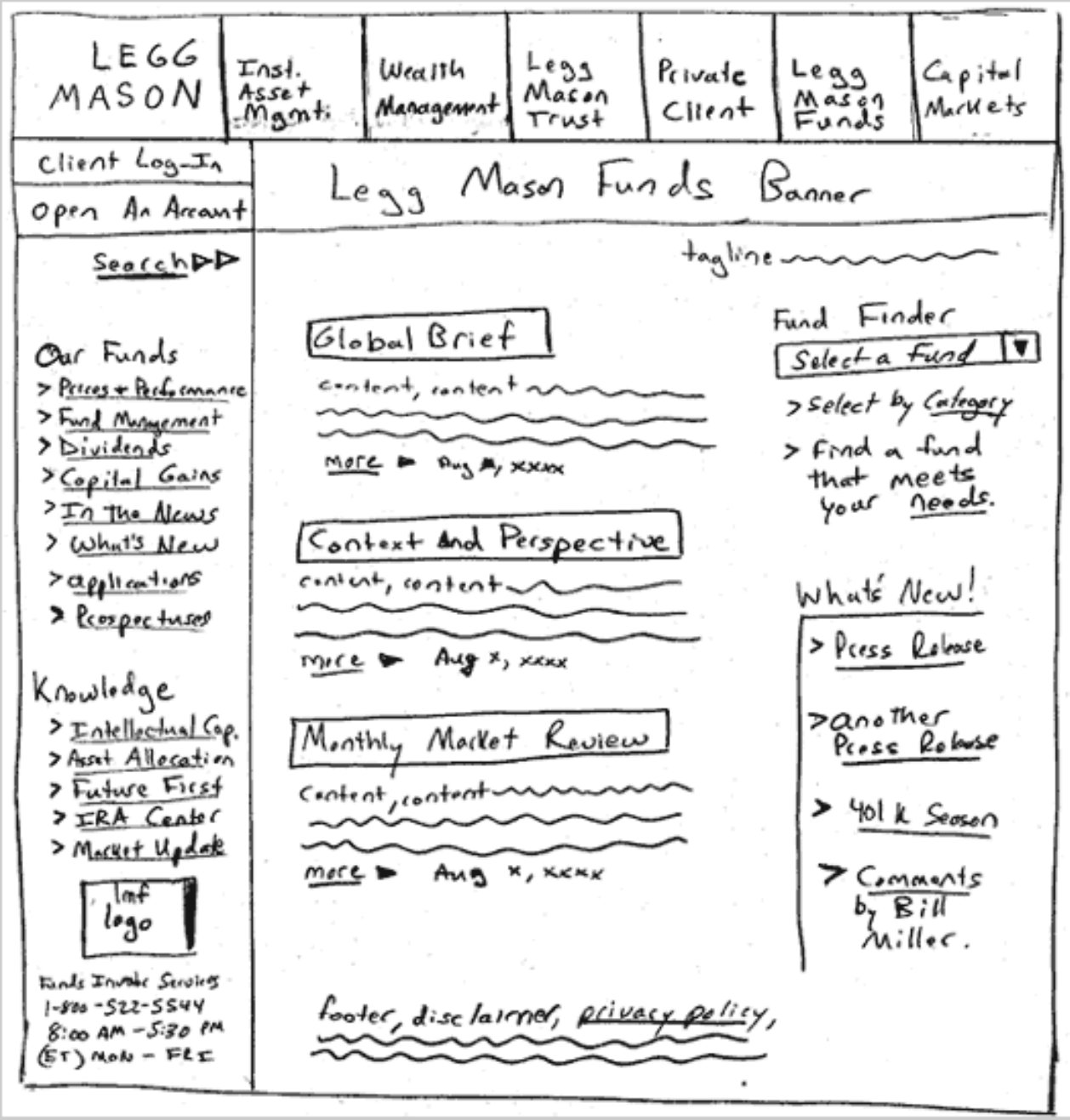
e.g., http://www.balsamiq.com/

Benefits of Paper Prototyping

- much faster to create than code
- easier to change than code
- encourages feedback, since it feels less permanent or final
- focuses on big things vs. small (like the font)
- implementation neutral
- can be done by non-technical people
- PP shows us "what" is in the UI, but also "how" the user can achieve their goals in the UI; helps uncover requirements



Paper Prototype for leggmasonfunds.com landing page



If the user pointed to the "Fund Finder" drop down menu, the full menu (below) would be presented.

Summary

- User Interface Design
  - Creative, but requires engineering
  - Can affect product success
  - Can cause happy/unhappy customers
  - Is as important as functionality
- UI design principles can help ensure success