User Interface Design

CSC 4700 Software Engineering

Why study user interfaces?

- Good UIs are critical to success
- UI programming is
  - easy (sophisticated algorithms not required)
  - straightforward (can immediately correct mistakes)
  - fun (results are immediately visible)
  - rational (apply simple rules)
- UI design is not graphic design

Cardinal axiom

- "A user interface is well-designed when the program behaves exactly how the user thought it would." – Joel Spolsky
  - user is happy = user in control = S/W correctly interprets user's actions
  - loss of control → depression, frustration
- All the other rules are just corollaries:
  - Golden rules: place user in control, reduce user's memory load, make interface consistent

User and program models

- User model: User's idea of what's happening
- Program model: Program's idea of what's happening (i.e., what's *actually* happening)
- Successful UI when program model corresponds to user model
  - Speak user's language
  - Follow real-world conventions, make information appear in natural and logical order
  - Use metaphors from real world

Example

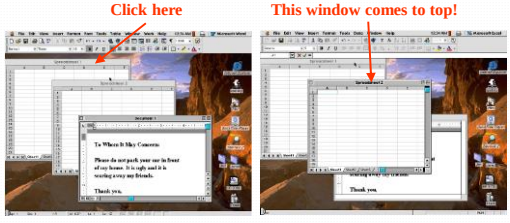
- Pictures in documents are
  - *embedded* in word processor (e.g., Word)
  - *not embedded* in HTML (pix in separate files!)
- With WYSIWYG HTML editor (e.g., FrontPage), what do you do?
  - change user model (describe in manual, explain with popup dialog box)
  - change program model (make copy of picture in subfolder)

How do you get the user model?

- Ask the users!
- The 50-cent usability test
  - Usually 5-6 people is enough, will start to see consensus
  - Don't need formal usability lab, or "people off the street"
  - Just sketch or prototype and ask your neighbor

User models are simple

- If your program model is nontrivial, it's probably wrong

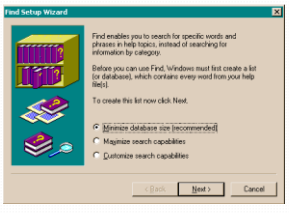


("invisible sheets" in Excel)

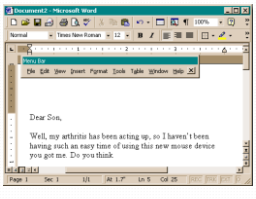
Choices

- "Every time you provide an option, you're asking the user to make a decision." – Joel Spolsky

This is "unequivocally the most moronic 'wizard' dialog in the history of the Windows operating system. This dialog is so stupid that it deserves some kind of award. A whole new *category* of award."



Too much freedom is dangerous



floating menu bar

huge system tray

How many users want these?

Metaphors

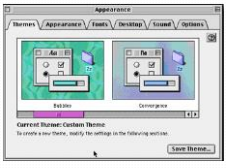
vs.

Also desktop, folders, paintbrush, …

Affordance

afford – to make available or provide naturally
(door with metal plate *affords* pushing)

vs.



(30% usability) **(100% usability)**

Affordance (cont.)

Where to grab?

Where to click?

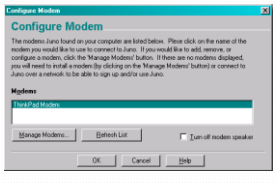
What to drag?

Consistency, not creativity

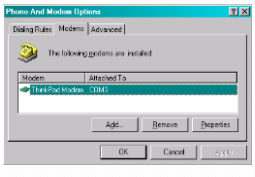
- "A *foolish* consistency is the hobgoblin of little minds" – Emerson
- Application should be consistent with itself *and* with other programs
- Examples: FrontPage, Visio
- Beware of creativity:
  - Less like user model
  - More work to implement
  - Do not leverage future/hidden features
  - "Just because Microsoft does it, doesn't mean it's right"
  - Examples: Tab from name to password, Netscape's reimplementation of common controls

Make explanations brief

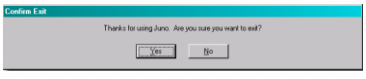
- "Users don't read the manual" – Spolsky
  - May not have the manual (on airplane, demo version)
  - Too busy / distracted / impatient
- "Users don't read anything" – Spolsky
  - advanced too busy
  - novice hope defaults are ok
  - in-between try to read but get confused



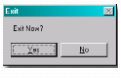
vs.



Many users are intimidated by computers



vs.



vs.

(no dialog)

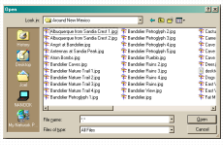
Which is better for an intimidated user?

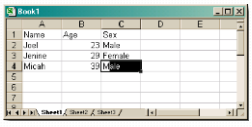
Users can't control the mouse well

- What's the problem?
  - sub-optimal pointing devices
  - bad conditions (dirty, old, or cheap mouse; crowded desk)
  - medical disabilities (young, old, arthritis, …)
  - in a hurry
- "Mile-high menu bar"
  - Macintosh: slam mouse to top, get menu
  - Windows: ½ by ¼-inch target
- Easiest places to point: four corners
  - (Windows 95 start menu blunder: 2 pixels from corner)
- Programmers generally stick to 0, 1, or n
  - They want to avoid magic numbers (Why can you only open 20 windows?)
  - But all n>1 are not equally likely (window close to edge should snap in place)

Don't tax the user's memory

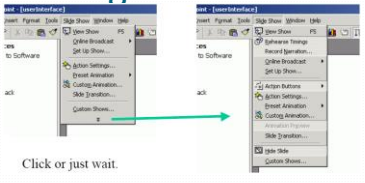
- Make objects, actions, and options visible
- User should not have to remember (too much) information





Some bad designs

adaptive menu



office "assistant"

What principle is being violated?

The bell curve

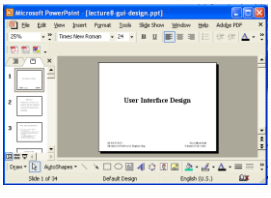
- Users lie on a bell curve
  - 98% can use a TV
  - 70% can use Windows
  - 15% can use Linux
  - 1% can program
- Users are not dolts
- But, the easier you make the program, the more people can use it
  (10% more usable → 50% more users)

Activity-based UI

- Two ways of designing UI:
  - What features should be there?
    - Greeting card example: add text, add picture, get predesigned card from library, send by email, print
  - What activities will users do?
    - Greeting card example: birthday greeting, party invitation, anniversary greeting
      (leads to unexpected features: remind to send next year)
- Example:
  - Excel was designed for financial number-crunching, but many use it for lists
  - Improv was to be "killer app" for NeXT
    - great for complicated multi-dimensional financial models
    - painful for lists

Open-ended vs. sequential operation

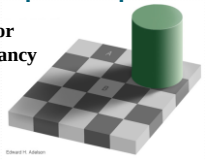
- History of UI goes back-and-forth b/w
  - user-in-control (command-line, Word, ...)
  - sequential steps (wizards, ...)



vs.

Visual perception

color constancy



font spacing:

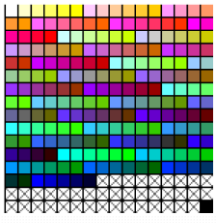
323 Fillmore Street

323 Fillmore Street

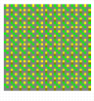
color-blind: 8% of men, 0.5% of women

[from Michael Black]

Web-safe colors



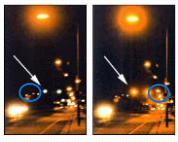
216 can be reproduced on all displays (including 8-bit)



dithering may produce other colors

Dangers of color

Driving at night in San Jose, where the street lights are yellow



traffic light is green

traffic light is yellow

Beyond WIMP

- WIMP (windows, icons, menus, pointers)
- WYSIWYG is WYSIAYG
- Importance of language
  - grouping, conditionals, referring to objects not immediately visible or future
  - support novice and power-user
  - provide concrete and abstract ways of manipulation
  - keyboard shortcuts / macros
- Shared control
  - Delegation of routine or complex tasks to computer

References

Joel Spolsky, ***User Interface Design for Programmers***

abridged version available at
`http://www.joelonsoftware.com`

Based on slides by Stan Birchfield, Clemson University