Introduction to Usability and User Interface Design

What is usability?

Usability is a measure of the effectiveness, efficiency and satisfaction with which specified users can achieve specified goals in a particular environment.

• ISO 9241
Why is usability important?

- poor usability results in
  - anger and frustration
  - decreased productivity in the workplace
  - higher error rates
  - physical and emotional injury
  - equipment damage
  - loss of customer loyalty
  - costs money

Human Computer Interaction

- A discipline concerned with interactive computing systems for human use
User and Task Descriptions

• First Goal: Articulate who the users are and what their tasks are
• This is the problem of collecting requirements
• Some Methods
  – Participatory Design
  – User-Centered Design
• Poor design can make an otherwise working system unusable

Early tractors

• Original design
  Terrain
  – un-surfaced
  – rough
  – hilly
  
  Using a high center of gravity, narrow wheel base
  
  Result
  
  Used to be called driver's error but accidents now infrequent as designs now have low center of gravity, wider wheel bases
Lessons Learned

• Lesson 1
  – Most failures of human-machine system are due to poor designs that don’t recognize peoples’ capabilities and fallibilities
  – This leads to apparent machine misuse and “human error”

• Lesson 2
  – Good design always accounts for human capabilities.

Pathological Design Example – What’s the Altitude?

– Early days (< 1000’):
  • only one needle needed

– As ceilings increased over 1000’
  • small needle added

– As they increased beyond 10,000’
  • box indicated 10,000’ increment through color change
    – < 10,000’
    – > 10,000’
Airspeed Indicator

Tape altimeter

• Human factors test showed:
  – eliminated reading errors
  – was faster to read

Figure 5: 1930’s Airspeed Indicator, reproduced from Chorley, 1976
Visual Affordance

- the perceived and actual fundamental properties of the object that determine how it could be used
  - Appearance indicates how the object should be used
    - chair for sitting
    - knobs for turning
    - slots for inserting things into
    - buttons for pushing
  - Just by looking the user should know
    - State of the system
    - Possible actions
    - Don’t violate these principles to make something “look cool”!
  - Complex things may need explaining but simple things should not
    - when simple things need labels & instructions, then design has failed

Many ideas in this deck are adapted from Don Norman’s book: The Design of Everyday things

Poor Visual Affordance

- Trapped between doors!
- Handles afford pulling
- Using a flat plate would constrain the user to push
The well-trodden path

Fedex Dropbox

Supplies “box” is taped shut!
The unusual urinal

Visual affordance

• needs familiar idiom and metaphor to work
Visual affordance problems

- A button is for pressing, but what does it do?
- Visual affordances for window controls are missing!

Visible constraints

- Limitations of the actions possible perceived from object's appearance
  - Provides people with a range of usage possibilities

Push or pull? Which side? Can only push, side to push clearly visible
Which Way?

Visible constraints: Entering a Date

[Image of a computer interface with date fields]

Controls constructed in Visual Basic
Mapping

• Controls and displays should exploit natural mapping
• Natural mapping takes advantage of physical analogies and cultural standards
  – Physical: Steering wheel
  – Cultural: red means stop, green means go

Mouse or Keyboard?
What Knob Goes Where?

Exploiting Natural Mapping
Causality

• the thing that happens right after an action is assumed by people to be caused by that action
  – interpretation of “feedback”
  – false causality
    • incorrect effect
      – invoking unfamiliar function just as computer hangs
      – causes “superstitious” behaviors
    • invisible effect
      – command with no apparent result often re-entered repeatedly
      – e.g., mouse click to raise menu on unresponsive system

– Can be responsive (show causality) but still take time to process
Feedback Examples

• Telephone button press tones
  – Telephone clicks
• Buzz typing virtual keys on a slate/tablet
• Clicker on your turn signal
• Animated icon while waiting for a web page to load

• Lack of feedback
  – Compiler – did it work? Entering password?

Poor Feedback in LViewPro

Effects visible only after Exec button is pressed
• Ok does nothing!
• awkward to find appropriate color level
Transfer effects

- people transfer their learning/expectations of similar objects to the current objects
  - positive transfer: previous learning's also apply to new situation
  - negative transfer: previous learning's conflict with the new situation

Conceptual model

- People have “mental models” of how things work, built from
  - affordances
  - causality
  - constraints
  - mapping
  - positive transfer
  - population stereotypes/cultural standards
  - instructions
  - interactions
- models allow people to mentally simulate operation of device
- models may be wrong
  - particularly if above attributes are misleading
- We can design interfaces to more closely match the mental models people are most likely to have
- Usability testing can reveal many design deficiencies