Interaction Techniques 2

SWE 632
Fall 2015
Administrivia

- HW 6 due today
- No class next week (Thanksgiving)
- HW 7 due on 12/3
Task structure
Hartson & Pyla Interaction Cycle

Diagram:
- Goal
  - Plan
  - Specify
  - Perform
  - Compare
  - Interpret
  - Perceive
- Bridge of Execution
- Bridge of Evaluation

Circle Diagram:
- Planning
- Assessment
- Outcomes
- Translation
- Physical Actions
Task structure

• Flow of tasks and task steps
• Task design simplicity, flexibility, efficiency
• Maintenance of locus of control
• Direct manipulation
Separate long tasks into sequences

• Reduce STM demands by having user only work on one aspect of larger task at a time

• Don’t interrupt users in the middle with unrelated tasks

• Provide closure of each subtask at the end
Design for flexibility & efficiency

• Users may take paths never envisioned by designer

• Using studies to identify different task flows, design flexible support for each
Show users how to fix errors

• Good: detecting user errors
• Better: directly showing how errors can be fixed
• (Best: using constraints to prevent errors from ever occurring)
Anticipate likely next actions

- Based on typical observed task flows, surface options for user to take likely next steps

what if folder does not exist?
Keep users in control

- Important users do not feel constrained
- Want users to feel that they can do things the way they want to do them, not as software dictates to them
Direct manipulation
Motivation

- User is trying to do a task, manipulating some [model] of world
- Hard to plan out long sequence of actions in advance
- Gulf of execution: hard to know if took correct action
- Gulf of evaluation: hard to understand if successfully manipulated world
- Hard to compare hidden world to desired world
Direct manipulation

- “Rapid incremental reversible operations whose impact on the objects of interest is immediately visible” (Shneiderman, 1982)
Benefits

• Supports exploration

• Don’t plan long sequence of actions: pick an action, try it, can change mind if want to do something else instead

• Provides immediate feedback

• Can quickly see what outcome of actions are in manipulating the world

• Easy to compare desired state of the world to actual state of the world
Example - GUI builder
Example - Spreadsheets
Example - Programming

- Bret Victor’s Learnable Programming
Example - Microsoft TerraServer
Example - Google Maps
Physical actions
Provide intermediate feedback during interactions

• As user is interacting with objects, provide feedback on interactions

• Examples
  • While dragging object, show new position
  • As selecting text, show selection
  • While clicking on button, show button changing
Avoid physical awkwardness

• Switching between input devices takes time

• Avoid forcing user to constantly switch between input devices (e.g., keyboard & mouse)
  
  • e.g., Effective tab order between fields

• Avoid awkward keyboard combinations
Dimensions of user disabilities

- **Perception** - visual & auditory impairments
  - Blindness or visual impairments
  - Color blindness
  - Deafness & hearing limitations

- **Motion** - muscle control impairments
  - Difficulties with fine muscle control
  - Weakness & fatigue

- **Cognition** - difficulties with mental processes
  - Difficulties remembering
  - Difficulties with conceptualizing, planning, sequencing actions
Design for all

• How can users with physical disabilities be supported in user interactions?

• Good: **assistive design** - offering equivalent actions for disabled users that cannot take normal actions

• Better: **design for all** - designing interactions so broadest set of users across age, ability, status in life can use normal actions
Example - Curb cut

- Initially designed for **accessibility** - support for disabled & wheel chairs

- But potentially benefits **all users** of public spaces - people w/ suitcases, hand carts, roller blades, bikes, …
7 Principles of Universal Design

- **Equitable use**: The design is useful and marketable to people with diverse abilities.

- **Flexibility in use**: The design accommodates a wide range of individual preferences and abilities.

- **Simple and intuitive**: Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

- **Perceptible information**: The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.

- **Tolerance for error**: The design minimizes hazards and the adverse consequences of accidental or unintended actions.

- **Low physical effort**: The design can be used efficiently and comfortably and with a minimum of fatigue.

- **Size and space for approach and use**: Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility.

http://www.ncsu.edu/ncsu/design/cud/about_ud/udprinciples.htm
Fitt's law

- Time required to move to a target decreases with target size & increases with distance to the target

- Movements typical consist of
  - one large quick movement to target (ballistic movement)
  - fine-adjustment movement (homing movements)

- Homing movements generally responsible for most of movement time & errors

- Applies to rapid pointing movements, not slow continuous movements
Design implications of Fitt's law

• **Constraining** movement to one dimension dramatically increases speed of actions

• e.g., scroll bars are 1D
Design implications of Fitt’s law

• Making controls **larger** reduces time to invoke actions

• Locating controls closer to user **cursor** reduces time

• e.g., context menus
Design implications of Fitt’s law

• Positioning button or control along **edge** of screen acts as barrier to movement, substantially reducing homing time & errors
System feedback
System response times

- 0.1 second - reacting **instantaneously**
  - requiring no special feedback except displaying result
  - limit for direct manipulation of objects in UI
- 1.0 second - **freely** navigating commands
  - noticeable delay, limit for keeping user's flow of thought uninterrupted
- 10 seconds - keeping users **attention**
  - limit for keeping user's attention focus in UI
  - longer delays create task breaks

[ Nielsen, Usability Engineering, 1993 ]
Automation

• Keep user in control at highest task levels

• Take control from user when need is obvious & user is busy

• Provide visibility of automation & opportunities to correct when necessary
Provide feedback for all user actions

- Feedback helps keep users on track in accomplishing goals
- Request confirmation to prevent costly errors (but use sparingly)
- Make feedback visible, noticeable, legible, located w/in users focus of attention
- Provide feedback early
- Provide feedback consistently
Crafting feedback text

• Clarity - support clear understanding of outcome
• Precise wording
• Completeness - include enough information to fully understand outcomes
Tone of feedback

• Establishes relationship with user
• Important not to take user feel “stupid”
• Make the system take blame for errors
• Be positive, to encourage
• Provide helpful messages, not cute messages
• Avoid violent, negative, demeaning, threatening terms (e.g., illegal, invalid)
Avoid anthropomorphism (in most contexts)

• Anthropomorphism - the attribution of human characteristics to non-human objects
  
  • e.g., “Sorry, I but I cannot find the file you need”

• Provides a false mental model
  
  • leads to user thinking they can interact with system as person
  
  • can be over promising & condescending

• May work in spoken interaction settings, where system does match user’s mental model
In Class Activity
Interaction design critique

- In groups of 2

- Pick an application or web app you know well
  - Should be something with long and complex user tasks (e.g., Photoshop, Illustrator, Word, Excel, Eclipse, VS)

- Critique the application from an interaction perspective

- Identify interaction strengths of the application

- Identify interaction weaknesses of the application