Interaction Techniques

SWE 632, Spring 2018
Today

• How do users determine which interface elements map to which actions?
• How can we design interactions that minimize physical effort?
• What's important in designing for mobile devices?
• What's universal design, and why does it matter?
Identifying actions

goals $\rightarrow$ action sequence
Signifiers

Is this a button?  Or a link?

- Goals
  - Show which UI elements can be manipulated
  - Show how they can be manipulated
  - Help users get started
  - Guide data entry
  - Suggest default choices
  - Support error recovery
Hinting

- Indicate which UI elements can be interacted with
- Possible visual indicators
  - Static hinting - distinctive look & feel
  - Dynamic hinting - rollover highlights
  - Response hinting - change visual design with click
  - Cursor hinting - change cursor display
Help users predict outcome of actions

- What does this do?
- Should I click it?
Clarity of wording (Example)

- Design for clarity & precision
Clarity of wording

- Choose words carefully
- Speak the user’s language
- Avoid vague, ambiguous terms
- Be as specific as possible
- Clearly represent domain concepts
Likely & useful defaults

• Default text, if relevant (e.g., date)
• Default cursor position
• Avoid requirements to retype & re-enter data
Modes

• Vary the effect of a command based on state of system
• Examples
  • caps lock
  • insert / overtype mode
  • vi / emacs command modes
  • keyboard entry used for controlling game and chatting
Challenges with modes

- Modes create inconsistent mapping
  - E.g., control S sometimes saves, sometimes sends email
  - Especially dangerous for frequent interactions that become highly automatic System 1 actions

- Avoid when possible
- Clearly distinguish if necessary
  - Make clear to user which mode they are in and how to change
Command interactions

• How can a user invoke a command?

• Common examples
  • Menus
  • Buttons
  • Toolbar
  • Dialog box
  • Keyboard shortcut
  • Gesture

• What are some advantages and disadvantages of each approach?
Physical actions
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
Moving the mouse

- After a user has (1) realized that a region is interactable, (2) decided that it will cause the desired action to be invoked
- How long does it take for a user to move the cursor to click on it?
- What factors might influence this time?
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
Mobile design
Responsive design

- Mobile devices often have smaller form factor than desktop / laptop OS
- Can design a separate UI
- Or may build a **fluid** UI that rescales for different display sizes
Where's the cursor?

- No cursor on many mobile devices
- Cannot use dynamic hinting to determine which elements can be interacted with
  - May require more use of static hinting
- Fitt's law still applies
  - Fingers are less sensitive, hard to select small buttons, occlude elements
Alternative inputs

- Modern mobile devices often have a wide range of sensors which can be used for input
  - Camera
  - Microphone
  - Accelerometer
  - Three-axis gyro
  - GPS
  - Barometer
  - Proximity sensor
  - Ambient light sensor

- Enables new interaction techniques
Augmented reality

- Overlaying generated content on top of view of the real world
Universal design
Supporting users with 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
Blindness and visual impairments

- Users use screenreader to listen to screen elements
  - Reads all of the text on the page
    - Through practice, learn to listen to text at 400+ words per minute
- Important to have **alt-text**
  - Images should have labels that explain them
- Important to have **hierarchy**
  - Rather than visually skimming page, skims page by listening to section heads to determine which level to navigate to next
Universal design

• 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: **universal design** - 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://universaldesign.ie/What-is-Universal-Design/The-7-Principles/]
In-Class Activity
In-Class Activity: Interaction Design Guidelines

- Take a design problem and build design recommendations
- List a set of alternative interaction techniques
  - Identify examples from desktop / web / mobile apps
- Offer guidance on pros and cons
- Identify mobile and universal design considerations

- (1) Navigating lists of items
  - Examples: grids, lists, pages of results, infinite scrolling, filtering
- (2) Invoking commands on content
  - Examples: toolbar, floating toolbar, cards, context menu, sidebar pane
- (3) Invoking top level commands
  - Examples: drawers, toolbar, menus, dialog
- (4) Entering formatted text
  - Examples: toolbar commands, Markdown, HTML
- (5) Panning and zooming
  - Example: zoom slider, scrollbars, pinch to zoom, drag to pan
- (6) Accelerometer-based control
  - Examples: shake to undo, rotate to pan, roll / pitch / yaw game control
- (7) Chat bots