Interaction Techniques
Outline

• Overview of Interaction Techniques
• Lots of Research Videos
Interaction Techniques

- A method for carrying out a specific interactive task
  - Example: enter a number in a range
    - could use… (simulated) slider
    - type in a number (text edit box)
    - (simulated) knob
Design of Interaction Techniques

• Different interaction techniques have different pros and cons

• Guidelines for interaction technique design
  – Affordances
  – Feedback
  – Difficulty of task
  – Efficiency of solution
  – Look and feel
Difficulty

- Typically measured by Fitts’ law
  - Predicts time to make a movement
  - Time = $A + B \cdot \log_2(\text{Dist/Size} + 0.5)$
  - Difficulty depends on distance and accuracy (size of target)

- Can also measure subjective workload
  - NASA TLX measures self-reported difficulty
  - Mental Demands, Physical Demands, Temporal Demands, Own Performance, Effort, Frustration

- Can measure pupil size as well
  - Pupil shrinks for difficult tasks
Efficiency

• Expert performance closely related to time required for movements
  – Not closely related to learning (or performance) of novices
  – Still need to consider cognitive load

• Guidelines when designing new interactions
  – Minimize required movements (accuracy & distance)
  – Avoid device swapping, ex. keyboard to mouse to keyboard
  – Avoid disturbing focus of attention

• Measures
  – Time on task, Number of Errors, Learnability
Look and Feel

• Look and Feel is tricky
  – Depends on physical input device, feedback
  – Really gets back to the difficulty of the movement, but harder to characterize

• Not a lot of guidelines here

• Tends to be measured subjectively
  – Fun
  – Attractive
Case Study #1

The original “Macintosh 7”

- Macintosh (1984) was first big success of GUIs
  - originally came with 7 interactors built into toolbox
    (hence used for majority of apps)
- Most not actually original w/ Mac
  - Xerox Star + Smalltalk (more in history portion of course)
Aside: Historical Resources

- Screenshots of nearly all GUIs
  - http://www.guidebookgallery.org
  - Mac screenshots in slides come from here

- Personal histories of the original Macintosh
  - http://www.folklore.org
The Macintosh 7

- Generally very well designed
  - Iterated with real users!
  - Very snappy performance
- Huge influence
  - These 7 still cover a lot of today’s GUIs
1 – Buttons

• Shaped as flat rounded rectangles
  (compare to “modern” boxish look…)

• Inverted for feedback
  – Recall Mac was pure B/W machine
  – Pseudo 3D appearance harder
    (and hadn’t been invented yet)
2 – Sliders

- Used for scroll bars
  - but fixed size “thumb”
  - Apple Lisa had proportional thumbs, dropped until Win95
Aside: a different scrollbar design

- Openlook scroll bar

Thumb (with up/down buttons)

Page extent indicator
3 – Pulldown Menu

- This was original with Mac
- Differs from Windows version you may be familiar with
  - had to hold down button to keep menu down
    (one press-drag-release) vs click to open
- Items highlight as you go over
- Selected item flashes
4-6 – Check Boxes, Radio Buttons, Text Entry Fields

- Pretty much as we know them
- Single or multi-line text supported from the beginning
7 – File Pick / Save

- More complex than the others
  - built from the other widgets + some extra features
    - e.g. no affordance, but you could type and file list would scroll to typed name
  - keep in mind floppy disks were common, hard disks really expensive
Original Mac also had others

- Window close and resize boxes
- Drag & open file icons and folders
- Not made generally available
  - not in toolbox, so not (re)usable by other programmers
Second Major Release of Mac Added More

• Lists
  – Single & multiple selection
  – Textual lists (possibly with icons)
• Hierarchical (“pull-right”) menus
• Window maximize box
A Few More Added Since Then

- Tabbed dialogs now widely used
- Hierarchical lists (trees)
- "Combo boxes"
  - Combination(s) of menu, list, text entry
Most GUIs Support These Interactions

- Work well, uniform
  - Good for usability

- But significant stagnation
  - Basic WIMP invented early 1970s
    - Windows, Icons, Menus, Pointers
    - “Perfected” by Macintosh in 1984
    - Not much change since then (even with web)

- GUI is victim of its own success
  - Opportunities lost by not customizing interaction techniques to tasks
  - Hard for better techniques to get traction
Videos

• **Lots** of interaction techniques to follow

• Kind of interaction technique?
  – Text entry, selection, drawing, etc

• Design constraints?
  – Assumes standard desktop? Pen? Mobile?

• Pros and cons
  – More difficult to implement?
  – Requires more screen space?
  – Higher cognitive load?
  – Compare to existing techniques?
Rapid Serial Visual Presentation (RSVP)

- Idea: rapidly show one word at a time
  - ~250 words per minute

- Issues:
  - Difficulty of implementation?
  - Screen real estate?
  - Cognitive load?
  - Deployability?
  - Performance?
SHARK

• Idea: Pen-based text input with gestures

• Issues:
  – Screen real estate?
  – Learning?
  – Deployability?
  – Performance?
Cascading Menus

- Idea: Use slight gestures to activate cascading menus

- Issues:
  - Implementation?
  - Deployability?
  - Depth of menus?
  - Learnability?
Fold and Drop

• Idea: Treat windows like sheets of paper that can be bent and folded

• Issues:
  – Implementation?
  – Learnability?
  – Performance?
K-Sketch

- Idea: Make it trivial to sketch out animations

- Issues:
  - Learnability?
  - Flexibility?
Chateau: Suggestive User Interfaces

• Idea: Provide an “auto-complete” for drawings
Suggestive User Interfaces

- Uses a suggestion engine with pluggable suggestions
  - Draw in plane
  - New structures
  - Beautify
Suggestive User Interfaces

- S1 creates a drawing plane
- S2 makes a plate in a closed loop
- S3 creates a rectangle from perpendicular lines
- S4 makes a box from 3 perpendicular lines
- S5 extrudes planar lines
- S6 creates a pyramid shape
- S7 resizes the highlighted group
- S8 makes plates between parallel lines
- S9 extrudes lines under a plate
Suggestive User Interfaces

- S10 makes a chamfer
- S11 cuts a corner of a polyhedron
- S12 trims a plate
- S13 divides lines at their intersection
- S14 duplicates a group
- S15 makes a flipped copy of a group
- S16 makes the third copy of a group
- S17 makes the gaps equal
- S18 makes equally spaced copies
Suggestive User Interfaces

S19 makes equally spaced stairs

S20 arranges lines to be rotationally symmetric
Suggestive User Interfaces

Figure 7: 3D drawings created by test users using Chateau.
Multi-Touch Board

• Idea: Use frustrated total internal reflection to create a multi-touch input board

• Issues:
  – Cost?
  – Deployability?
  – Maintenance?
Projector Calibration

- Idea: Make it easy to project on arbitrary surfaces

- Issues:
  - Cost?
  - Quality?
  - Motion?
  - Interaction?
**Bumptop**

- **Idea:** Make a pen-based desktop more like real world

- **Issues:**
  - Learnability
  - Flexibility
  - Fun
  - How to actually work?
Administrativia

- P3 is out
  - Visualizing Bluetooth encounters

- Groups
  - 2 people per group