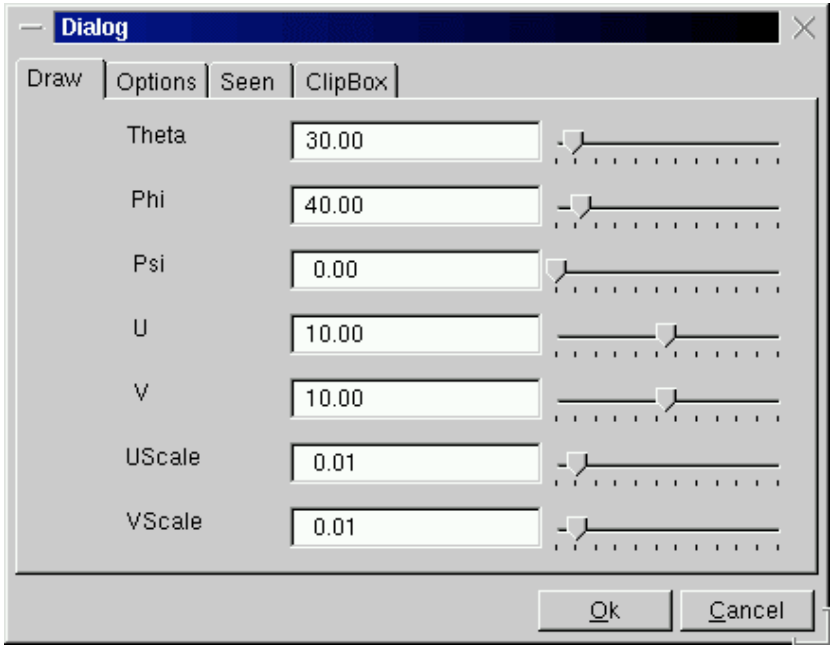
Interaction Techniques

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

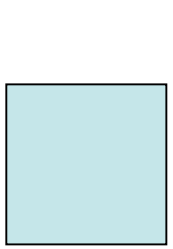


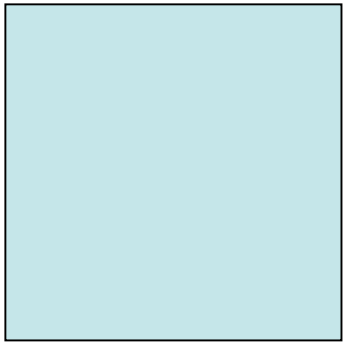
Design of Interaction Techniques

- 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*$\log_2$(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


KPT Spheroid Designer
OPTIONS
Make 50 Spheroids

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

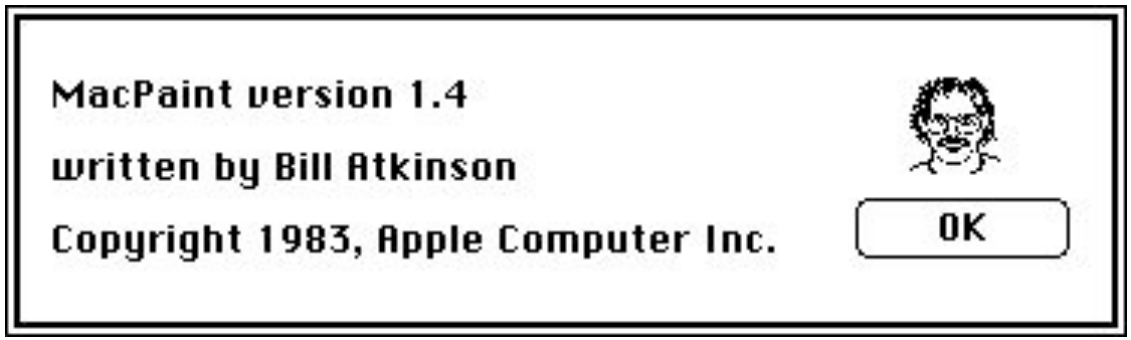
The Macintosh 7

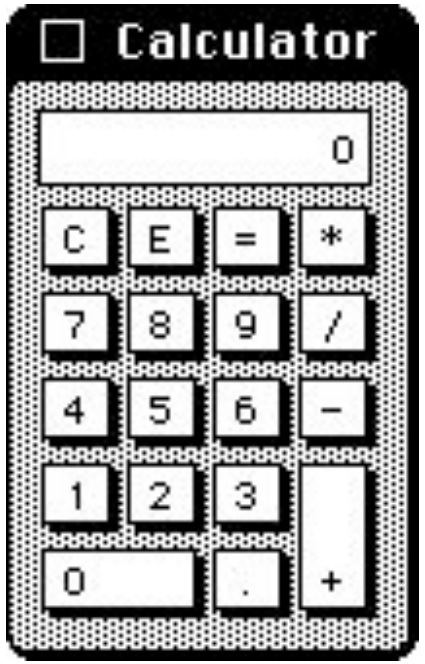
- Generally very well designed
  - Iterated with real users!
  - Very snappy performance
- Huge influence
  - These 7 still cover a lot of today's GUIs

1 – Buttons

- Shaped as flat rounded rectangles

  (compare to “modern” boxish look…)





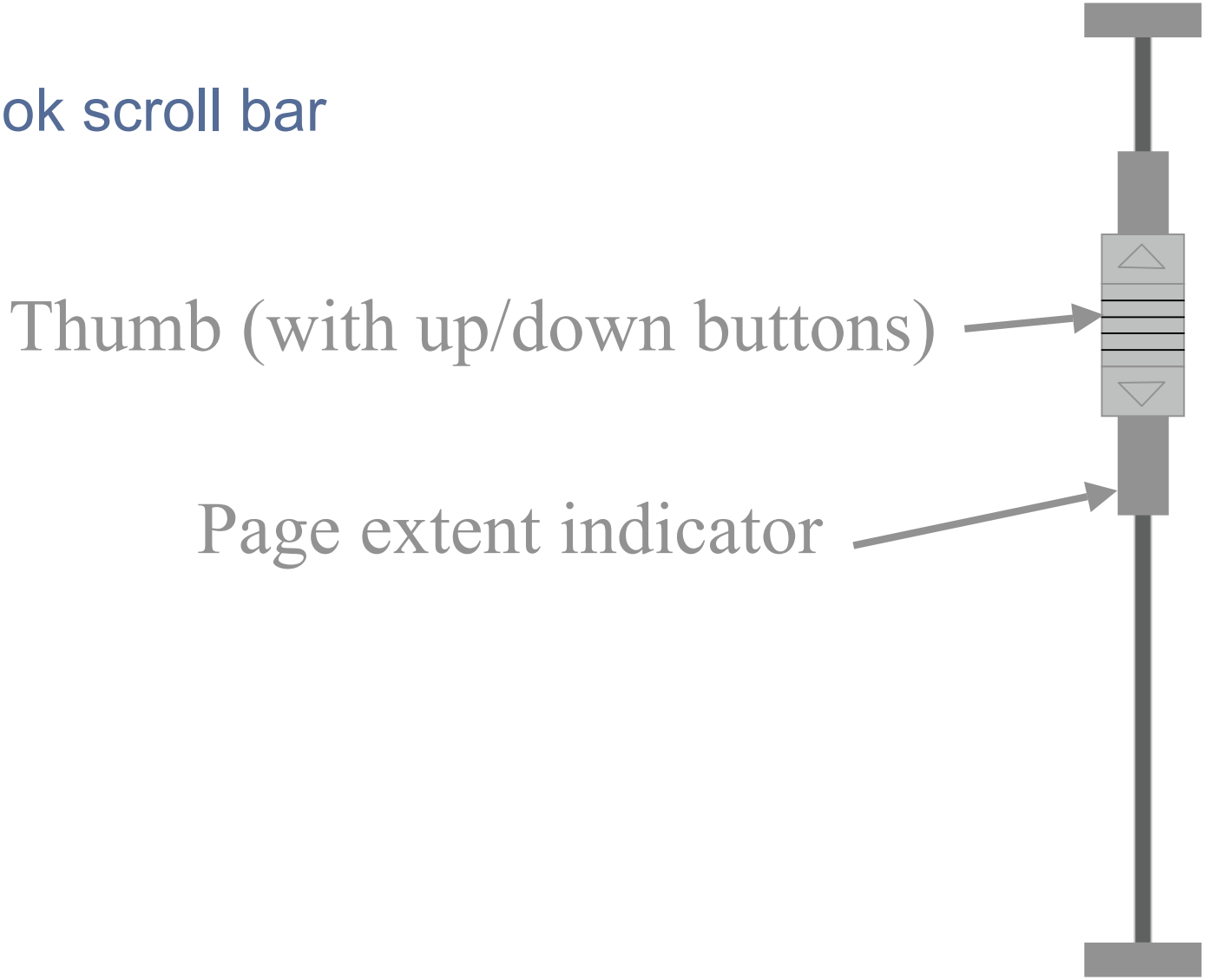
- Inverted for feedback
  - Recall Mac was pure B/W machine
  - Pseudo 3D appearance harder
    (and hadn’t been invented yet)

2 – Sliders

- Used for scroll bars
  - but fixed size “thumb”
  - Apple Lisa had proportional thumbs, dropped until Win95

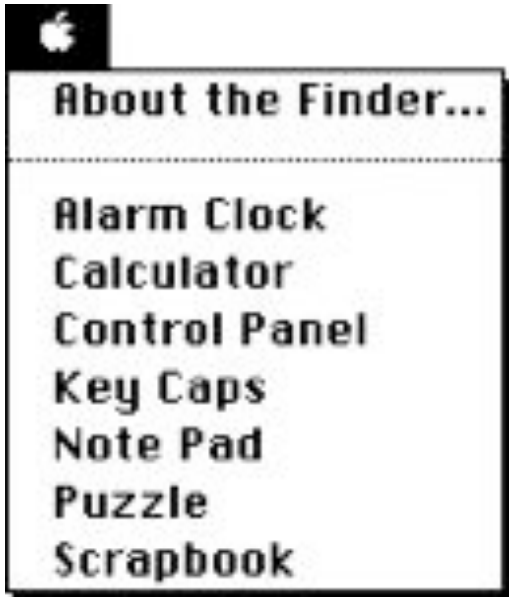
Aside: a different scrollbar design

- Openlook scroll bar



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

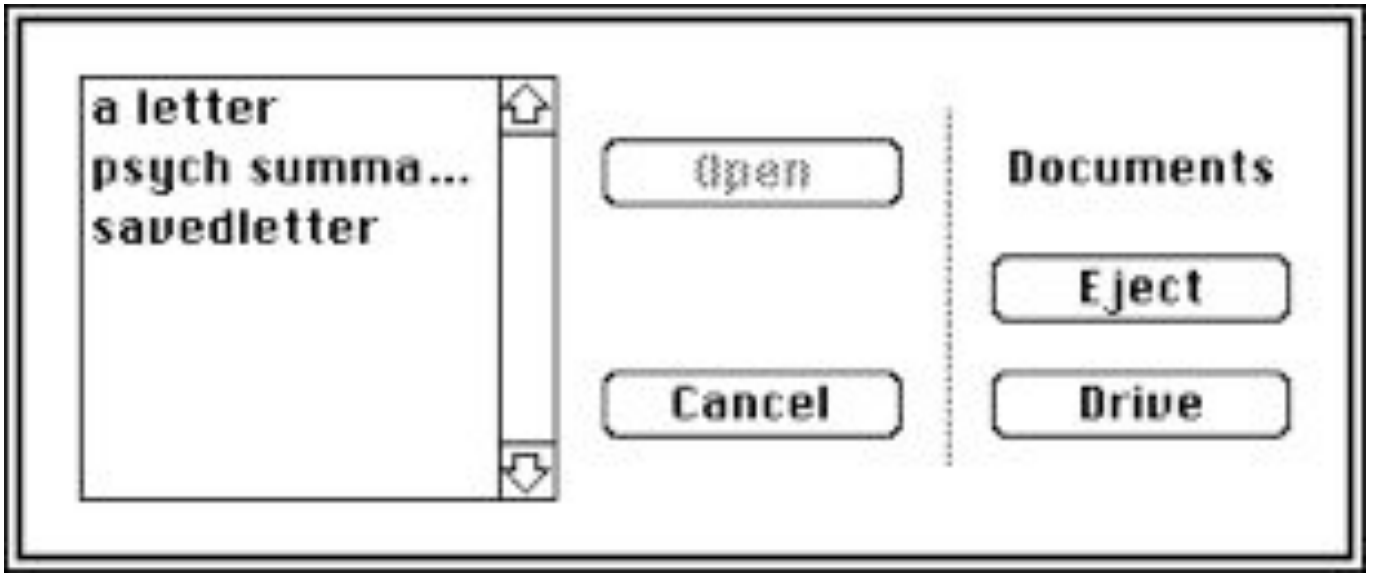


4-6 – Check Boxes, Radio Buttons, Text Entry Fields

- 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

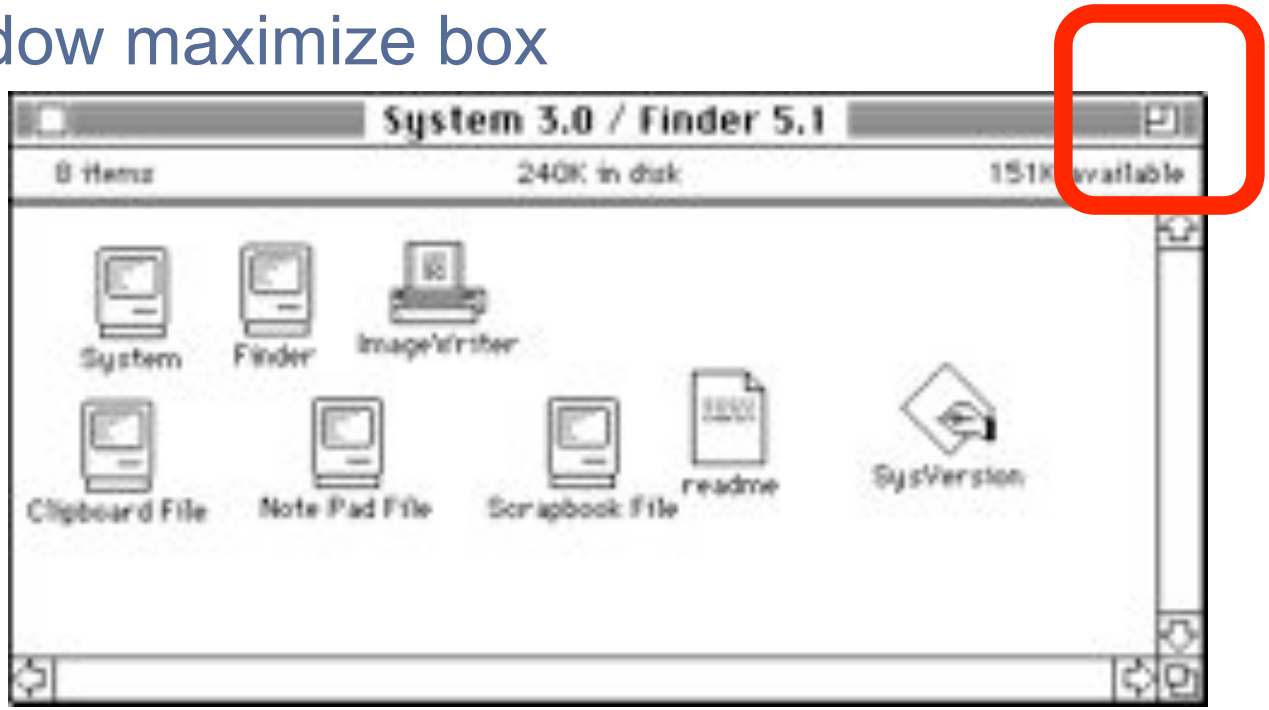


Original Mac also had others

- 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

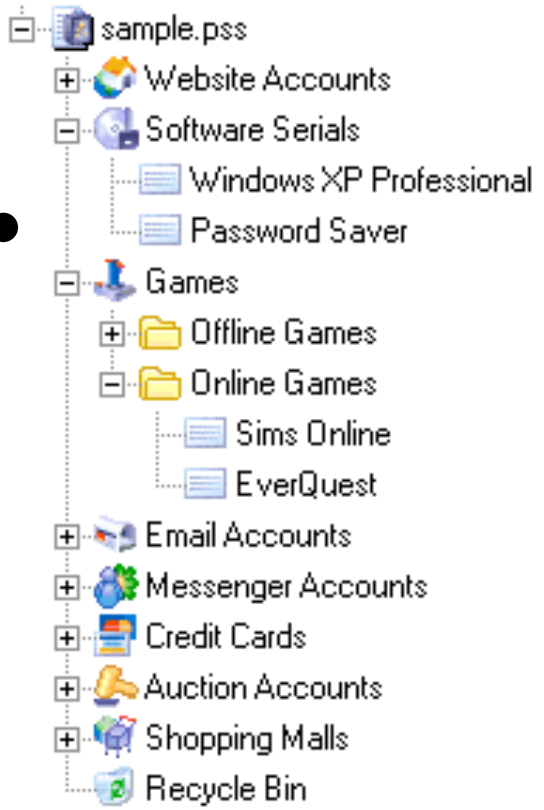
Second Major Release of Mac Added More

- Lists
  - Single & multiple selection
  - Textual lists (possibly with icons)
- Hierarchical (“pull-right”) menus
- Window maximize box



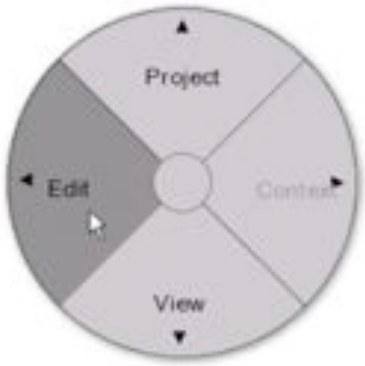
A Few More Added Since Then

- 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?

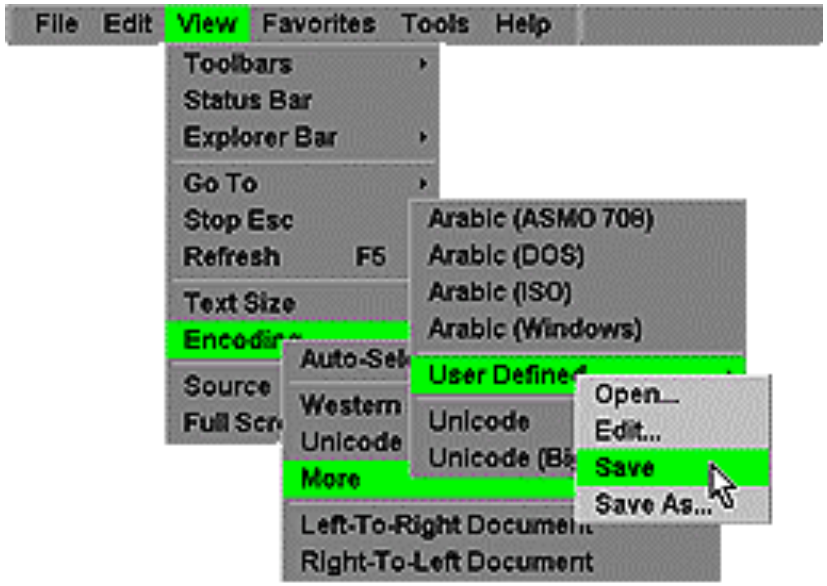
SHARK

- 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?

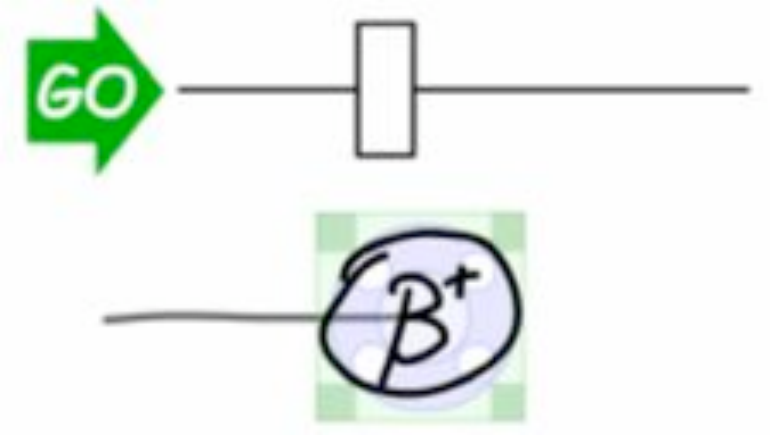
Fold and Drop

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

- Issues:
  - Implementation?
  - Learnability?
  - Performance?

K-Sketch

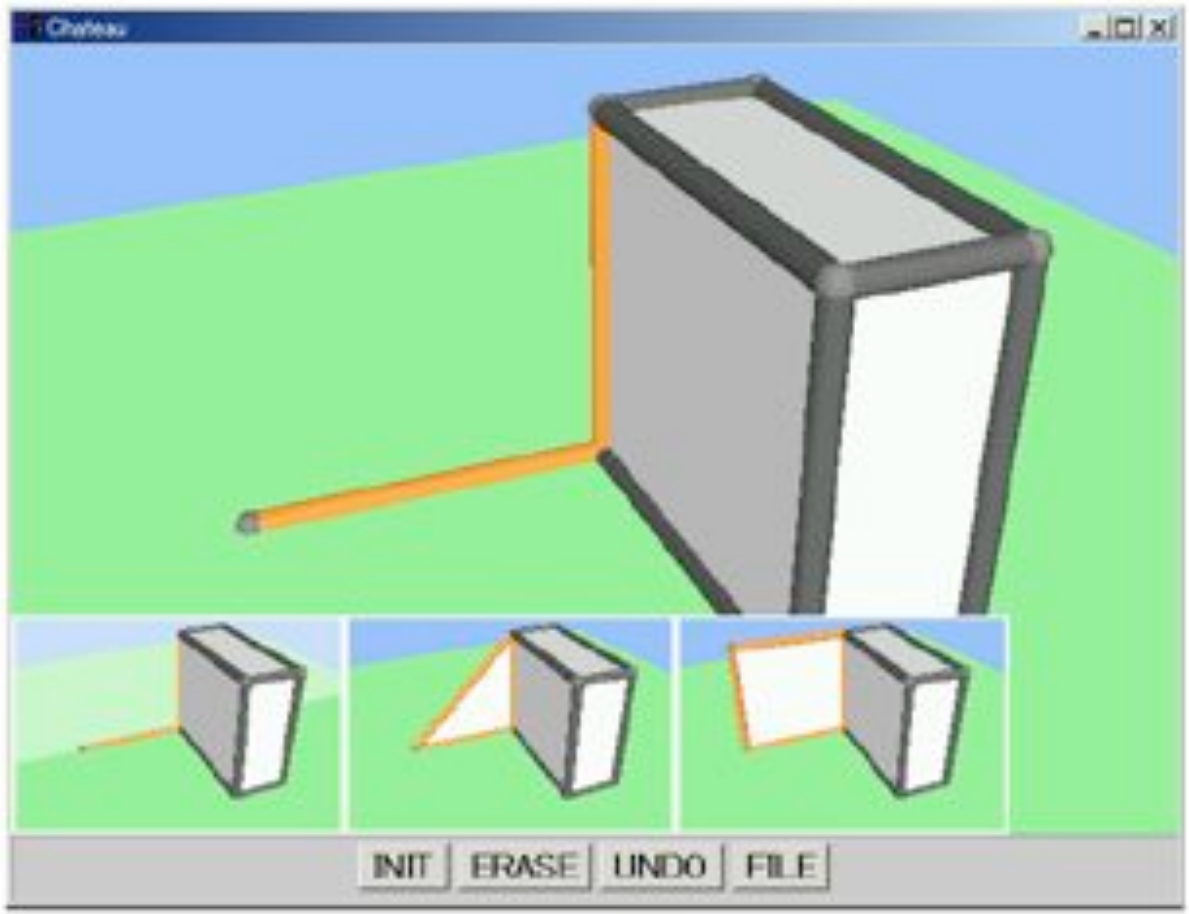
- Idea: Make it trivial to sketch out animations



- Issues:
  - Learnability?
  - Flexibility?

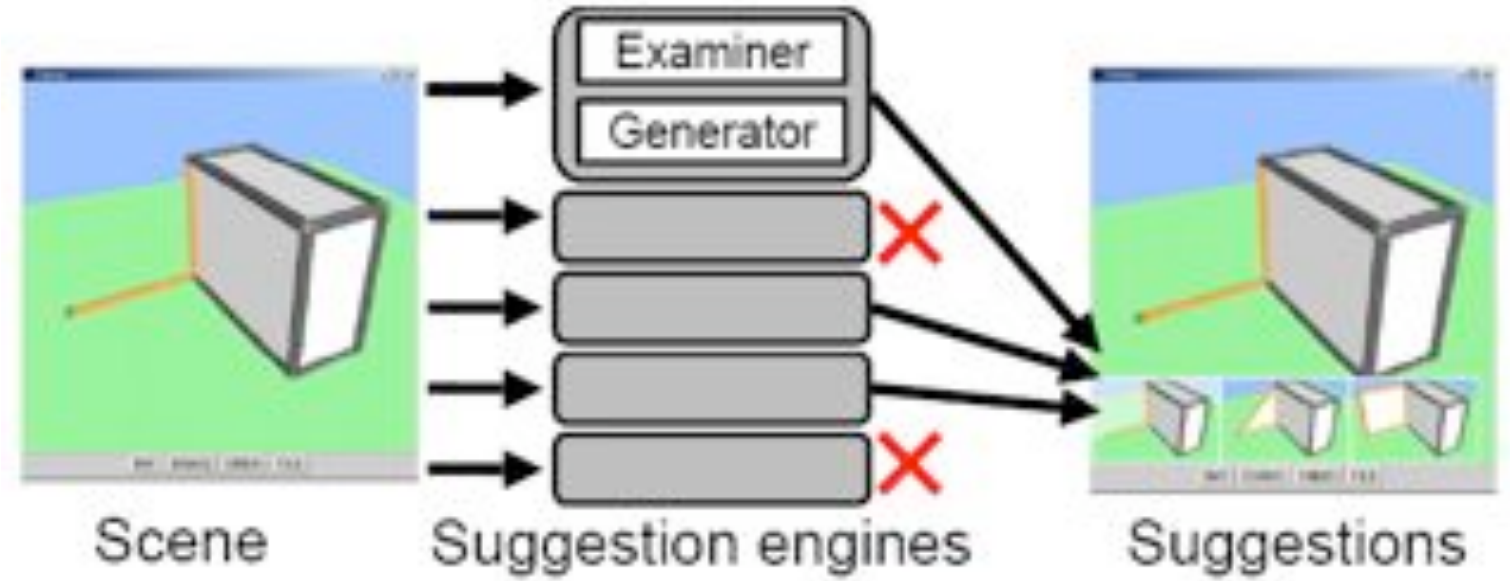
Chateau: Suggestive User Interfaces

- Idea: Provide an “auto-complete” for drawings

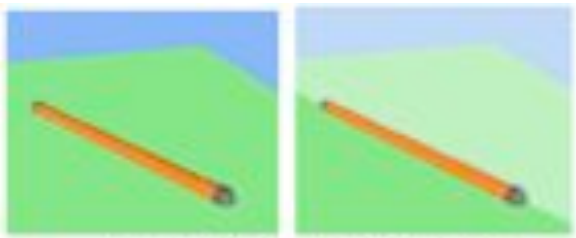


Suggestive User Interfaces

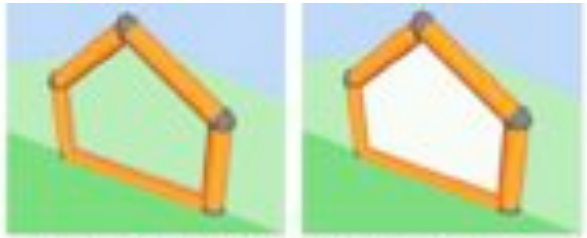
- Uses a suggestion engine with pluggable suggestions
  - Draw in plane
  - New structures
  - Beautify



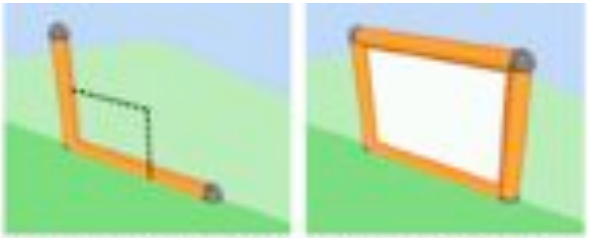
Suggestive User Interfaces



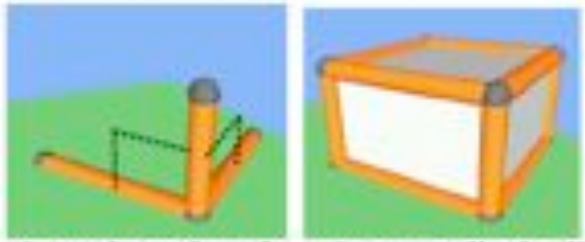
S1 creates a drawing plane



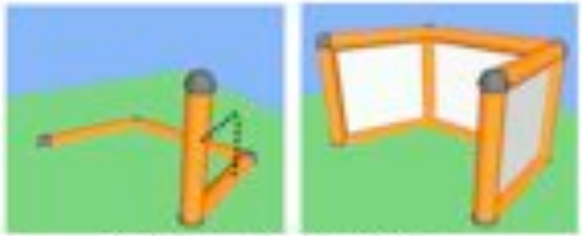
S2 makes a plate in a closed loop



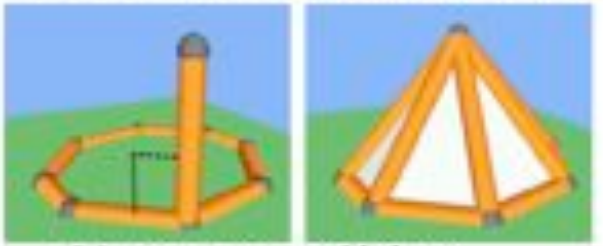
S3 creates a rectangle from perpendicular lines



S4 makes a box from 3 perpendicular lines

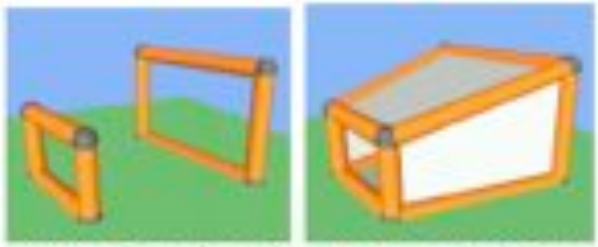


S5 extrudes planar lines

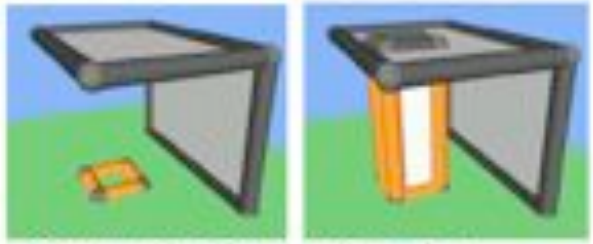


S6 creates a pyramid shape

S7 resizes the highlighted group



S8 makes plates between parallel lines

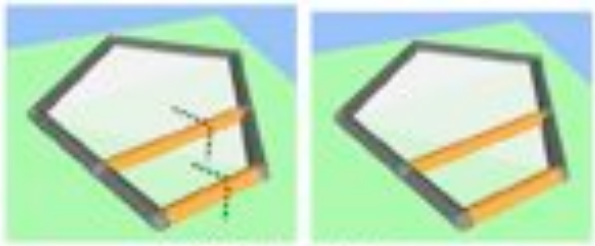


S9 extrudes lines under a plate

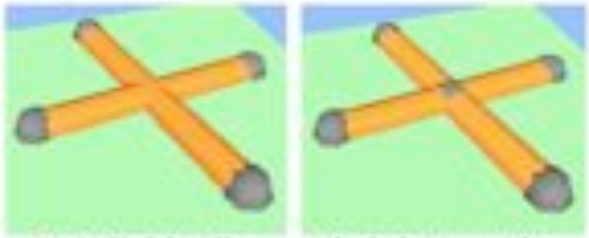
Suggestive User Interfaces

S10 makes a chamfer

S11 cuts a corner of a polyhedron



S12 trims a plate

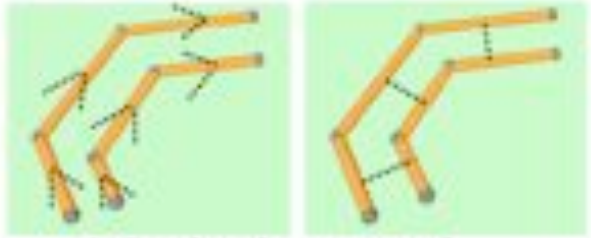


S13 divides lines at their intersection

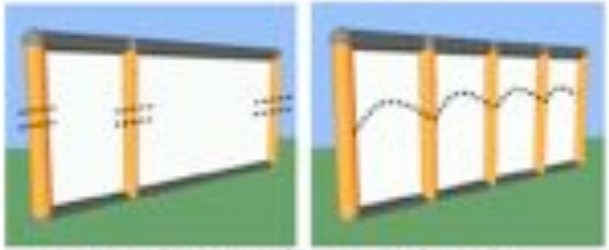
S14 duplicates a group

S15 makes a flipped copy of a group

S16 makes the third copy of a group

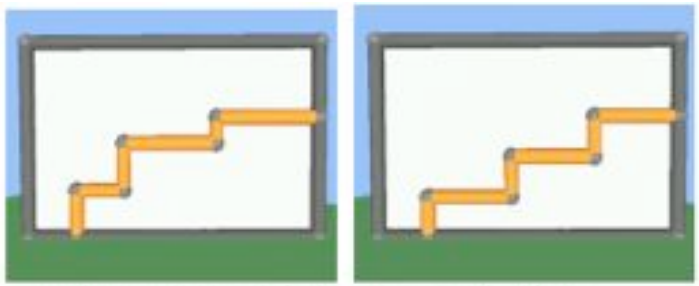


S17 makes the gaps equal

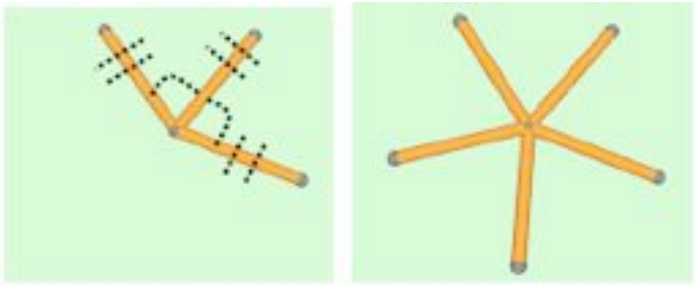


S18 makes equally spaced copies

Suggestive User Interfaces



S19 makes equally spaced stairs



S20 arranges lines to be rotationally symmetric

Suggestive User Interfaces

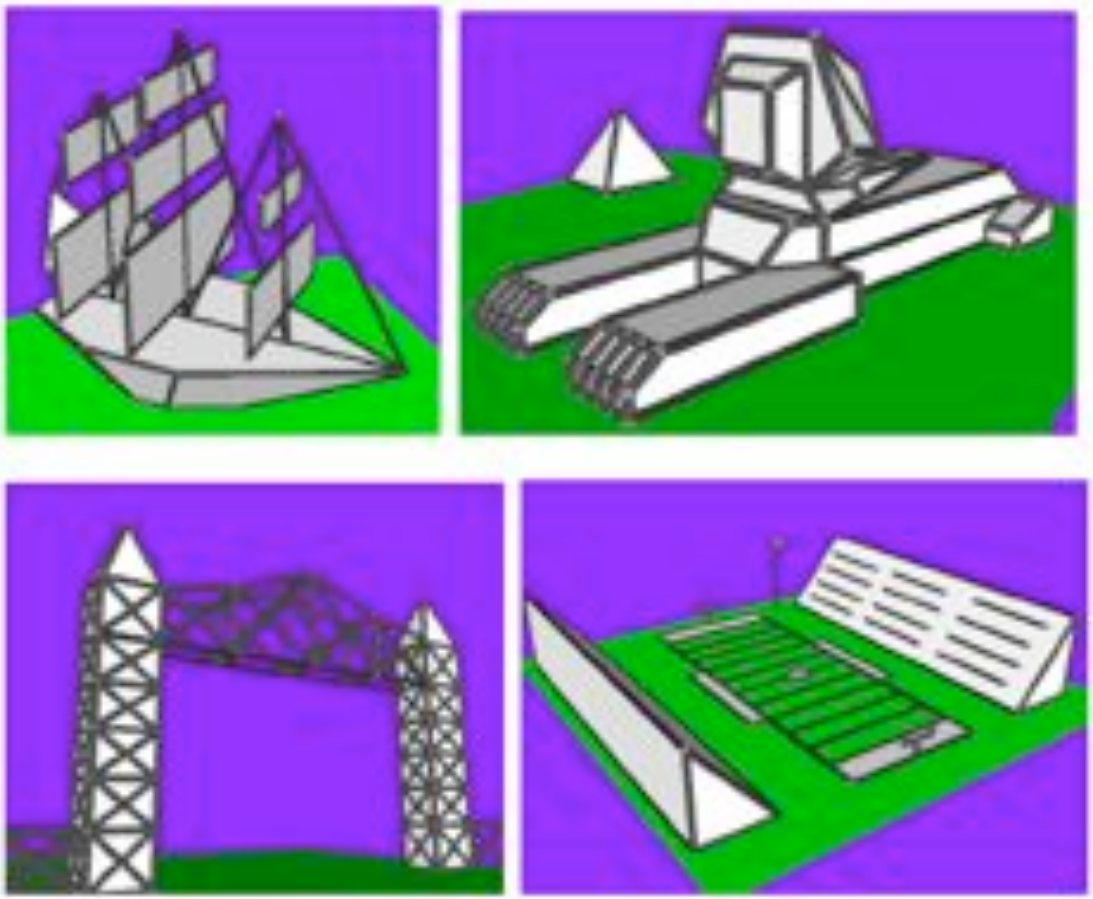
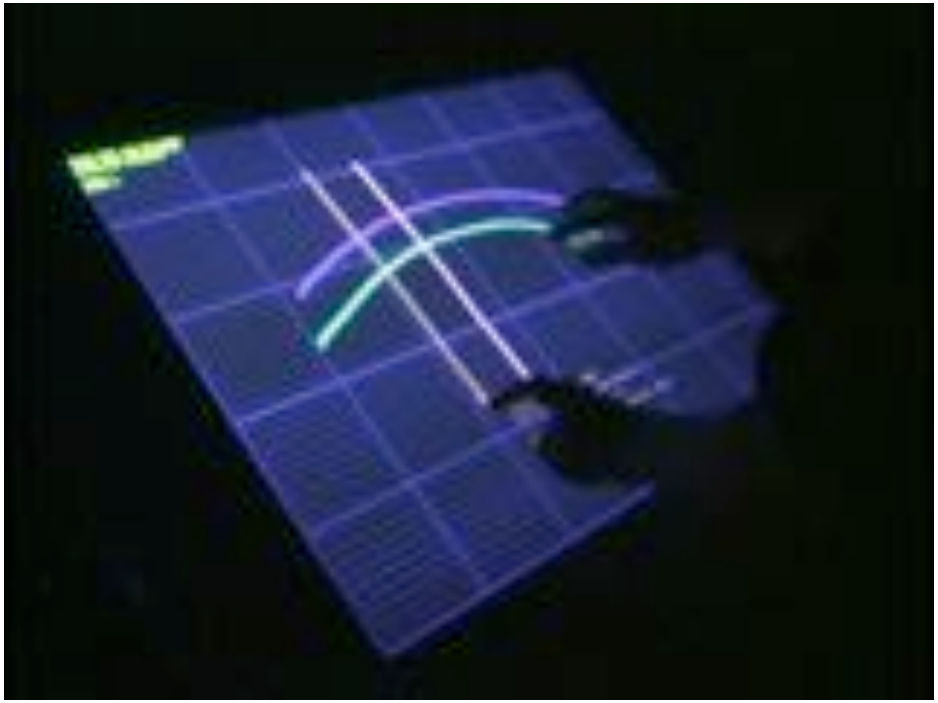


Figure 7: 3D drawings created by test users using Chateau.

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