Announcements

- 1/24, 1/26: HCI for Pen Computing
- 1/31: Real Time Stylus (Arin Goldberg)
- 2/2: Topic TBA (Valentin)
- 2/7: No class (probably)
- 2/9: Prototype presentations (teams)

What criteria would you use to evaluate these UI choices

Describe three different pen-based interfaces for tic-tac-toe

Evaluation criteria
Topics

- Low level mechanisms
  - Double tap
- Targeting
  - Fitt's law
- Mode problems
- Input
  - Pointing
  - Discrete Selection
  - Content Selection
- Recognition
  - Gestures
  - Content

Low level mechanisms

- State machine model
  - Registers
    - X, Y, Pressure
  - Pen state
    - Down, Hover, Out-of-range
  - Pen button
    - Up, Down
- Polling model

Control primitives

- Hover
- Tap
- Double Tap
- Press-and-hold
- Hold-through
- Drag
- Hold-drag

Write pseudocode for a low level routine to detect a double tap

- Condition for testing for a double tap
- Test condition to fire a double tap event

Experiment: measure time to move cursor to target

\[ T(A, W) \text{ Targeting time for amplitude } A \text{ and width } W \]
Index of difficulty

- How does $T$ behave as a function of $A$ ($W$ fixed)?

- How does $T$ behave as a function of $W$ ($A$ fixed)?

Fitts’ Law

- A task’s movement difficulty is given by $ID = \log_2(A / W)$
  - $ID$ – index of difficulty
  - $A$ – amplitude of the move
  - $W$ – width of the target region
  - $T = a + b \ ID$

Interpretation of Fitt’s Law

- Scale invariance
  - Dependence on $A/W$
- Exponential targeting
  - Log factor – as in binary search

Menu design

- What can you say about the cost of accessing items in the following menu
  - Cursor is at the top of the menu

Mode Problem

- Cognitive difficulties in remembering / keeping track of modes
  - Which mode?
  - Remapping operations
  - Retaining mode across context switch
- But modes are very useful
  - Efficient use of limited input controls
- Not all modes are the same
  - Shift key vs. Caps Lock
  - Mouse move vs. mouse drag
  - Pen color

Do cars have modes?

- A system has modes if it has states where the controls have different functions.
- Do cars have modes? If so, give an example
Pen mode solutions

- Problem: How do you allow different operations with a pen
  - Ink vs. erasing
  - Explicit modes
  - Ink vs. gesture
  - Recognition of gesture overrides ink
  - Ink vs. recognition vs. control
  - Area based modes

Pen mode study
Yang Li et al., CHI 2005

- Barrel Button
- Hold
- Non-preferential hand button
- Pressure
- Eraser

Quick poll

A. Barrel Button
B. Hold
C. Non-preferential hand button
D. Pressure
E. Eraser

Table 1. The participants’ preferences for each technique

<table>
<thead>
<tr>
<th>Technique</th>
<th>Inking</th>
<th>Ink vs. erasing</th>
<th>Ink vs. gesture</th>
<th>Area based modes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ink vs. erasing</td>
<td>4.4</td>
<td>4.3</td>
<td>4.7</td>
<td>3.5</td>
</tr>
<tr>
<td>Ink vs. gesture</td>
<td>4.0</td>
<td>4.3</td>
<td>4.3</td>
<td>3.3</td>
</tr>
<tr>
<td>Area based modes</td>
<td>3.9</td>
<td>3.8</td>
<td>4.0</td>
<td>3.5</td>
</tr>
</tbody>
</table>

Coming next:

- Pen Input
  - Pointing
  - Discrete Selection
    - Control
    - Text Input
  - Content selection
  - Recognized input
    - Glyphs
    - Gestures
    - Diagrams
    - Handwriting