L25: Input Technology

- HW2 due Sun
- GR5 out Mon, due May 11
From Ryan Young:

“While using the Xbox program 'Xbox FTP Client', I stumbled upon this alternative to the tried-and-true approach. The letters are placed like those on a phone pad, three letters and a number to each box. The left analog stick is used to select the box, and the right analog stick is used to highlight the letter/number of your choosing. Once the appropriate glyph is highlighted, you pull the right trigger with your index finger (a very natural motion, with both thumbs resting on the analog sticks) to select the letter/number. Once familiar with the interface, I've found I can type my name ("ryan young") in about 20 seconds, whereas it takes about 50 seconds with a traditional cursor and keyboard combination.”

- natural mapping
- external consistency
Today’s Topics

- Pointing devices
- Direct touch
Mouse
Touchpad
Trackpoint
Trackball

Focusing on indirect pointing devices today – Friday’s lecture will say more about direct touch on the screen
Properties of Pointing Devices

- Direct vs. indirect
  - Direct touch on screen
  - Indirect control of mouse pointer
- Relative vs. absolute
- Throughput
- Control/display (C/D) ratio

more about direct touch on Friday


http://www.yorku.ca/mack/CHI01.htm
Throughput

- Throughput
  - also called index of performance
    \[ T = a + b \log (D/S + 1) \]  \text{seconds}
    \[ ID = \log (D/S + 1) \]  \text{bits}
    \[ IP = 1/b \]  \text{bits/second}

- mouse: 5 bits/sec
- trackball: 3 bits/sec
- touchpad: 3 bits/sec
- joystick: 2 bits/sec
Control/Display Ratio

- Control: how far user’s hand moves
  - in meters
- Display: how far cursor moves on screen
  - in pixels
- Direct touch: C/D = 1
- Mouse acceleration

No acceleration

With acceleration

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demo at http://www.infres.enst.fr/~blanch/projects/SemanticPointing/demo/
Direct Touch

- Mouse = indirect pointing
- Stylus or finger = direct pointing
Technology for Direct Touch

- Resistive
  - Two conductive sheets with a gap between
  - Responds to finger, stylus, any object

- Capacitive
  - Human skin changes surface capacitance
  - Responds only to bare skin

- Inductive
  - EM field from tablet induces signal from stylus
  - Responds only to special (expensive!) stylus

- Optical
  - Camera watches the surface
  - Responds to anything

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Resistive Touch Sensing

1 V

Resistive Touch Sensing

2 V

Resistive Touch Sensing

3 V

Resistive Touch Sensing

Stripped Wire

Stripped Wire

Stripped Wire
Resistive Touch Sensing

Capacitive Touch Sensing

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Capacitive Touch Sensing

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Capacitive Touch Sensing

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Light is faster through air than glass, so it overshoots and heads back into glass.

Light is slower through a finger than glass, and the finger diffuses the light.

Infrared
Issues for Direct Touch Technology

- Finger only, stylus only, or both
- Pressure sensitivity
- Hovering vs. clicking
- Occlusion of display by finger or hand
  - “Fat finger” problem
- Multitouch
- Tactile feedback
- Multiple users
Summary

- Pointing devices
  - Mouse, touchpad, joystick, trackpad
  - Throughput, C/D ratio
- Keyboards
  - QWERTY, Dvorak, alphabetical
  - Typing speed, finger movement