

## HCI for Pen Computing

CSE 481b  
January 24, 2006

## Draw a picture of a Tablet PC

Student Submission

## 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)

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

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## What criteria would you use to evaluate these UI choices

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## 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

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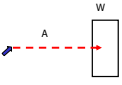
## Targeting

- Fundamental operation
  - Moving a cursor to a specific location
  - Pointing and selection

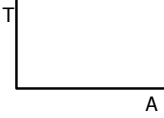
## Experiment: measure time to move cursor to target

$T(A, W)$  Targeting time for amplitude  $A$  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

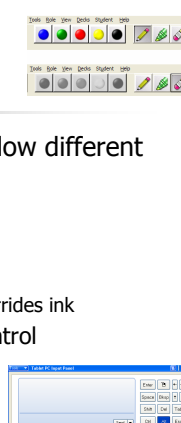
## Do cars have modes?

- 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

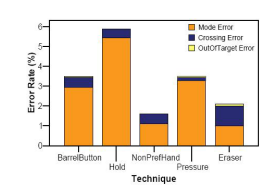
## Quick poll

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

Students  
Quick Poll

Table 1. The participants' preferences for each technique.

Dimension	Barrel-Button	Hold	NonPref-Hand	Pressure	Eraser
Learning	4.4	3.5	4.7	3.5	4.2
Use	3.7	2.2	4.1	3.4	2.4
Accuracy	3.7	2.9	4.6	3.3	3.6
Speed	4	1.7	4.5	4	1.9
Eye fatigue	4.1	3.3	4.4	3.9	4.2
Hand fatigue	3.5	3.3	4.1	3.3	2.1



## Coming next:

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