

## Pen Based User Interface II

CSE 481b  
January 25, 2005

## Today

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

## 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)

## 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

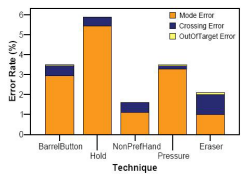
## Quick poll

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

Student  
Quick Poll

Table 1. The participants' preferences for each technique.

Dimension	Barrel-Button	Hold	Non-Pref-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



## Classify input activities with a pen

What type of input activities are easy with a pen?

What type of input activities are difficult with a pen?

Student Submission

## Activity classification

Easy

Moderate

Difficult

## Discrete selection

- Choose from a finite set
  - Command from a menu
  - Character from an alphabet
- Repeated selection from finite sets
  - Hierarchical menus
  - Commands with arguments
  - Sequences of characters
    - Words
    - Multi-digit numbers

How many distinct mechanisms can you construct to select between four choices with a pen?

Assume a pen without a button

Student Submission

## Selection mechanisms

- Crossing
- Pointing
- Writing
- Tapping
- Pressure

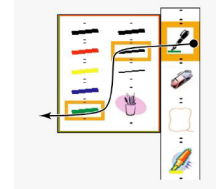
## Basic pen operation

- Crossing
  - Operation triggered by a stroke crossing a line segment



## CrossY: Crossing based UI

- Specify operations by drawing through

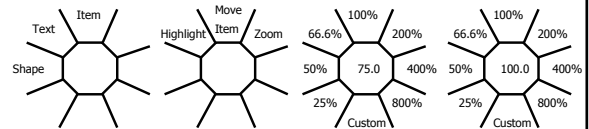


## Hierarchical crossing

- Principle – multiple commands without lifting the pen

## Flow Menu

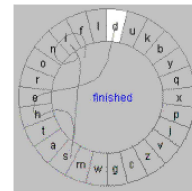
- Use movement through octants for control information



## Abstract writing

- Enter text with specialized, stroke based recognition
  - Optimized for automatic recognition
  - Not human readable
  - Character based or word based

## Cirrus (Georgia Tech)



interaction  
education

## Quikwrite [Perlin, NYU]

Diagram illustrating the Quikwrite interface, showing a central sun-like shape with letters arranged around it. The letters are: a s k p f n, m l, q x, h e c u t y, v w j r, o g z b d i. To the right, there are several small geometric shapes (triangles, squares) with arrows indicating movement or transformation between them.

## Write helloworld

Diagram illustrating the Quikwrite interface, showing a central sun-like shape with letters arranged around it. The letters are: a s k p f n, m l, q x, h e c u t y, v w j r, o g z b d i.

Student Submission

## Selection problem

- Identify one or more graphical elements from a domain
- Mechanisms
  - Bounding Region
  - Geometric defined by stroke
  - Distance from cursor

## If the red circle is a selection tool, what is selected?

Handwritten text on lined paper:
   
Todo ✓ send testimony
   
lecture for - m -
   
vsts - note to class
  
marty interview - note to s/r
   
post ~~meeting~~ slides ✓

Student Submission

## Bubble cursor

- Selection radius depends on object proximity

Diagram illustrating the Bubble cursor concept, showing a central crosshair with several green dots scattered around it. The dots are of varying sizes, representing different selection radii based on their proximity to the cursor.

## Recognition UIs

- UIs based on attaching meaning to ink
  - Gestures
  - Diagram recognition
  - Handwriting recognition
    - Free form
    - Constrained recognition

## Gestures

- Commands issued with a single stroke
- May be drawn or invisible
- Support from SDK
  - Register gestures to be recognized
- UI Issues
  - Similar to keyboard short cuts
    - Speed up for experts
    - Hard to learn / remember

## Gestures

- Ambiguity
  - Distinction between gestures
  - Distinction between gesture and other ink
- Robustness
  - Handling misrecognized gestures
    - False positive
    - False negative
  - Gesture initiated actions should be undoable

## Diagram recognition

- Challenges to recognition
  - Even simple shapes are hard!
  - Variation in drawing
  - Ink artifacts

## Text recognition

- We will have a great lecture later in the course!
- Basic approach
  - Collect a huge amount of data
  - Use data to train neural net

## Handwriting Recognition: Identify the following words

programmers

optimists

attracts

sorcery

godmothers

Student  
Recognition

## Recognition results

All programmers are optimists. Perhaps this motion sorcery especially attracts those who believe in happy endings and fairy godmothers.

Converted text: All propounders are oppugns), Perhaps 2-3 motion sorcery especially attracts Those who believe in happy adios of Sais godmothers	Ink from note: optimists
Alternative: oppugns), optimists, optimists, oppugns), opuses), opuses), optimist, optimists	



## Recognition scenarios

- What level of error is tolerable
- How is feedback provided to the user on recognition
- How does the user specify corrections?