



# CSE 165: 3D User Interaction

Lecture #13: Symbolic Input

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# Announcements

- Homework Assignment #4
  - Due Friday February 26<sup>th</sup> at 2pm

# Universal 3D Interaction Tasks

- Navigation
- Selection
- Manipulation
- System control
- Symbolic input

# Symbolic Input

- Entering text, numbers, math, symbols, etc...
- Difficult in 3DUIs
  - Rarely present in immersive systems
    - Keyboards not usually part of VR systems

# Usage Scenarios

- ◉ Filename entry
- ◉ Labeling, annotation, markup
- ◉ Precise object manipulation
- ◉ Design annotation (e.g., architecture)
- ◉ Setting parameters numerically
- ◉ Communication via text messages  
(collaborative applications)

# Boundary Conditions of Symbolic Input in 3DUIs

- Users often standing
- Users may physically move around
- No surface to place keyboard
- VR often low-light: hard to see keys
- Different hardware configurations compound problem

# Symbolic Input Tasks

- Alphanumeric input
- Editing entered alphanumeric symbols
- Markup entered text: highlighting, font specification, text color, etc.

# Symbolic Input Techniques

- Keyboard-based techniques
- Pen-based techniques
- Gesture-based techniques
- Speech-based techniques



# Miniature Keyboards



# Low Key Count Keyboards

- Reduced number of physical keys
  - Example: mobile phones



*Logitech Cordless Number Pad*



# Chord Keyboards

- Keyboard with functionality of a full-sized keyboard, but using many fewer keys
- Often requires pressing multiple keys at the same time (chord)

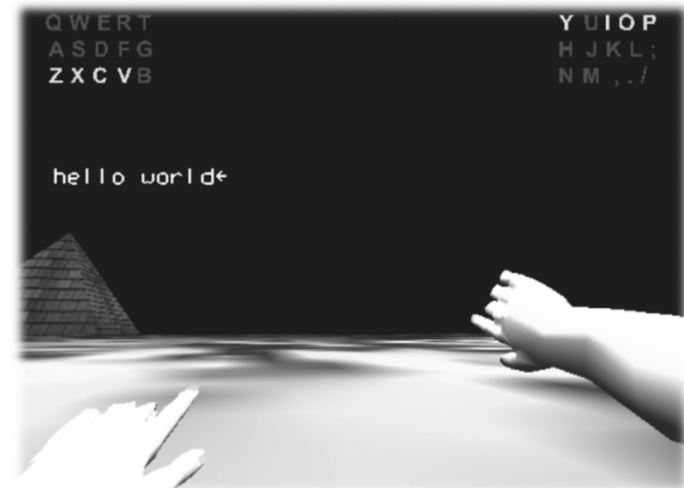


*Spaceman Spiff's Chording  
Keyboard Experiment (SpiffChorder)*



# Pinch Keyboard

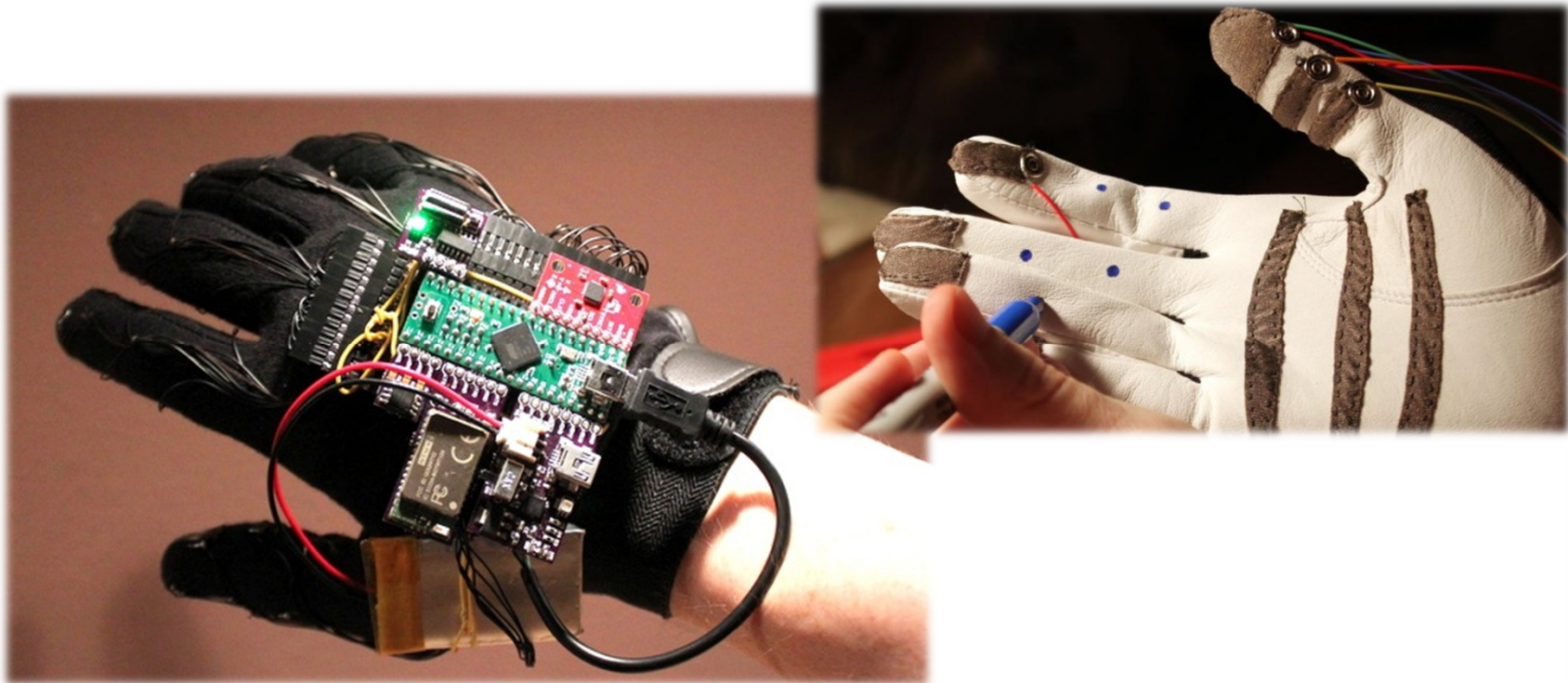
- Bowman et al. 2001
- Pinch with a finger and the thumb represents a key press by same finger
- Uses rotation of hand to reach “inner keys”
- Uses hand distance from body to distinguish keyboard rows





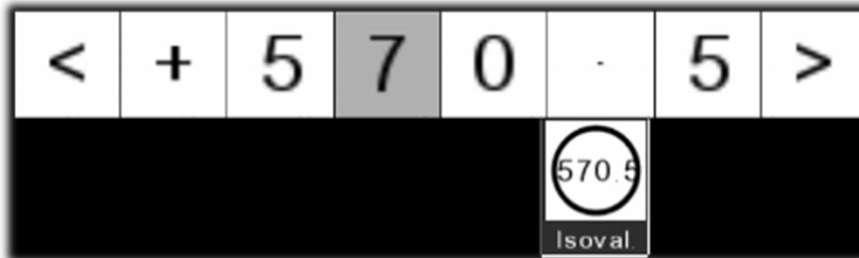
# Keyglove

- Video at <http://www.keyglove.net>



# Soft Keyboard

- Keyboard implemented in software: virtual keys
- Does not use physical keys

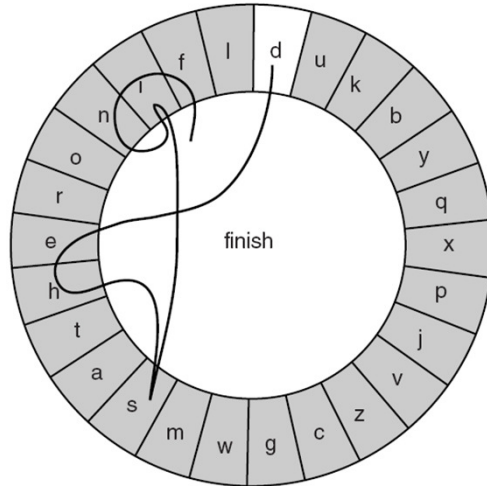


*FloatOmeter (2005)*

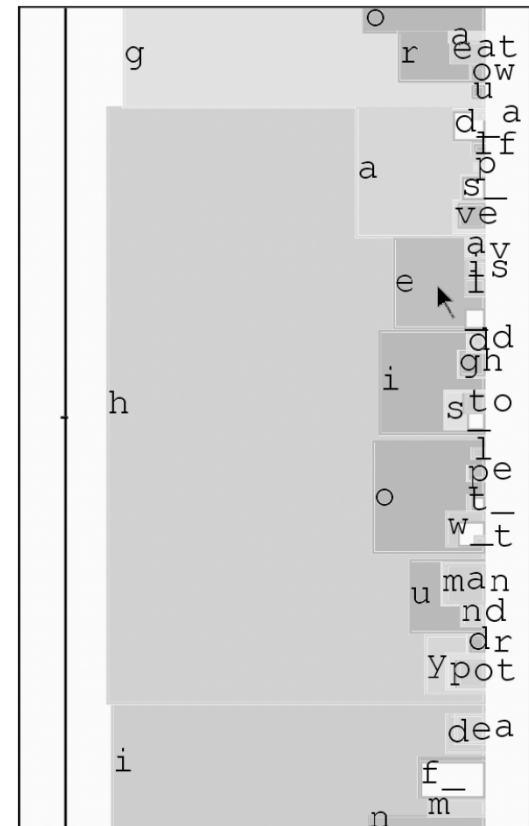


# Pen-Based Keyboards

- Pen-stroke gesture recognition



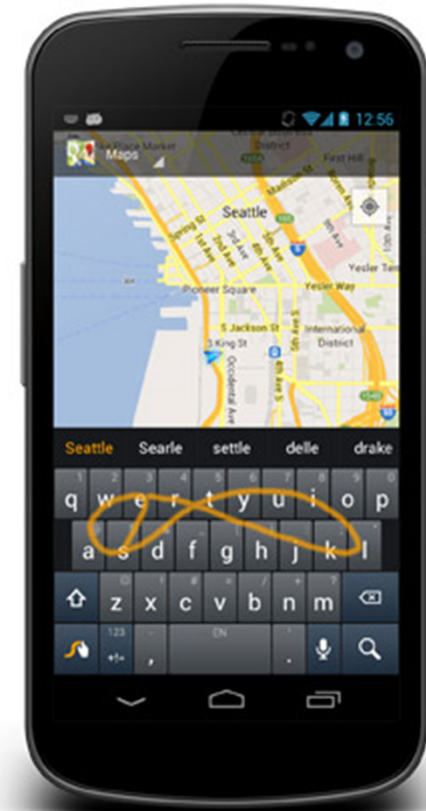
*Cirrin soft keyboard (Mankoff and Abowd 1998)*



*Dasher (Ward et al., 2002)*

# Pen-Based Keyboards –Swype

- Typing by continuous finger or stylus motion across the screen keyboard



[www.swype.com](http://www.swype.com)



# Pen-Based Keyboards – Digital Ink

- Poupyrev et al., 1998
- Write with “digital ink”



# Gesture-Based Techniques

- Sign language
  - Example: *American Sign Language Recognition using Kinect Skeleton features*
    - [http://www.youtube.com/watch?v=qFH5rSzm\\_gFE](http://www.youtube.com/watch?v=qFH5rSzm_gFE)
- Numerical gestures
  - one finger raised = 1, etc.

# Speech-Based Techniques

- Single character: words entered by spelling them out
- Whole word: unreliable without training
- Unrecognized speech input
  - e.g., annotations by audio recordings

# User Performance

● Bowman et al. 2002

