



CSE 165: 3D User Interaction

Lecture #14: Symbolic Input

Upcoming Deadlines

- Sunday, February 21st at 11:59pm:
 - Homework project 3 due
- Sunday, February 28th at 11:59pm:
 - Homework project 3 late deadline
- Sunday, March 7th at 11:59pm:
 - Homework project 4 due
- Sunday, March 14th at 11:59pm:
 - Homework project 4 late deadline

3D UI Presentations

- Cynthia Butarbutar:
 - Colibri VR
- Tianheng Ma
- John Li:
 - Half-Life: Alyx - Locomotion Deep Dive

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

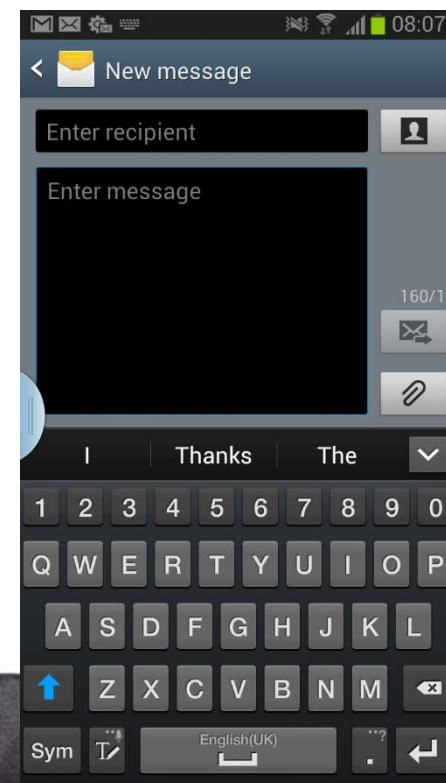
Symbolic Input Tasks

- 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
 - T9 on early cell phones
 - Wireless number pad



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)*



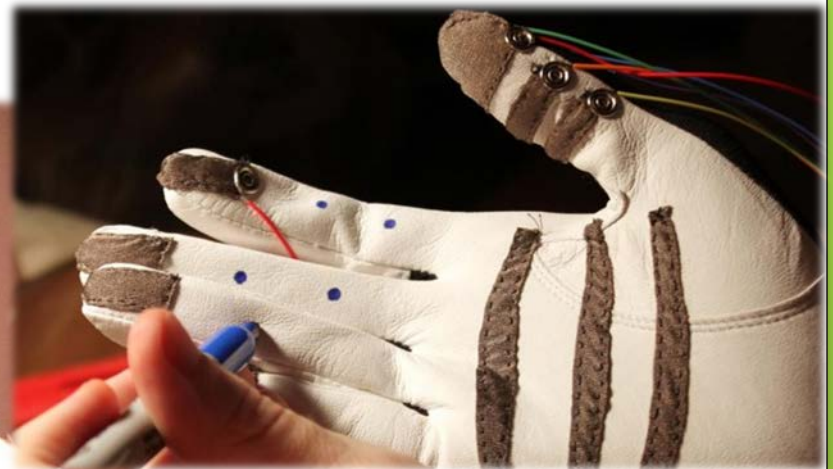
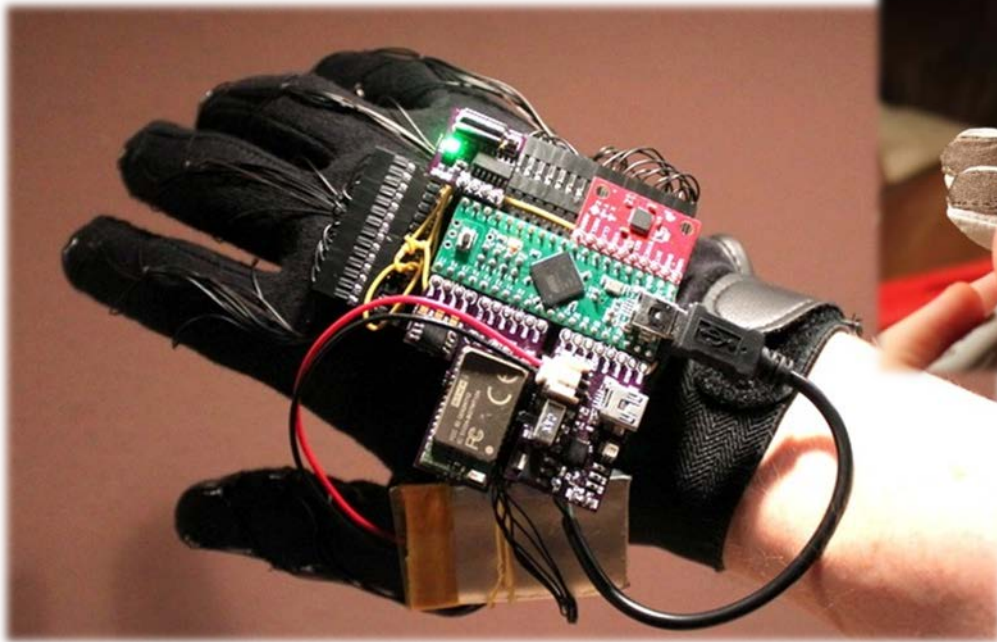
Pinch Keyboard

- Bowman et al. 2001
- Maps a real keyboard to the hand
- 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

- <https://vimeo.com/59319446>



Soft Keyboard

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



iMore



Cube - Bluetooth Laser Projected Keyboard

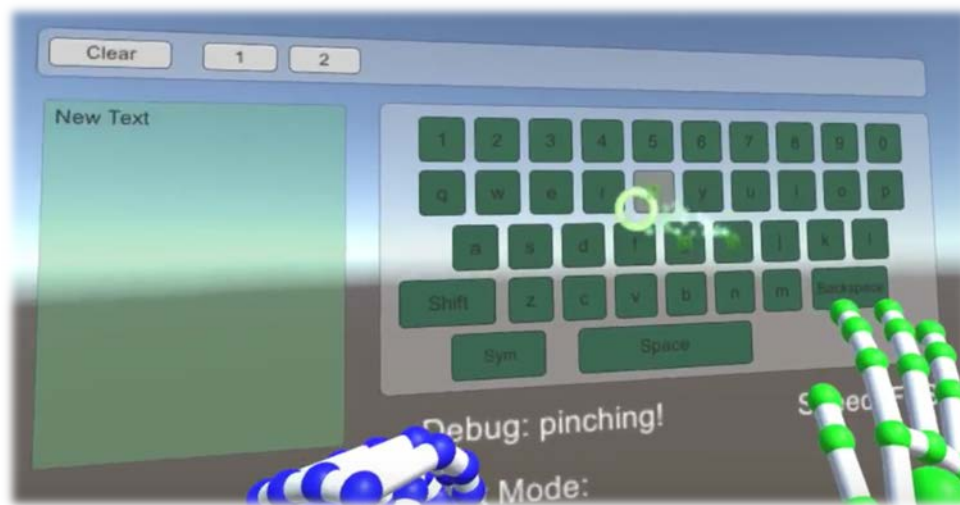


Windows 10 On Screen Keyboard

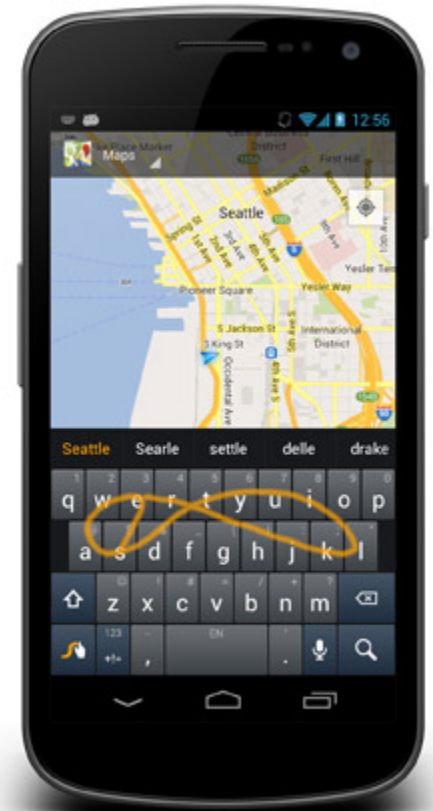


Continuous Motion Keyboards

- Typing by continuous motion across on-screen keyboard
- Examples: Swype, SwiftKey



Leap controlled keyboard (Janis Jimenez)
<https://www.youtube.com/watch?v=qpv2lexdlSM>



www.swype.com

Punchkeyboard

- <https://vimeo.com/205302540>

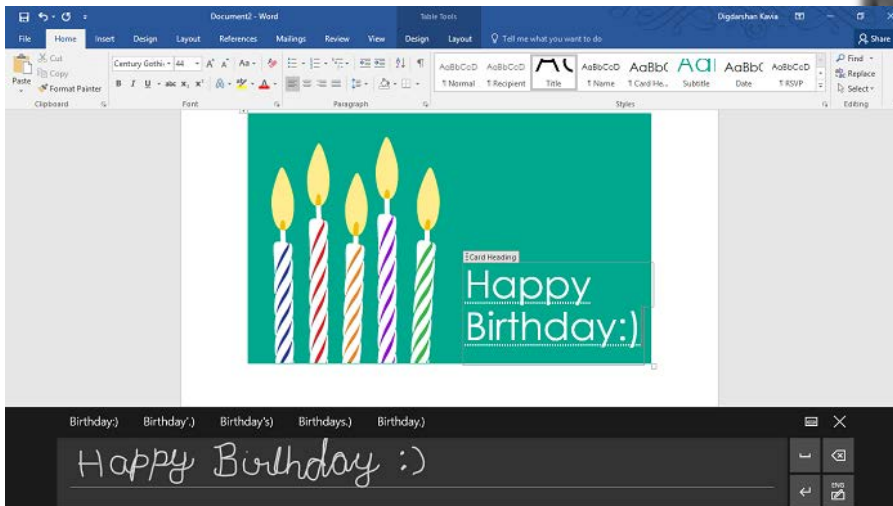


Pen-Based Keyboards

- Write with “digital ink”
- Optional parsing of handwriting into ASCII text

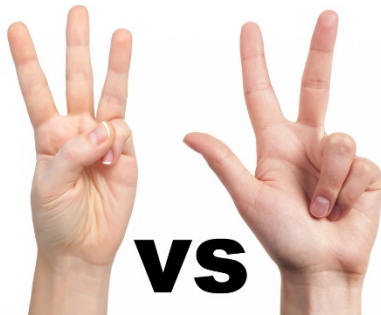


Virtual Notepad: Handwriting in Immersive VR (Poupyrev 1998)



Gesture-Based Techniques

- Sign language
 - American Sign Language Recognition using Kinect Skeleton features
 - <http://www.youtube.com/watch?v=qFH5rSzmgFE>
 - ASL Tutor -- Leap Motion + machine learning to recognize sign language -- TAMUHack 2015
 - <https://www.youtube.com/watch?v=KUIJNmyelaY>
- Numerical gestures
 - one finger raised = 1, etc.



Speech-Based Techniques

- ◉ Single character: words entered by spelling them out
- ◉ Whole word
- ◉ Raw storage of speech input (no parsing)
 - ◉ e.g., audio annotations
- ◉ Examples:
 - ◉ Microsoft Speech Recognition API
 - ◉ Mac OS speech recognition engine
 - ◉ Free IBM Watson Unity asset
 - ◉ <https://assetstore.unity.com/packages/tools/ai/ibm-watson-unity-sdk-108831>