CSE 165: 3D User Interaction

Lecture #12: Symbolic Input

Announcements

- Final Project
  - Due Thursday, March 21st at 3pm
  - Two blog entries due 3/11 and 3/18
- Today VR club using lab 4:30-6:30pm
- Midterm to be returned and reviewed next Tuesday

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

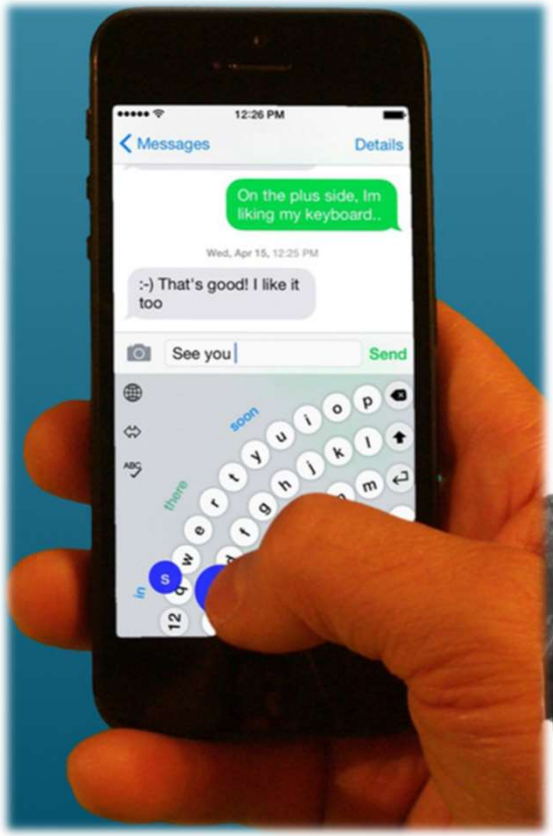
Symbolic Input Tasks

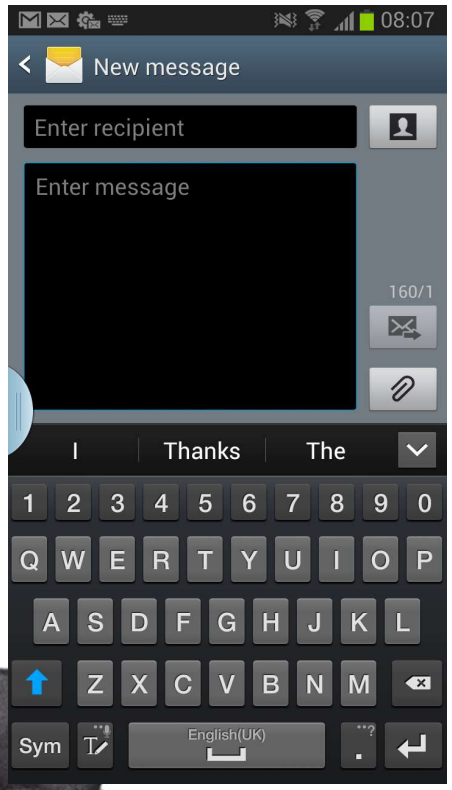
- Alphanumeric input
- Editing entered alphanumeric symbols
- Markup entered text: highlighting, font specification, text color, etc.

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

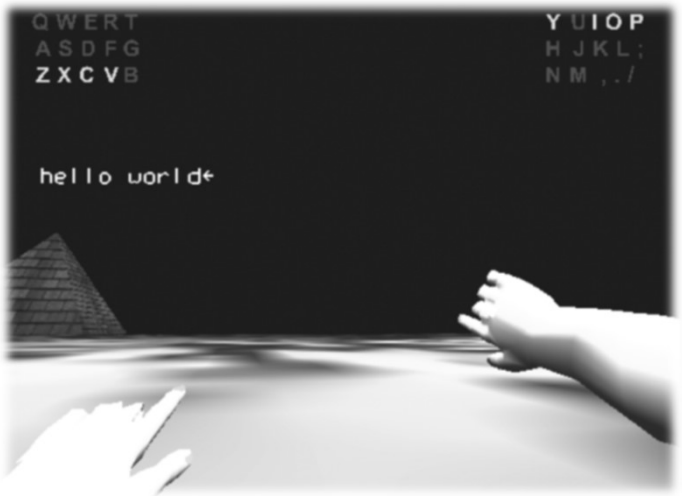
Chord Keyboards

- 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)

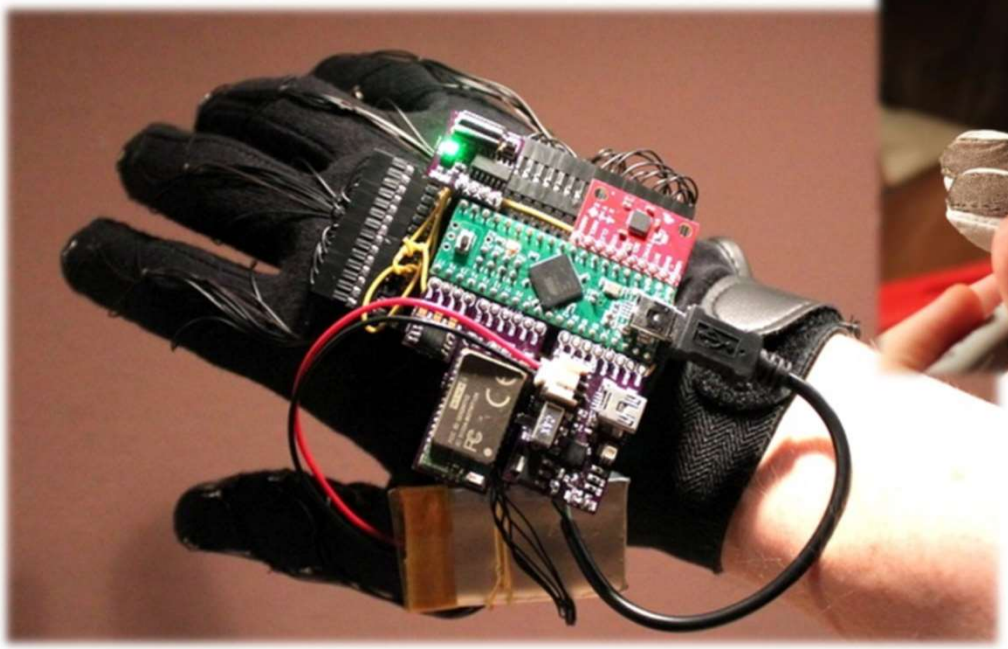
Pinch Keyboard

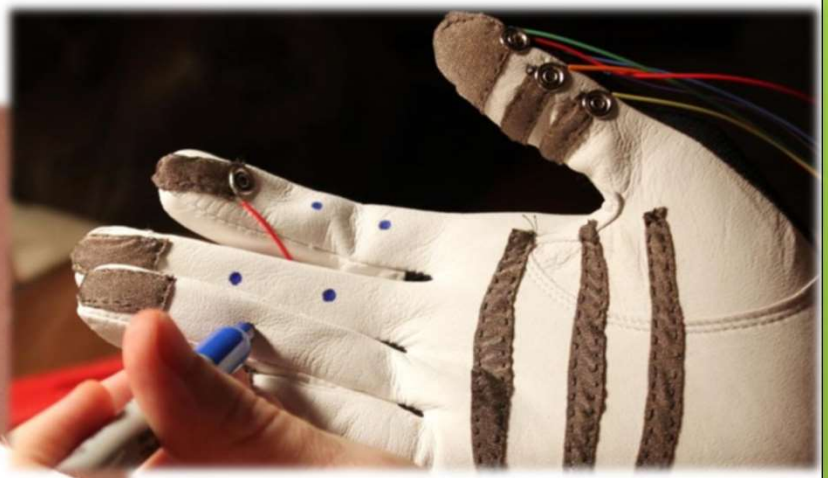
- Bowman et al. 2001
- Maps a real keyboard to the hand
- Pinch with a finger and the thumb represents a key press by same finger
- Uses rotation of hand to reach “inner keys”
- Uses hand distance from body to distinguish keyboard rows



Keyglove

- https://vimeo.com/59319446





Soft Keyboard

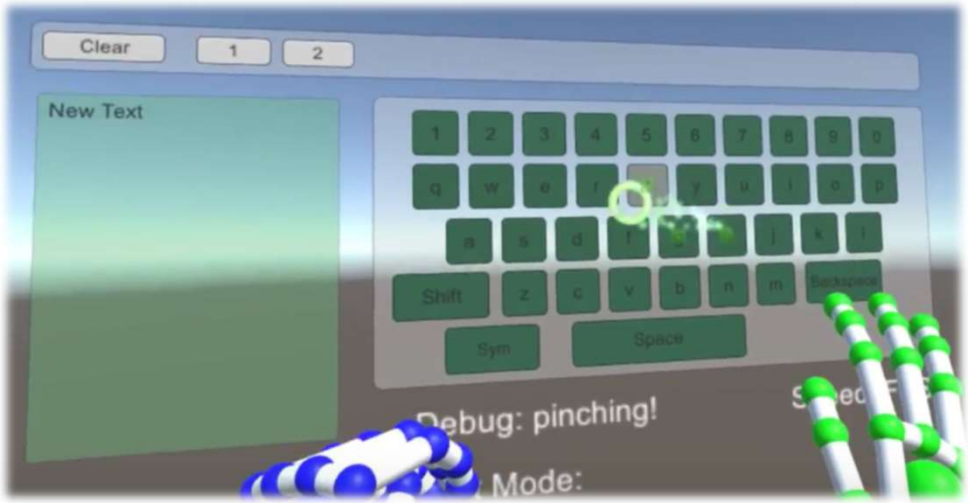
- Keyboard implemented in software: virtual keys
- Does not use physical keys

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=qpv2IexdlSM

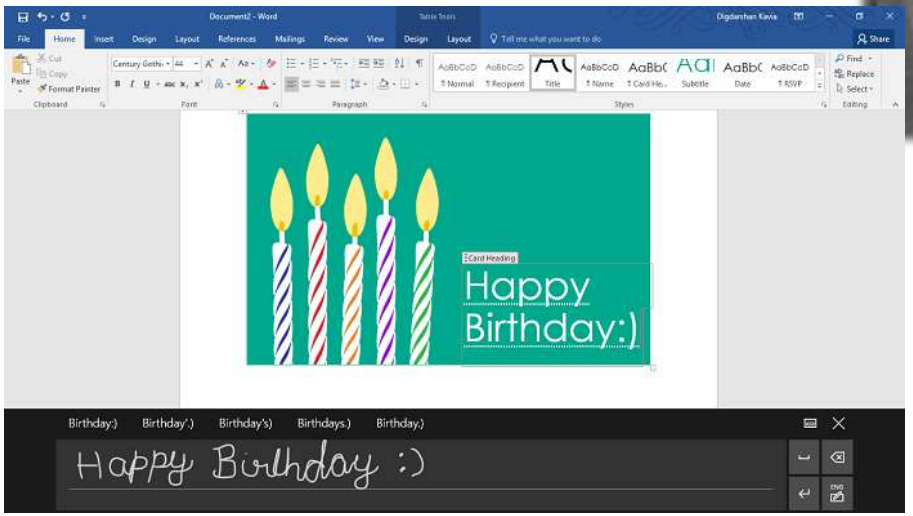
www.swype.com

Punchkeyboard

- https://vimeo.com/205302540

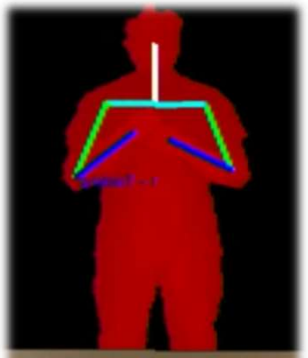
Pen-Based Keyboards

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

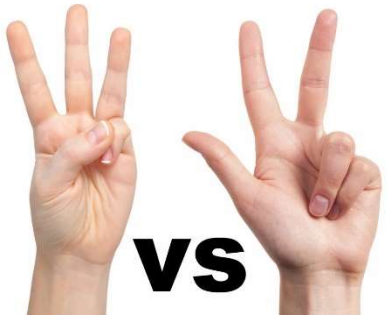


Virtual Notepad: Handwriting in Immersive VR (Poupyrev 1998)

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=KUlJNmyelaY
- 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