#### CSE 165: 3D User Interaction

Lecture #14: System Control

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#### Announcements

Homework Assignment #4
Due tomorrow at 1:00pm

• Homework Assignment #5 is on-line

# System Control cont'd

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#### Universal 3D Interaction Tasks

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

# Classification



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# Graphical Menus – Adapted 2D Menus



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#### Graphical Menus – 1-DOF Menus



# Graphical Menus – TULIP

- Uses pinch gloves
- Limited to 16 menu items
  - 8 per hand
- More than 16 menu items possible with "more" option on pinky finger



Bowman, Wingrave 2001

#### Hovercast VR Menu (2015)

# https://www.youtube.com/watch?v=1xc VdYGffdY



#### Graphical Menus – 3D Widgets (1)





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#### Graphical Menus – 3D Widgets (2)

Command and Control Cube



Grosjean, Coquillart 2001

# Graphical Menus – Design

- Placement
  - world-referenced (freely in world)
  - object-referenced (centered to object in world)
  - head-referenced (view centered)
  - body-referenced
  - o device-centered
- Selection
  - Degrees of freedom, constraints
- Representation and structure
  - form, size, space
  - hierarchy: functional and semantic grouping, context sensitivity, control coding

## Voice Commands

- Speech recognition
- Spoken dialogue techniques
- Requires
  - speech recognition engine
    - speaker dependent vs. independent
    - varying vocabulary size
  - good microphone
- Invisible to the user
- Push to talk

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#### Gestural Commands

One of the first system control techniques
Posture – static hand configuration
Gesture – dynamic movement



#### Gesture Command Types

- Speech connected gestures: spontaneous gesticulation while talking
- Mimic gestures: directly describe a concept
- Symbolic: e.g., thumbs up
- Sign language: artificial vocabulary



#### Holotouch File Browser

#### • <u>http://www.youtube.com/watch?v=mPK</u> <u>dTMmdQ9A</u>



Devehat 2014

#### Tools

- Provide directness of interaction
- Familiar (real-world derived)
- Physical tools
  - real physical objects (props)
  - may have graphical representation
- Virtual tools





*CavePainting (Keefe 2001)* 

# Virtual Tool belt



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# Tricorder





Wloka, Greenfield 1995
 Physical input device has virtual representation

Functionality changes according to selected tool

# Tangible User Interfaces



Reactable (Jorda et al., 2005)

Video: https://www.youtube.com/watch?v=tgcpyZIqvT8



# Multimodal System Control

- More than one input modality (speech, gesture, facial expression, etc...)
- Advantages
  - Allows decoupling of interaction modes
    - Avoids switching between, e.g., navigation and other interaction mode
  - Error reduction and correction
  - Flexibility and complementary behavior
  - Control of mental resources: reduce cognitive load

#### Multimodal Interaction – Examples



Hand gestures and speech [Van Dam et al. 2000]