IMGD 5100:
Immersive HCI

Selection & Manipulation

Robert W. Lindeman
Associate Professor
Interactive Media & Game Development
Department of Computer Science
Worcester Polytechnic Institute
gogo@wpi.edu
Overview

- How do we choose objects?
  - Selecting single objects
  - Disambiguation
  - Selecting groups of objects
  - Releasing objects

- How do we change objects?
  - Choosing among object properties
  - Natural mappings of actions to changes
  - Arbitrary mappings
Object Selection

- In the real world, we select by
  - Touching/grabbing
  - Pointing
    - With finger: direct
    - With pointer: extended
    - With mouse: indirect
  - Voice
  - Device
    - Car radio
  - Other ways
    - Context?
    - Eye gaze?
Selection-Task Decomposition

- Indicate
  - Denote which object we intend to select
  - Can be open-loop or closed-loop task

- Confirm
  - Verbal
  - Dwell
  - Click
Selection in VR

- Indication
  - Avatar-hand movement
  - Device movement
  - Virtual "beam" for closed-loop feedback
  - Selection from a list

- Confirmation
  - Click
  - Dwell
  - Verbal
Reaching Objects

- Need to be able to indicate at a distance
  - Go-go techniques
  - Two-handed pointing
  - Worlds-in-Miniature (WIM) techniques
    - [http://www.lsi.upc.edu/~virtual/DWIM/](http://www.lsi.upc.edu/~virtual/DWIM/)
  - Flashlight
  - Voodoo dolls

- Image-plane techniques
Manipulation

- Typical tasks
  - (Re)Position
  - Rotate
  - Property modification

- Approaches
  - WIM
  - 3D widgets
    - Virtual sphere for rotation
    - Jack for scaling
  - Non-isomorph trans./rot.
  - Skewers
  - 2D widgets
Design Guidelines

- Use existing techniques unless a large amount of benefit might be derived from designing a new, application-specific technique
- Use task analysis when choosing a 3D manipulation technique
- Match the interaction technique with the device
- Use techniques that can help reduce clutching
- Non-isomorphic techniques are more useful and intuitive
Design Guidelines (cont.)

- Use pointing techniques for selection, and virtual hand techniques for manipulation
- Use grasp-sensitive object selection
- Constrain degrees of freedom when possible
- There is no, single best interaction technique
- Test, test, test!

[Bowman, Kruijff, LaViola, Poupyrev, 3D User Interfaces, 2005]