



CS-525V:
Building Effective
Virtual Worlds
Selection & Manipulation

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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
 - Flashlight
 - Voodoo dolls

- Image-plane techniques

Manipulation

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

- Approaches
 - WIM
 - 3D widgets
 - Virtual sphere for rotations
 - Jack for scaling
 - Non-isomorphic position/rotation
 - 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]