IMGD 5100:
Immersive HCI

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
    - 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-isomorphic trans./rot.
  - ■ Skewers
  - ■ 2D widgets

Translation Manipulator

Rotation Manipulator

Scale Manipulator

Combo Manipulator
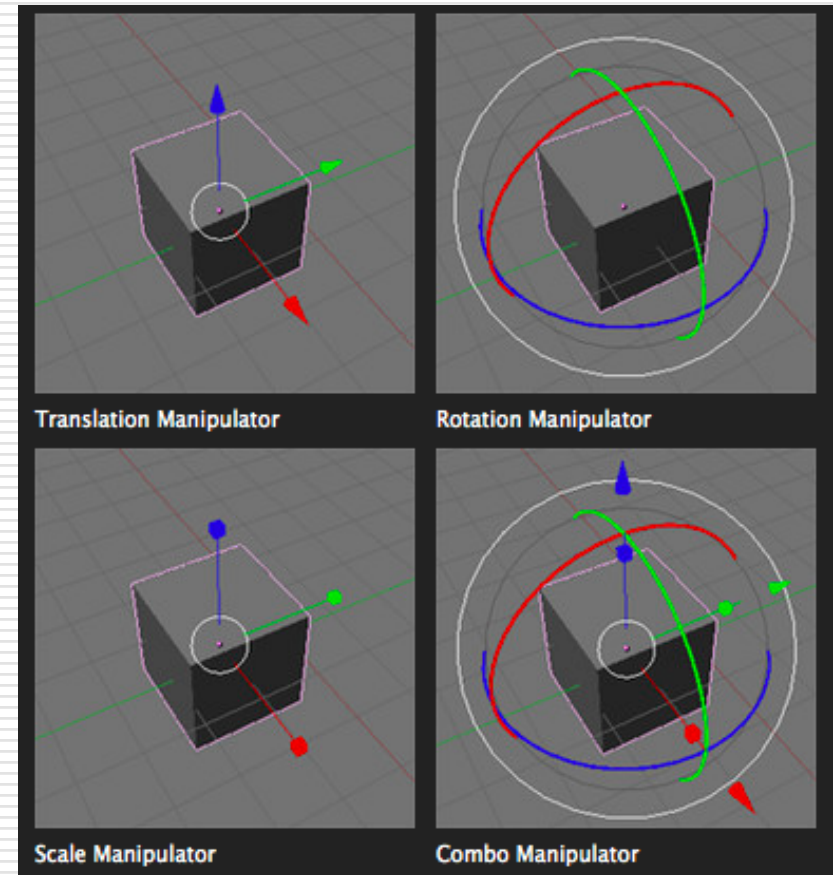
Design Guidelines

- 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]