Selection and Manipulation

8

Selection and Manipulation

- Two core parts of 3D interactions
  - Pick the things to work on
  - Work on them
- Various ways to organize this and think out about
  - Both book organize it differently!
  - But essentially the same information; VR book mixes "UI techniques" with application issues to give a sometimes broader view

3D Manipulation

- *Spatial Rigid Object Manipulation*
- Canonical Tasks
  - Selection
    - incl. exploration
  - Positioning
  - Rotation
  - Scaling

Table 7.1 Tasks and their parameters.

Task	Parameters
Selection	Distance and direction to target, target size, density of objects around the target, number of targets to be selected, target occlusion
Positioning	Distance and direction to initial position, distance and direction to target position, translation distance, required precision of positioning
Rotation	Distance to target, initial orientation, final orientation, amount of rotation, required precision of rotation
Scaling	Distance to target, initial scale, final scale, amount of scale, required precision of scale

- App-Specific Tasks

Manipulation and Input Devices

- Control Dimensions & Integration of Control Dimensions
  - How many, how many at once?
  - Consider Quest Controller

- Force vs Position
- Device Placement and Form Factor
  - Which muscle groups?

Classification of Techniques

- Isomorphic vs non-isomorphic
- Task decomposition

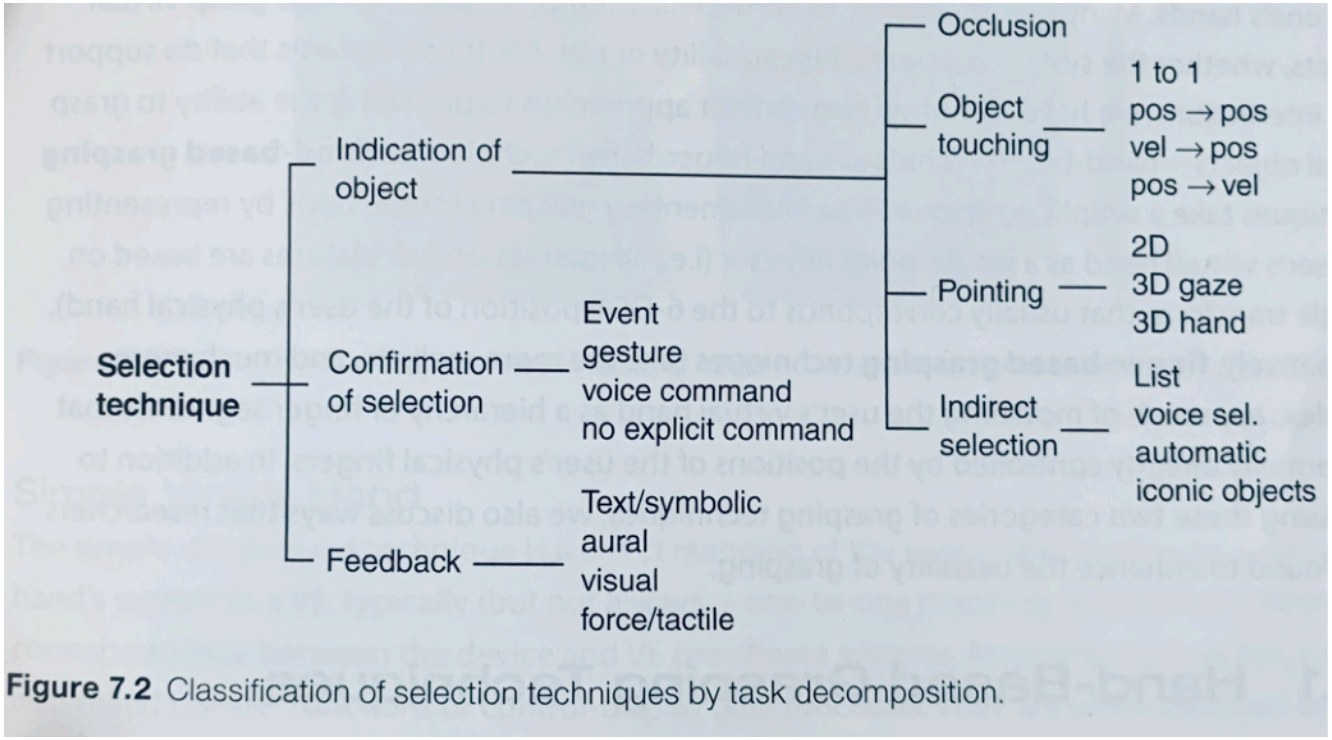


Figure 7.2 Classification of selection techniques by task decomposition.

- Metaphors: forms a mental model, affordances and constraints

Grasping

- Hands
  - Single interactor, maps to controller well
    - Simple hand, "Go-Go"
- Fingers
  - Rigid-Body
  - Soft-Body
  - "god" fingers (simulate soft-body with simplified model)
- Improvements
  - various versions of snapping

Pointing

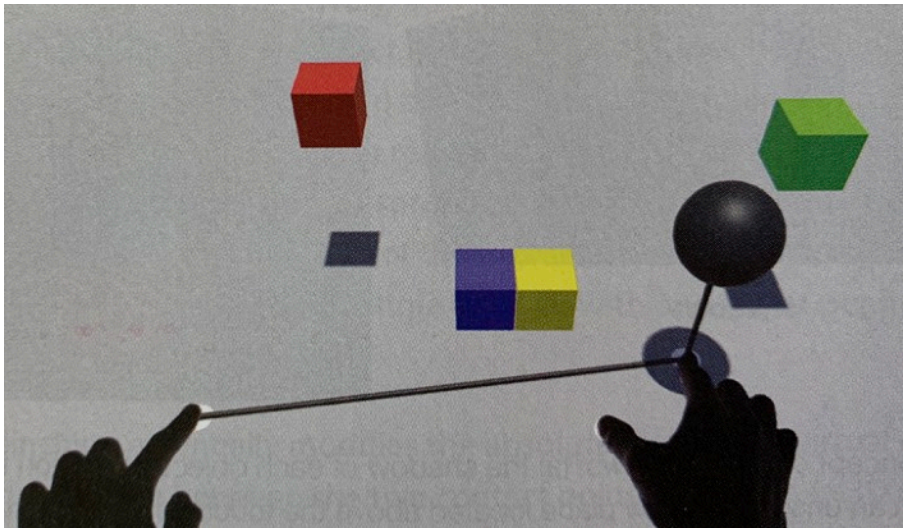
- defined by *direction* and how the *selection candidates* are determined

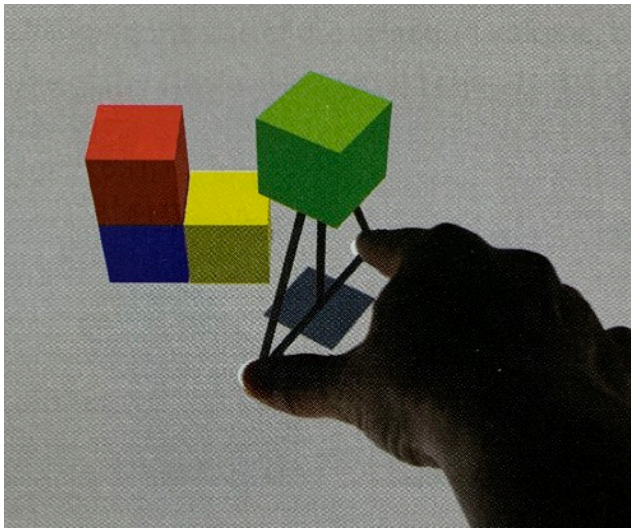
- Vector-based
  - ray-casting, fishing reel (add length control), image-plane
- Volume-based
  - vectors + volume or spread
  - cones, apertures, spheres, etc

- Enhancements
  - again, mostly doing snapping and semantic refinement to get around difficulties with perception, clutter, and improve speed over real-world metaphors

Surface-based Metaphors

- 2D surfaces
  - dragging, rotating
- 3D surfaces
  - pinching (scaling)
  - void-shadows (fake shadows for hidden objects)
  - ballons, corkscrews, triangles





Indirect Metaphors

- manipulate objects without direct interaction
- analogous advantages to 2d
  - don't have to travel to object (e.g., touch vs mouse)
  - occlusion issues (e.g., interact to side of touch point on phone)
  - unnatural constraints (e.g., scroll bar is 1-DOF)

- Categories
  - Control-space
  - Proxy
    - WIM, Voodoo-Dolls
  - Widgets

Other Metaphors

- Bimanual
  - Asymmetric/Symmetric, Synchronous/Asynchronous
- Hybrid
  - HOMER

Other Aspects and Guidelines

- Make sure to read 7.10 and 7.11