CSE 165: 3D User Interaction

Lecture #11: Travel

Announcements

- Homework 3 is on-line, due next Friday at 2pm
- March 1: Midterm exam
- More Rifts have been added

Independent Study

- Limited amount of CSE 198/199 projects available in spring quarter
- Apply by email or come to office hour
- Topics:
  - Easy to use VR viewer for CT/MRI images
  - VR for autistic children
  - Rendering of video point clouds
  - Cyber-Archaeology on the CAVE Kiosk
  - ARKit alternative for Samsung phones
  - Meditation with VR support

Navigation

Wayfinding – Cognitive Component

Travel – Motor Component

Travel

- Motor component of navigation
  - But good travel techniques integrate wayfinding aids
- Movement between two locations, setting the position (and orientation) of the user's viewpoint
- The most basic and common VE interaction technique, used in almost any large-scale VE

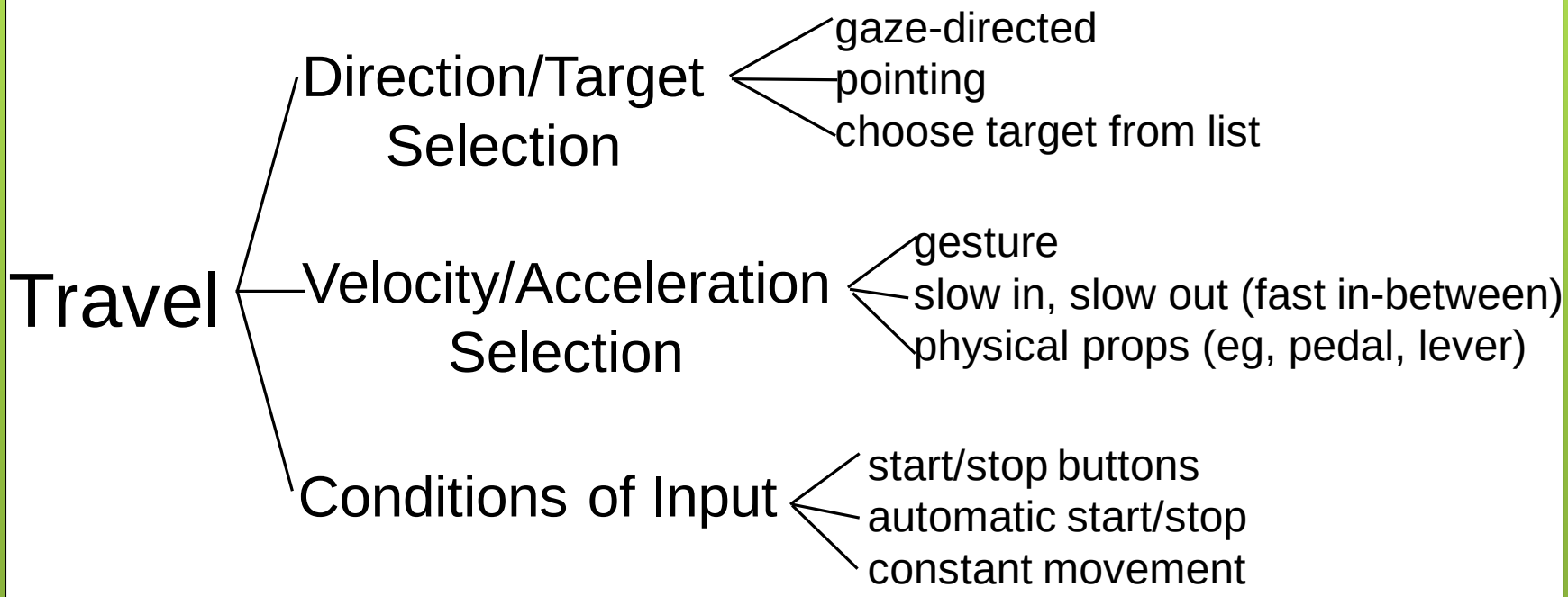
Travel Tasks

- Exploration
  - travel which has no specific target
  - build knowledge of environment
- Search
  - naïve: travel to find a target whose position is not known
  - primed: travel to a target whose position is known
  - build layout knowledge; move to task location
- Maneuvering
  - travel to position viewpoint for task
  - short, precise movements

Travel Characteristics

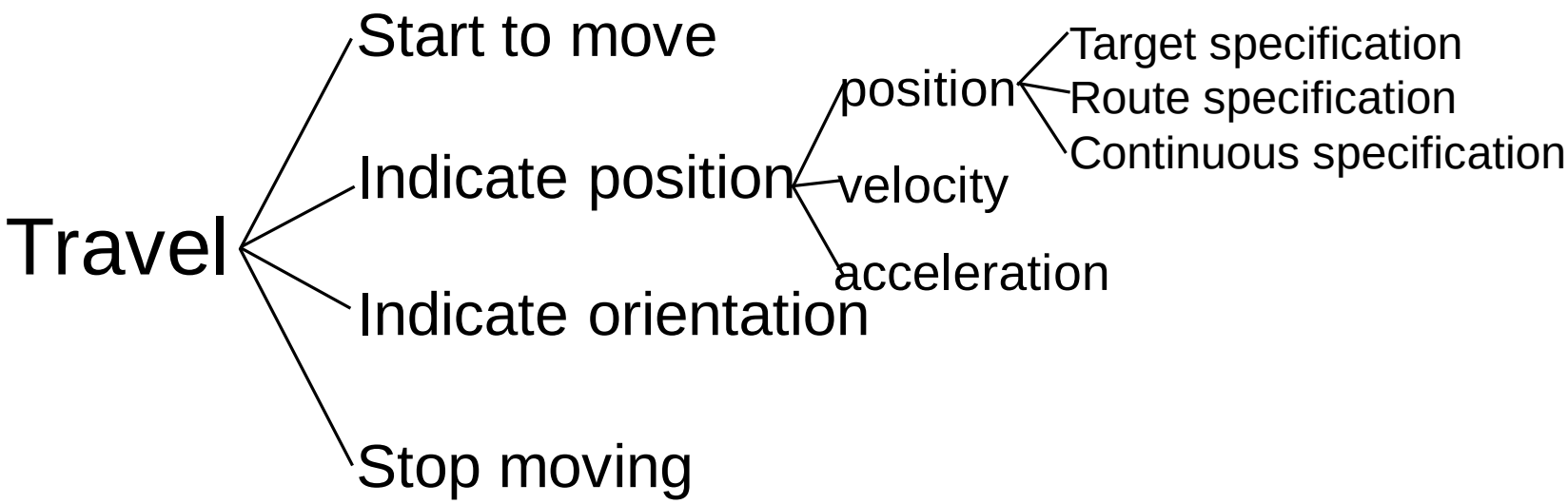
- Travel distance
- Amount of curvature/number of turns in path
- Target visibility
- DOF required
- Accuracy required
- Other tasks during travel
- Active vs. passive
- Physical vs. virtual

A Technique Classification – Component Decomposition



From: Bowman, Koller, and Hodges, Travel in Immersive Virtual Environments. IEEE VRAIS '97

Alternate Technique Classification – User Control Level



Travel Techniques

- Physical locomotion ("natural" metaphors)
- Steering techniques
- Route planning
- Target-based techniques
- Manual manipulation
- Viewpoint orientation techniques

Physical Locomotion Techniques

- Walking techniques
  - Large-scale tracking
  - Walking in place
- Treadmills
  - single-direction with steering (Gait Master)
  - omni-directional (Omni)
- Bicycles
- Other physical motion techniques
  - Magic carpet
  - Disney's river raft ride

Large Scale Tracking

Omni-Directional Treadmill

- Video:
  - http://www.youtube.com/watch?v=BQw1tsgrJOs

Omni

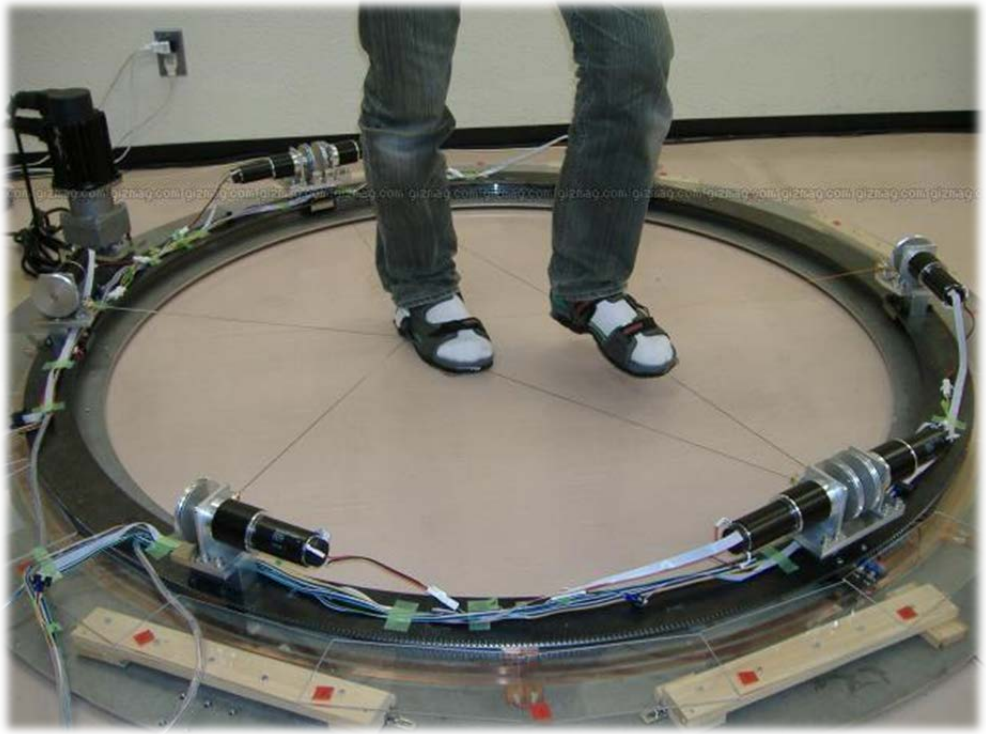
- https://www.kickstarter.com/projects/1944625487/omni-move-naturally-in-your-favorite-game

Gait Master

- Video
  - http://www.youtube.com/watch?v=RDDH1iqoDzU

String Walker

- Video from Emerging Technologies, SIGGRAPH 2007
  - http://www.youtube.com/watch?v=hyLKjyL-Dw8



Steering Techniques

- Steering:
  - Continuous specification of direction of motion
- Techniques:
  - Eye gaze
  - Head direction
  - Hand pointing
  - Torso-directed
  - Physical device (steering wheel, etc.)

Steering by Eye Gaze

- Move viewpoint in direction of eye gaze
- Gaze direction determined from eye tracker
- Cognitively simple
- Doesn't allow user to look to the side while traveling

Steering by Head Orientation

- Move viewpoint in direction head is pointed
- Direction determined from head tracker
- Cognitively simple
- Allows user to look to the side while traveling, but hard to decouple eye gaze and head direction

Steering by Pointing

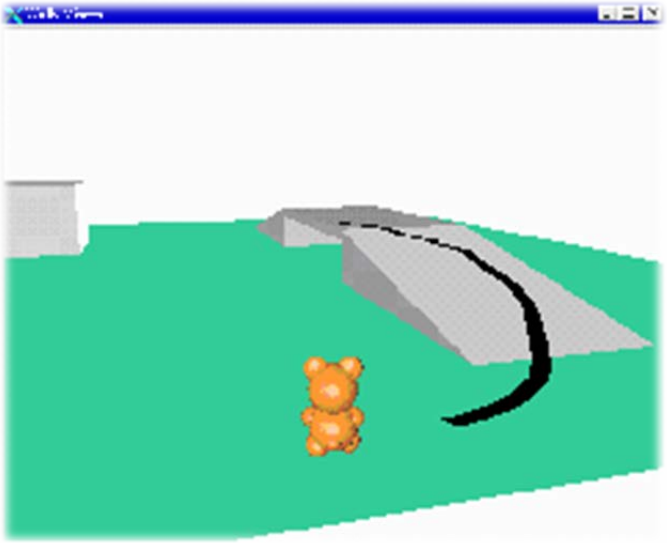
- Similar to steering by head orientation, but uses hand tracker instead of head tracker
- Cognitively slightly more complex than steering by eye/head
- Allows travel and eye gaze in different directions

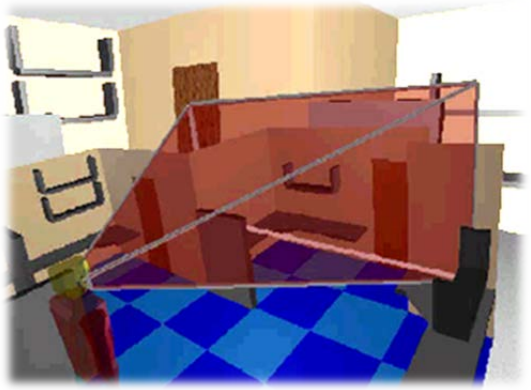
castAR

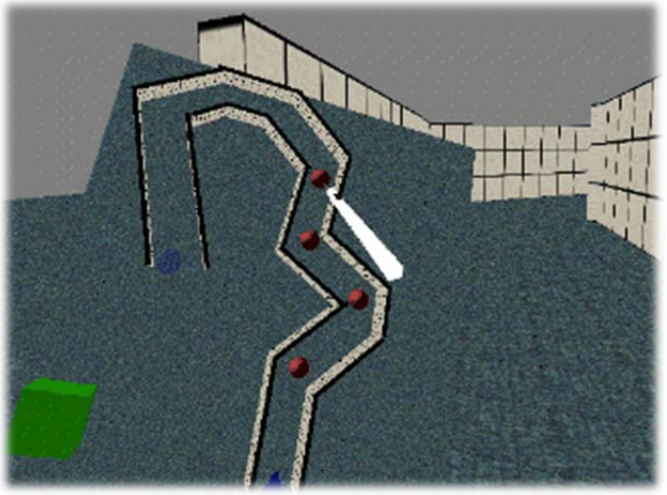
- https://www.youtube.com/watch?v=hL1qT0TK6aw

Route-Planning

- One-time specification of path
- Implementation:
  - Draw entire path
  - Specify points along path
  - Manipulate user representation





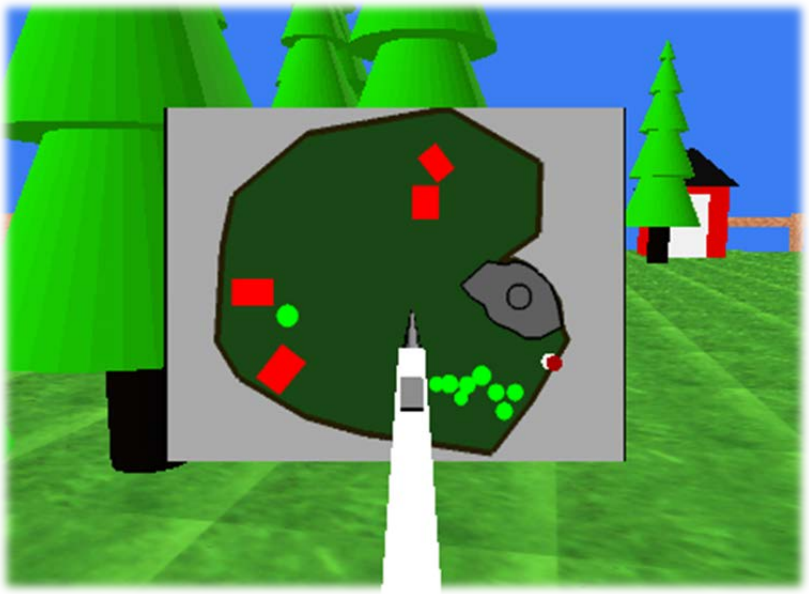


Target-Based Techniques

- Direct specification of destination
- A.k.a. Teleportation
- Techniques:
  - Point at target location on ground
  - Point at target object
  - Choose target from list
  - Enter coordinates
  - Use Map/WIM

Map-Based Travel Techniques

- User represented by icon on 2D map
- Drag icon with stylus to new location on map
- When released, viewpoint moves smoothly to new location



Manual Manipulation – Grabbing the Air Technique

- Use hand gestures to move yourself through the world
- Metaphor of pulling a rope
- Can be one-handed, but often a two-handed technique
- Works well with tracked gloves or Vive/Touch style controllers

Viewpoint Orientation Techniques

- Head tracking
- Orbital viewing
- Non-isomorphic rotation
- Virtual sphere (trackball)