CSE 165: 3D User Interaction

Lecture #9: Navigation

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Today's Research Papers

- Zach Johnson
  - Improving digital handoff using the space above the table
- Andrei Thompson
  - Tapping-In-Place: Increasing the naturalness of immersive walking-in-place locomotion through novel gestural input

Tuesday's Papers

- Kyler Schwartz
  - An evaluation of two simple methods for representing heaviness in immersive virtual environmentsl input
- Anurag Kalavakunta
  - Smelling screen: Technique to present a virtual odor source at an arbitrary position on a screen

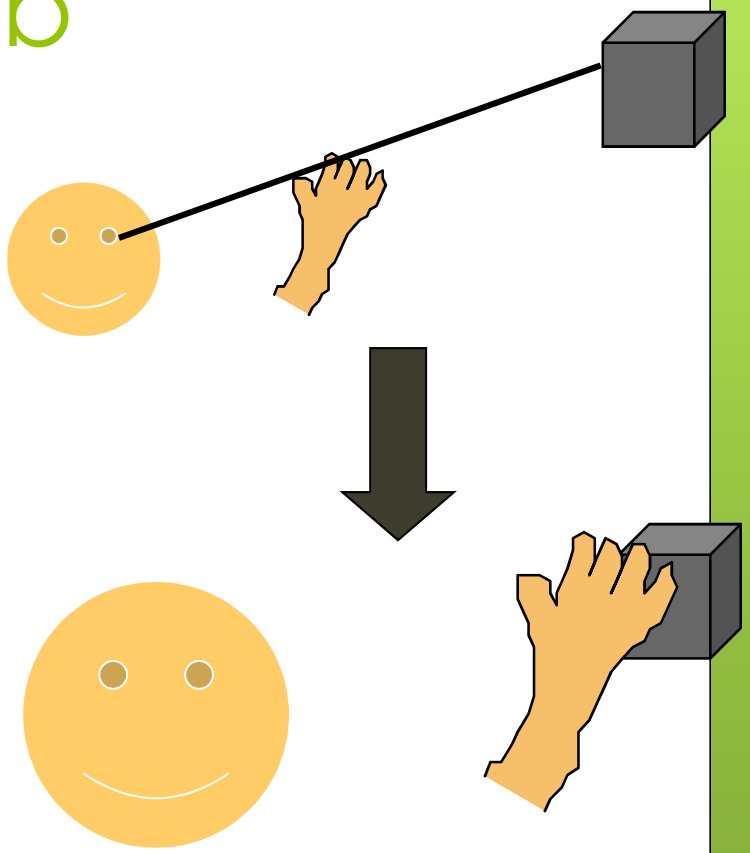
Announcements

- Homework assignment #2
  - Due tomorrow at 1:30pm in CSE lab 260
- Homework assignment #3
  - On-line by Saturday morning
  - Leap sign-out starts today after lecture
  - Due Friday, February 21st at 1:30pm in lab 260
  - Homework Q&A by Thinh on Wednesday, February 12th at 4pm in lab 260

More on Selection/Manipulation

Scaled-World Grab

- By Mine et al., 1997
- Often used with occlusion
- At selection, scale world down so that virtual hand touches selected object
- User initially does not notice a change in the image

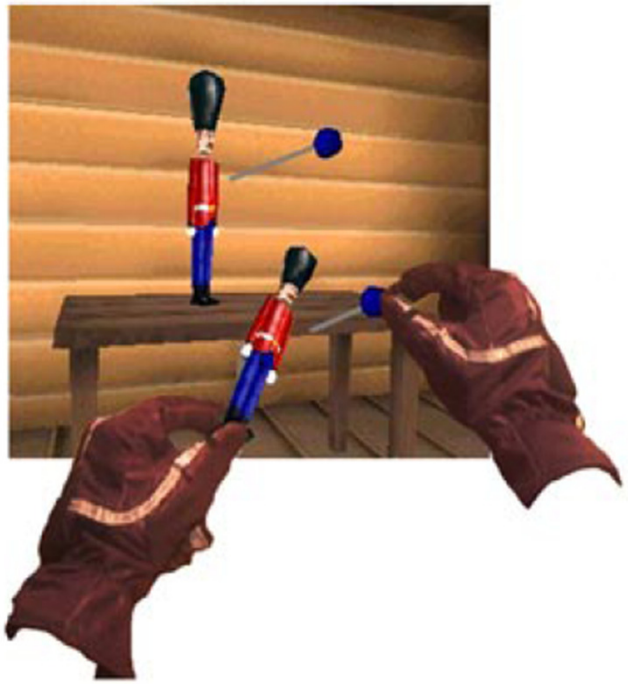


Forced Perspective

- Museum of Simulation Technology
  - http://www.youtube.com/watch?v=HOfll06X16c

Voodoo Dolls

- Pierce et al. 1999
- Two-handed technique
- Builds upon image plane and WIM techniques
- Developed for pinch gloves
- Creates copies of objects (dolls) for manipulation
- Non-dominant hand: stationary frame of reference
- Dominant hand: defines position and orientation



Navigation

Wayfinding – Cognitive Component

Travel – Motor Component

Wayfinding

- Cognitive process of defining a path through an environment
  - use and acquire spatial knowledge
  - aided by natural and artificial cues
- Common activity in our daily lives
- Often unconscious activity (except when we are lost)

Information for the Wayfinding Task

- Landmarks
- Signs
- Maps
- Directional information

Transferring Spatial Knowledge

- Want to transfer knowledge to the real world
  - training
  - planning
- Navigation through complex environments to support other tasks

Wayfinding in 3DUIs

- Difficult problem
- Differences between wayfinding in real world and virtual world
  - unconstrained movement
  - absence of physical constraints
  - lack of realistic motion cues
- 3DUIs can provide a wealth of information

Wayfinding and Travel

- Exploration
  - browsing environment
  - useful in building cognitive map
- Search
  - spatial knowledge acquired and used
  - naïve search – not enough info in cognitive map
  - primed search – use of cognitive map defines success
- Maneuvering
  - uses very little of cognitive map

Wayfinding and Spatial Knowledge

- Landmark knowledge
  - visual characteristics of environment
  - shape, size, and texture
- Procedural knowledge
  - sequence of actions required to follow a path
  - requires sparse visual information
- Survey knowledge
  - topographical knowledge
  - object location/distance/orientation

Egocentric and Exocentric Reference Frames

- Egomotion – feeling we are the center of space
- Egocentric – first person
  - relative to human body
- Exocentric – third person
  - relative to world
- Build up exocentric representation of world
  - survey knowledge
- Use egocentric when exploring for first time
  - landmark/procedural knowledge

User-Centered Wayfinding Support (1)

- Field of view
  - small FOV can inhibit wayfinding
    - user requires repetitive head movements
    - lack of optical flow in periphery
- Motion cues
  - enable judgment of depth and direction
  - supports backtracking of user's own movement
  - cue conflicts can hinder cognitive map development
- Multisensory Output
  - audio
  - Tactile maps

Tactile Map

User-Centered Wayfinding Support (2)

- Presence (feeling of "being there")
  - assumed to have impact on spatial knowledge
  - closer to real world
- Search strategies