

3D User Interface Wayfinding Techniques

Lecture #10: Navigation II – Wayfinding
Spring 2009
Joseph J. LaViola Jr.

Spring 2009

CAP6938 – 3D User Interfaces for Games and Virtual Reality

©Joseph J. LaViola Jr.

Universal 3D Interaction Tasks

- **Navigation**
 - Travel – motor component
 - **Wayfinding – cognitive component**
- Selection
- Manipulation
- System control
- Symbolic input

Spring 2009

CAP6938 – 3D User Interfaces for Games and Virtual Reality

©Joseph J. LaViola Jr.

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 (not 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

Spring 2009

CAP6938 – 3D User Interfaces for Games and Virtual Reality

©Joseph J. LaViola Jr.

Wayfinding in 3DUIs

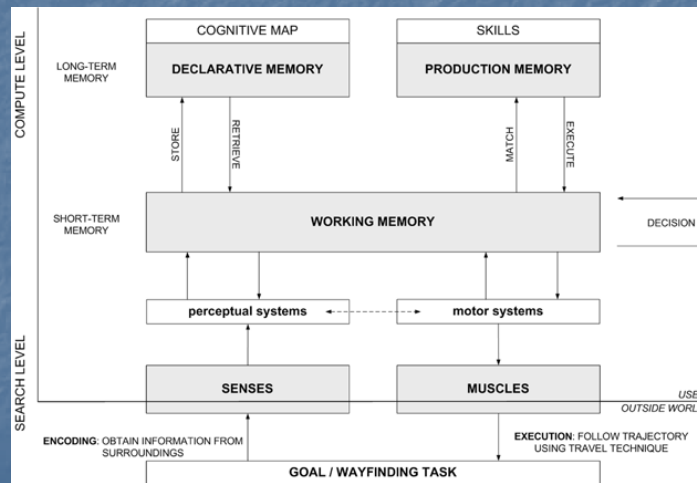
- Difficult problem
- Differences between wayfinding in real world and virtual world
 - unconstrained movement
 - absence of physical constraints
 - lack of realistic motion cues
- 3DUIs can provide a wealth of information

Spring 2009

CAP6938 – 3D User Interfaces for Games and Virtual Reality

©Joseph J. LaViola Jr.

Wayfinding as Decision Making Process



Spring 2009

CAP6938 – 3D User Interfaces for Games and Virtual Reality

©Joseph J. LaViola Jr.

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

Spring 2009

CAP6938 – 3D User Interfaces for Games and Virtual Reality

©Joseph J. LaViola Jr.

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

Spring 2009

CAP6938 – 3D User Interfaces for Games and Virtual Reality

©Joseph J. LaViola Jr.

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

Spring 2009

CAP6938 – 3D User Interfaces for Games and Virtual Reality

©Joseph J. LaViola Jr.

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 dead reckoning (backtracking of user's own movement)
 - cue conflicts can hinder cognitive map development
- Multisensory Output
 - audio
 - Tactile maps

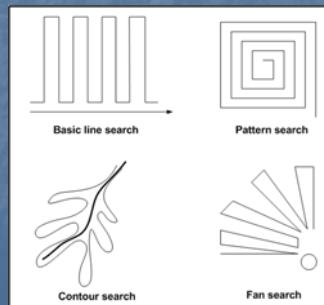
Spring 2009

CAP6938 – 3D User Interfaces for Games and Virtual Reality

©Joseph J. LaViola Jr.

User-Centered Wayfinding Support (2)

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



Spring 2009

CAP6938 – 3D User Interfaces for Games and Virtual Reality

©Joseph J. LaViola Jr.

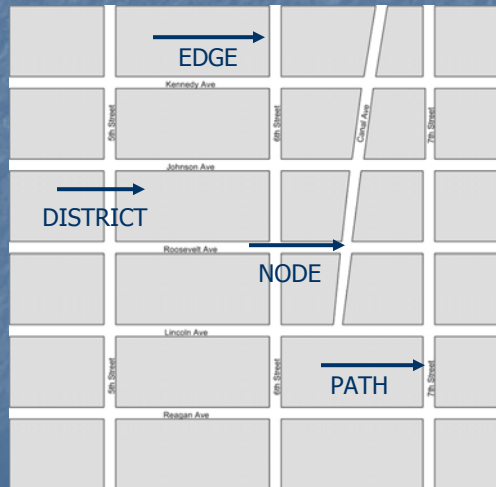
Environment-Centered Wayfinding Support

- Environmental design
- Artificial aids

Environmental Design (1)

- World's structure and format can aid in wayfinding
- Legibility techniques
 - divide large scale environment into parts with distinct character
 - create simple spatial organization
 - include directional cues to support egocentric/exocentric reference frames
 - often repetitive

Environmental Design (2)



Spring 2009

CAP6938 – 3D User Interfaces for Games and Virtual Reality

©Joseph J. LaViola Jr.

Environmental Design (3)

- Natural environment
 - horizon, atmospheric color, fog, etc...
- Architectural design
 - lighting
 - closed and open spaces
- Color and texture

Spring 2009

CAP6938 – 3D User Interfaces for Games and Virtual Reality

©Joseph J. LaViola Jr.

Artificial Cues

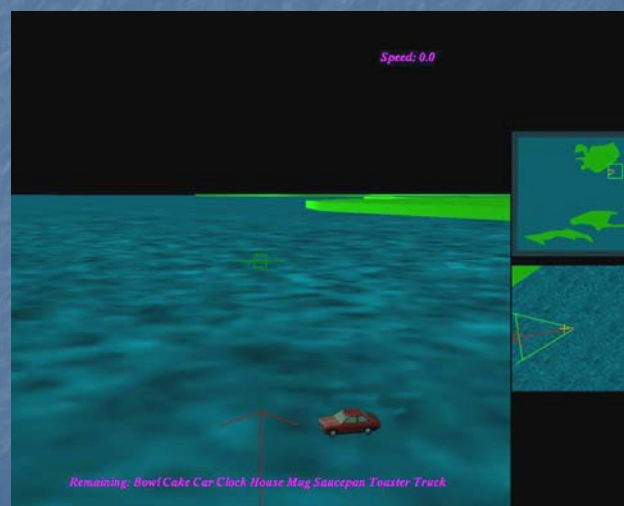
- Maps
- Compasses
- Signs
- Reference objects
- Artificial landmarks
- Trails

Spring 2009

CAP6938 – 3D User Interfaces for Games and Virtual Reality

©Joseph J. LaViola Jr.

Maps (1)

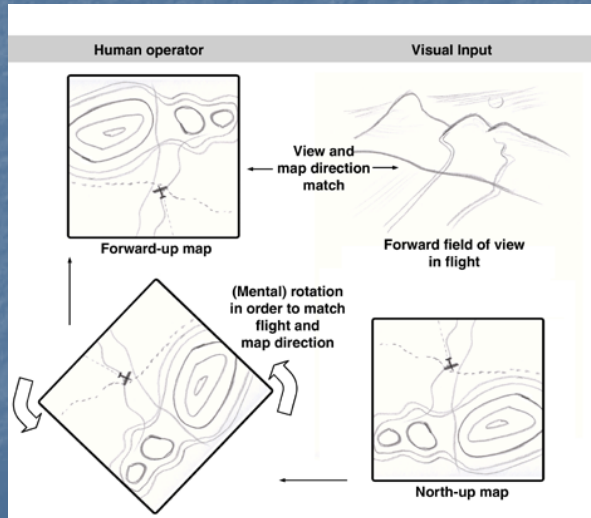


Spring 2009

CAP6938 – 3D User Interfaces for Games and Virtual Reality

©Joseph J. LaViola Jr.

Maps (2)



Spring 2009

CAP6938 – 3D User Interfaces for Games and Virtual Reality

©Joseph J. LaViola Jr.

Maps (3)

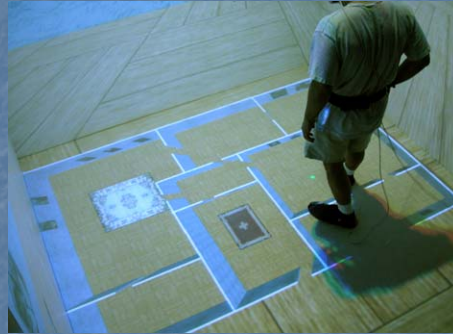


Spring 2009

CAP6938 – 3D User Interfaces for Games and Virtual Reality

©Joseph J. LaViola Jr.

Maps (4)

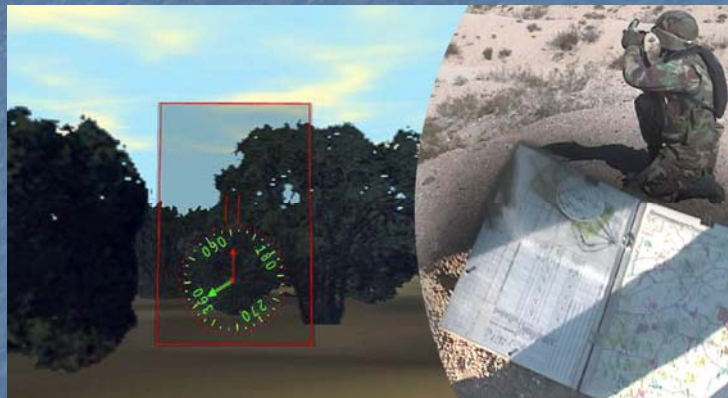


Spring 2009

CAP6938 – 3D User Interfaces for Games and Virtual Reality

©Joseph J. LaViola Jr.

Compasses

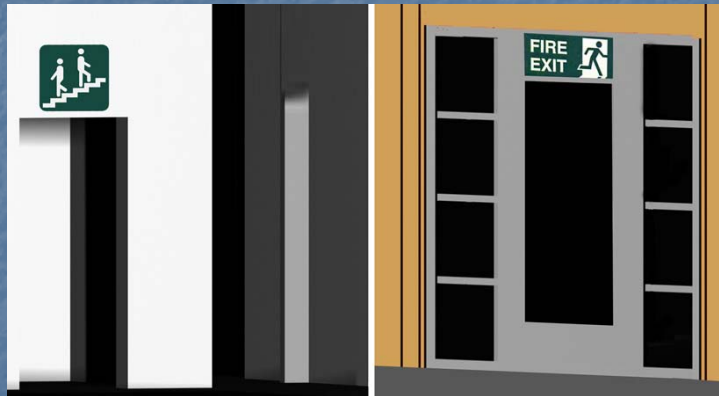


Spring 2009

CAP6938 – 3D User Interfaces for Games and Virtual Reality

©Joseph J. LaViola Jr.

Signs



Spring 2009

CAP6938 – 3D User Interfaces for Games and Virtual Reality

©Joseph J. LaViola Jr.

Reference Objects

- Objects that have well known size
 - chair, human figure, etc...
- Useful to estimate distances

Spring 2009

CAP6938 – 3D User Interfaces for Games and Virtual Reality

©Joseph J. LaViola Jr.

Artificial Landmarks

- Local – help users in decision making processes
- Global – seen from any location



Spring 2009

CAP6938 – 3D User Interfaces for Games and Virtual Reality

©Joseph J. LaViola Jr.

Trails

- Help user retrace steps
- Show what parts have been visited

Spring 2009

CAP6938 – 3D User Interfaces for Games and Virtual Reality

©Joseph J. LaViola Jr.

Next Class

- System Control
- Readings
 - 3DUI Book – Chapter 7