



CSE 165: 3D User Interaction

Lecture #10: Wayfinding

Announcements

- Homework Assignment #2 due tomorrow at 2pm
 - Grading in VR lab B210
- Monday 4pm: Homework discussion for assignment #3

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

Wayfinding in Virtual Worlds

- Issues with wayfinding in virtual world compared to real world:
 - Less constrained movement
 - 6 DOF possible
 - Absence of physical constraints
 - No fundamental limitations by vehicle or environment
 - Lack of physical motion cues
 - User's motion in physical space does not match motion in virtual space

Wayfinding in Virtual Worlds

- Advantages of wayfinding in virtual worlds:
 - Potential to provide much more information
 - Distractions have less severe consequences



Objectives for Wayfinding

- Exploration

- browse environment
- useful to build cognitive map

- Search

- spatial knowledge acquired and used
- naïve search – not enough info in cognitive map
- primed search – use of cognitive map

Useful Spatial Knowledge

- Landmark knowledge
 - visual characteristics of environment
 - shape, size, texture
 - relative positioning
- Procedural knowledge
 - sequence of actions required to follow a path (eg, turn by turn directions)
 - requires only sparse visual information
- Survey knowledge
 - maps
 - topographical knowledge

Egocentric and Exocentric Reference Frames

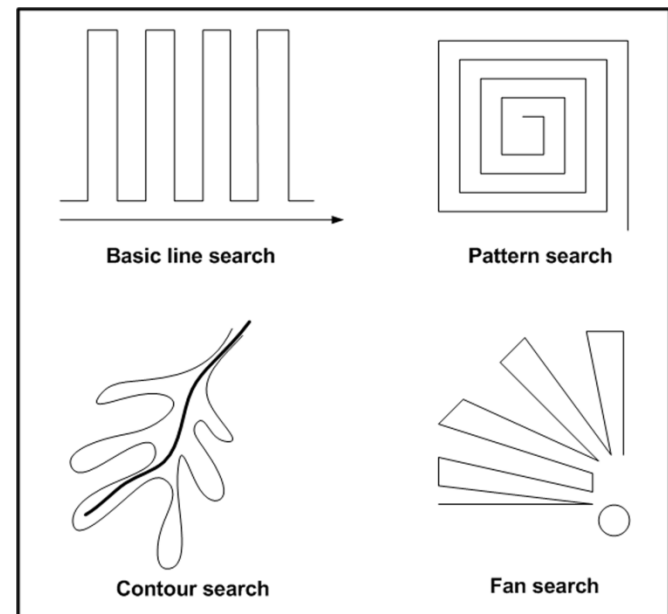
- Egocentric – first person
 - viewpoint in reference frame of human body
- Exocentric – third person
 - viewpoint in reference frame of world
- We use egocentric when exploring for first time
 - creates landmark/procedural knowledge
- Repeated wayfinding builds up exocentric representation of world
 - creates survey knowledge

User-Centered Wayfinding Support

- Large field of view desirable
 - small FOV can inhibit wayfinding
 - especially with HMDs
 - 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 (physical vs. virtual) can hinder cognitive map development

User-Centered Wayfinding Support

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



Environment-Centered Wayfinding Support

- Environmental design
- Artificial aids

Environmental Design

- 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

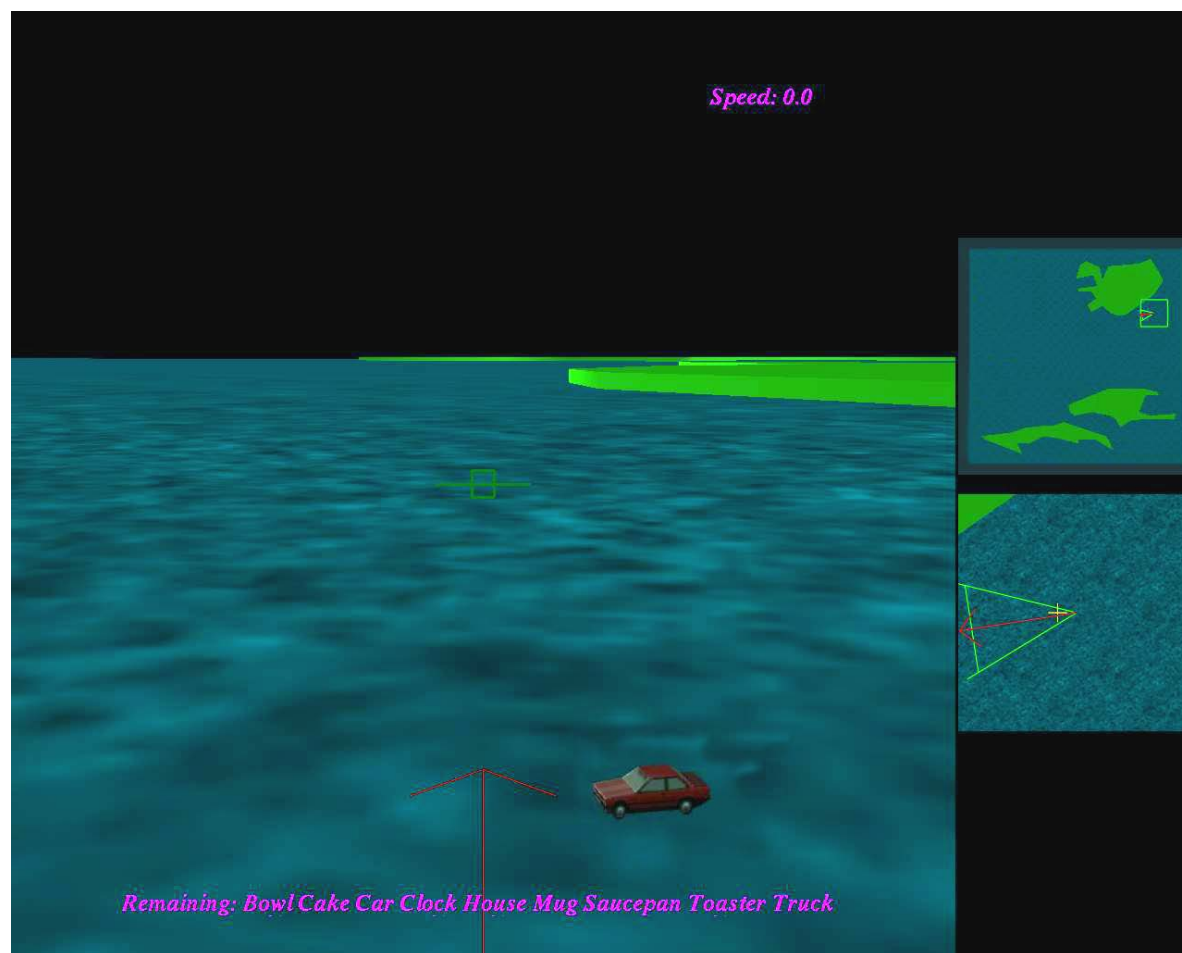
Environmental Design

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

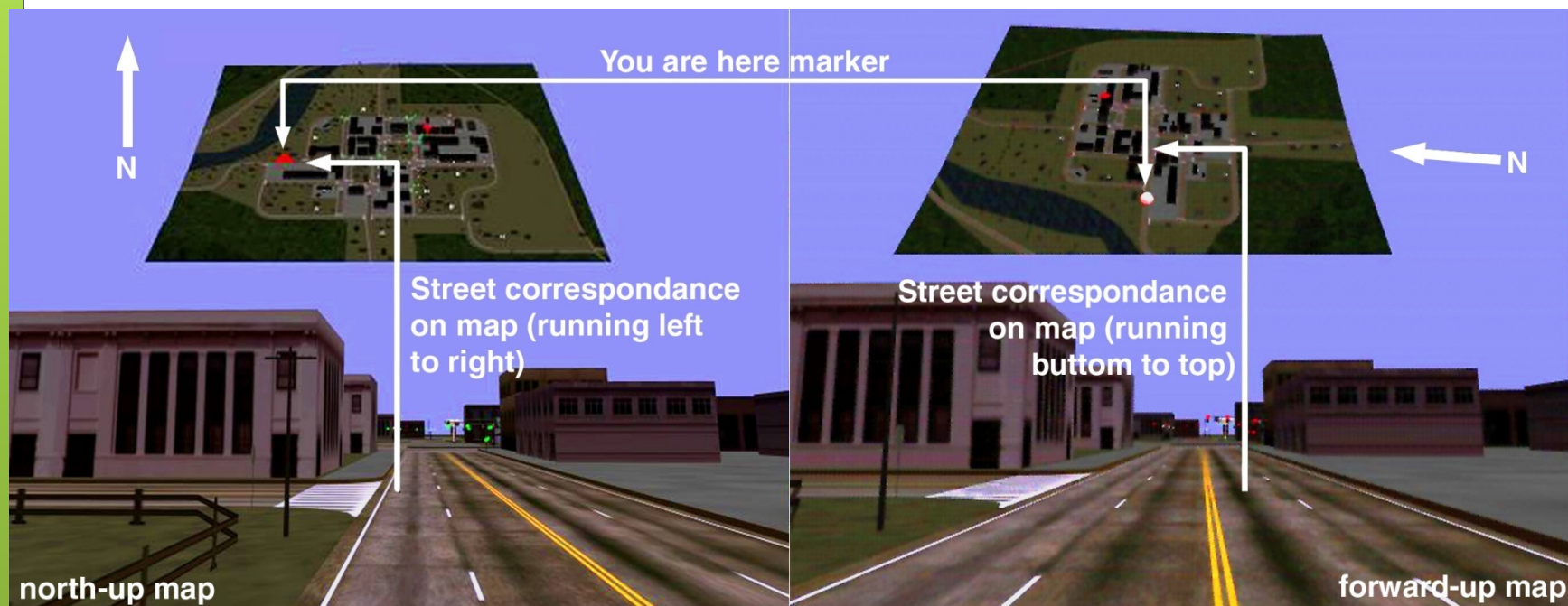
Artificial Cues

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

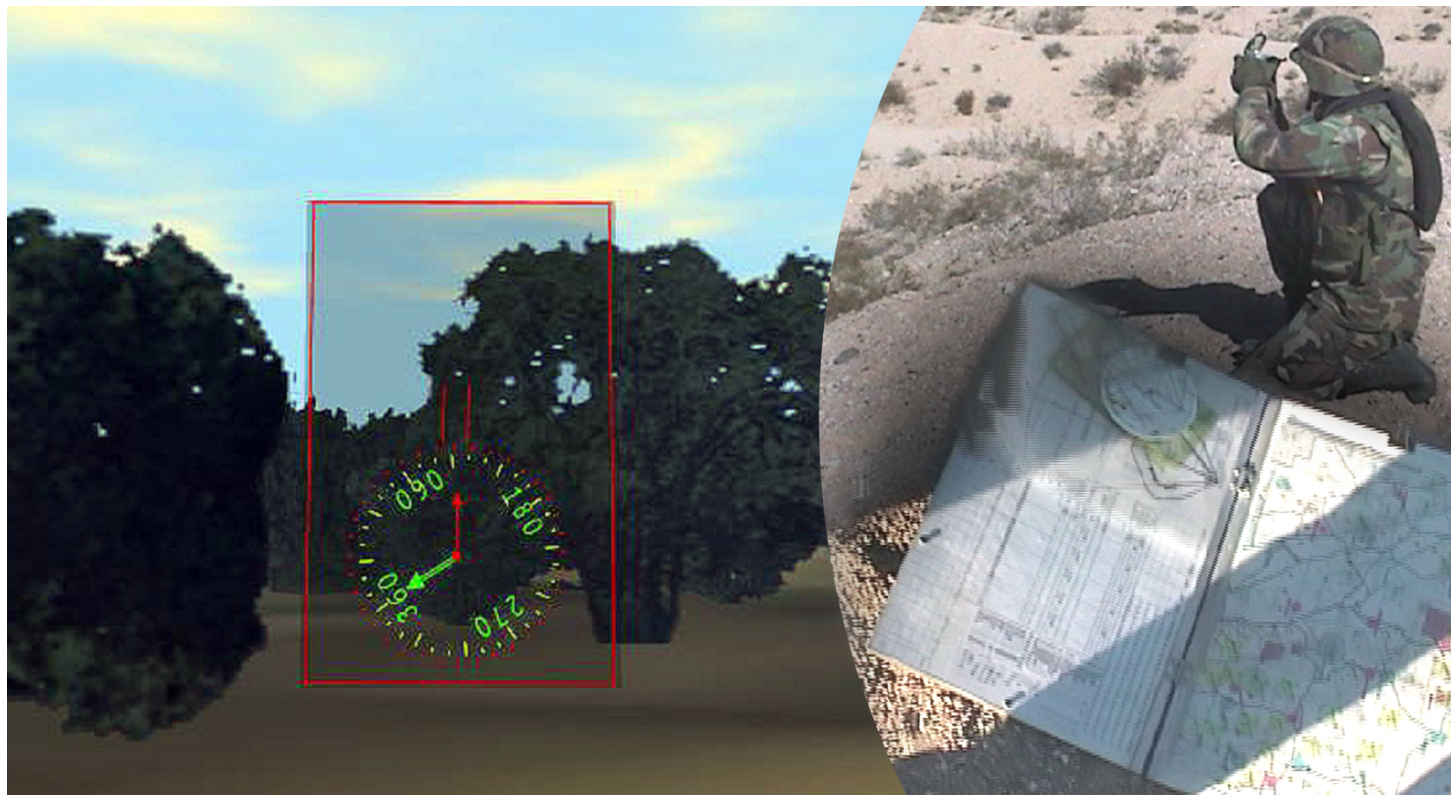
Maps



North Up vs. Forward Up



Compass



Signs



Reference Objects

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

Artificial Landmarks

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

Trails

- Aka. Hansel and Gretel's bread crumbs
- Help user retrace steps
- Show what parts have been visited