



CSE 165: 3D User Interaction

Lecture #8:
Wayfinding

Announcements

- Homework Assignment #3
 - Due next Friday at 2pm
 - Homework discussion next Monday at 6pm

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)

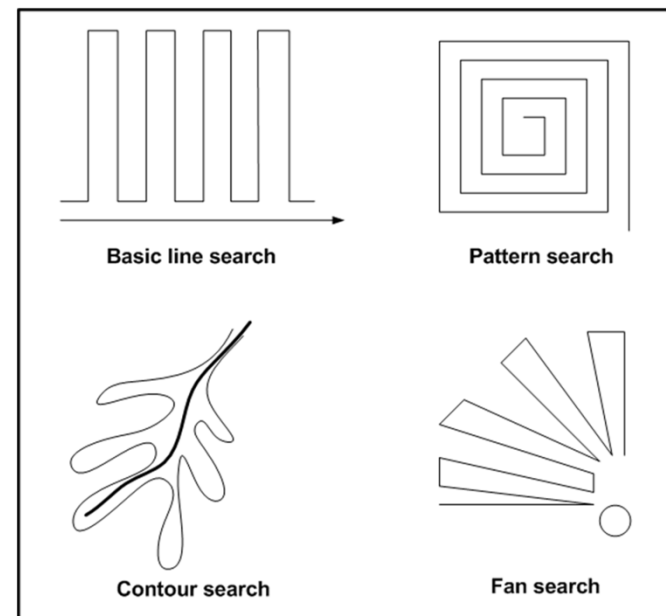
- Field of view
 - small FOV can inhibit wayfinding
 - user requires repetitive head movements
 - lack of optical flow in periphery
- Motion cues
 - enable judgment of depth and direction
 - supports backtracking of user's own movement
 - cue conflicts can hinder cognitive map development
- Multisensory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



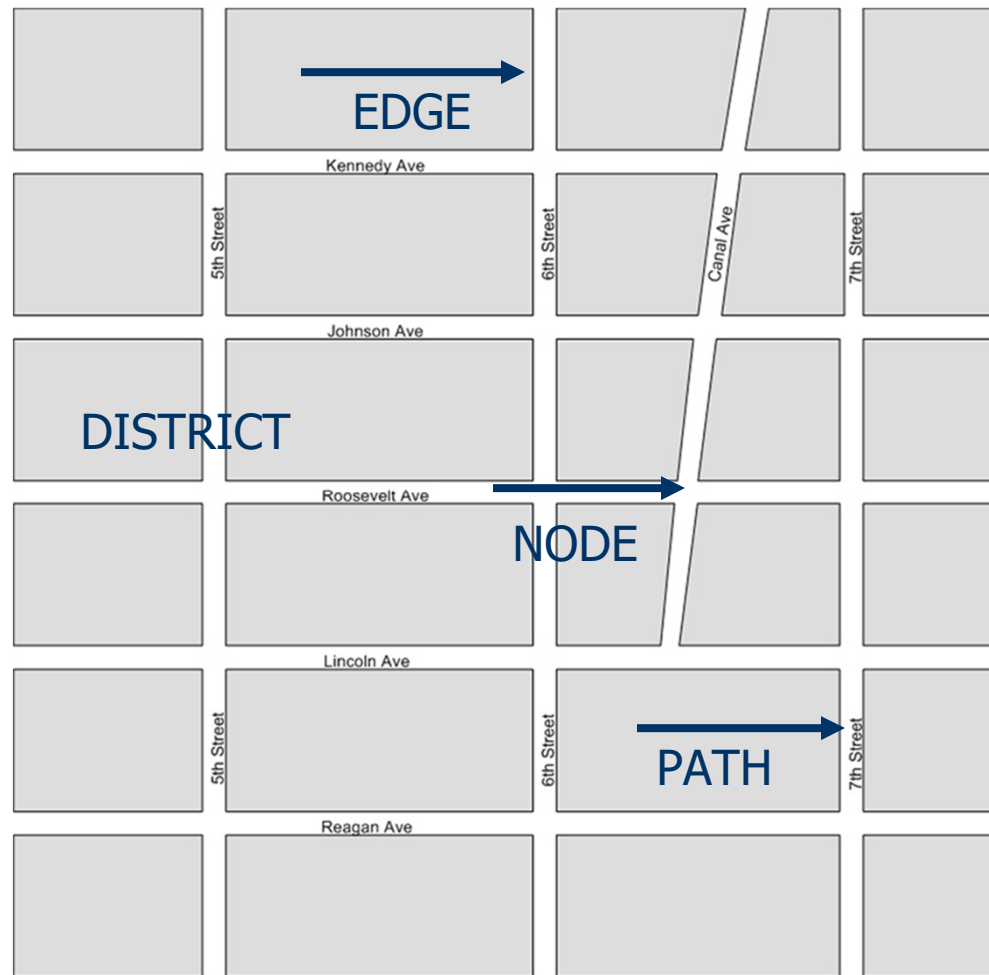
Environment-Centered Wayfinding Support

- 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)



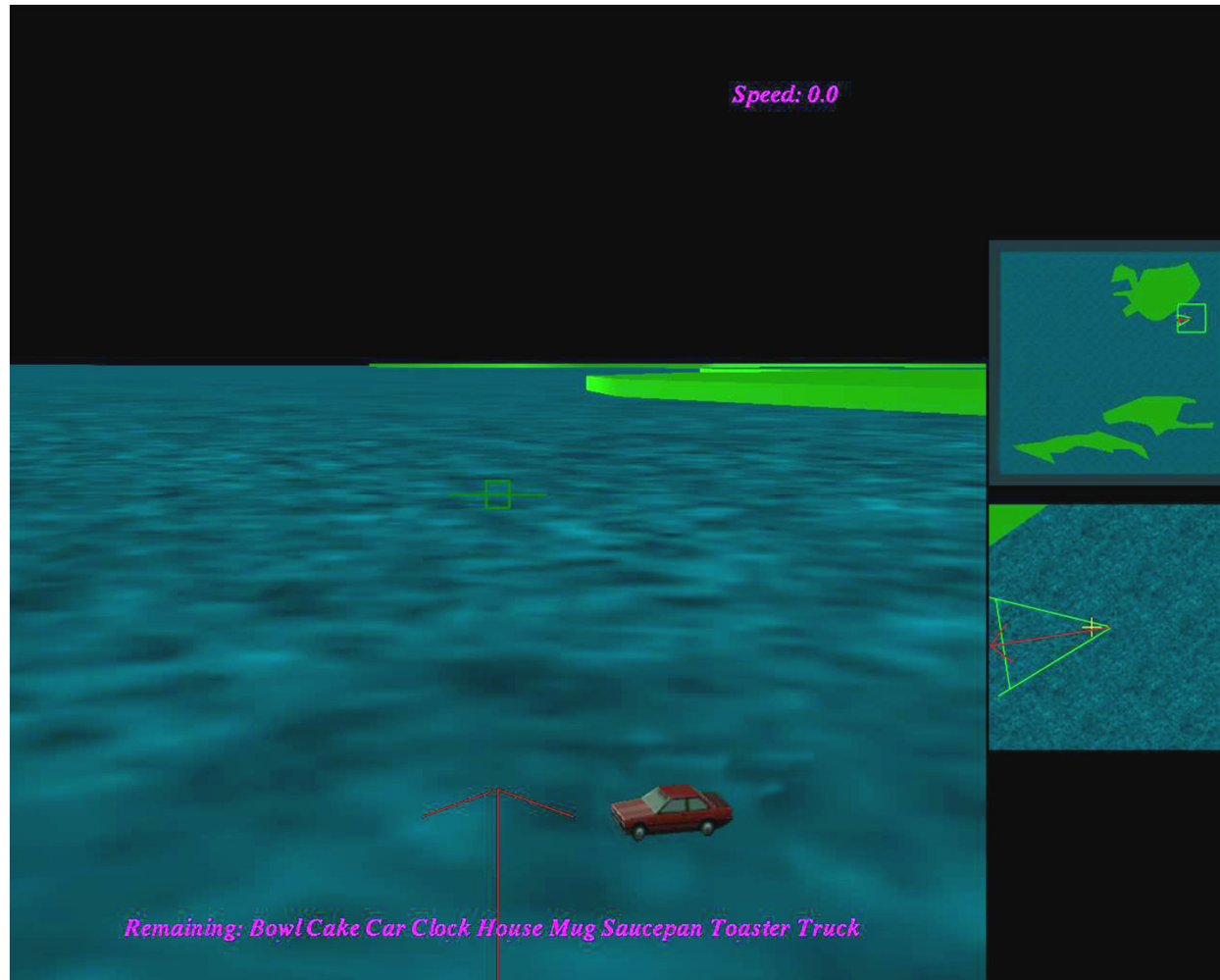
Environmental Design (3)

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

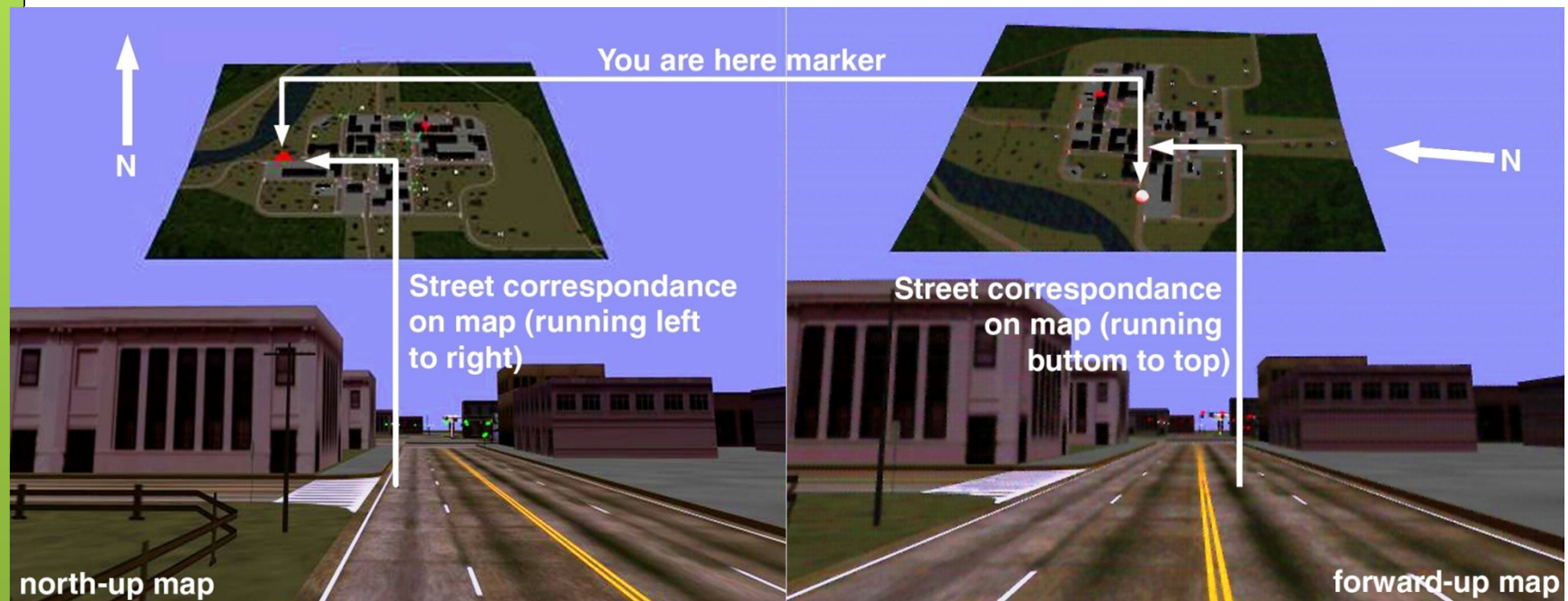
Artificial Cues

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

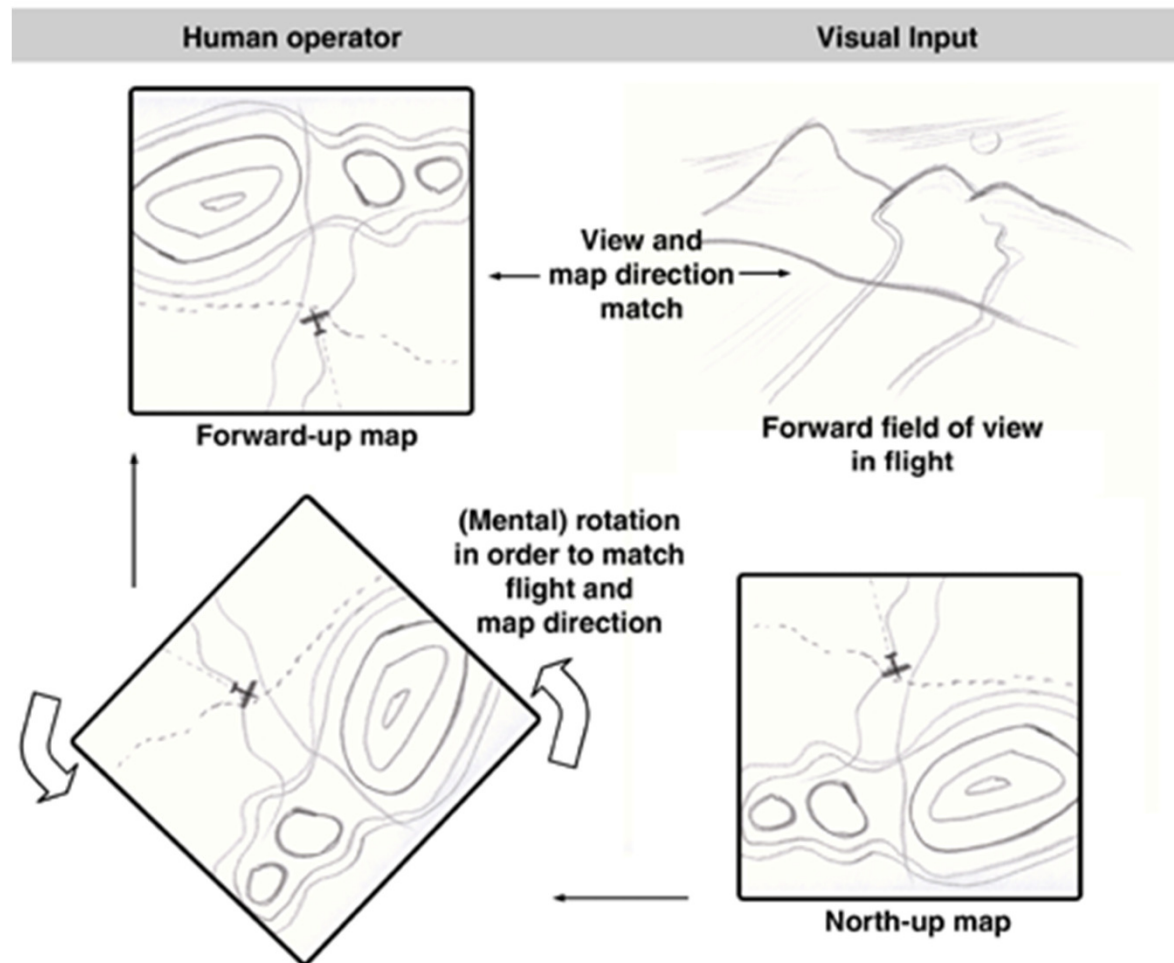
Maps (1)



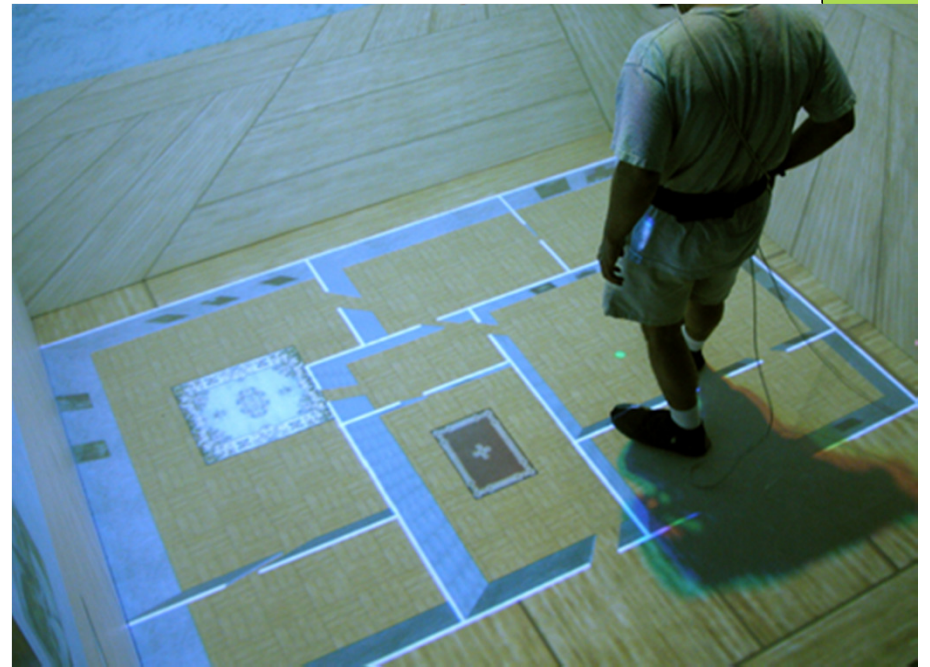
Maps (3)



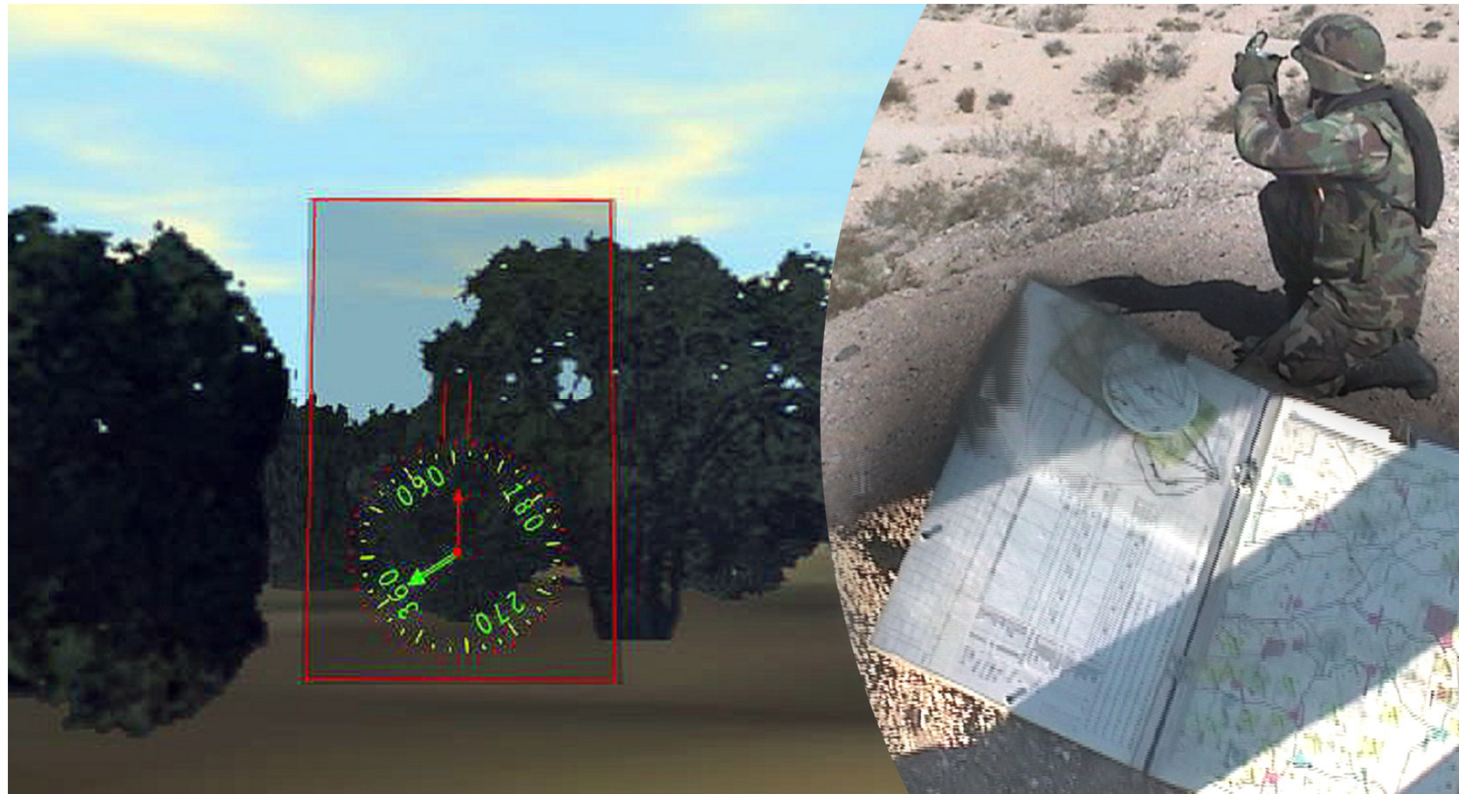
Maps (2)



Maps (4)



Compasses



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

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