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

Basic line search   Pattern search

Contour search   Fan search
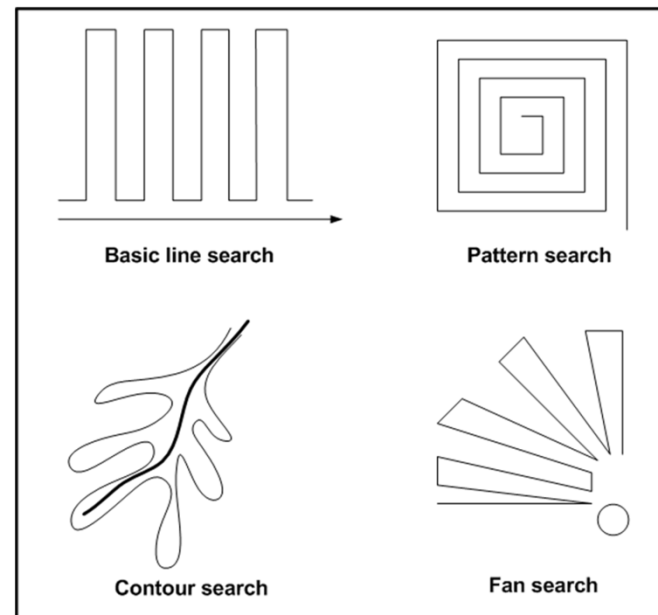
3D UI With the Leap

- Selection
  - Hover w/timeout
  - Trigger with non-dominant hand gesture
  - Two finger near-pinch
- Manipulation
  - Hand orientation
  - 3-finger orientation
  - 2-finger orientation (2 DOF)

Menus

- Hover over buttons
- Leap API-Supported gestures:
  - Rotate
  - Swipe

General Tips

- Finger pinches hard to detect
- More than 3 fingers hard to distinguish
- Fingers hard to distinguish when hand not close to horizontal
- Hand detection (left/right): need to bring hands into FOV from back edge
- Options for camera motion: rotate around circle, set with non-dominant hand, map orientation of non-dominant hand
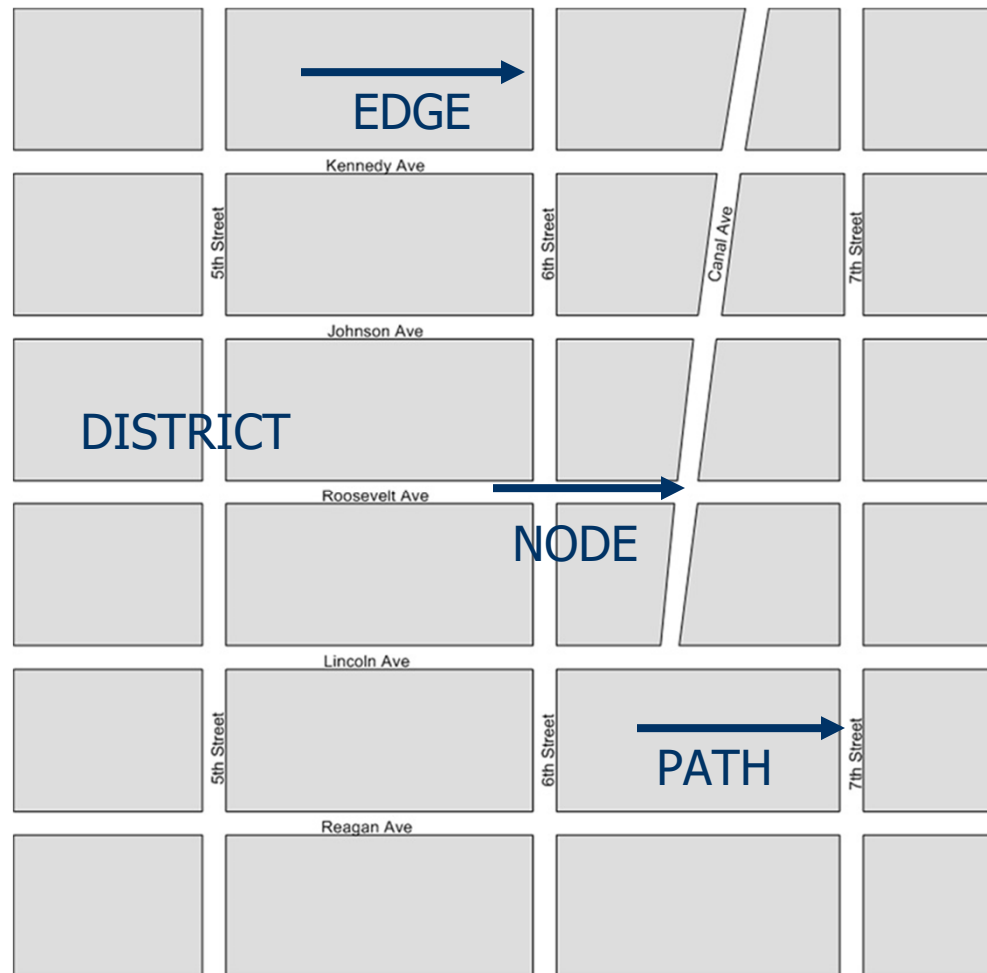
Environment-Centered Wayfinding Support

- 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
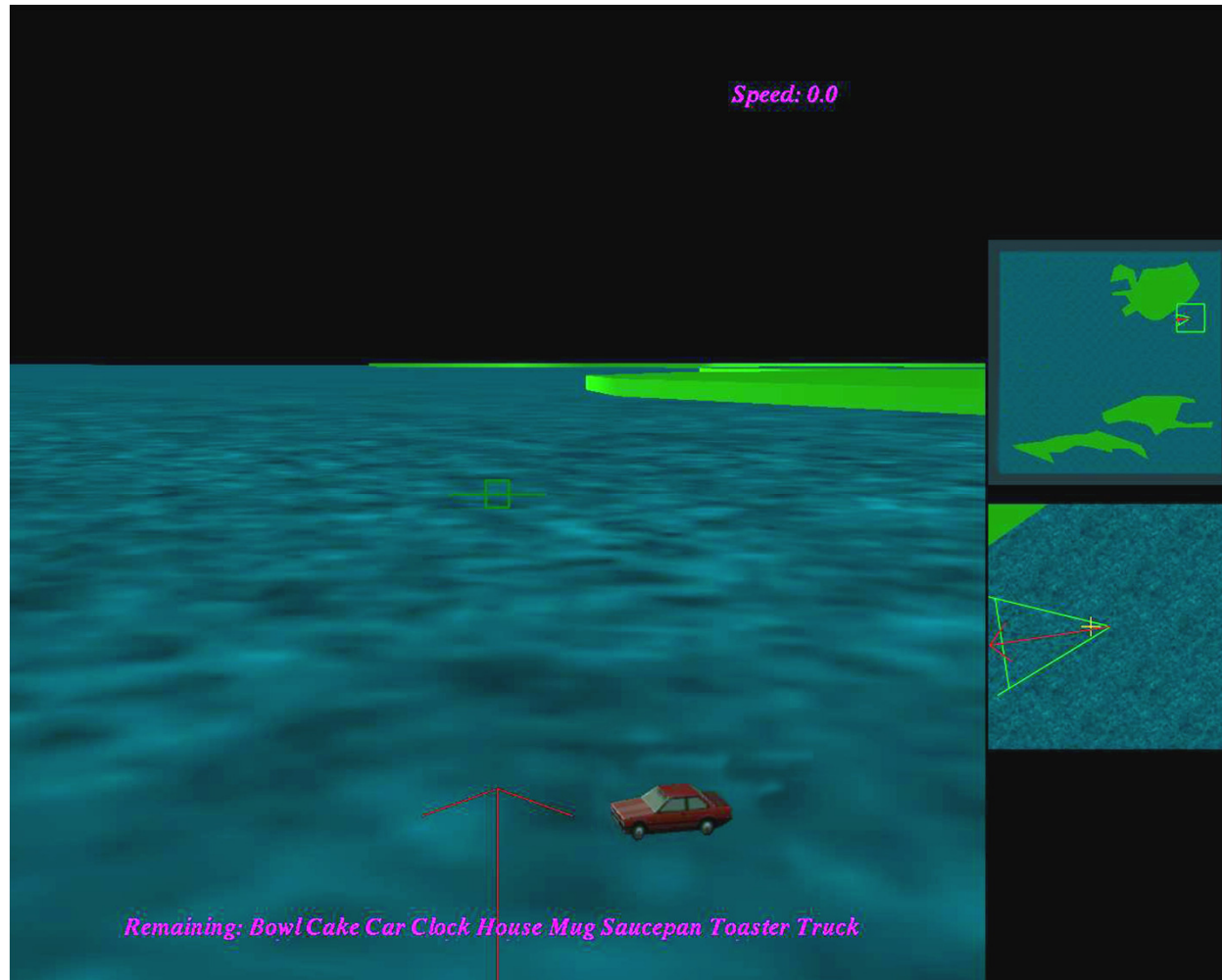 - often repetitive

Environmental Design (2)

EDGE

Kennedy Ave

5th Street   6th Street   Canal Ave   7th Street

Johnson Ave

DISTRICT

Roosevelt Ave

NODE

Lincoln Ave

5th Street   6th Street   7th Street

PATH

Reagan Ave

Environmental Design (3)

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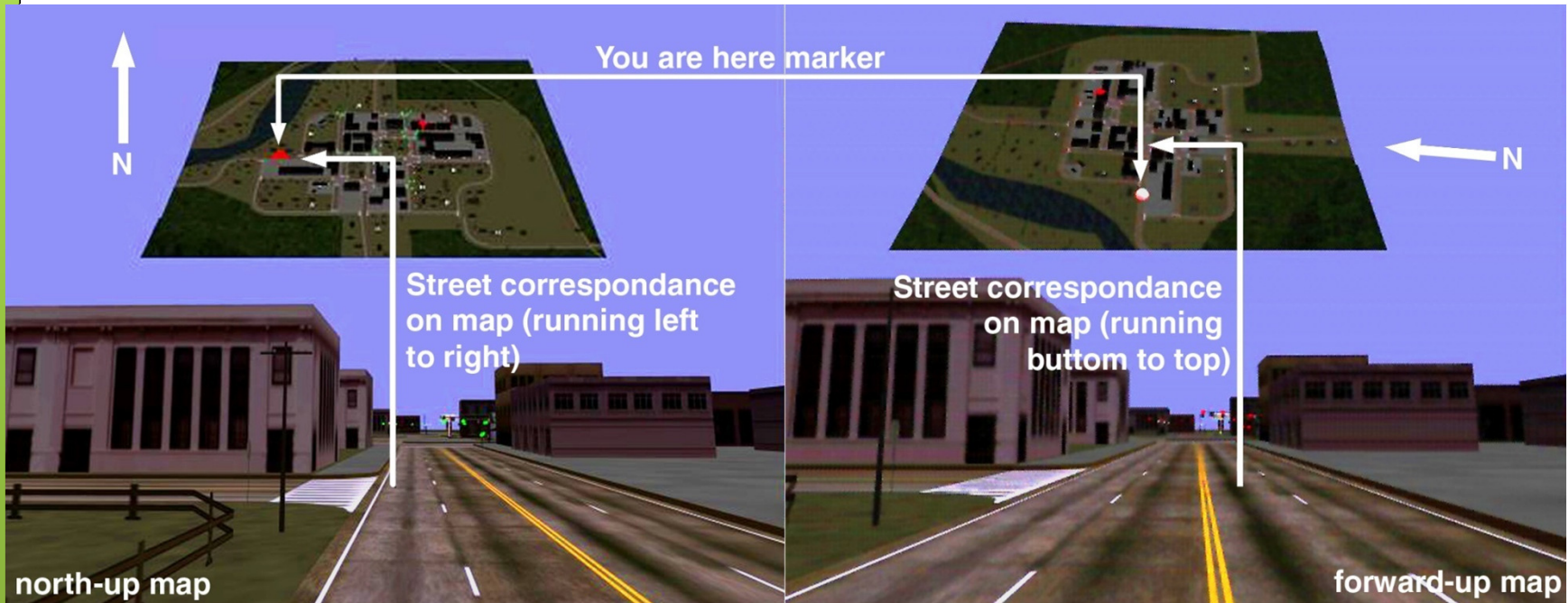 - lighting
  - closed and open spaces
- Color and texture

Artificial Cues

- Maps
- Compasses
- Signs
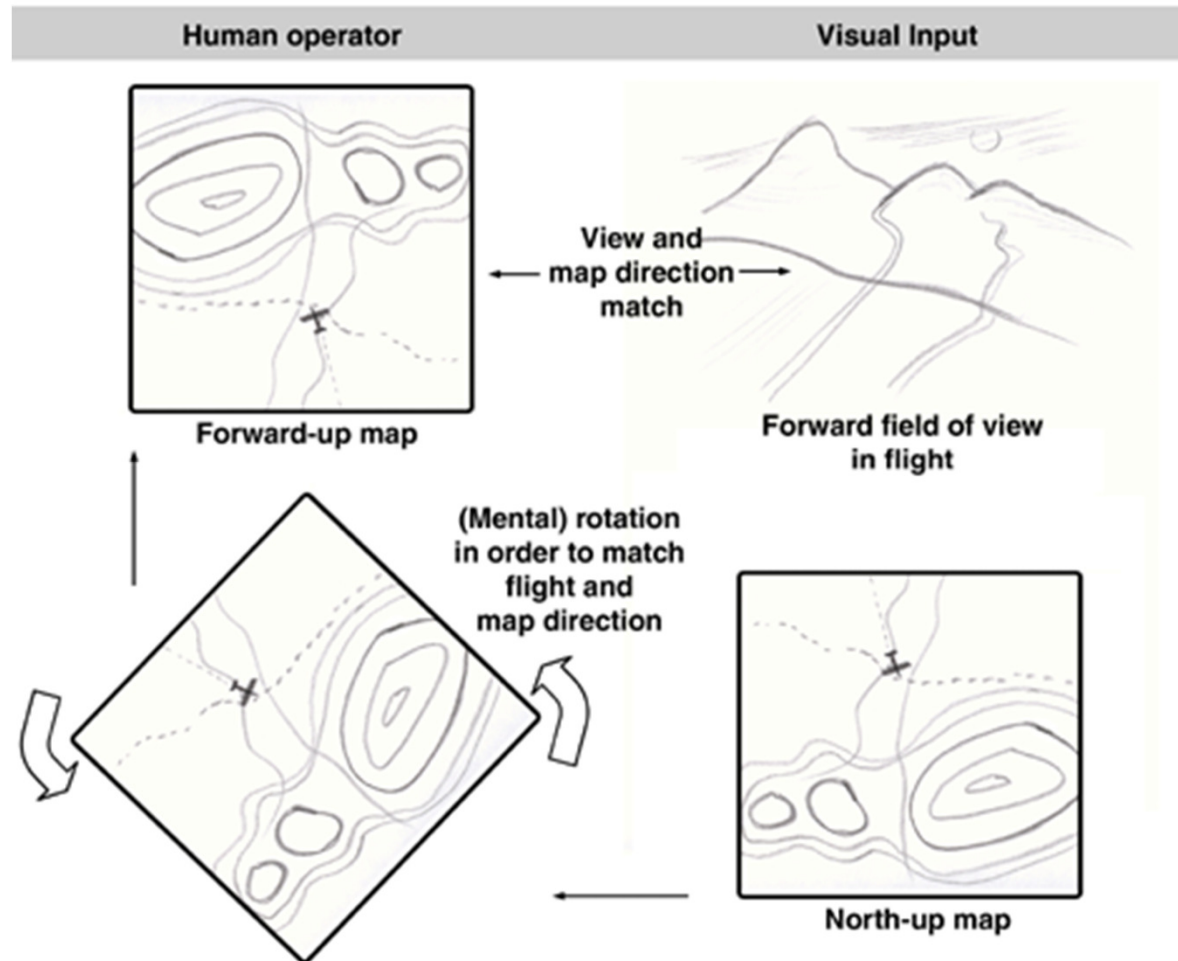- Reference objects
- Artificial landmarks
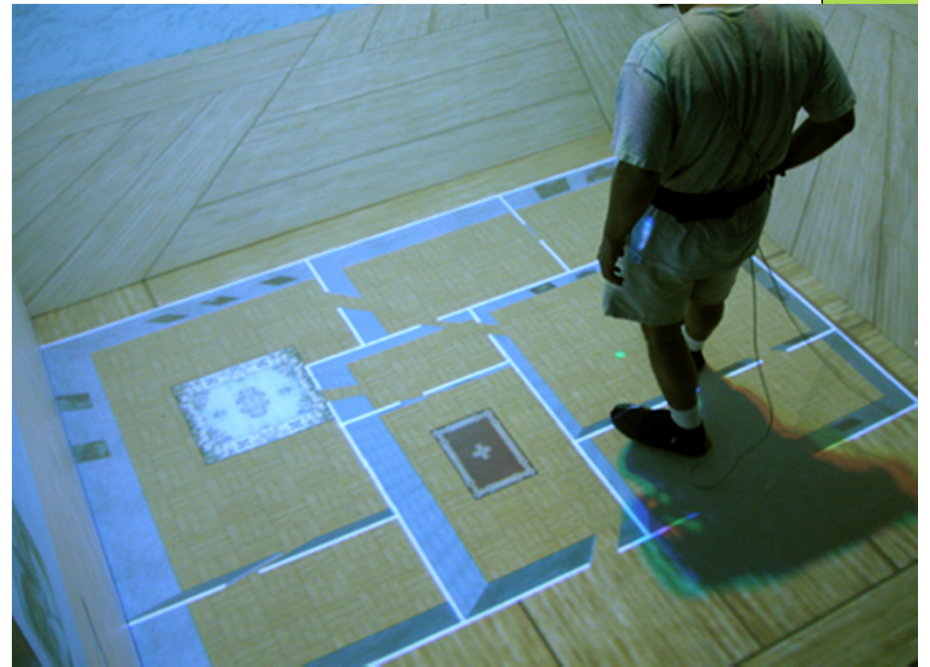- Trails
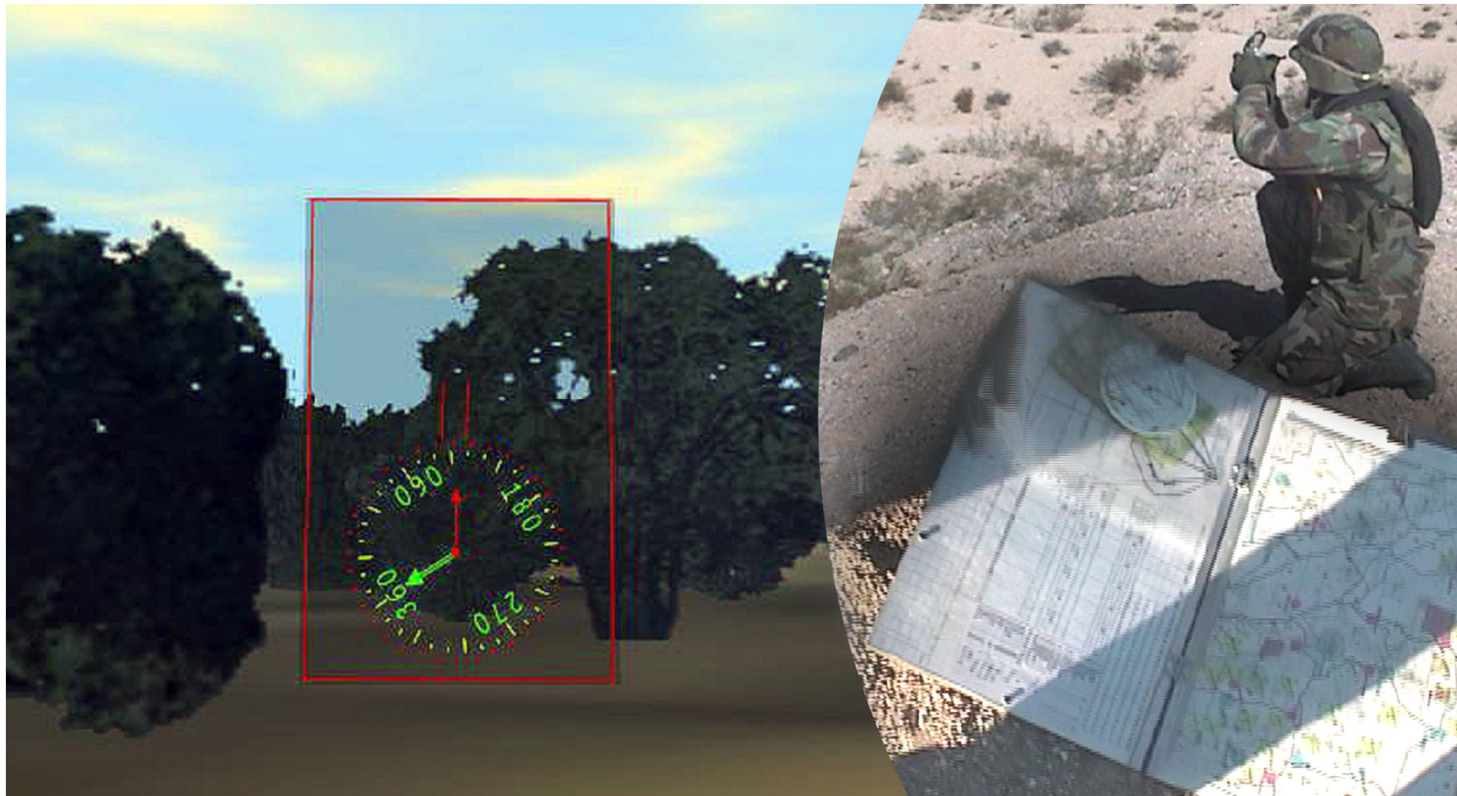
Maps (1)

Maps (3)

north-up map

forward-up map

You are here marker

Street correspondance on map (running left to right)

Street correspondance on map (running buttom to top)

N

N

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

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