CSE 165: 3D User Interaction

Lecture 6: Wayfinding

Announcements

- Sunday, January 24th at 11:59pm:
  - Homework Project 1 due
- Sunday, January 31st at 11:59pm:
  - Late deadline for project 1
- Sunday, February 7th at 11:59pm:
  - Homework project 2 due

3D UI Presentations

- Patrick Pajarillaga
  - VR in focus: The first foveated light-field Virtual Reality experience by CREAL
- Dayyan Sisson
  - 360 VR Design in Adobe Xd | DraftXR | Design Weekly

Navigation

- Navigation = Wayfinding + Travel
  - Wayfinding: Cognitive Component
  - Travel: Motor Component

Today's Focus: 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

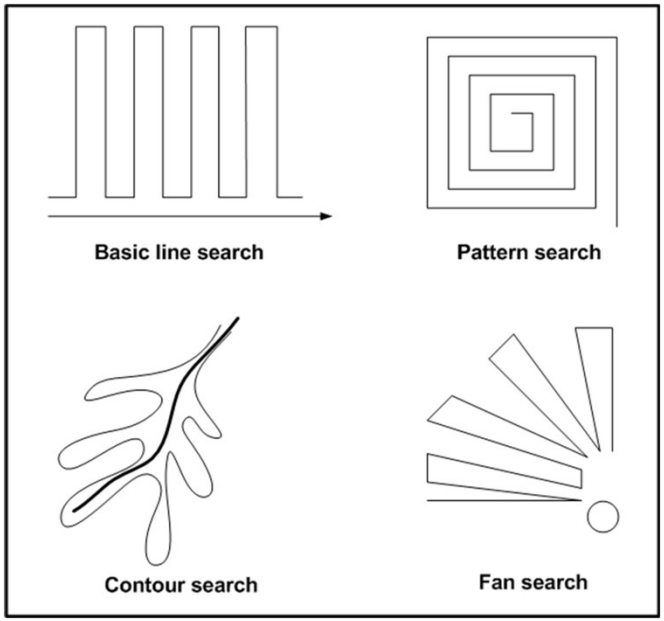
- Egocentric – first person
  - viewpoint in reference frame of human body
- Exocentric – third person
  - viewpoint in reference frame of world
- We use egocentric when exploring for first time
  - creates landmark/procedural knowledge
- Repeated wayfinding builds up exocentric representation of world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

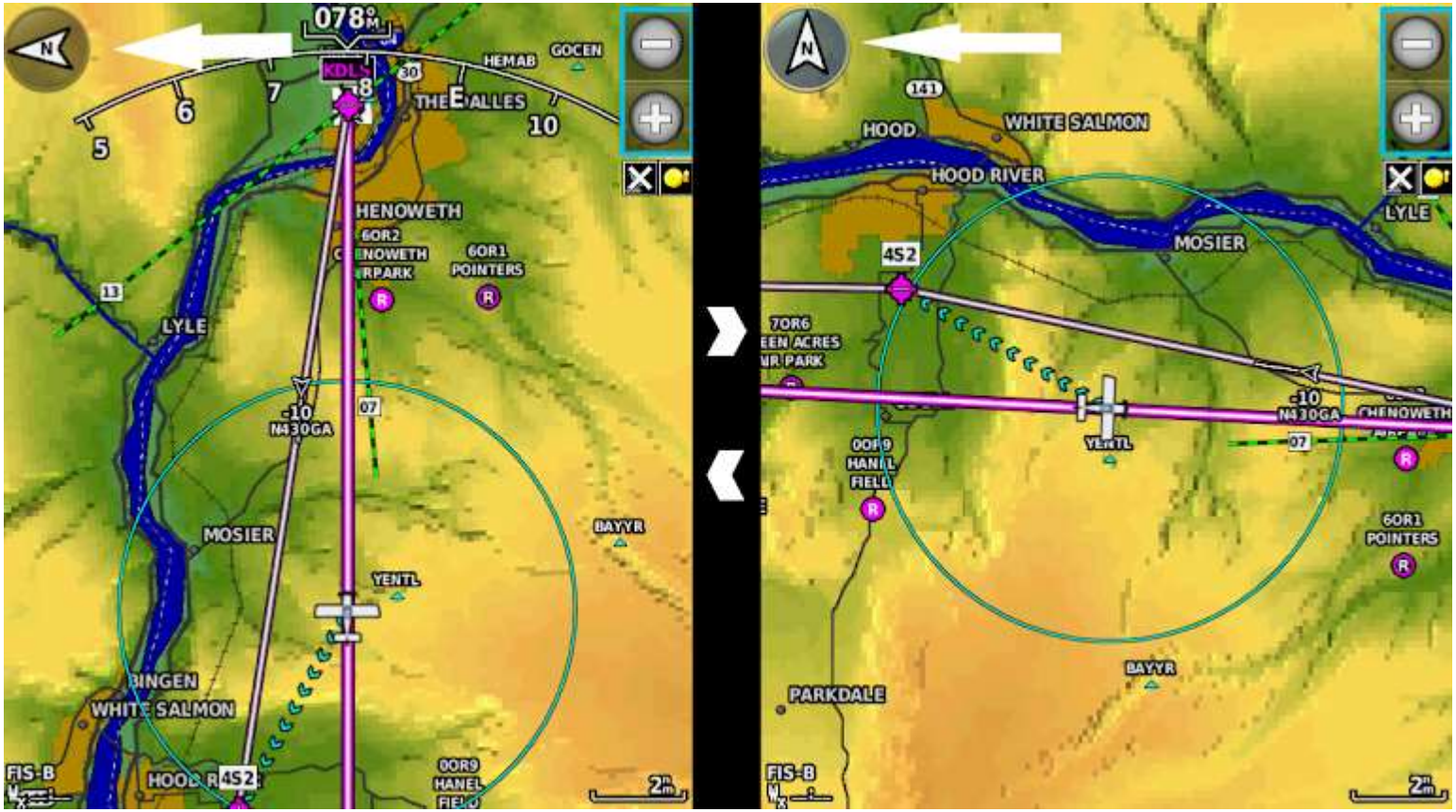
Maps


National Elevation Data Set Shaded Relief of the United States
USGS

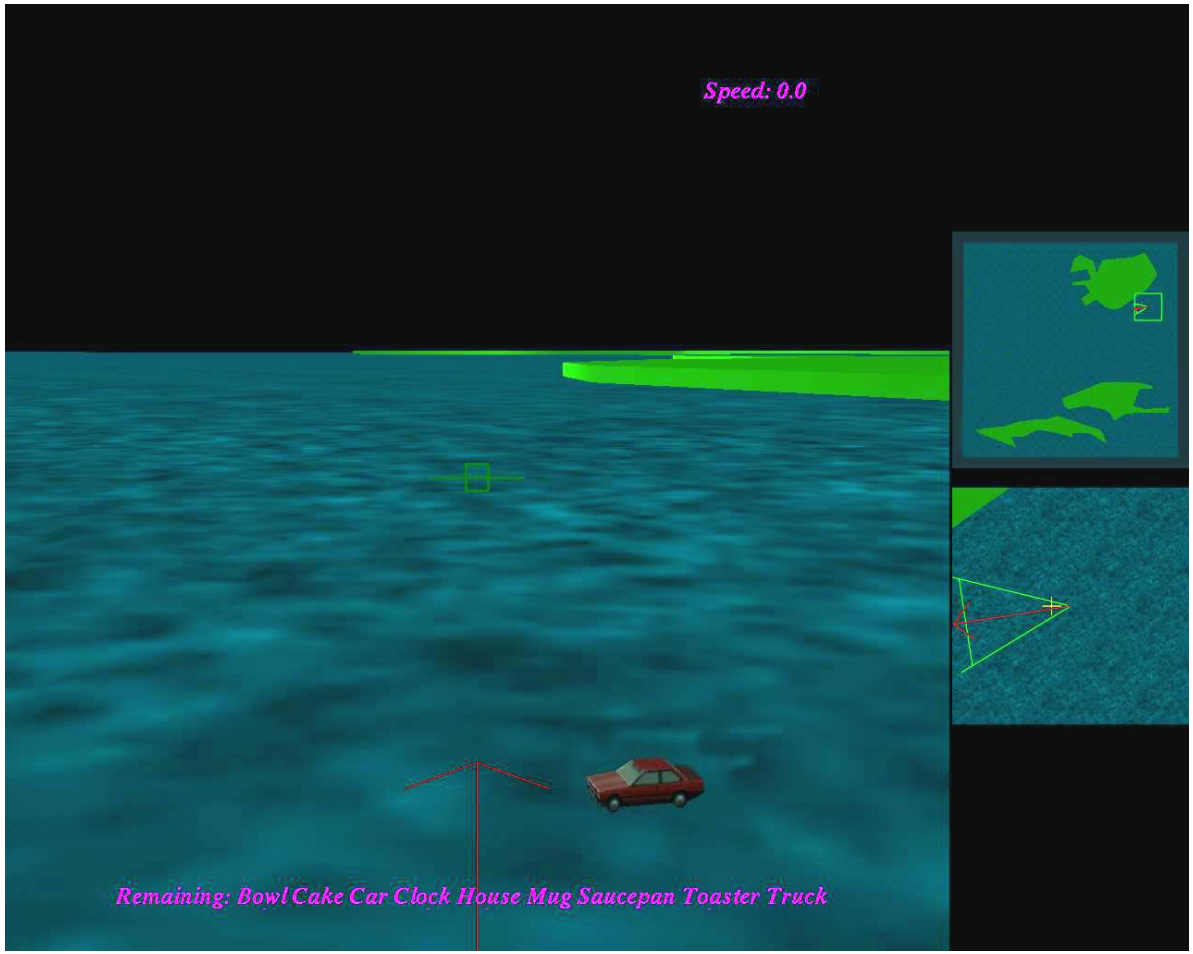
Parameters

- Location and size on screen
- Current location and destination
- Scale level: e.g., 1:1000
- Level of detail
  - Types of information: roads, buildings, moving objects, etc.
  - Map density
- Orientation (north up, forward up, 3D)
- Abstraction level
  - Stylized vs photorealistic

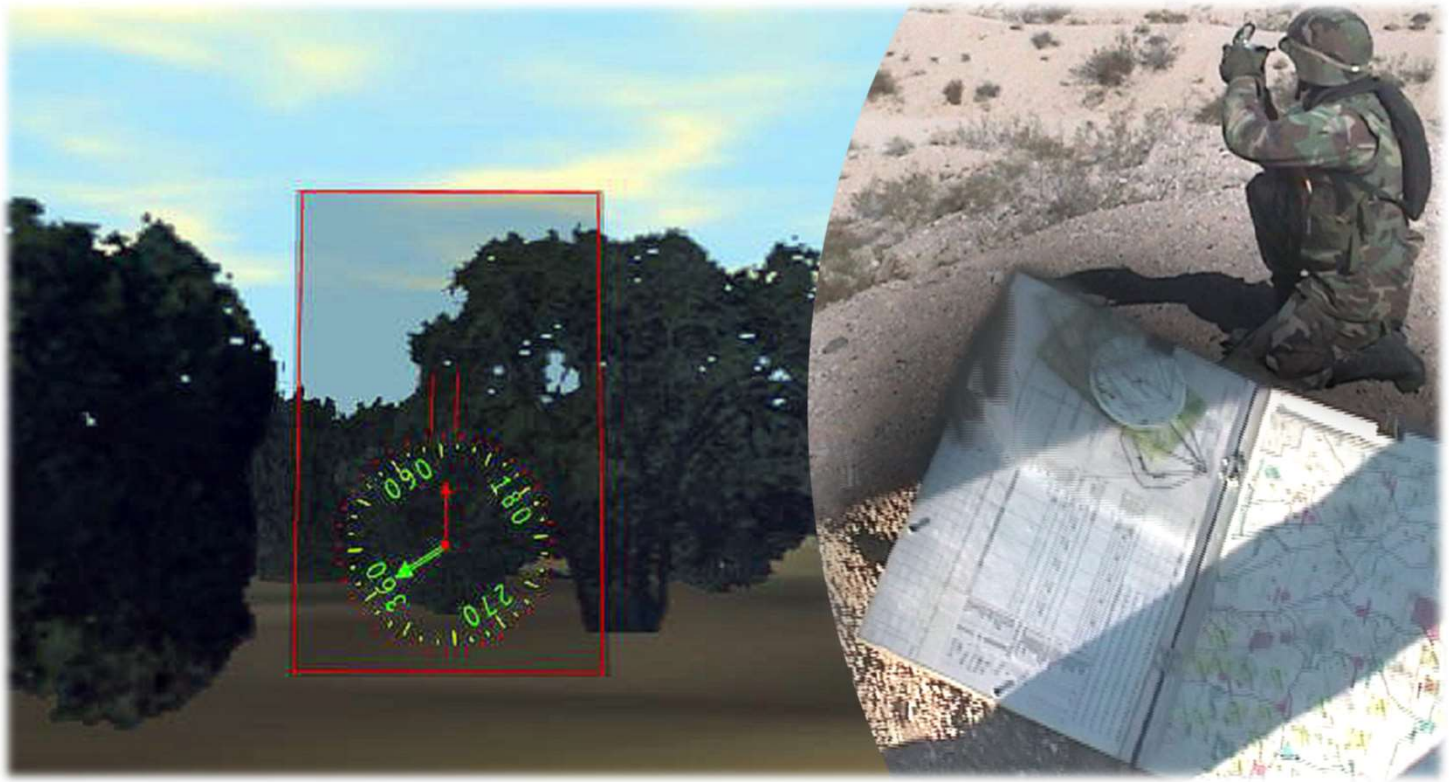
North Up vs. Forward Up



Example

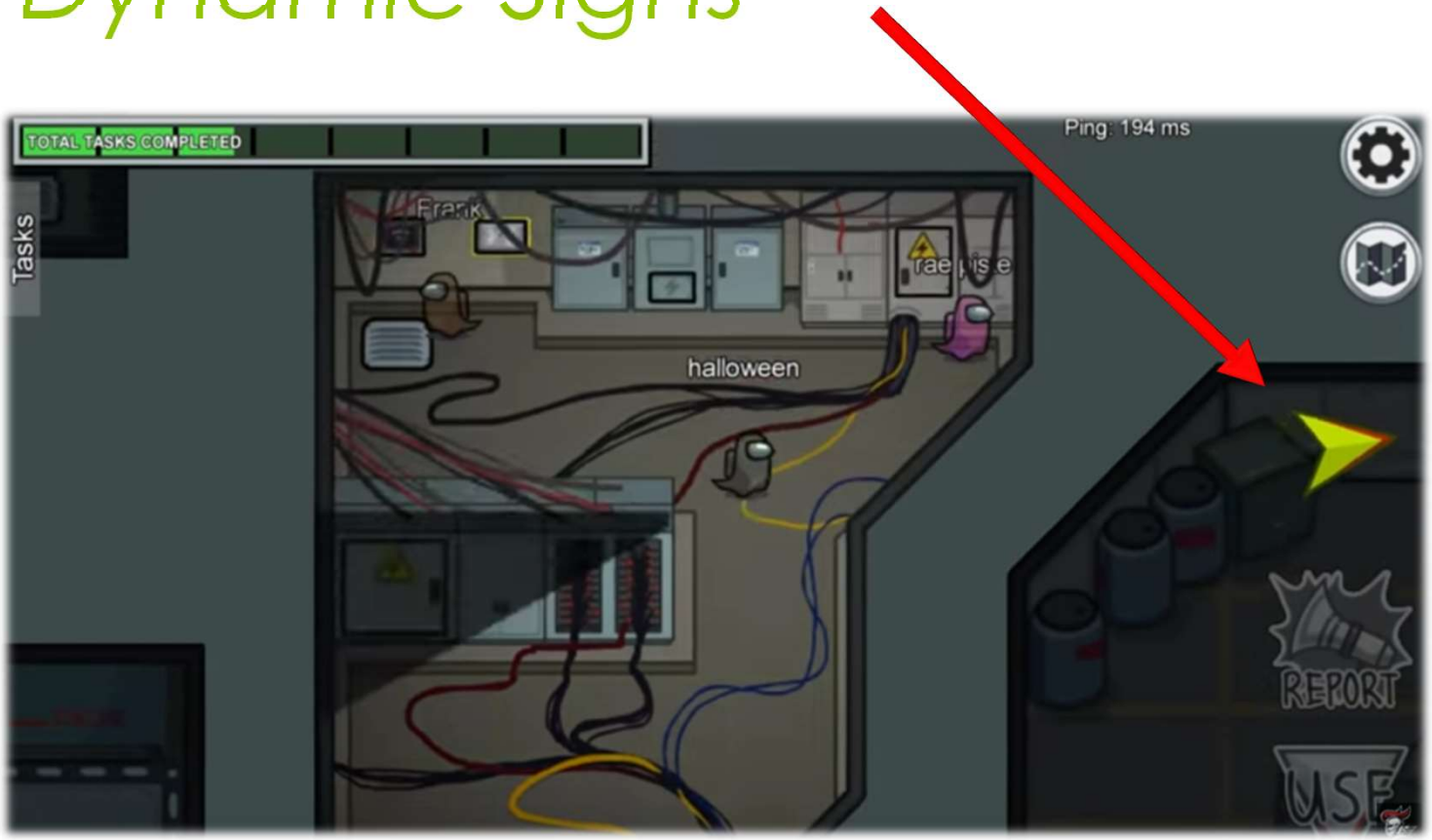

Speed: 0.0
Remaining: Bowl Cake Car Clock House Mug Saucepan Toaster Truck

Compass

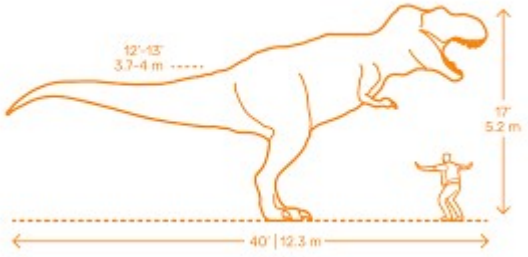


Signs

Dynamic 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

Path Visualization

- Display of continuous path to destination
- Useful in VR, but even more in AR