**PROBLEM STATEMENT**

Successful navigation requires perceiving orientation within the environment. To recover absolute orientation people utilize environmental properties (landmarks and layout) differently depending on experience, context, and task [1-4]. Most studies use simplified indoor environments.

Natural environments are usually far more complex and vary in amount of clutter and view similarity.

**RE-ORIENTATION TASK**

1) Teleport into natural environment and show **Target**
2) **Disorient** in a starfield
3) Teleport back into natural environment at a random orientation
4) **Reorient** towards target location

**VR SYSTEM**

HMD: Rift CV1 (Oculus, Irvine CA); 110° diagonal FOV; resolution: 1080 x 1200 pixels per eye.

Rendering: Alienware Aurora (2017, Round Rock TX); 60 fps; generated in Unity 2017.3 (Unity Technologies, San Francisco CA).

Tracking: Head position and rotation tracked with 3 infrared sensors and built-in accelerometer

Responses: Oculus touch controller to record responses.

**STIMULI & CONDITIONS**

- **8 equirectangular images ("Photospheres")**
- **Experiment 1: Snapshot view** Photospheres visible for 750 ms before participant starts responding
- **Experiment 2: Continuous feedback** Photosphere visible while participant responds

**SNAPSHOT VIEW**

- Friedman test: \( \chi^2(3) = 17.64, p < 0.001 \)
- all outdoor vs indoor \( p < 0.05 \)

**CONTINUOUS FEEDBACK**

- Friedman test: \( \chi^2(3) = 7.08, p = 0.07 \)

**IMAGE ANALYSIS**

- **Segment photospheres into 8 equally spaced, overlapping views**
- **Scale invariant clutter:** Average number of image segments across views [5]
- **View similarity:** Variance of view GIST (spatial envelope) [6]

**DISCUSSION**

Impaired visual acuity or field of view may hamper access to environmental properties

How do visually impaired navigators utilize landmark and layout information?

**REFERENCES**