

VR FIND

REDIRECTED LOCOMOTION IN LARGE VIRTUAL ENVIRONMENTS

Background

- Virtual Reality (VR) offers immersive environments but is limited by the small size of tracked physical spaces.
- Locomotion, how users move in VR, greatly influences comfort, presence, and usability.
- Redirected Walking (RDW) subtly manipulates visual feedback so users can explore large virtual areas while staying within a confined real space.

Study Focus

This project evaluates how combining traditional locomotion techniques, such as joystick movement, fixed-point and free-point teleportation with RDW, to reach and interact with physical props, affects users Simulator Sickness, Presence and Usability.



Experimental Setup

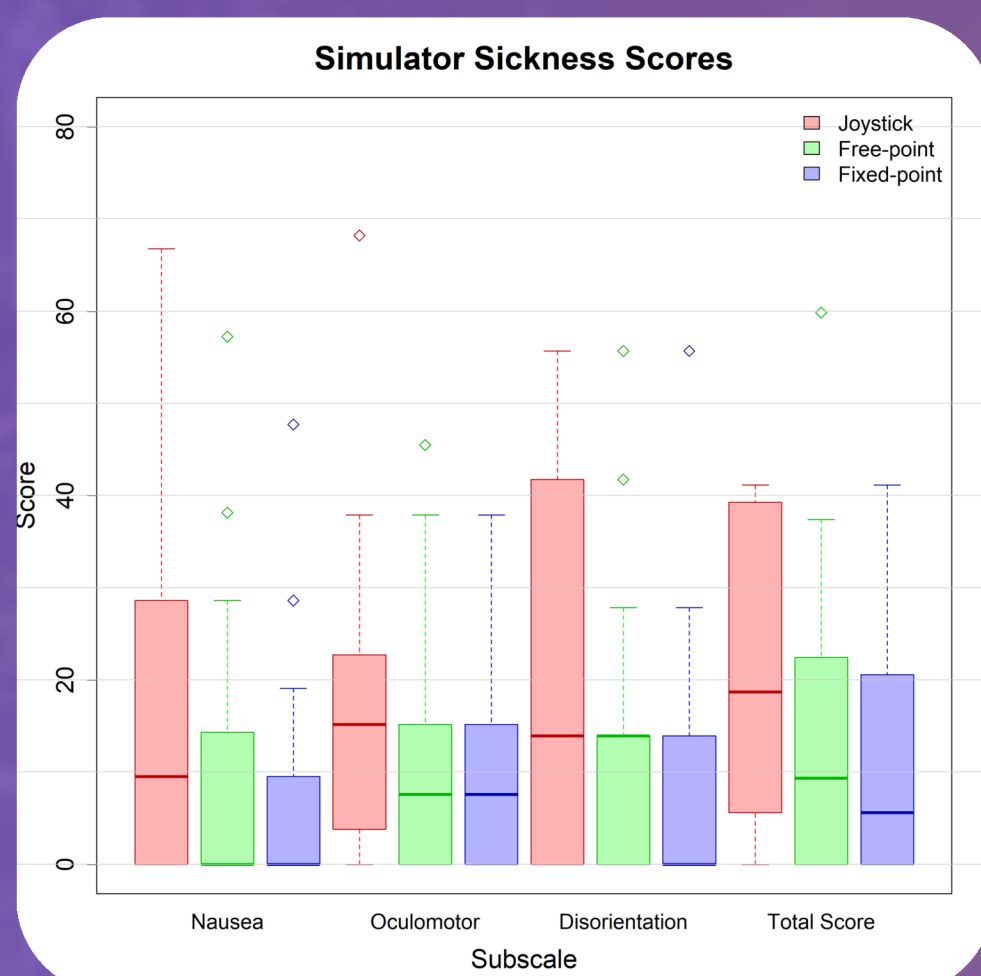
- Participants:** 24
- Physical space:** 2.5 m × 2.5 m
- Virtual world:** Three 100 m × 100 m forest environments
- Hardware:** HTC Vive Pro 2 + Trackers

- Software:** Unity HDRP, XR Toolkit
- Design:** Within-subjects — all users experienced all three locomotion methods

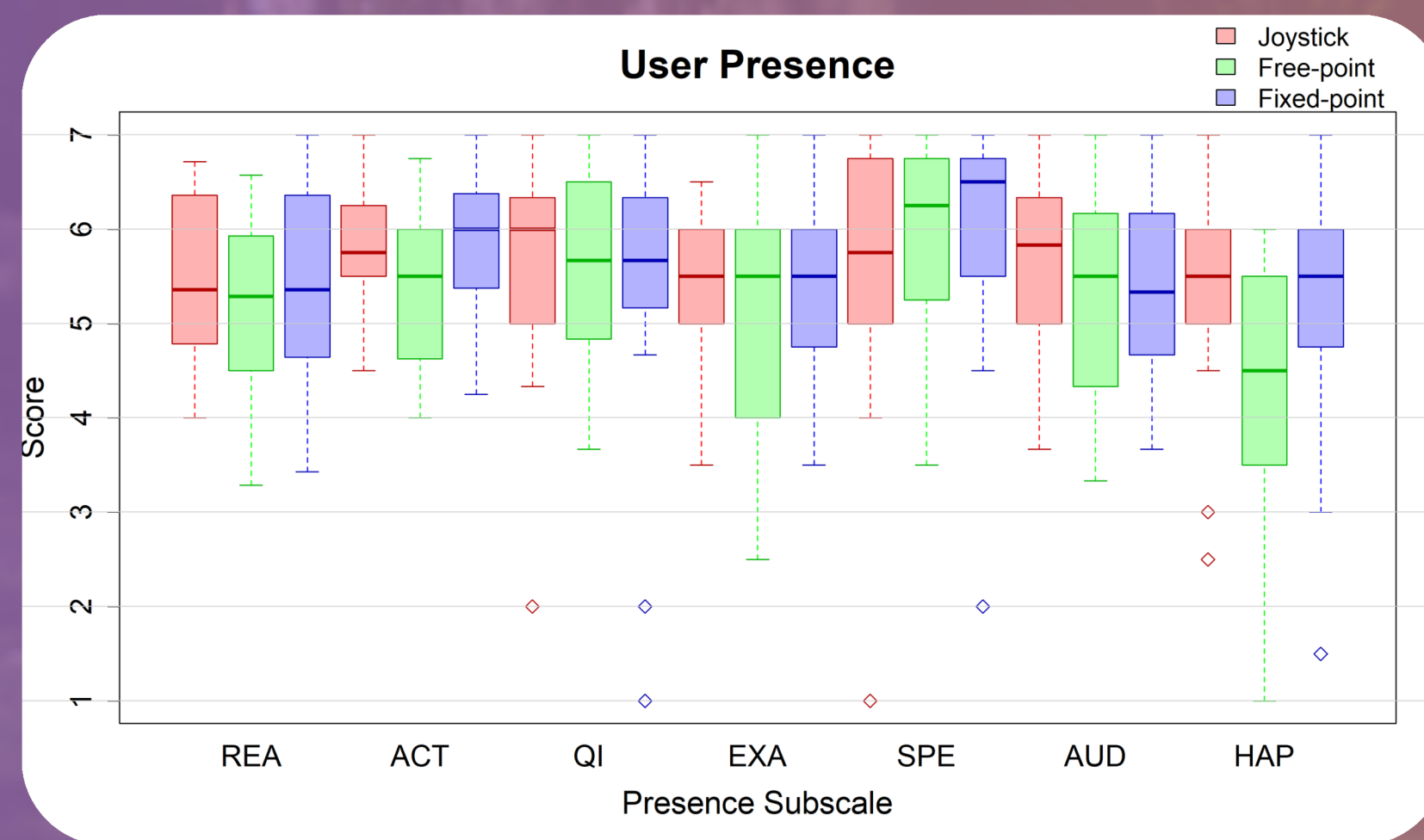
SSQ: Measures motion-related discomfort across locomotion types.

PQ: Assesses immersion and sense of presence in VR. 1 = low : 7 = high

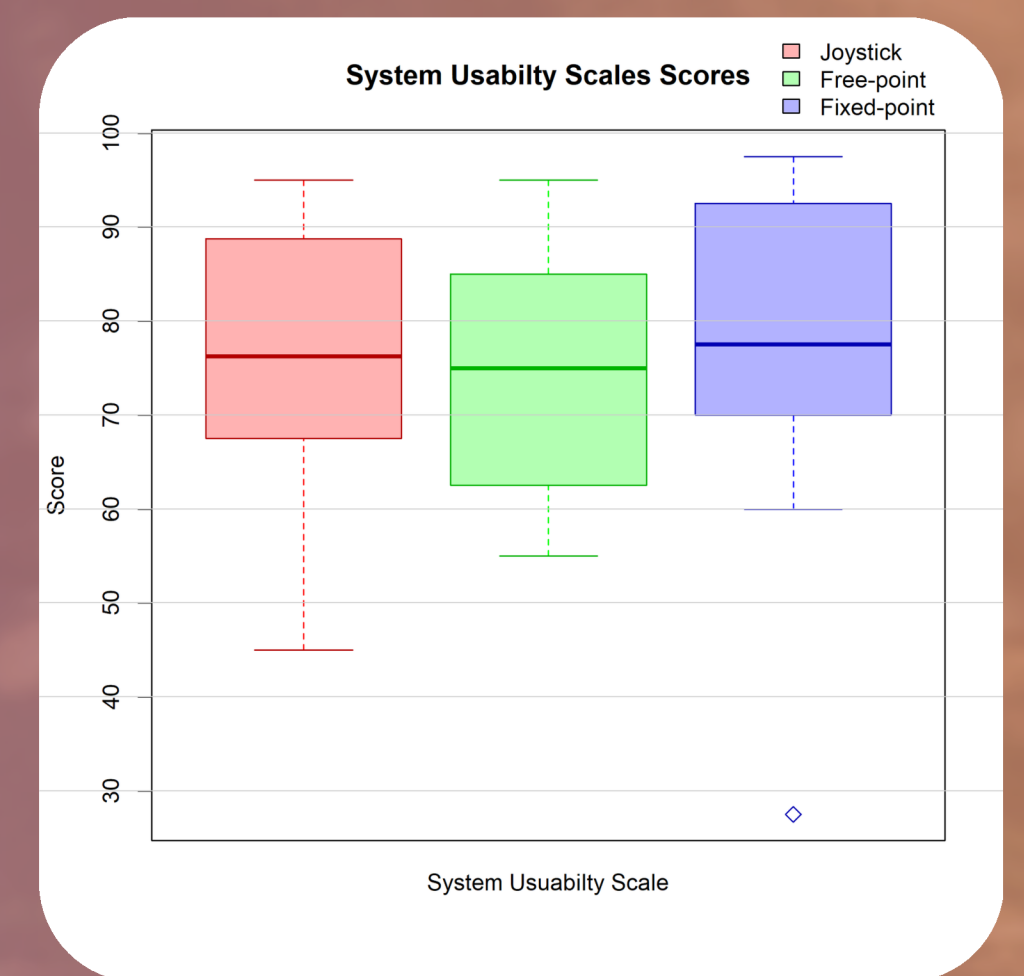
SUS: Rates ease of use and overall system usability.



SSQ results



Presence results scored by Realism, Possibility to Act, Quality of Interface, Possibility to Examine, Self-Evaluation of Performance, Sounds, and Haptics



SUS results

Interpretation

- Joystick locomotion produced highest sickness, confirming prior research.
- Teleportation methods, especially fixed-point, minimized discomfort while maintaining presence.
- Free-point teleportation with RDW faced technical challenges, such as difficulty aligning trajectories and physical space limits.
- Environment scale (100 m × 100 m virtual → 2.5 m × 2.5 m physical) demanded high translation gains (> 2), which exceeded imperceptible thresholds and occasionally broke immersion.

Conclusions

- Teleportation remains the most comfortable navigation technique for confined spaces.
- Joystick movement offers intuitive control but induces motion sickness.
- RDW integration is promising but requires finer-tuned gain adjustment and predictive redirection algorithms.
- Participants maintained high presence despite occasional discomfort, confirming the immersive potential of hybrid locomotion systems.