

Movement methods and environmental complexity, and their impact on navigation and spatial memory

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Introduction

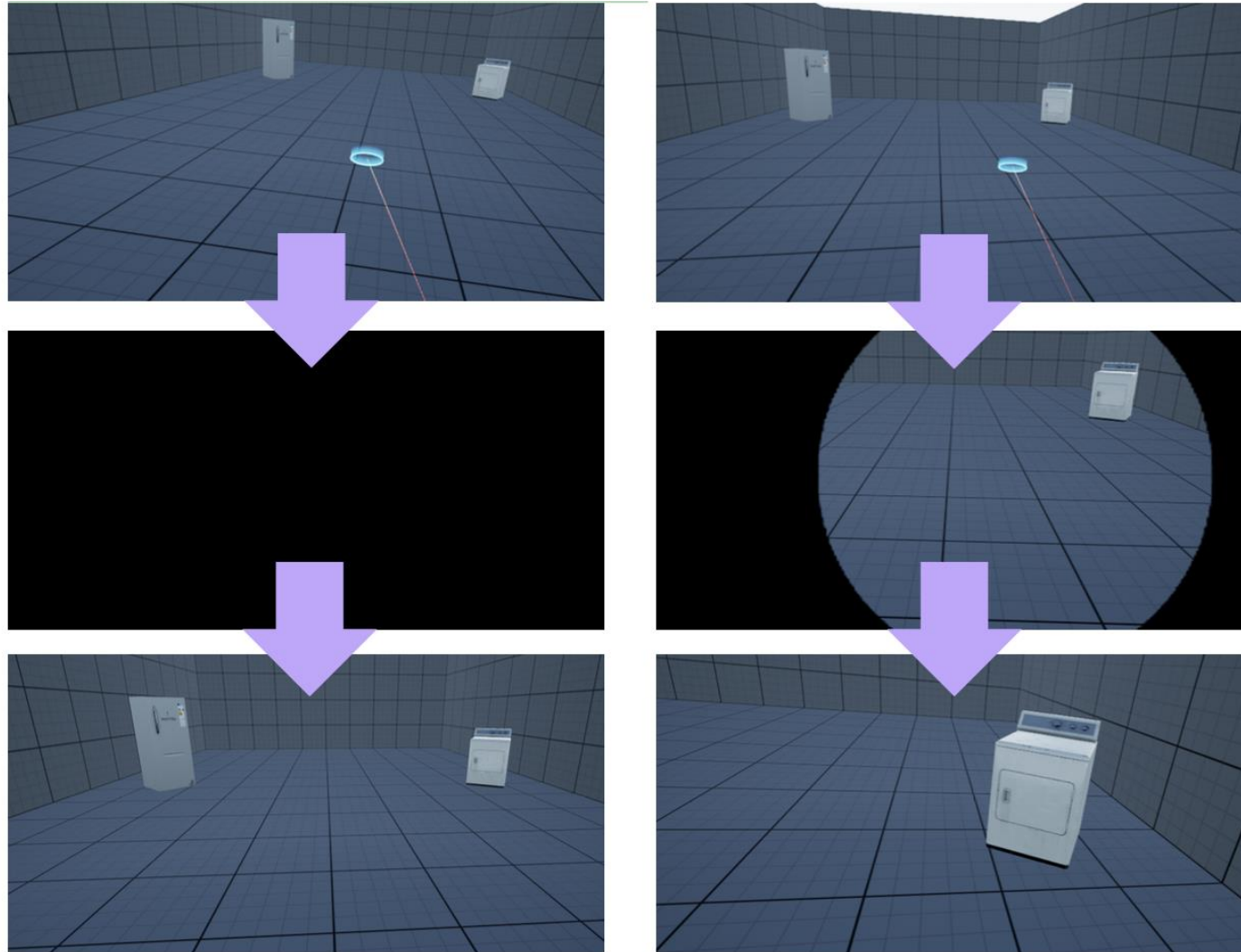
- Navigation in VR is enabled by various Locomotion methods (LMs)
- A key challenge in virtual reality is designing locomotion methods that feel natural without causing disorientation or cybersickness
- A widely used LM is Teleportation
 - It is a safe method that is less likely to cause cybersickness
 - However, it can disrupt spatial awareness by removing visual cues of movement (Prithul et al., 2021)



Goals

- Comparison of two methods of locomotion in a VR experiment – **teleportation and teleportation with optical flow**
 - How will they affect navigation and spatial memory?
 - Examining the rate of cybersickness
- Investigating the influence of **environment size and complexity** on navigation and spatial memory
 - Will the LMs interact with environmental properties?
 - How will the environments affect navigation and spatial memory?

Teleportation with optic flow



Environments

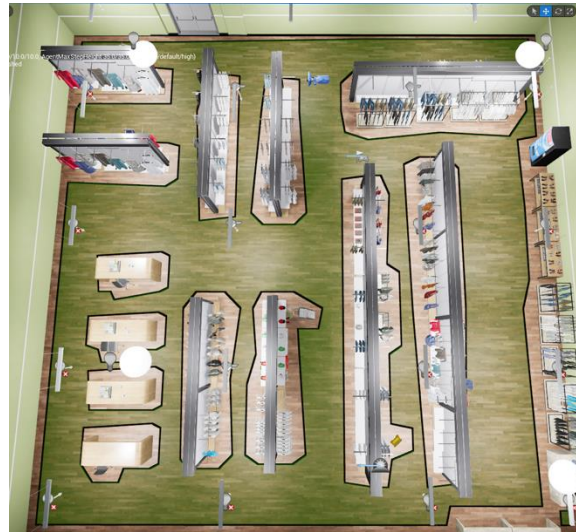
- 8 indoor environments in different contexts
- Two sizes of environments
 - **Small** – 36 m²
 - **Large** – 144 m²
- Two different complexities of environments
 - **Vista** = the entire environment is visible from any one point (Montello, 1993)
 - **Environmental** = the space is divided and not fully visible at once (Montello, 1993)
- The individual sizes of the environments had the same layout

Environmental x Vista



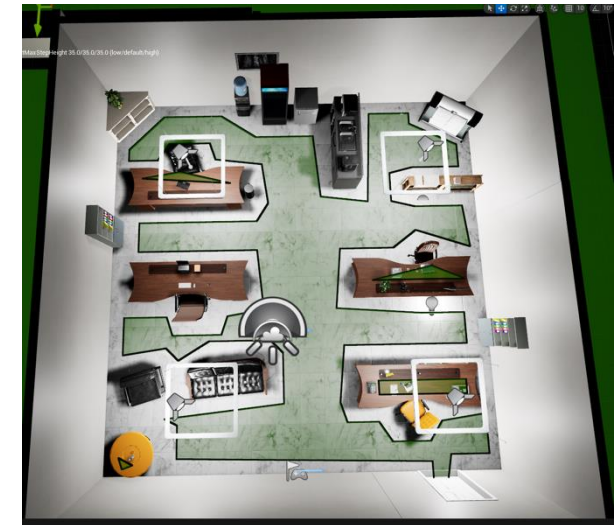
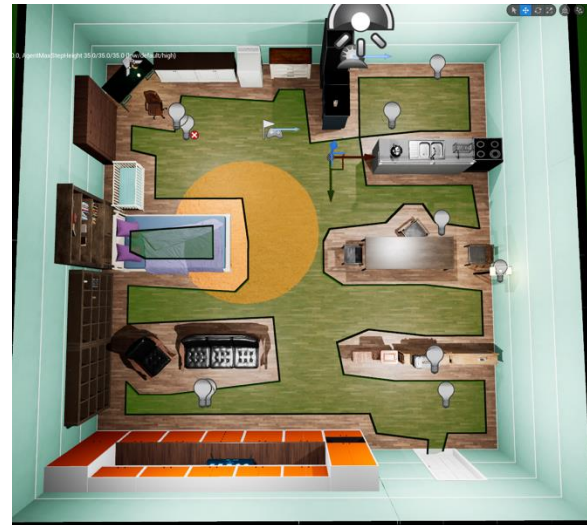
Environments

- 4 large environments (144 m²)
- Same layout in two contexts:
 - Supermarket
 - Clothing shop
- In both contexts:
 - One vista
 - One environmental



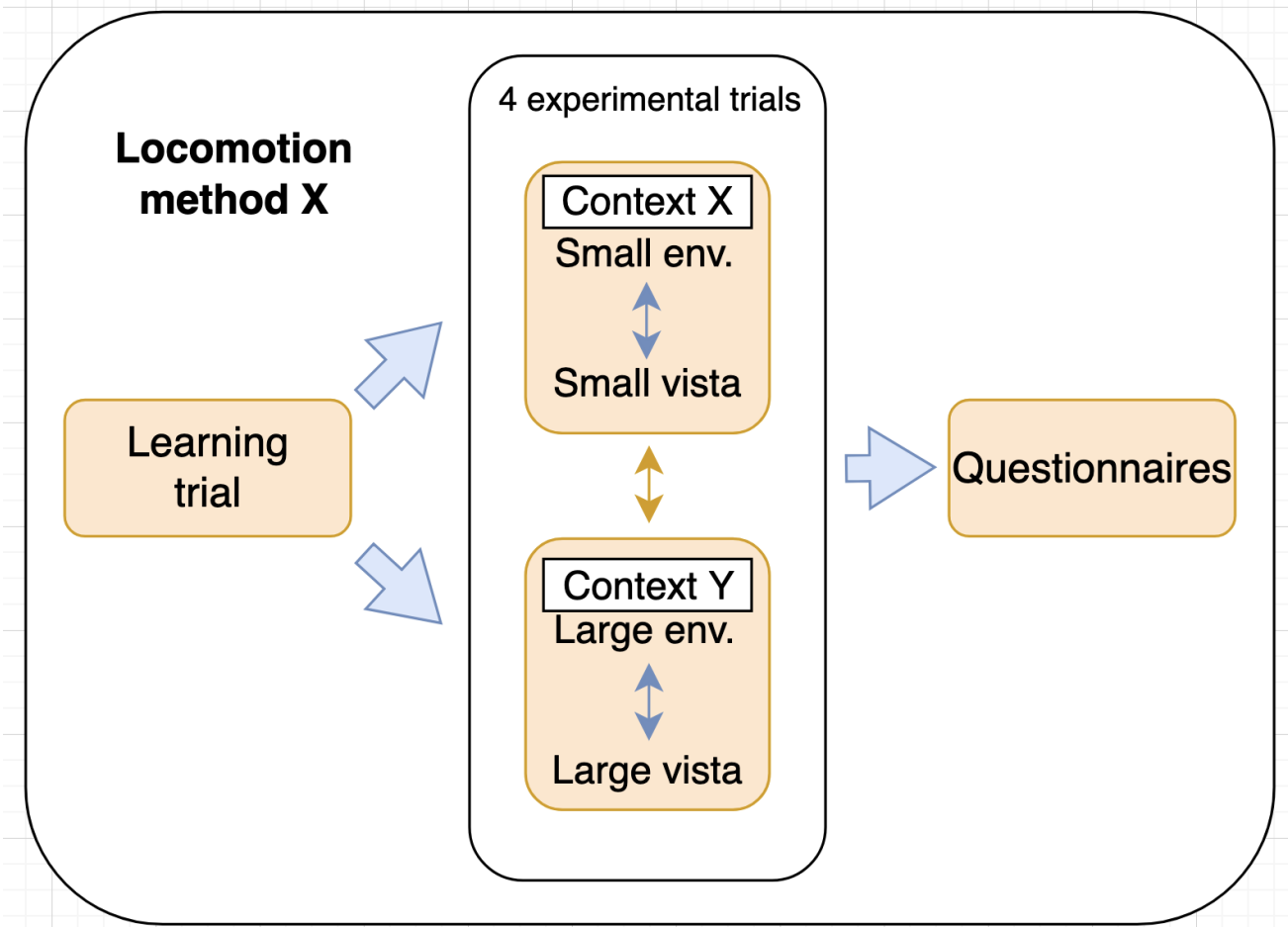
Environments

- 4 small environments (36 m²)
- Same layout in two contexts:
 - Office
 - Apartment
- In both contexts:
 - One vista
 - One environmental

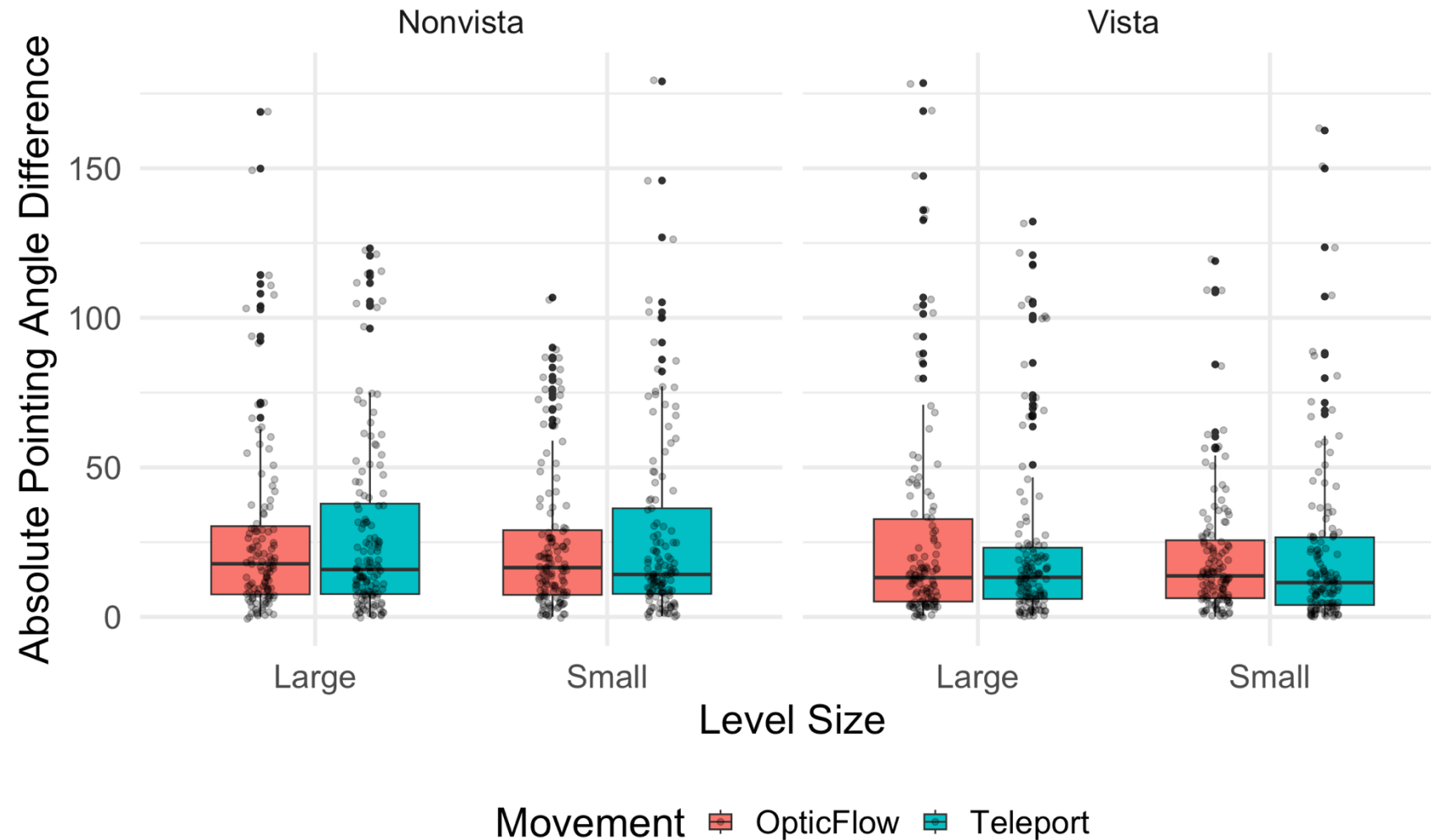


Methods

- Within-subject VR experiment
- Search and pointing task
 - Search for 4 objects -> Return to entrance door -> Point to locations of found objects
- **SSQ** (Kennedy et al., 1993)
- **VRLEQ** (Boletsis, 2020)

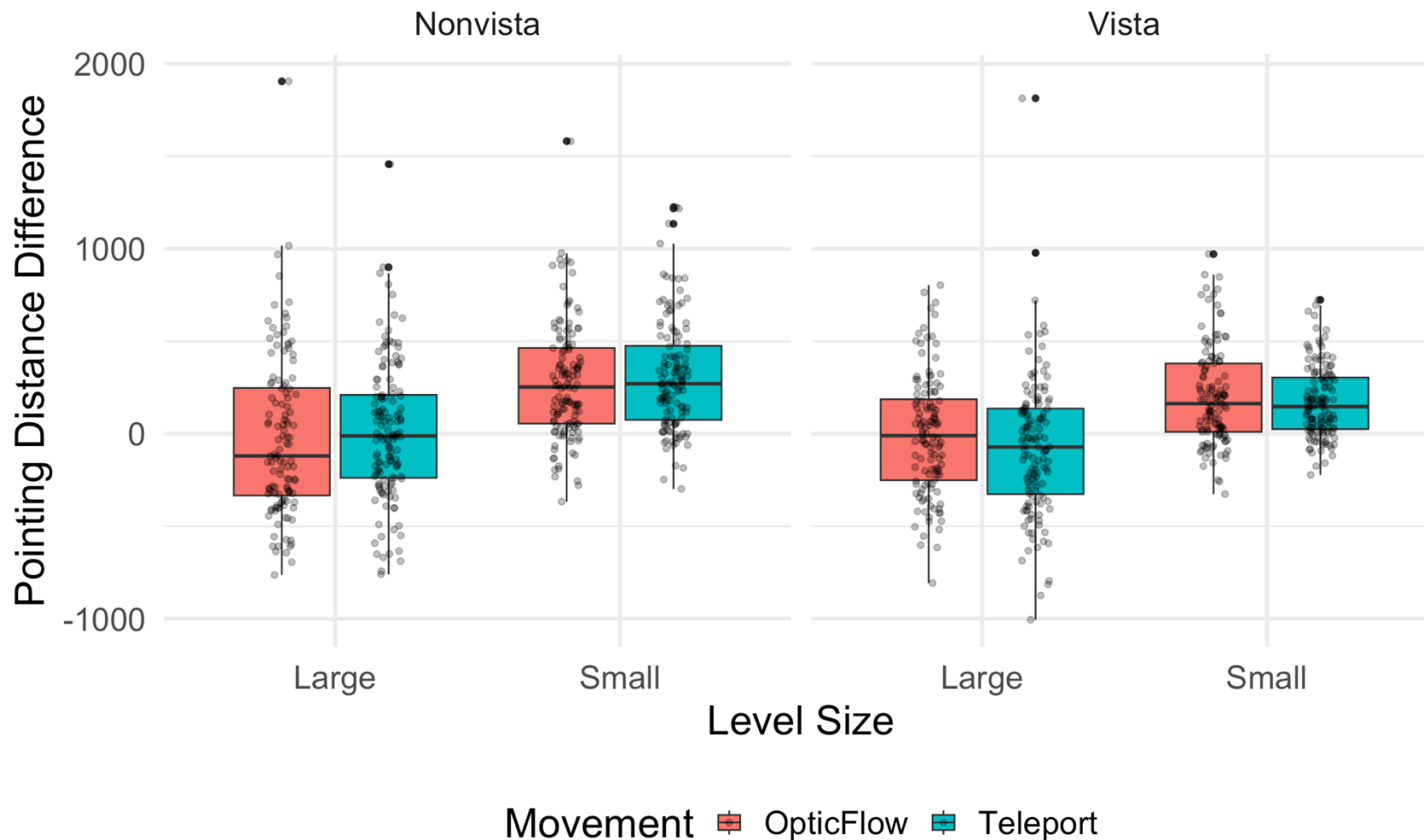


Absolute Pointing Angle Error



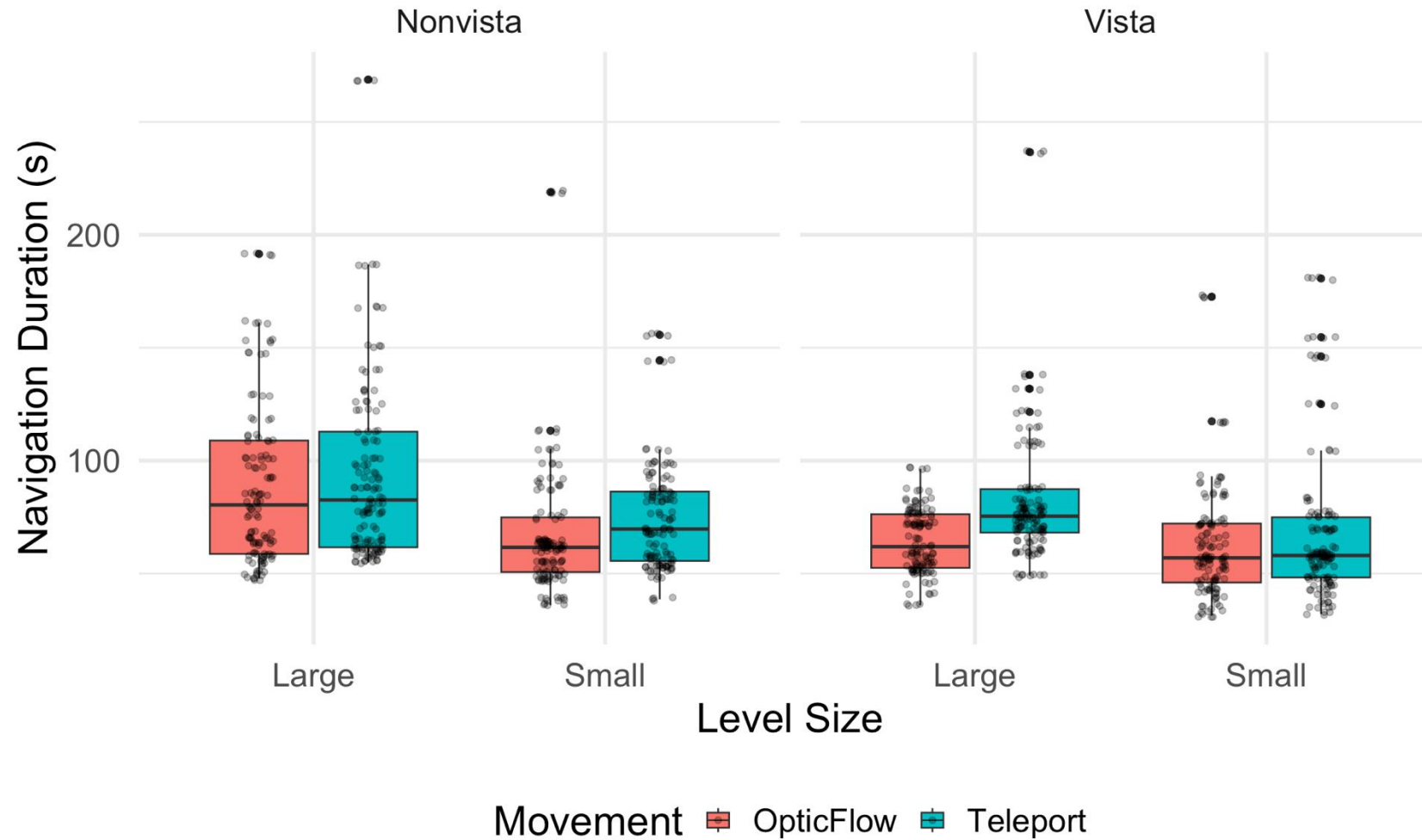
Larger environments lead to larger angle errors.

Pointing Distance Error



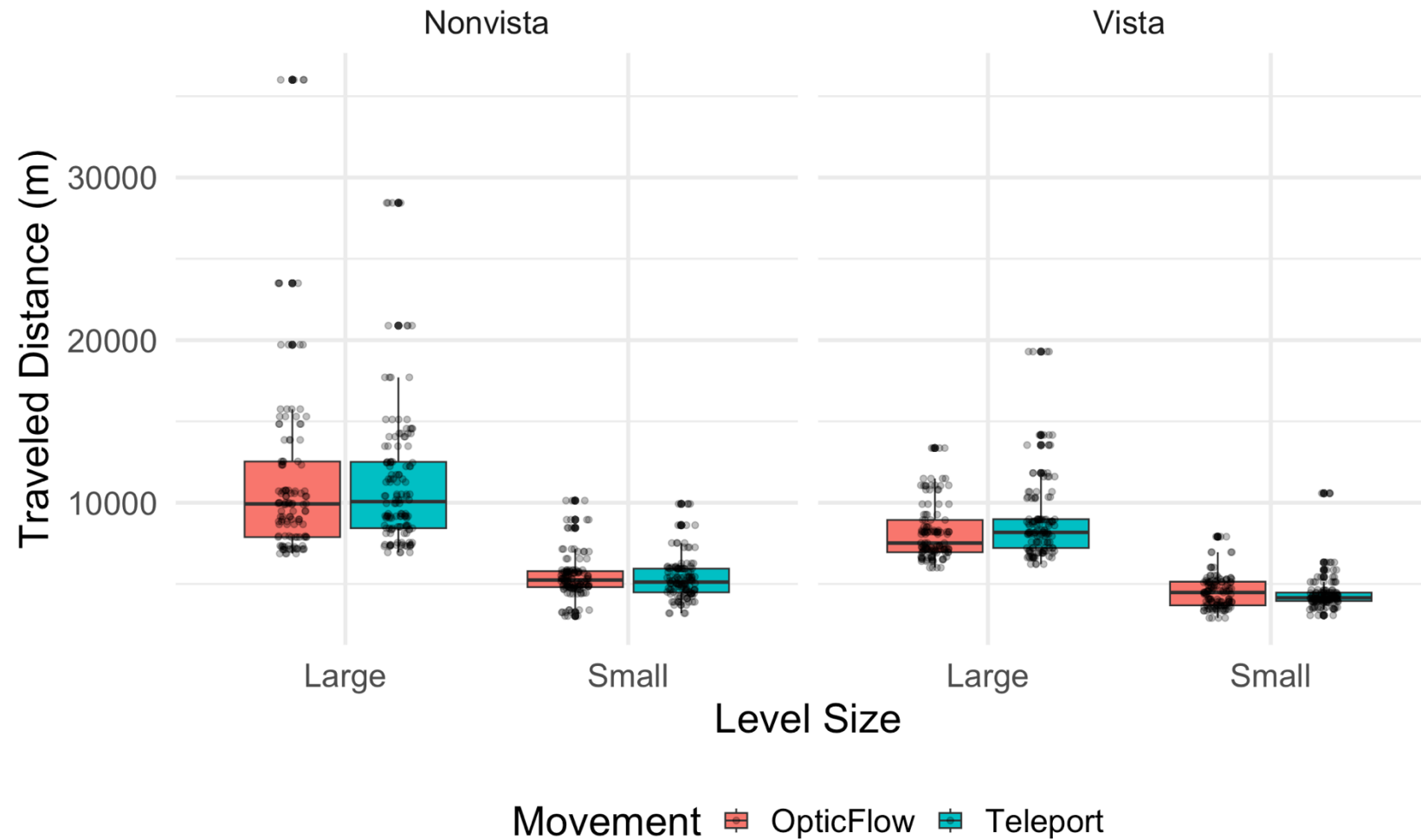
Participants overshoot the pointed distances in small environments.

Navigation Duration



Vista environments enabled quicker navigation.

Traveled Distance



Participants navigated shorter distances in vista environments.

Summary

- Surprisingly, the added optic flow did not affect navigation performance or pointing accuracy
- Environmental factors played a much larger role
 - Participants navigated faster and were more accurate in vista environments
- Another interesting finding is that participants overshoot pointed distances in small environments
- As for the cybersickness, Teleportation with optic flow caused slightly more nausea and disorientation

Thank you for your attention

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