



# Tracking Perceptual Depth with Eye Vergence Movements in Real World, Augmented Reality, and Virtual Reality Environments

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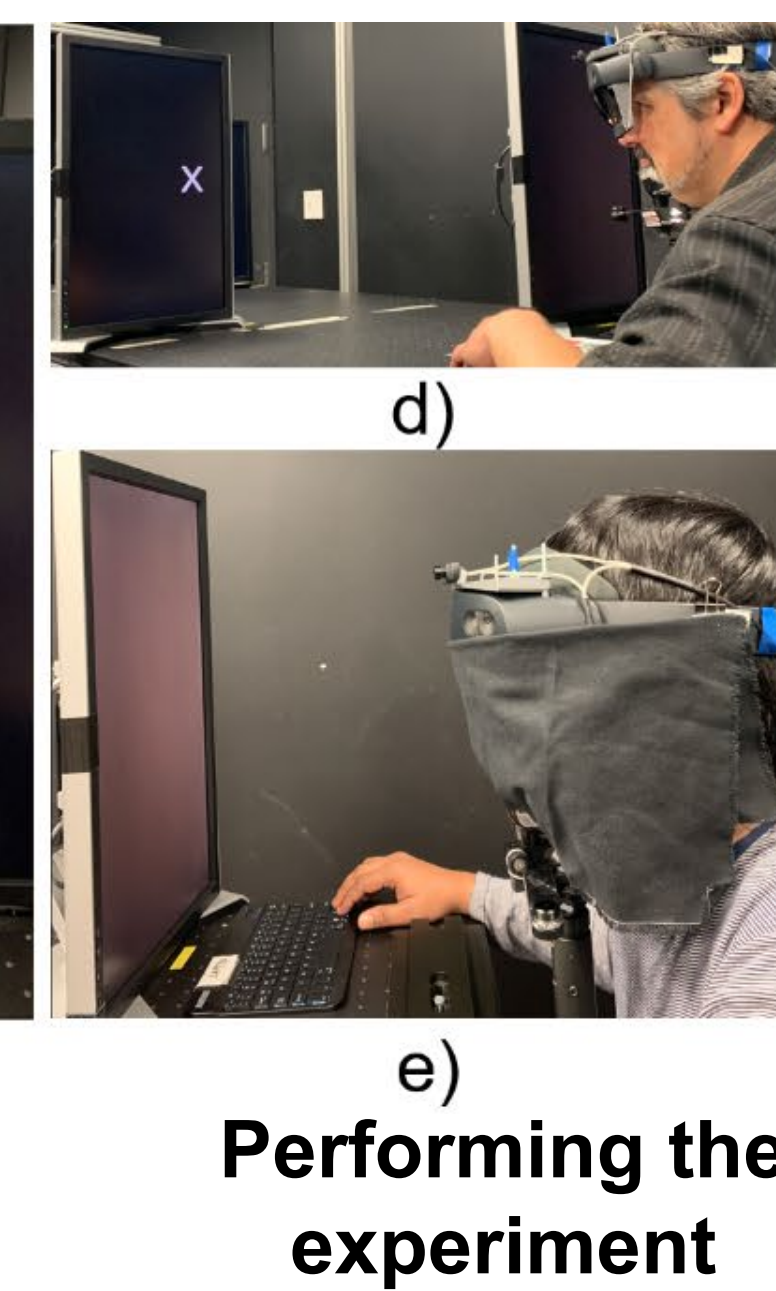
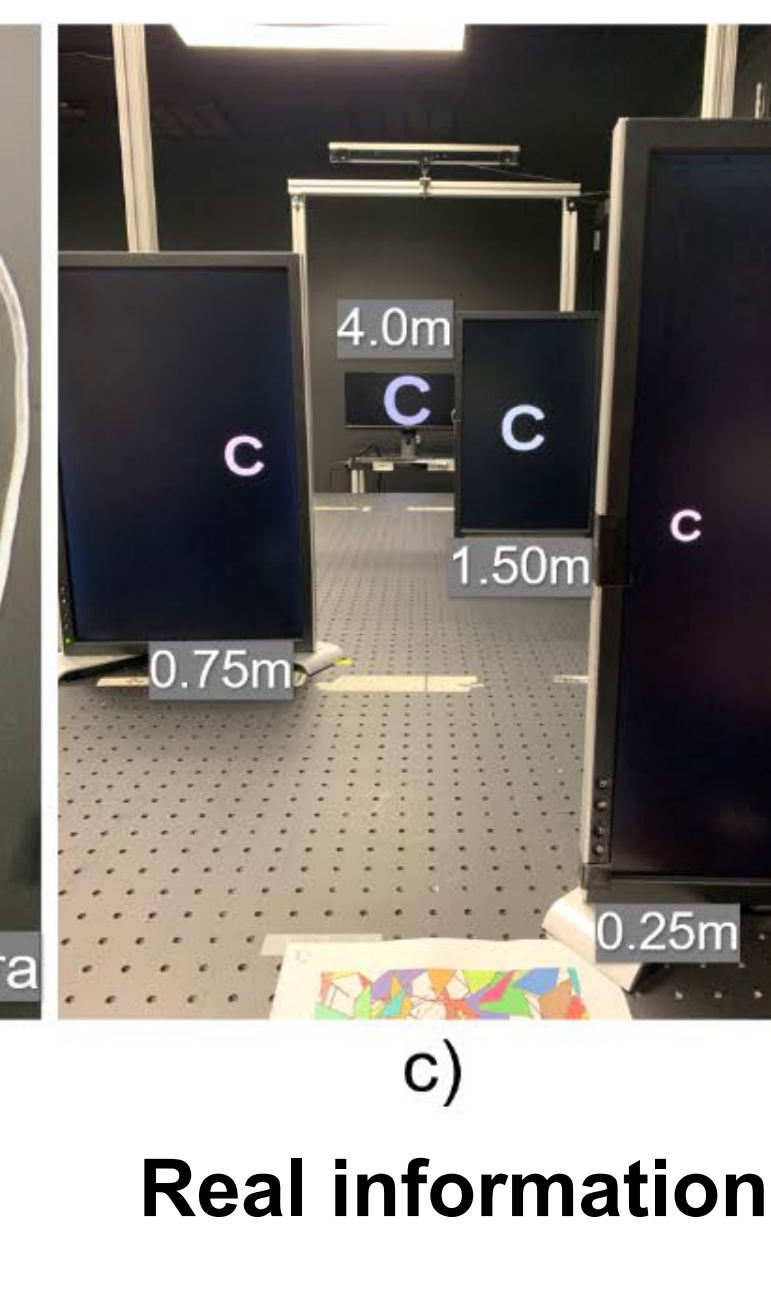
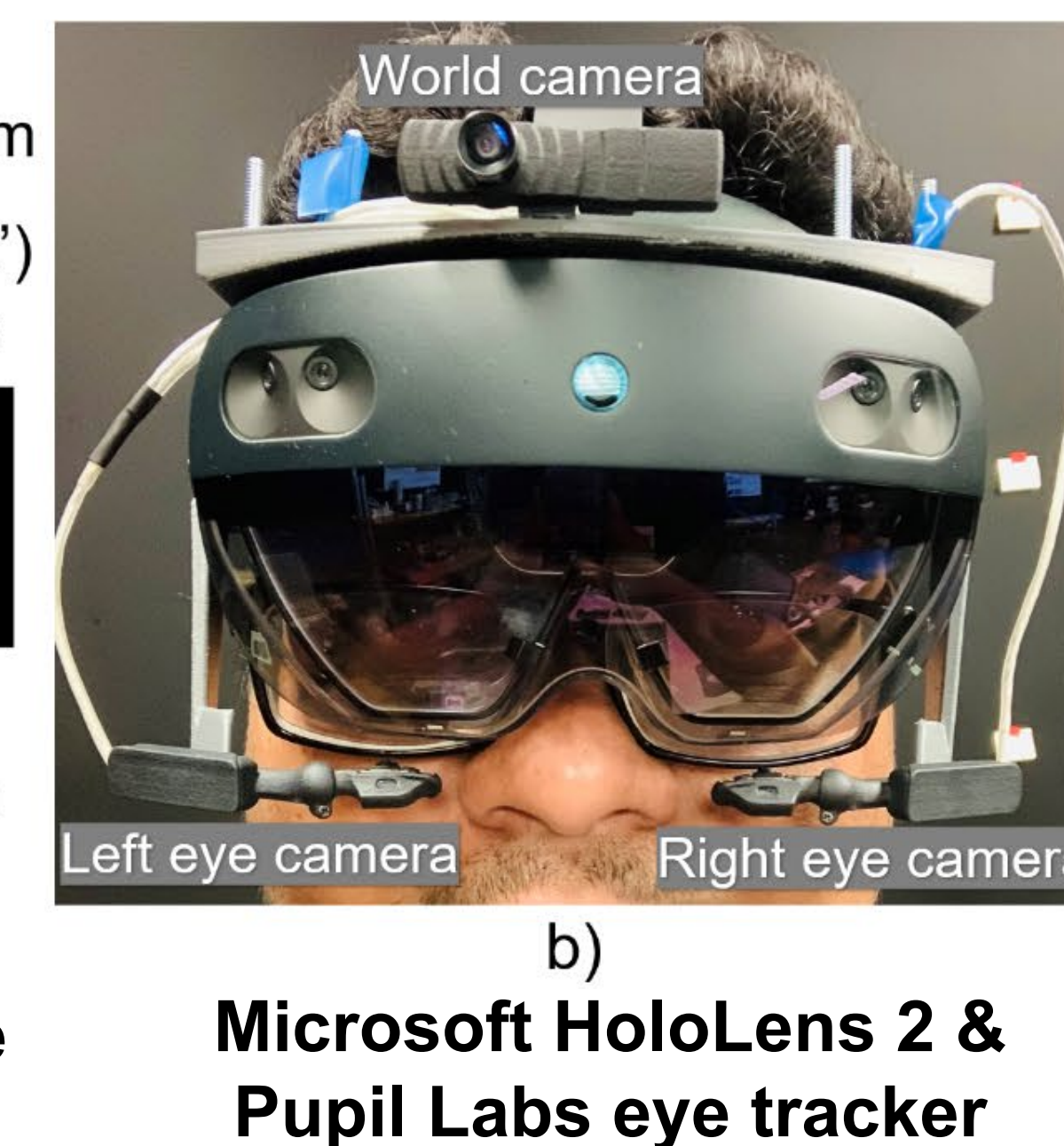
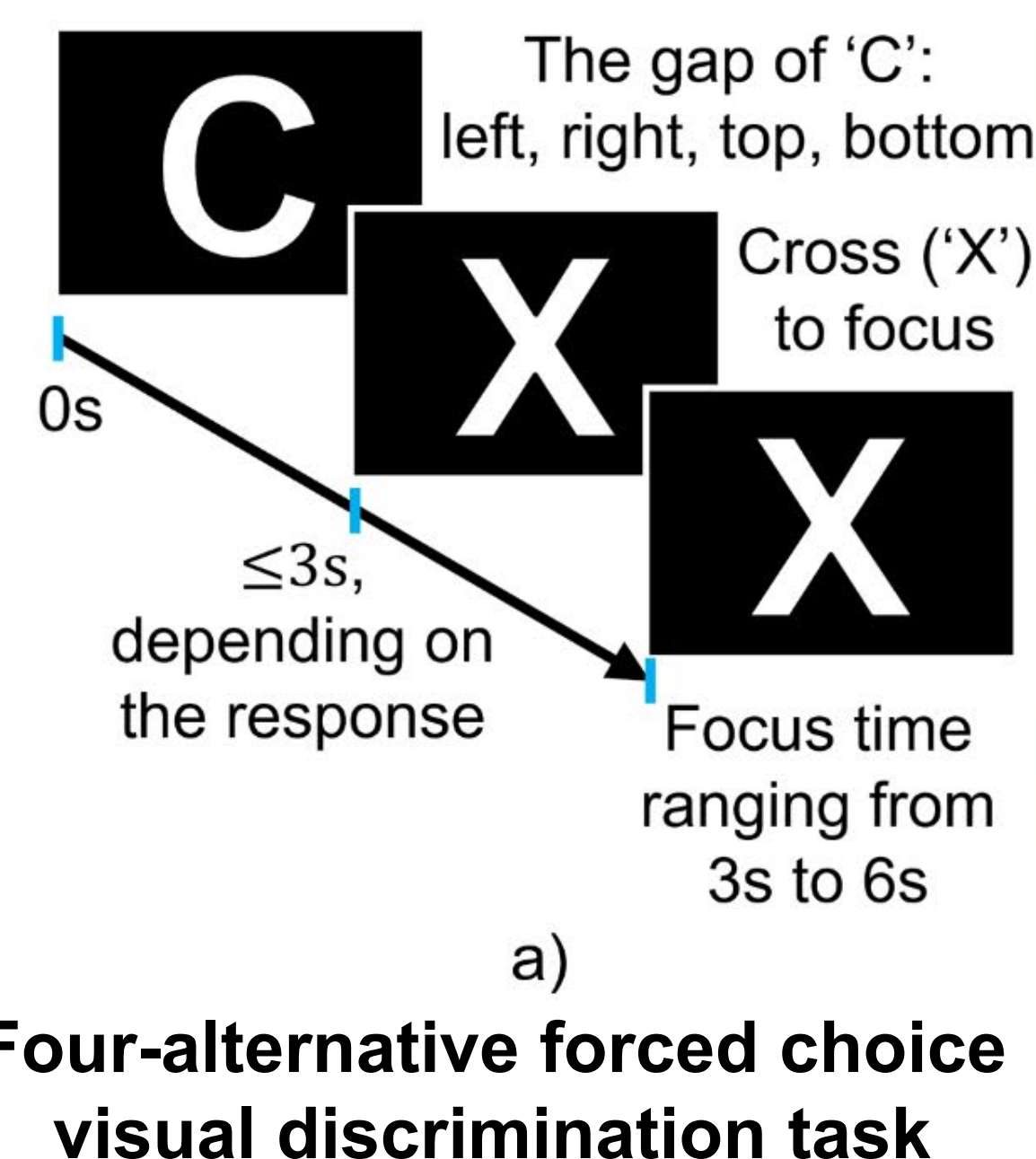
**Introduction** Eye vergence angle (EVA) is the angle formed between the visual axis of two eyes under binocular vision.

## Hypotheses

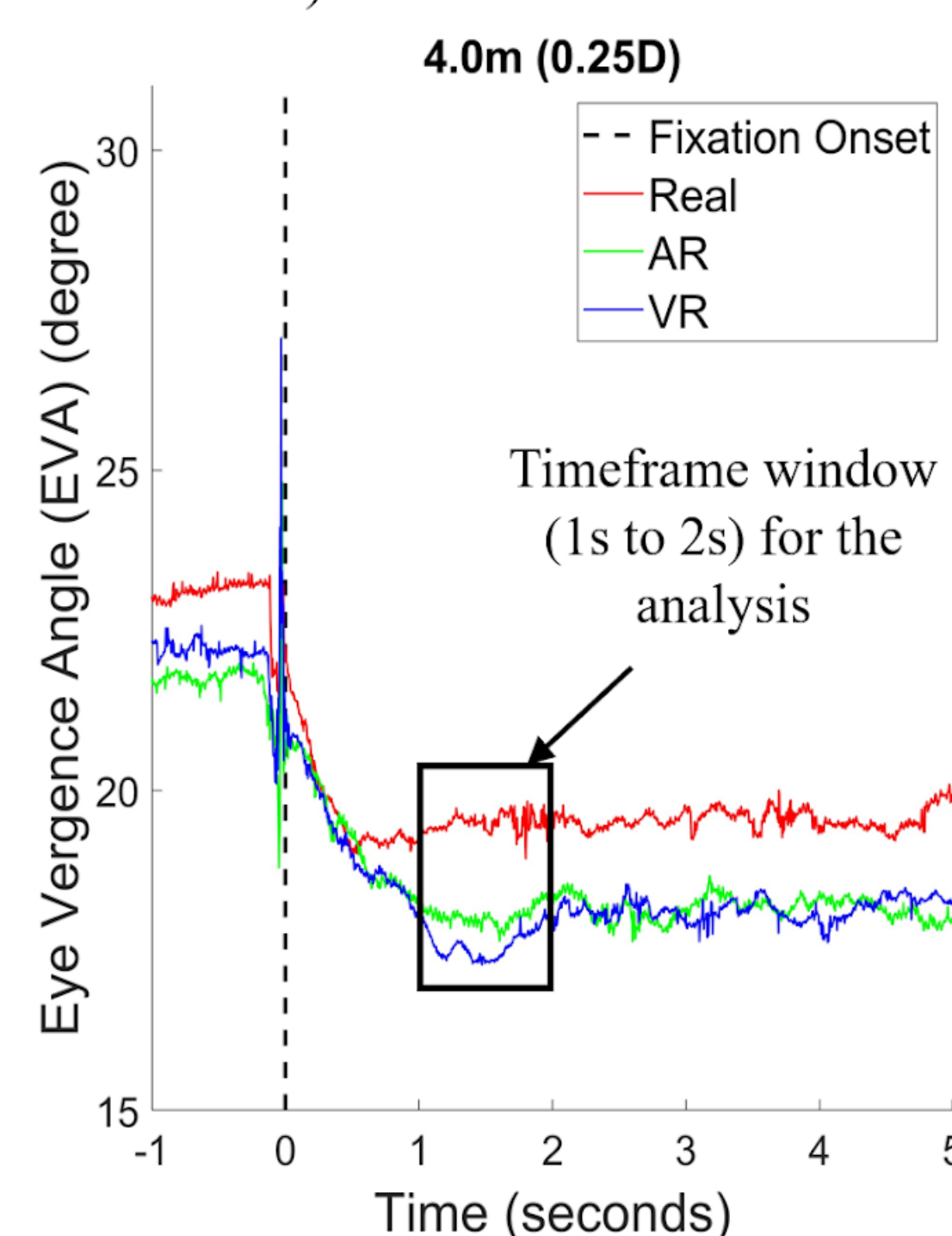
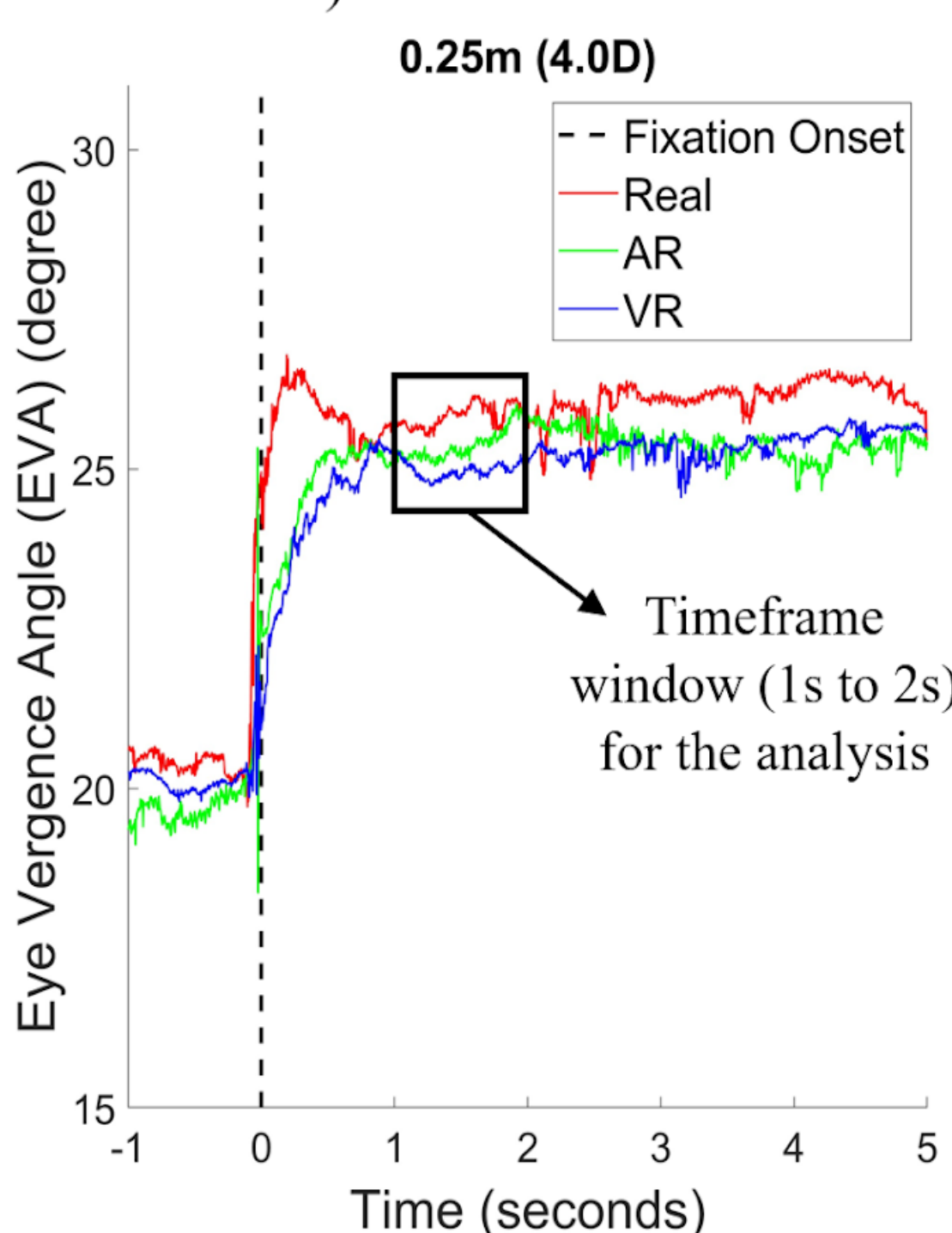
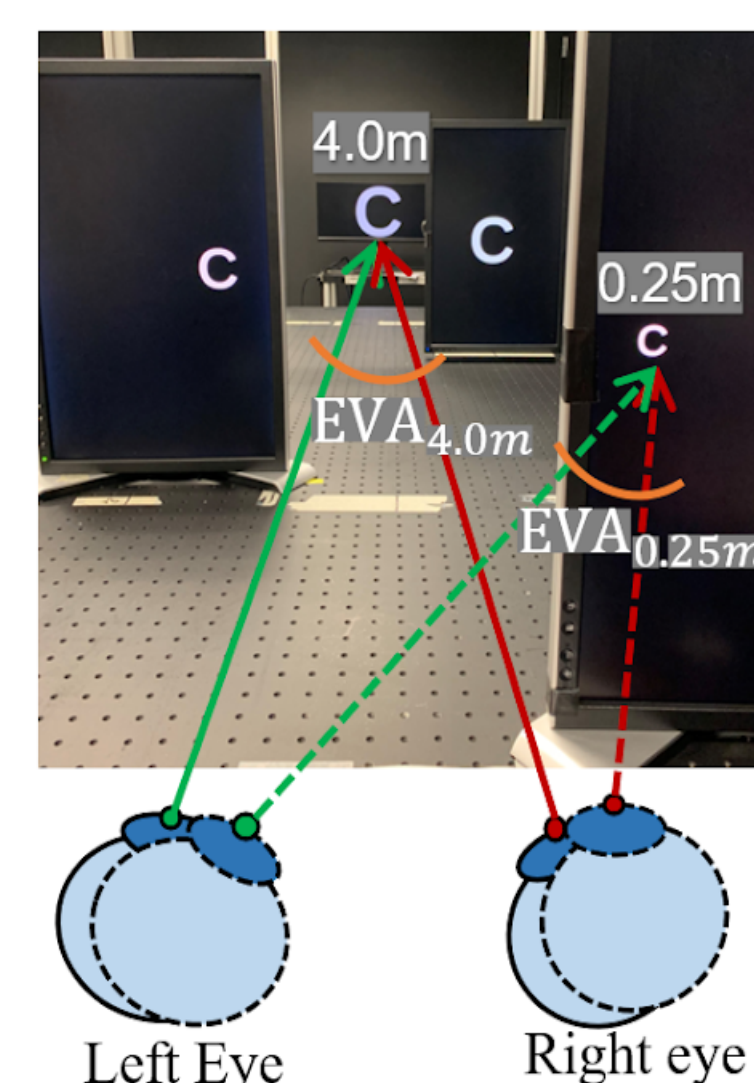
- ❑ **H1:** EVA will co-vary with the depth of the fixated object for real, AR, and VR environments. Due to the vergence-accommodation conflict, EVA in real environment will differ from AR and VR environments, but EVA in AR and VR environments will have similar functionality.
- ❑ **H2:** After shifting the eye gaze from far distance to near distance (convergence) or the near distance to the far distance (divergence), the eye vergence angle of a specific depth will be stable.
- ❑ **H3:** Subjective (verbal report) and objective (eye tracker) measurement of depth will be consistent.

## Methods

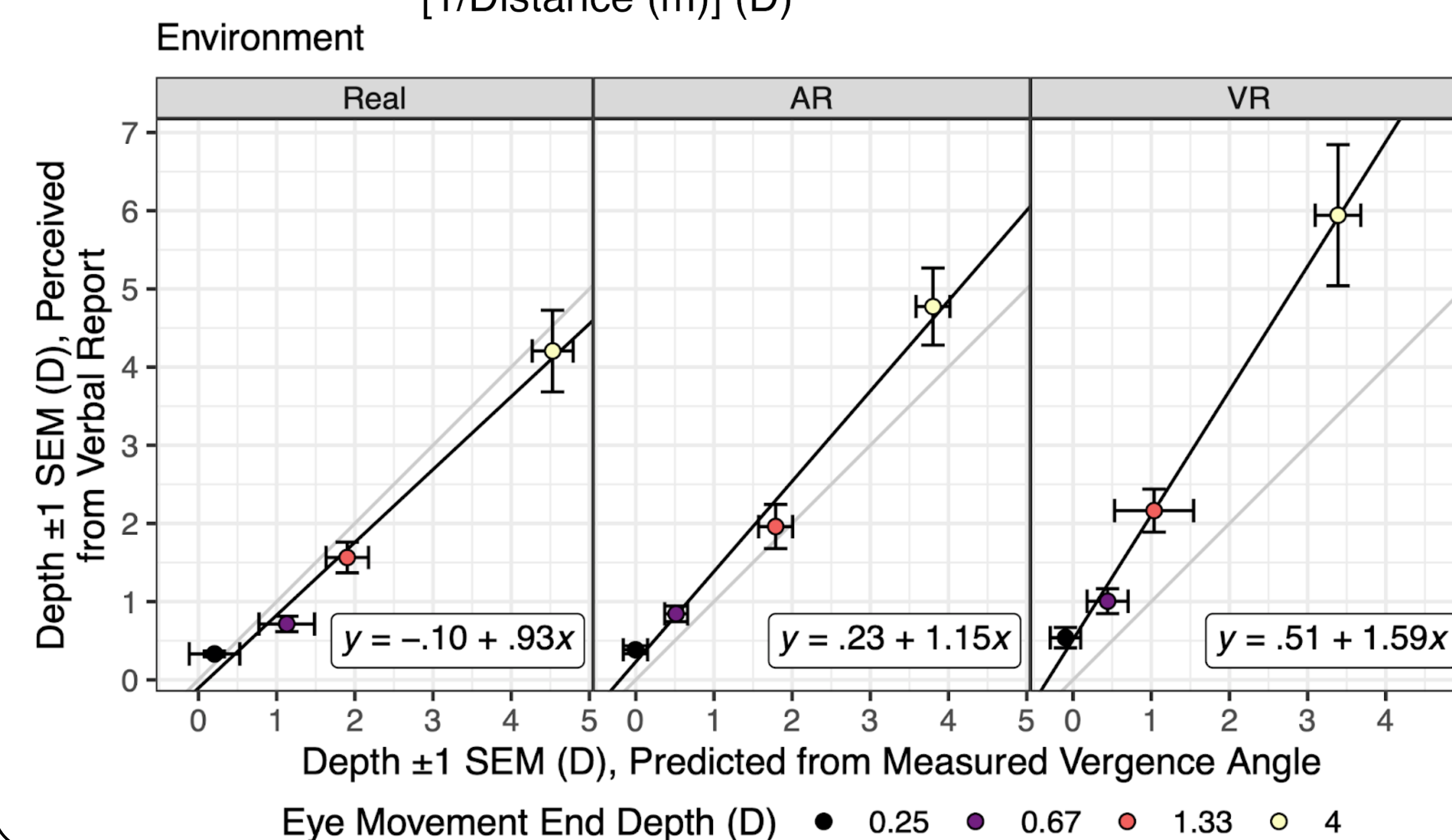
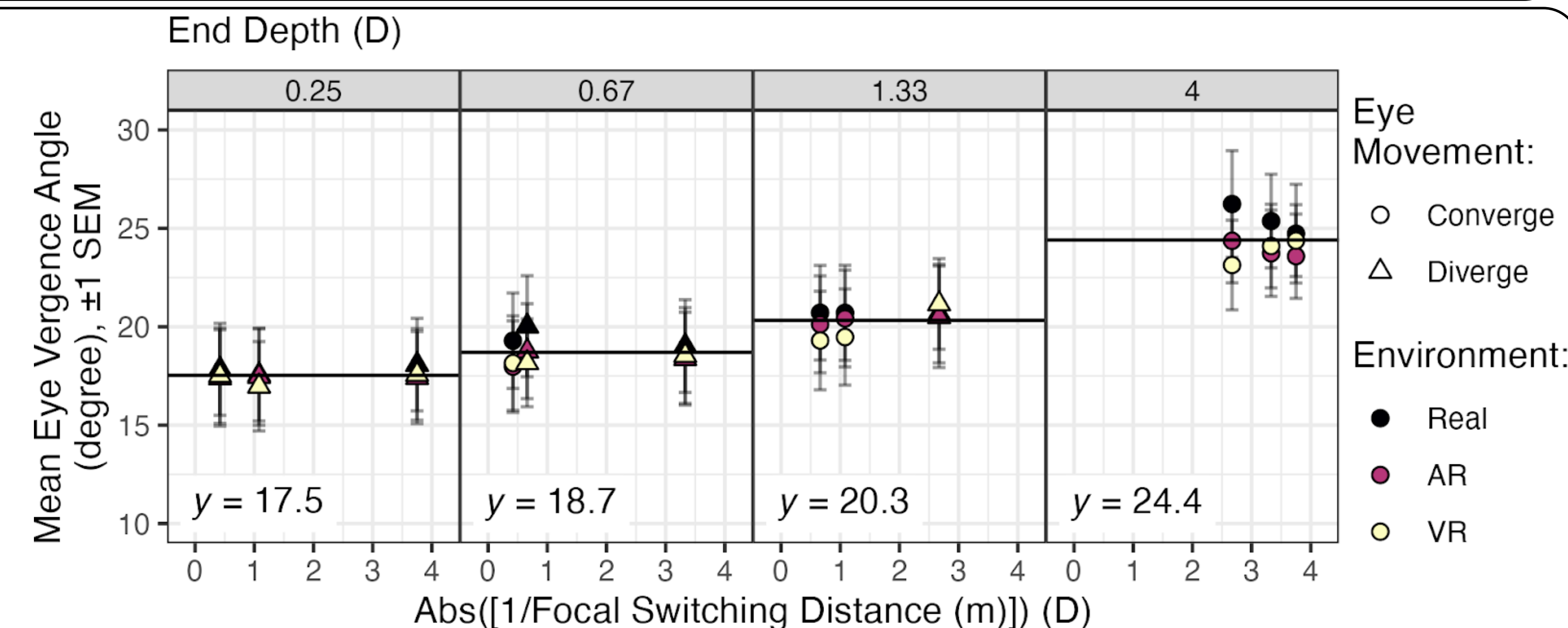
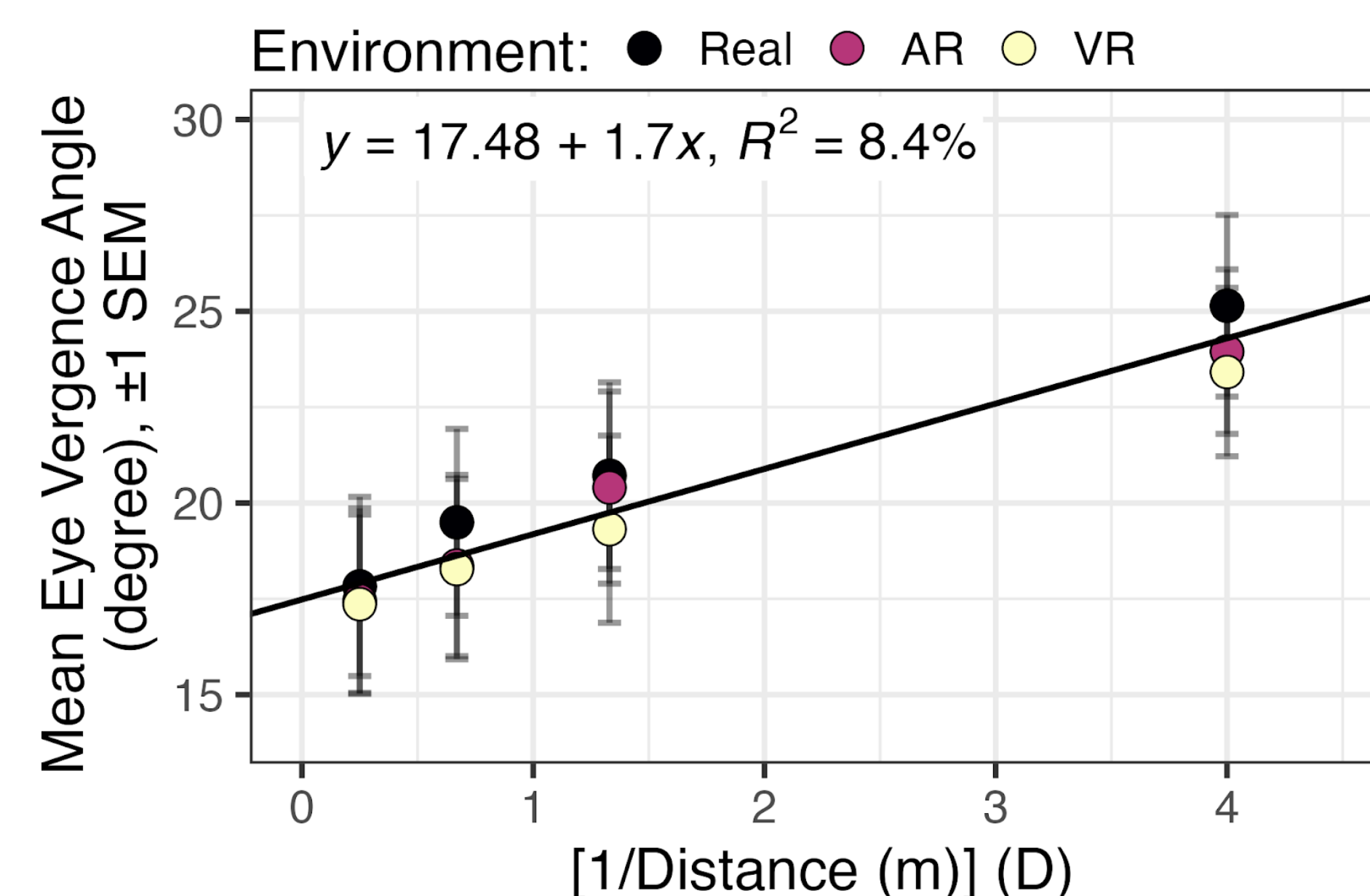
- **13 Subjects**
- **Visually-matched real world, AR, and VR conditions**



## Analysis



## Results



## Conclusion

- EVA successfully tracked perceived depth. However, H1 is partially supported:
  - The vergence angle changes as a linear function of depth in diopters in real-world, AR, and VR environments.
  - Surprisingly, no effect of vergence-accommodation conflict was observed in EVA with depths.
- EVA was stable with near-to-far (convergence) and far-to-near (divergence) eye movements for sharp focus in real, AR, and VR environments, as hypothesized in H2.
- Subjective (verbal report) and objective (eye tracker) measurements of depth are consistent with each other in real environment but not in AR and VR environments (underestimation).

FOR FURTHER INFORMATION:

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