Understanding origins of symptom onset for binocular and monocular minification

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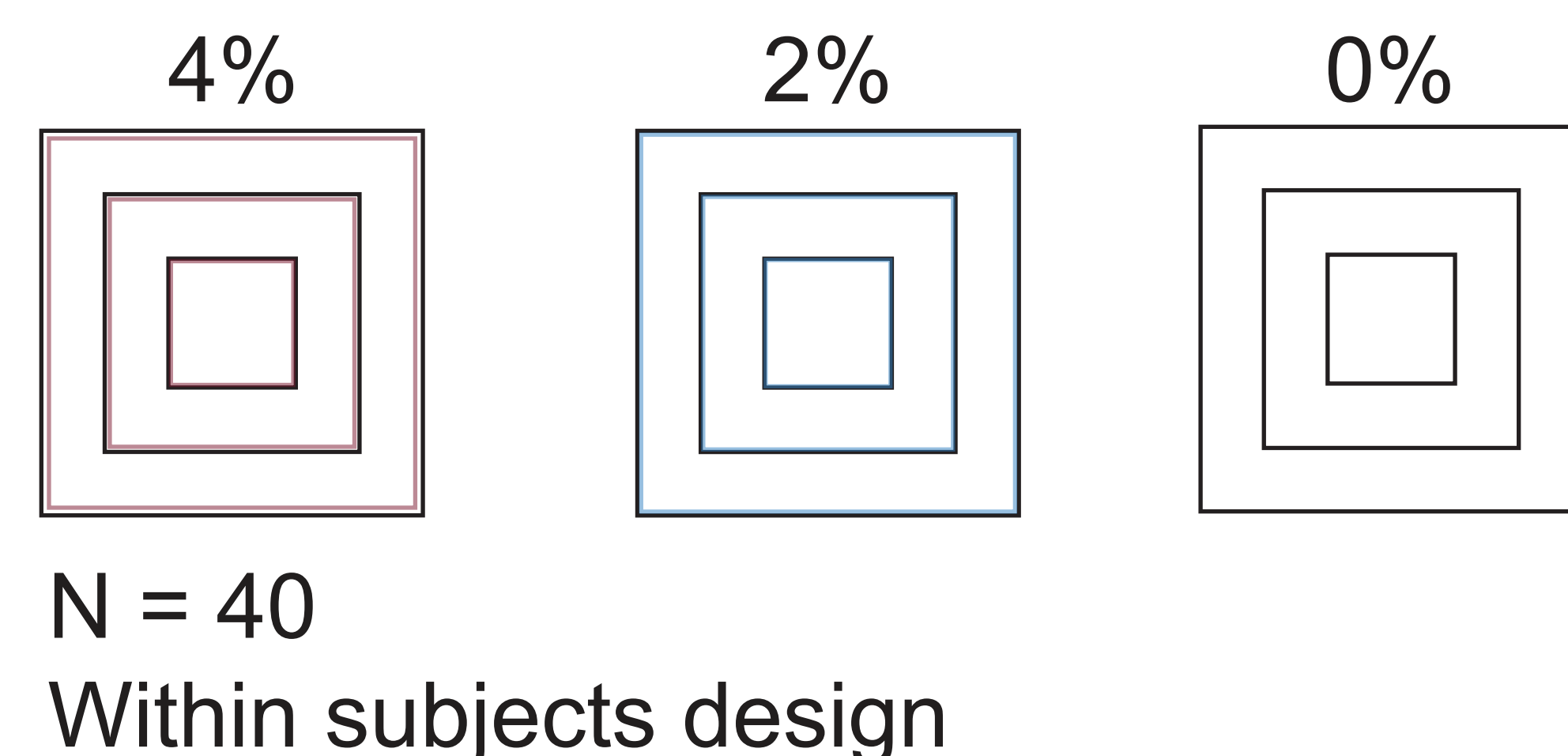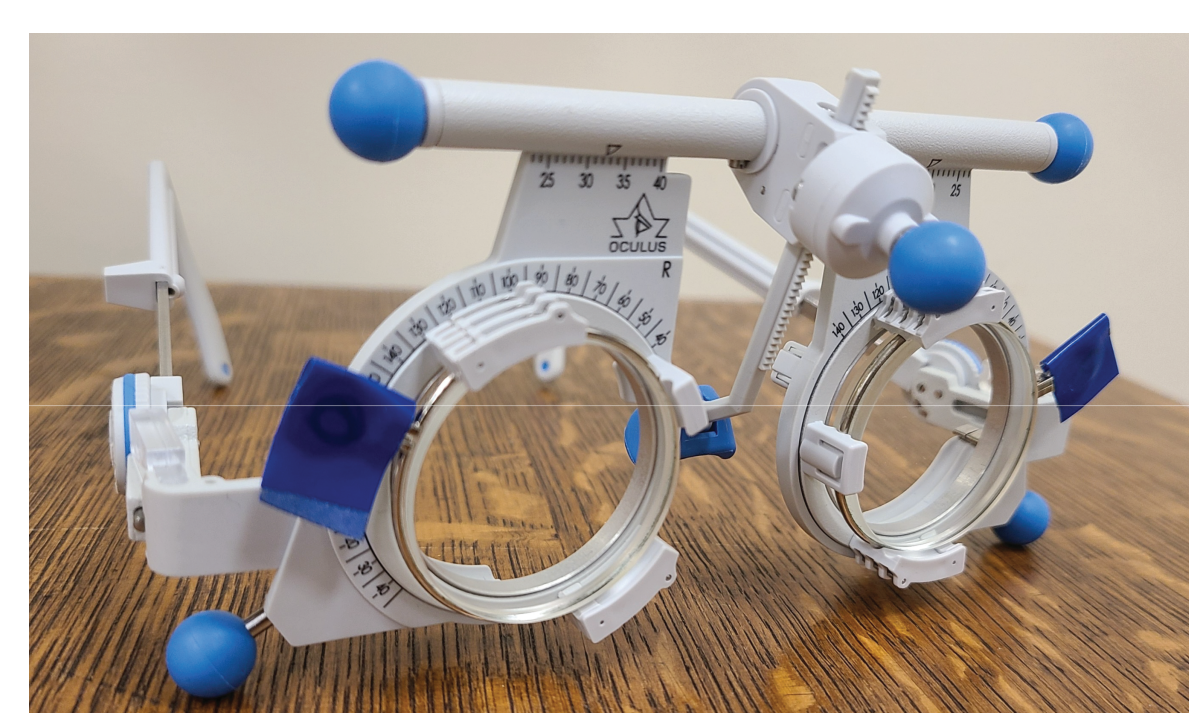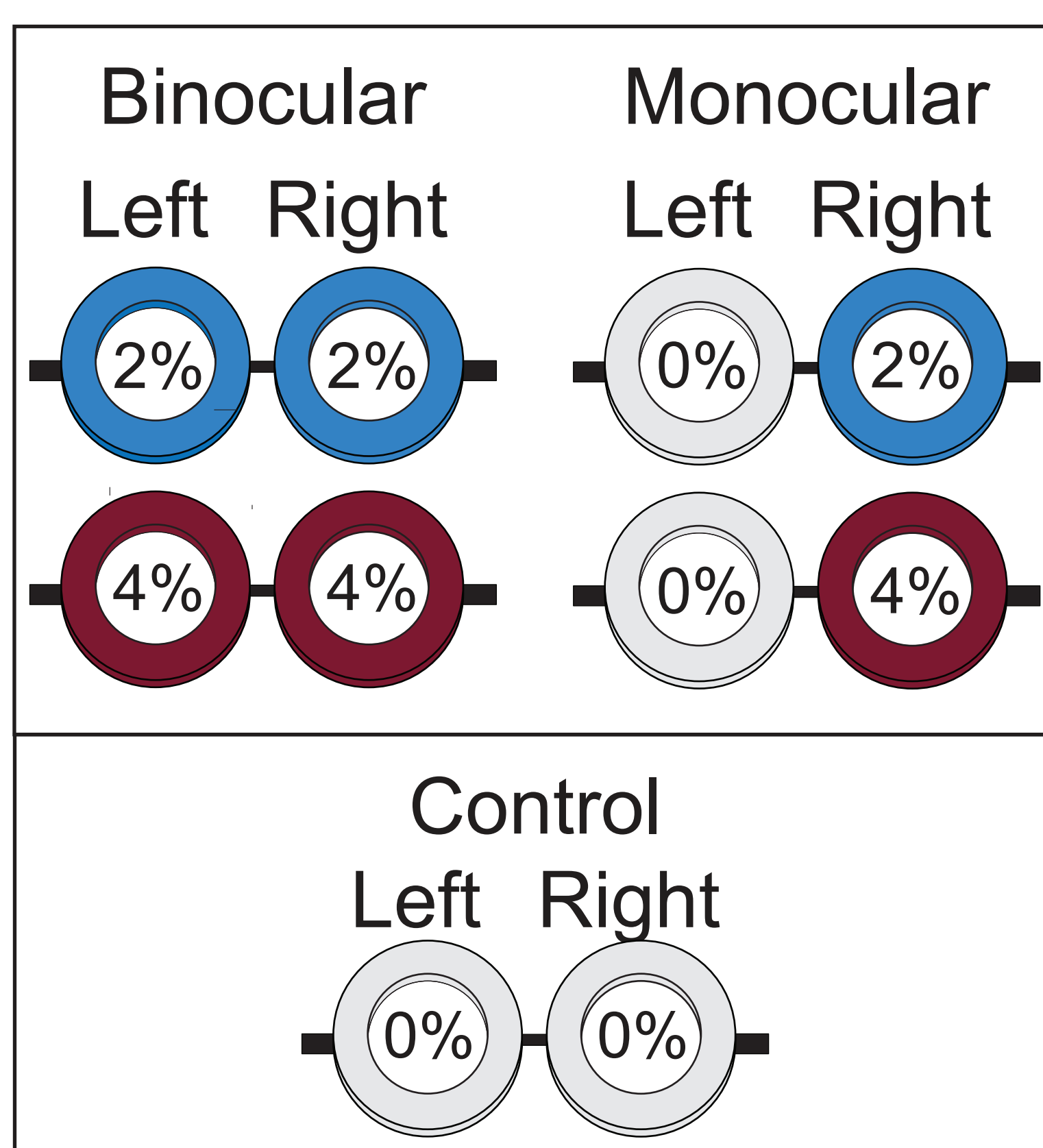
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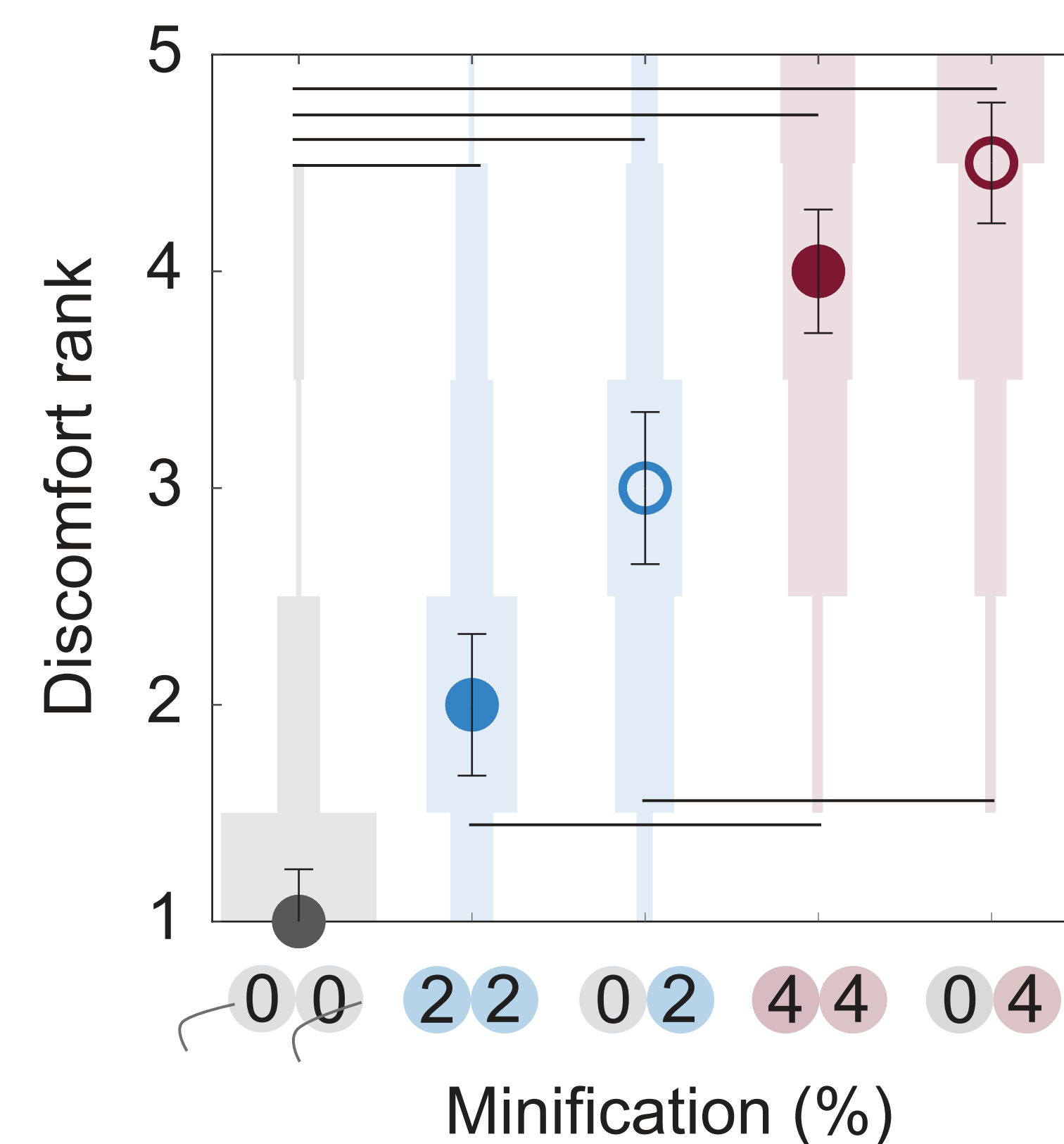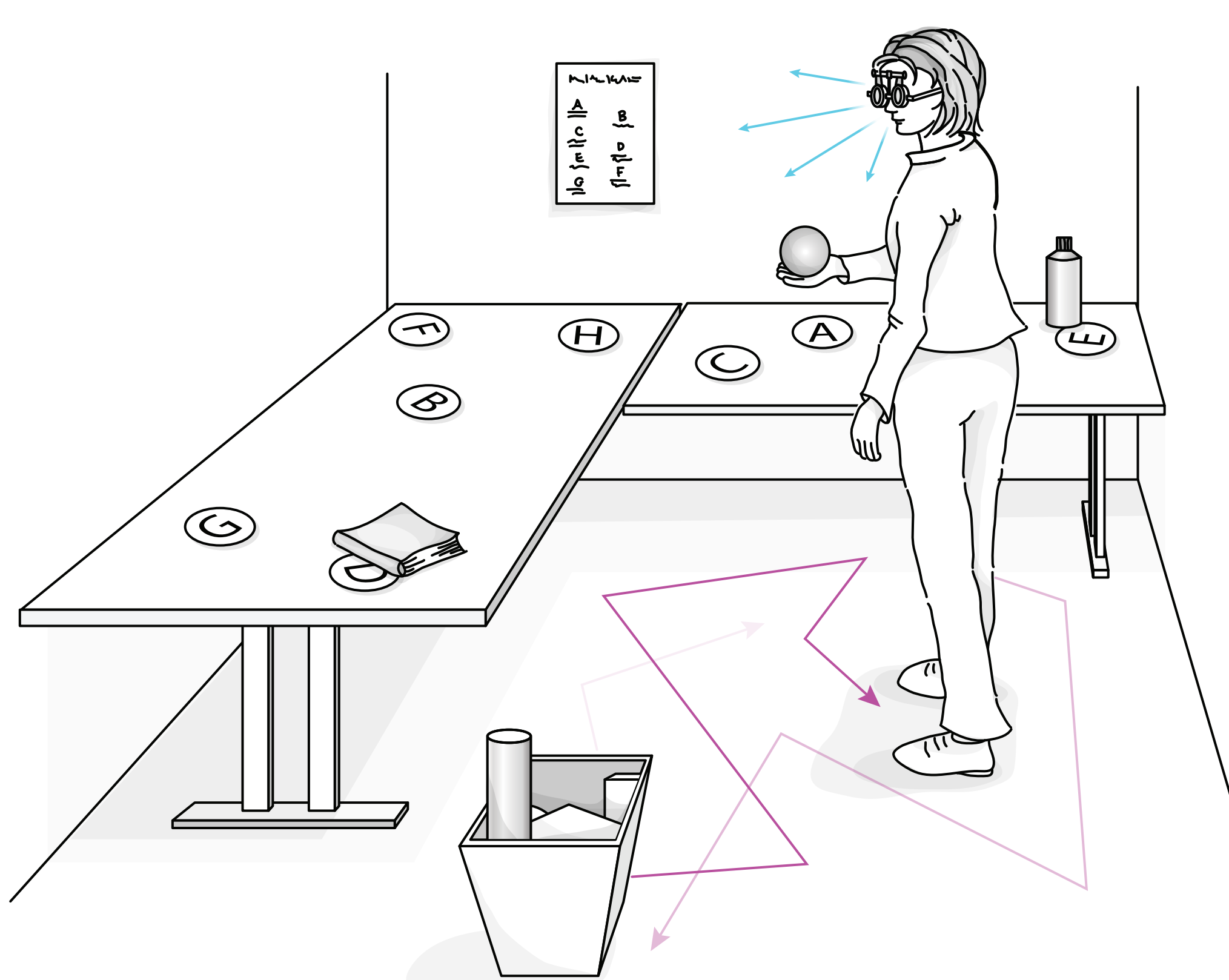**Berkeley** — Herbert Wertheim School of Optometry & Vision Science

Introduction

• Optical distortions, present in wearable optics, can produce some discomfort. However, the magnitude and causes of this discomfort are not well understood[1,2].
• Differences between the eyes may be especially disruptive[3].
• Comfort is a pressing issue for mixed reality devices as viewers may be less motivated to overcome discomfort.
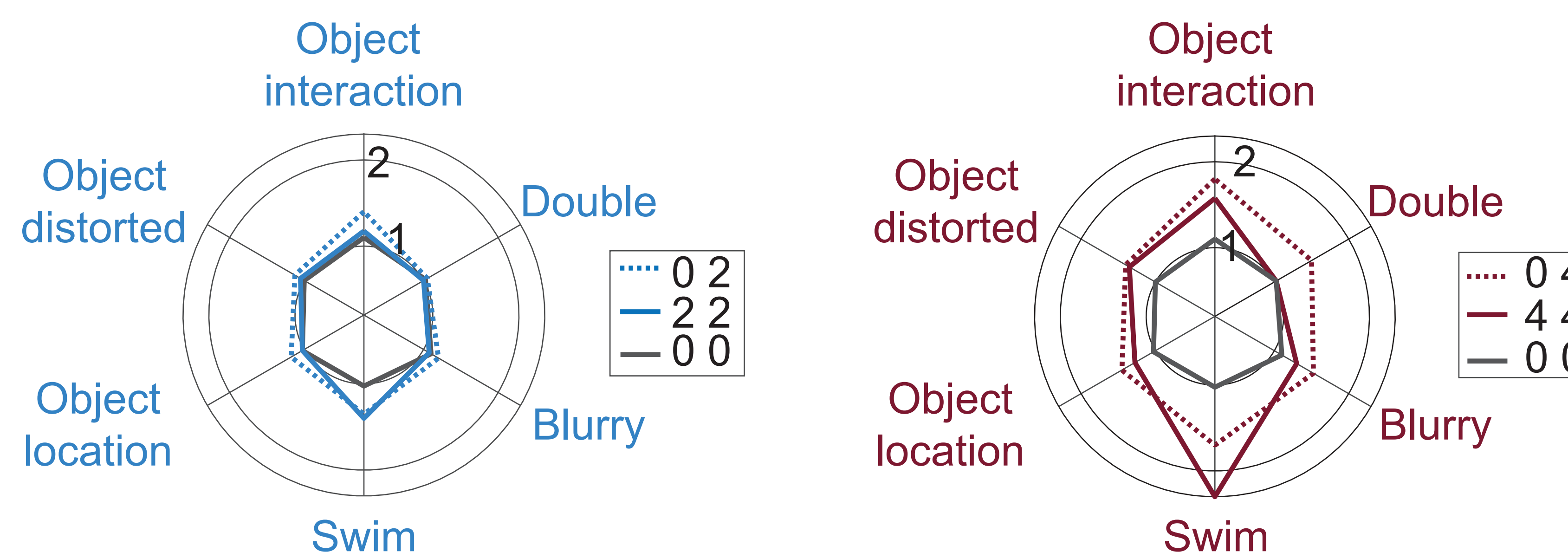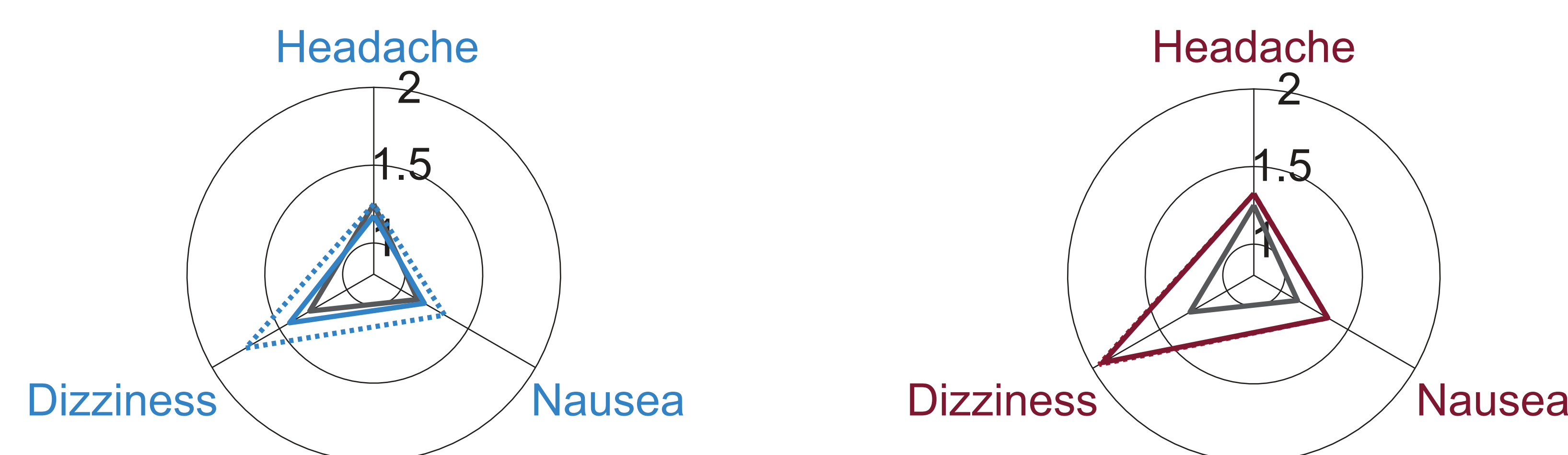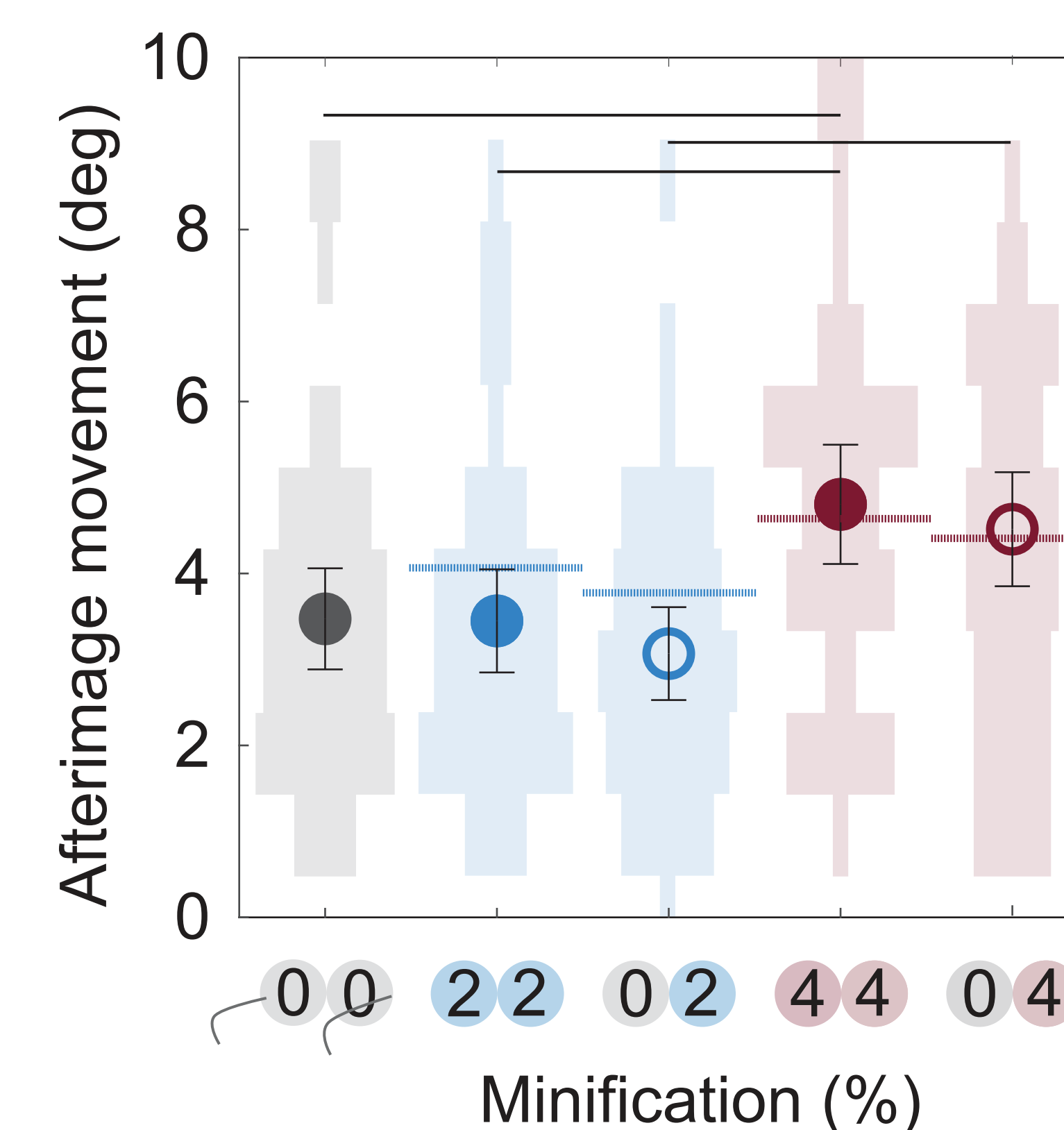
Minification conditions

Binocular — Left Right: 2% 2%, 4% 4%
Monocular — Left Right: 0% 2%, 0% 4%
Control — Left Right: 0% 0%

4%   2%   0%

N = 40
Within subjects design

Naturalistic task

Discomfort rank vs Minification (%): 0 0, 2 2, 0 2, 4 4, 0 4

Perceptual symptoms (1-5 likert scale)

Object interaction, Double, Blurry, Swim, Object location, Object distorted
Legend: 0 2, 2 2, 0 0 / 0 4, 4 4, 0 0

Physical symptoms (1-5 likert scale)

Headache, Nausea, Dizziness

Perceived swim task

Head rotation, Eye rotation, Retinal motion, Binocular minifiers, Monocular minifier

Afterimage movement (deg) vs Minification (%): 0 0, 2 2, 0 2, 4 4, 0 4
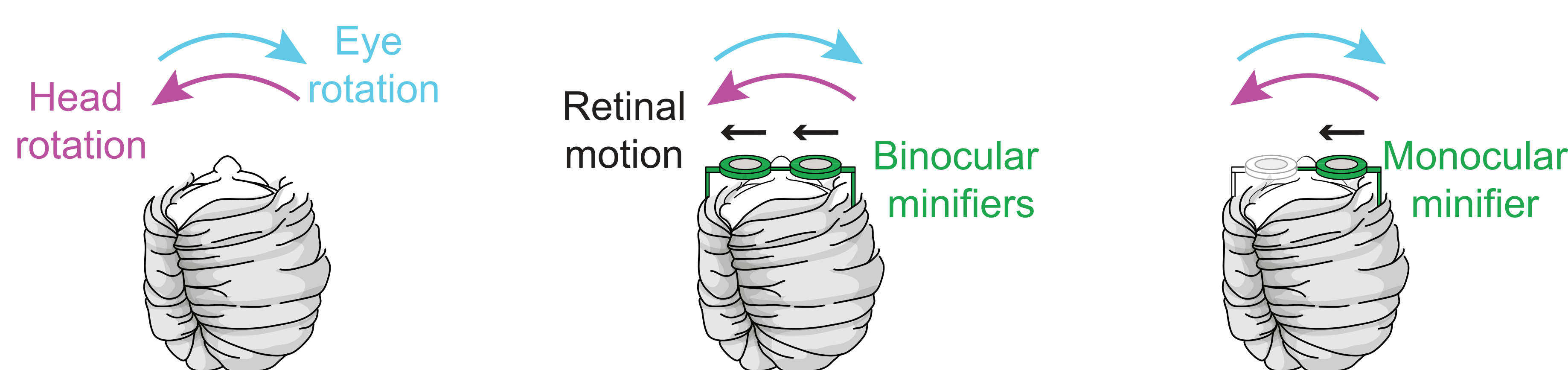
Controlled head and eye movement task

Pursuits, Saccades, Convergence, Head rotation, Body rotation
6m

Mean severity (likert scale 1-5) vs Pursuits, Saccades, Convergence, Head rotation, Body rotation
Dizziness, Headache, Nausea
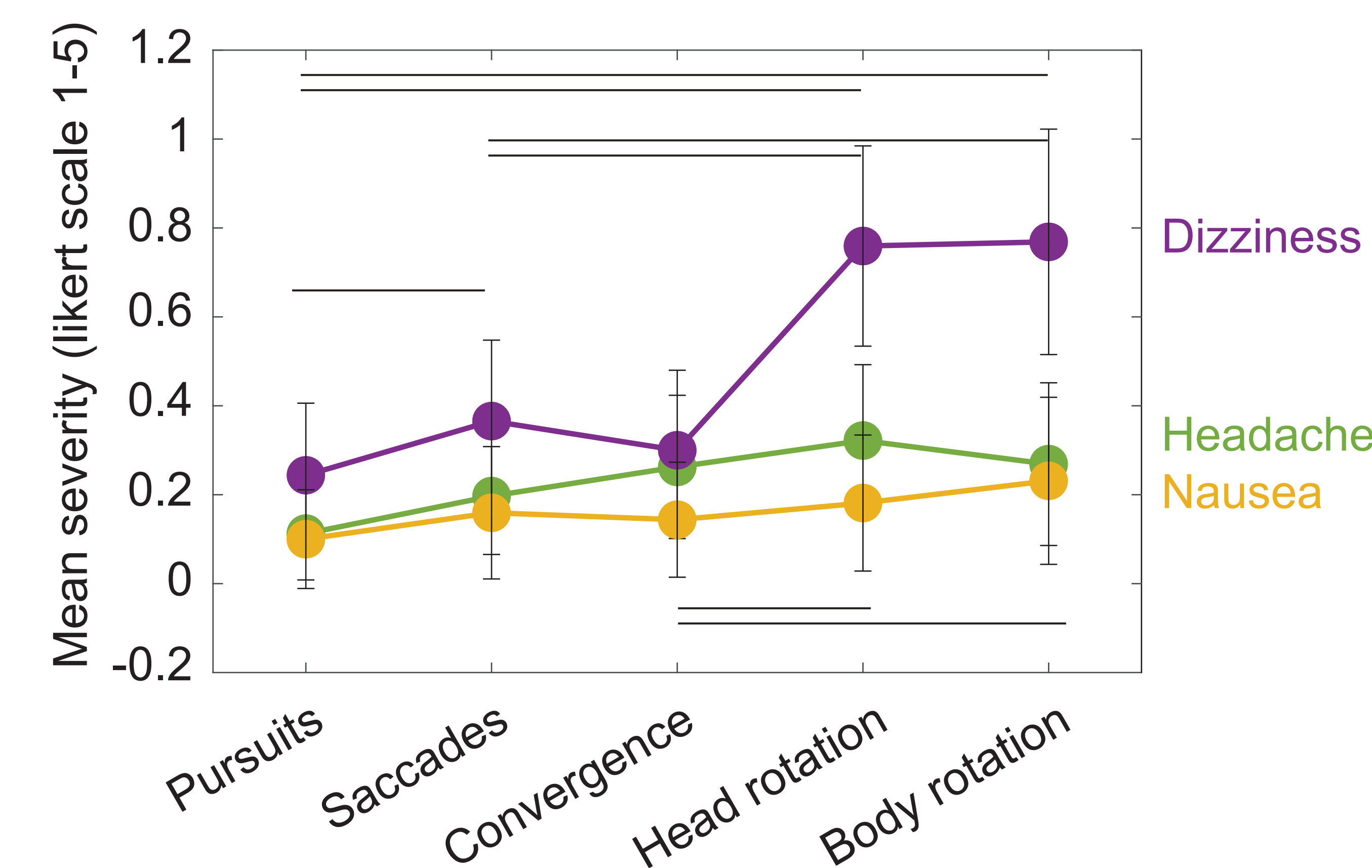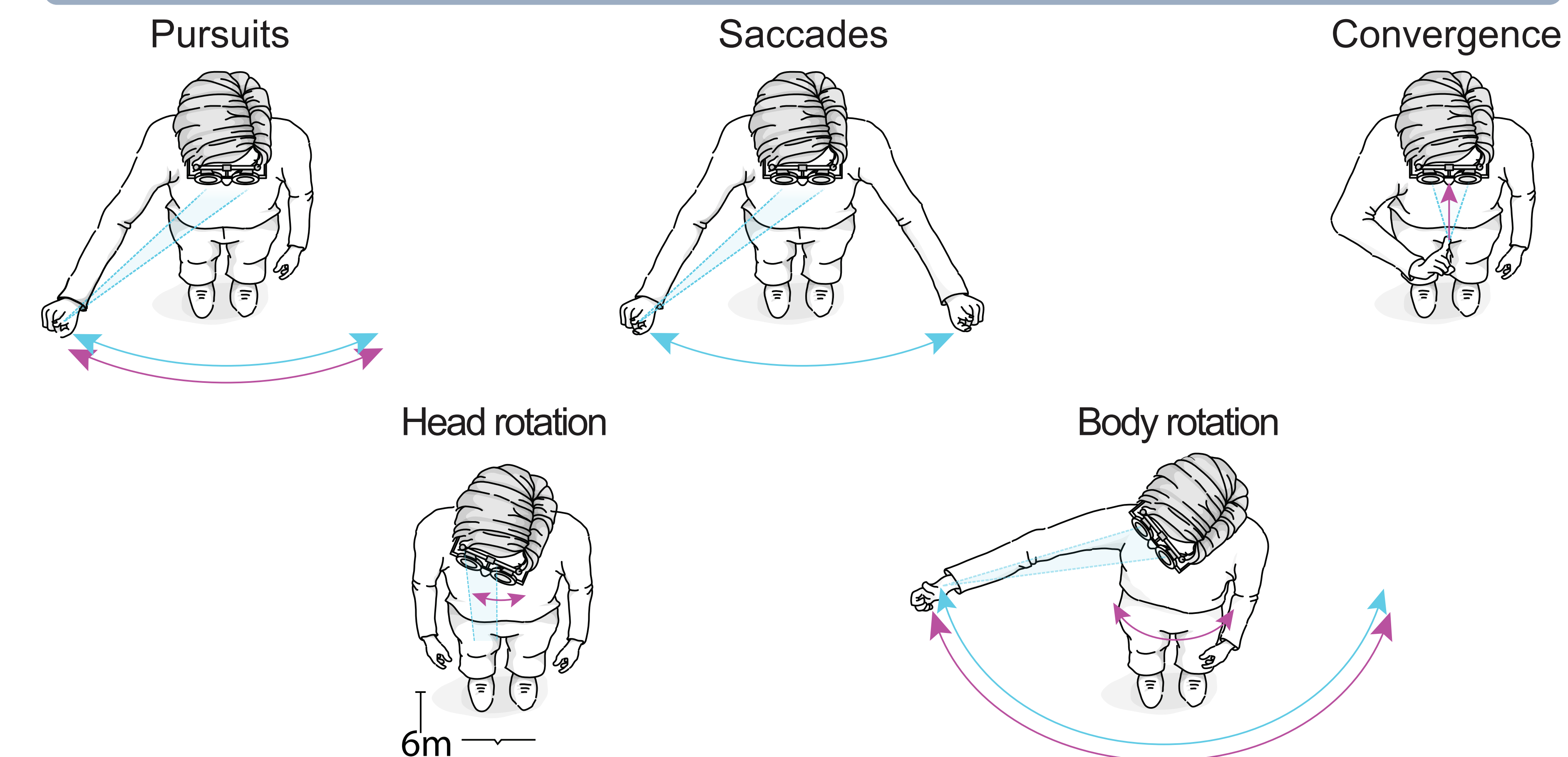
Conclusion

• Swim and dizziness were frequent symptoms suggesting that they may be key factors for comfort in wearable optics.
• Discomfort may result from visual vestibular conflicts associated with vestibulo-ocular reflex disruption.
• These data provide preliminary tolerance guides for initial experience in binocular and monocular minification.
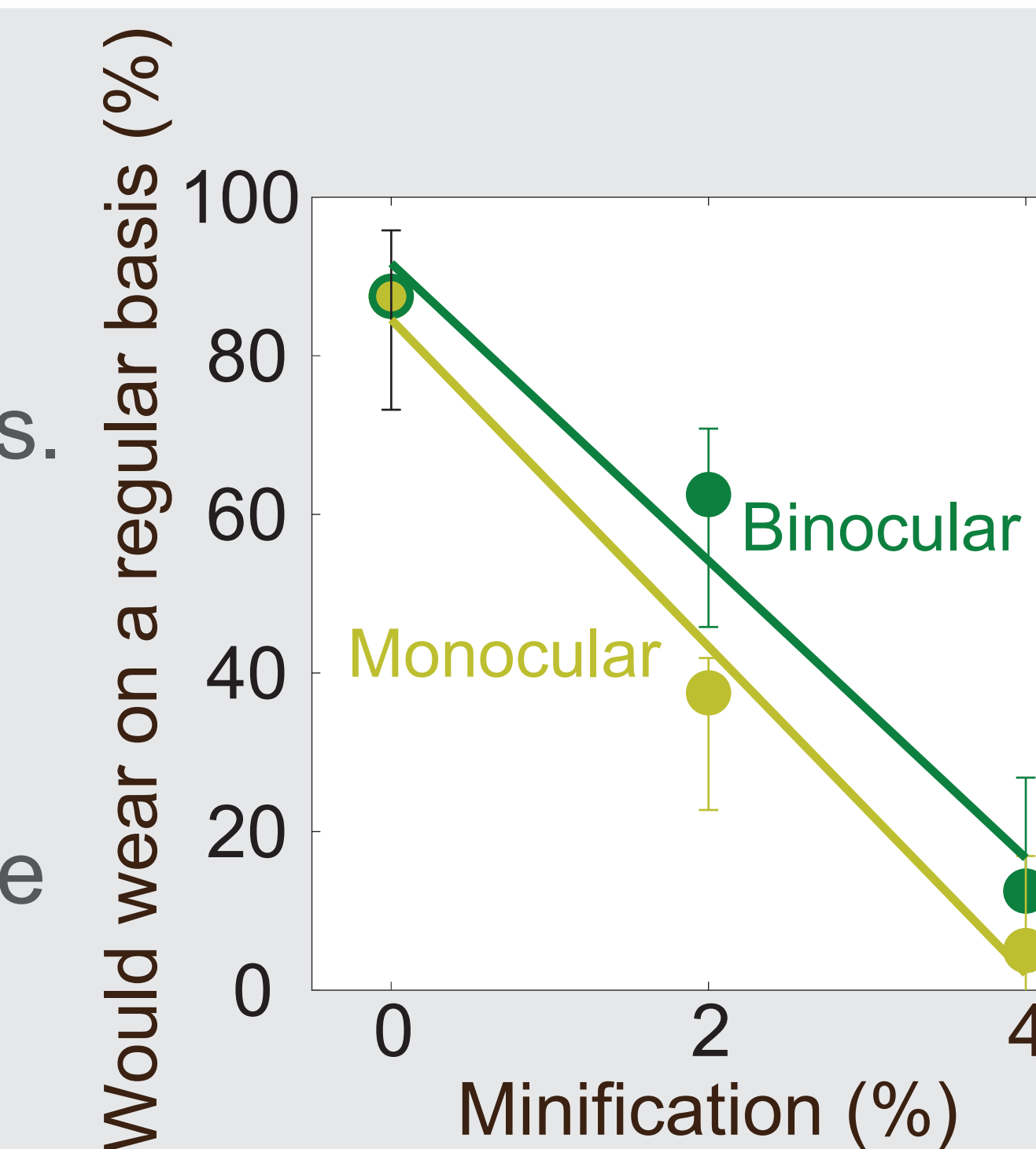
Would wear on a regular basis (%) vs Minification (%): Binocular, Monocular

References

1. Bist, J., Kaphle, D., Marasini, S., & Kandel, H. (2021). Spectacle non-tolerance in clinical practice – a systematic review with meta-analysis. Ophthalmic and Physiological Optics, 41(3), 610–622.
2. Meister, D., & Sheedy, J. E. (2008). Introduction to opthalmic optics (6th ed.). San Diego: Carl Zeiss Vision.
3. Hrynchak, P. (2006). Prescribing spectacles: Reasons for failure of spectacle lens acceptance. Ophthalmic and Physiological Optics, 26(1), 111–115.