

# DOES ACCOMMODATION RESPOND EQUALLY TO ARTIFICIALLY BLURRED, AND TO REAL OUT-OF-FOCUS RETINAL IMAGES?

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## INTRODUCTION

Consider the three following questions:

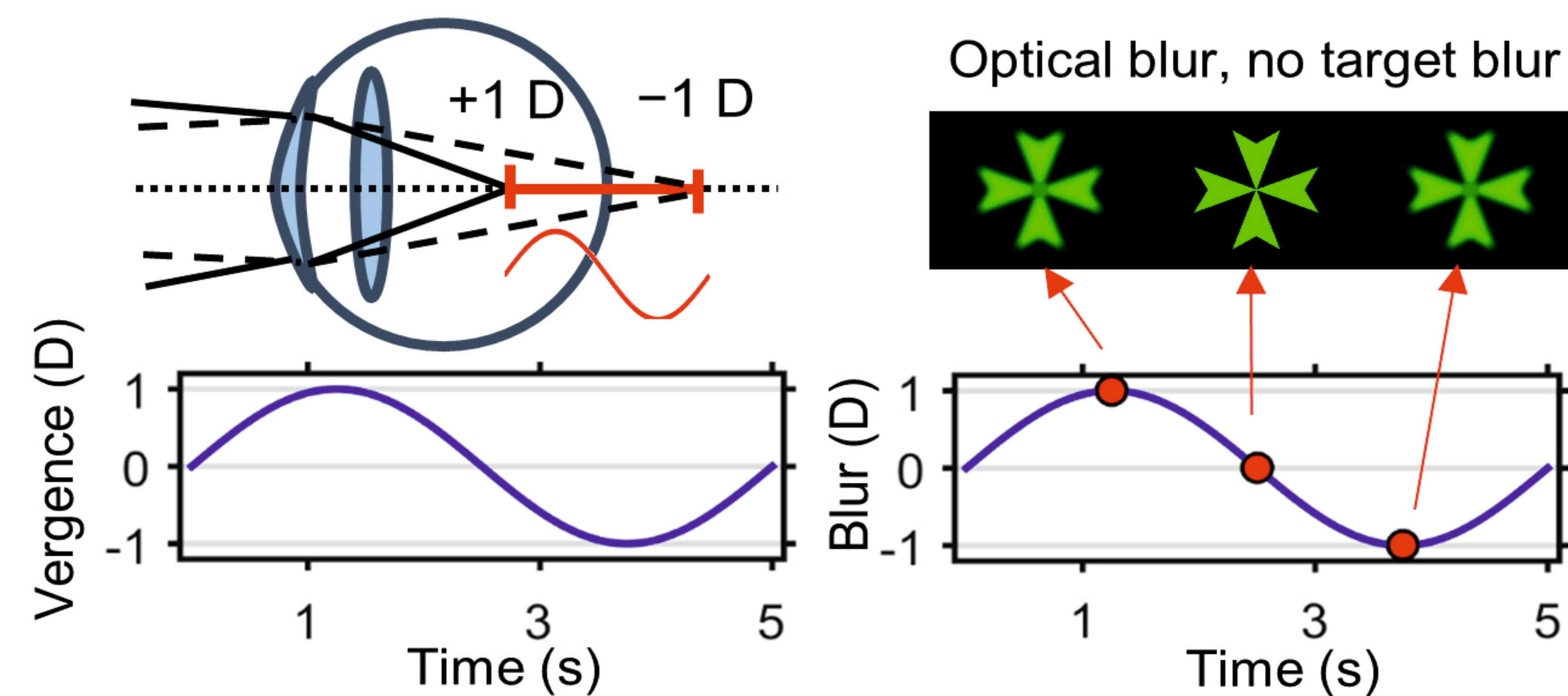
1: How do you know that this Maltese cross is artificially blurred and not out of focus due to an accommodative error?

2: What if there were no binocular or monocular cues?

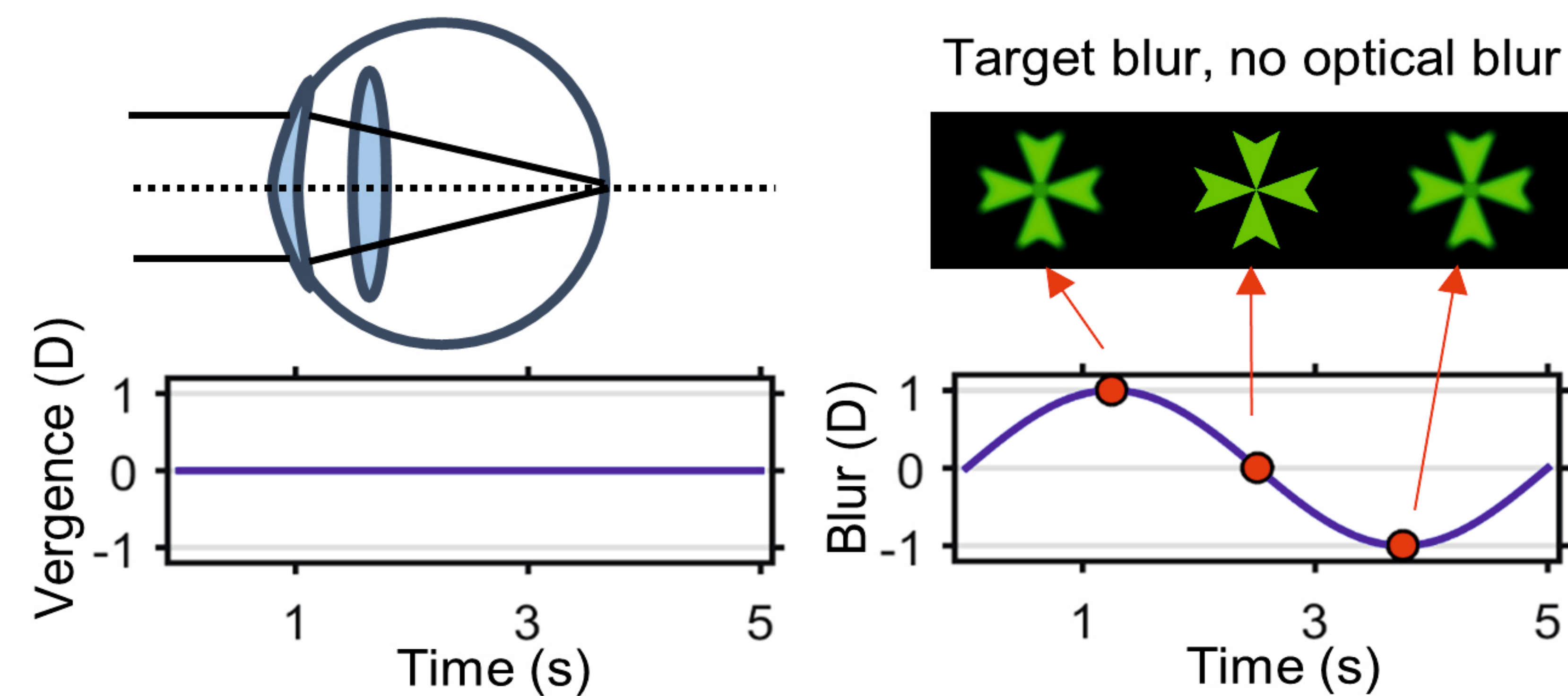
3: Now, imagine the cross moves forward and backward without changing its size, stimulating accommodation, as in **a)**. Will accommodation be stimulated if the cross stays in focus on the retina, but is artificially blurred, as in **b)**?



### a) Vergence-driven



### b) Blur-driven

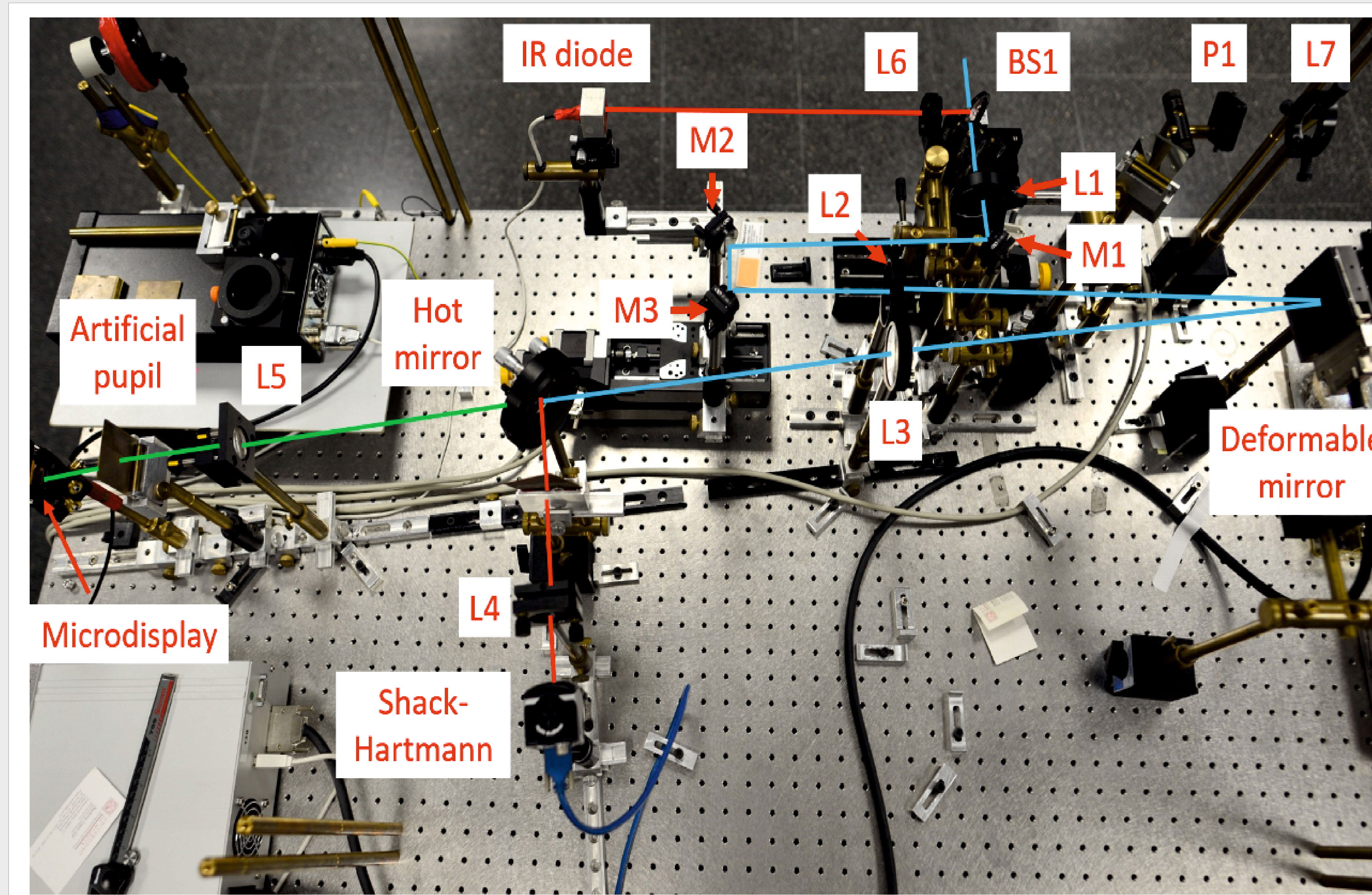


## PURPOSE

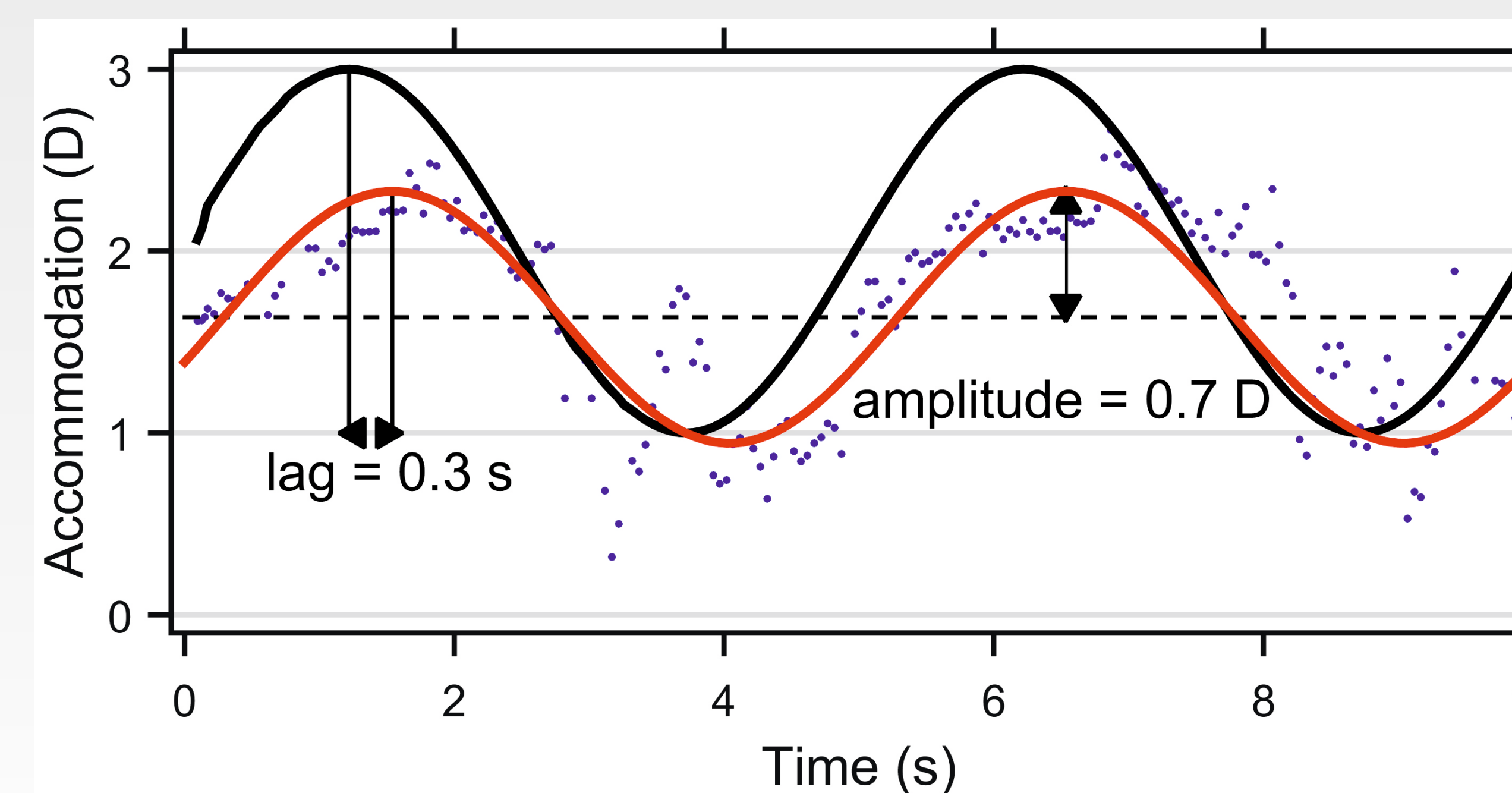
We tested whether accommodation is driven by change in light vergence (vergence driven condition), or by the sole presence of defocus blur in the retinal image (blur-driven condition) without feedback.

## METHODS

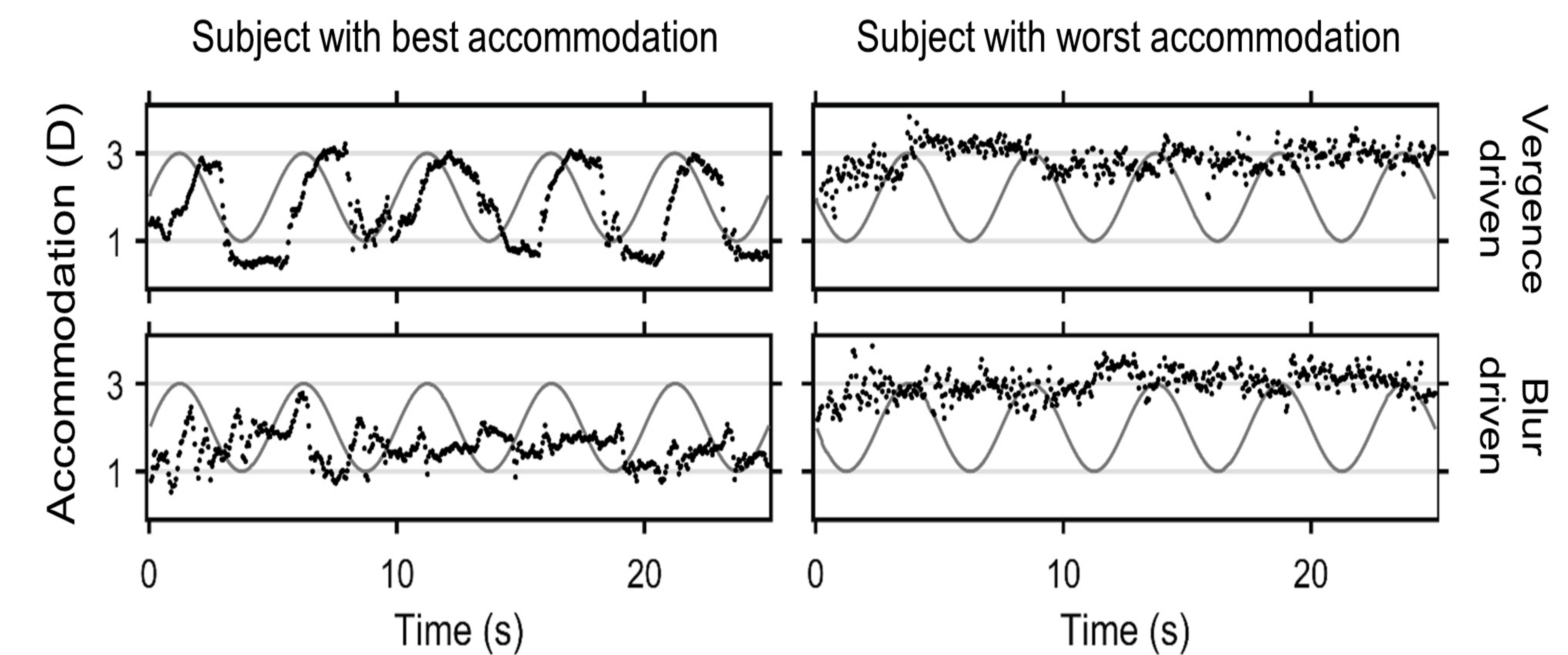
- Monochromatic light ( $550 \pm 5$  nm) Maltese cross ( $2^\circ$ ).
- Monochromatic aberrations corrected with an adaptive optics system at 20Hz.
- Vergence changed sinusoidally at 0.2Hz during 50 seconds between an accommodation demand of 1D to 3D.
- 4-mm artificial pupil.
- 9 normal subjects ( $27 \pm 6$  yo).



- Gain and phase values (see figure) were computed under two conditions: vergence-driven and blur-driven.

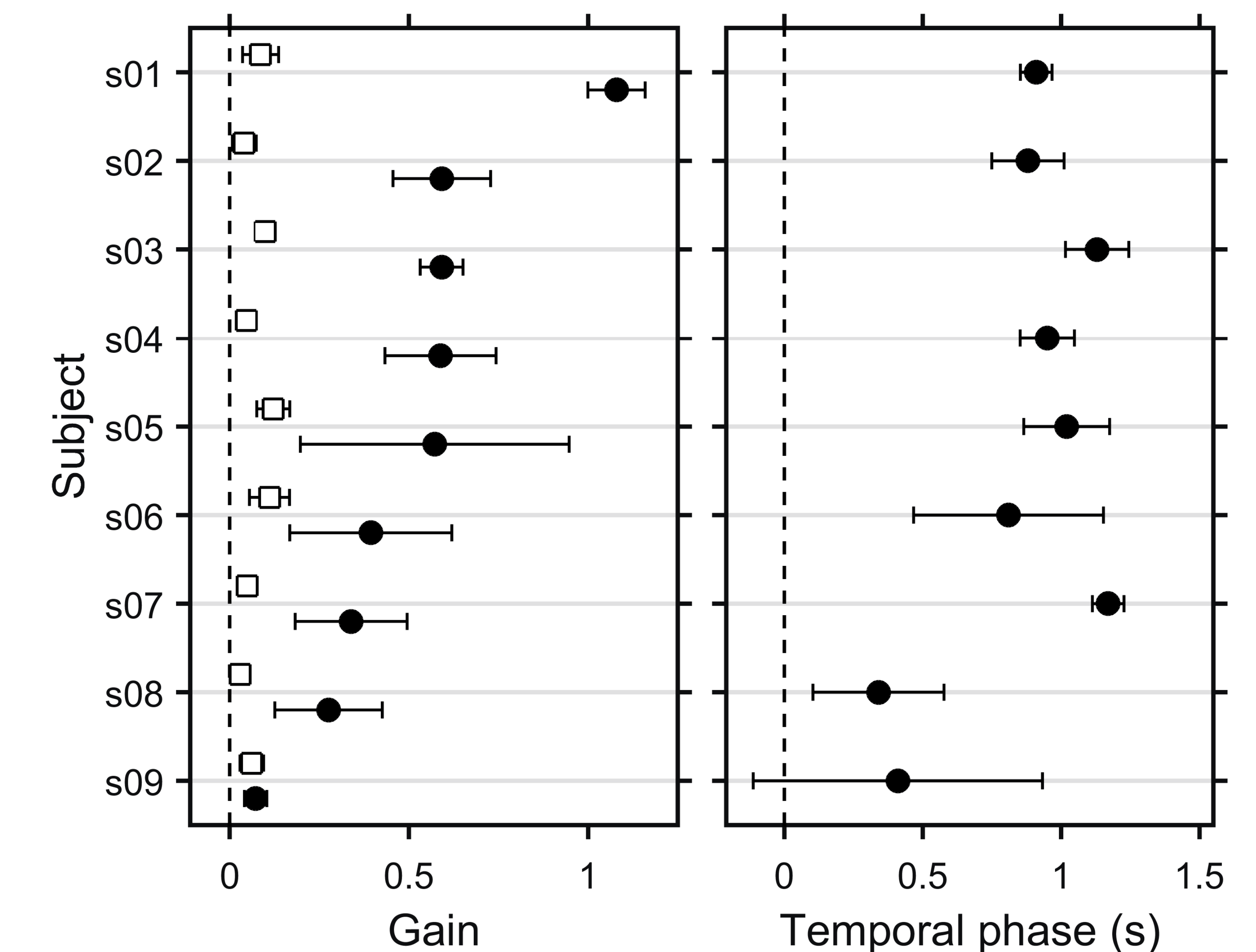


## RESULTS



### GAIN AND PHASE RESULTS IN ALL SUBJECTS:

All subjects except one (s09) accommodated much better to real changes in vergence than just the change in retinal blur.



## CONCLUSIONS

**Accommodation responds more efficiently to changes in optical vergence than to changes in defocus blur without feedback.**

Similar but not totally equal results have been found when the subject in the blur-driven condition was rewarded or penalized depending on the accommodative error (with feedback in the blur-driven condition). See oral presentation in Room 316 on monday, 3:45 pm.

The results of this study have been published in IOVS  
"Accommodation Responds to Optical Vergence and Not Defocus Blur Alone",  
58(3):1758-63, doi: 10.1167/iovs.17-21280. March 2017.