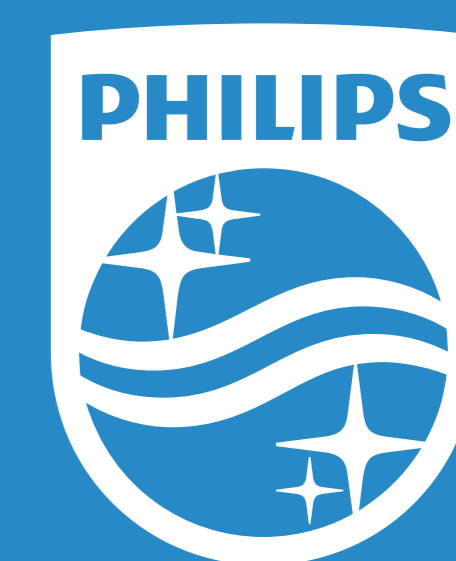


Short wavelength light increases pupil constriction but not (!) visual acuity at equillumiance



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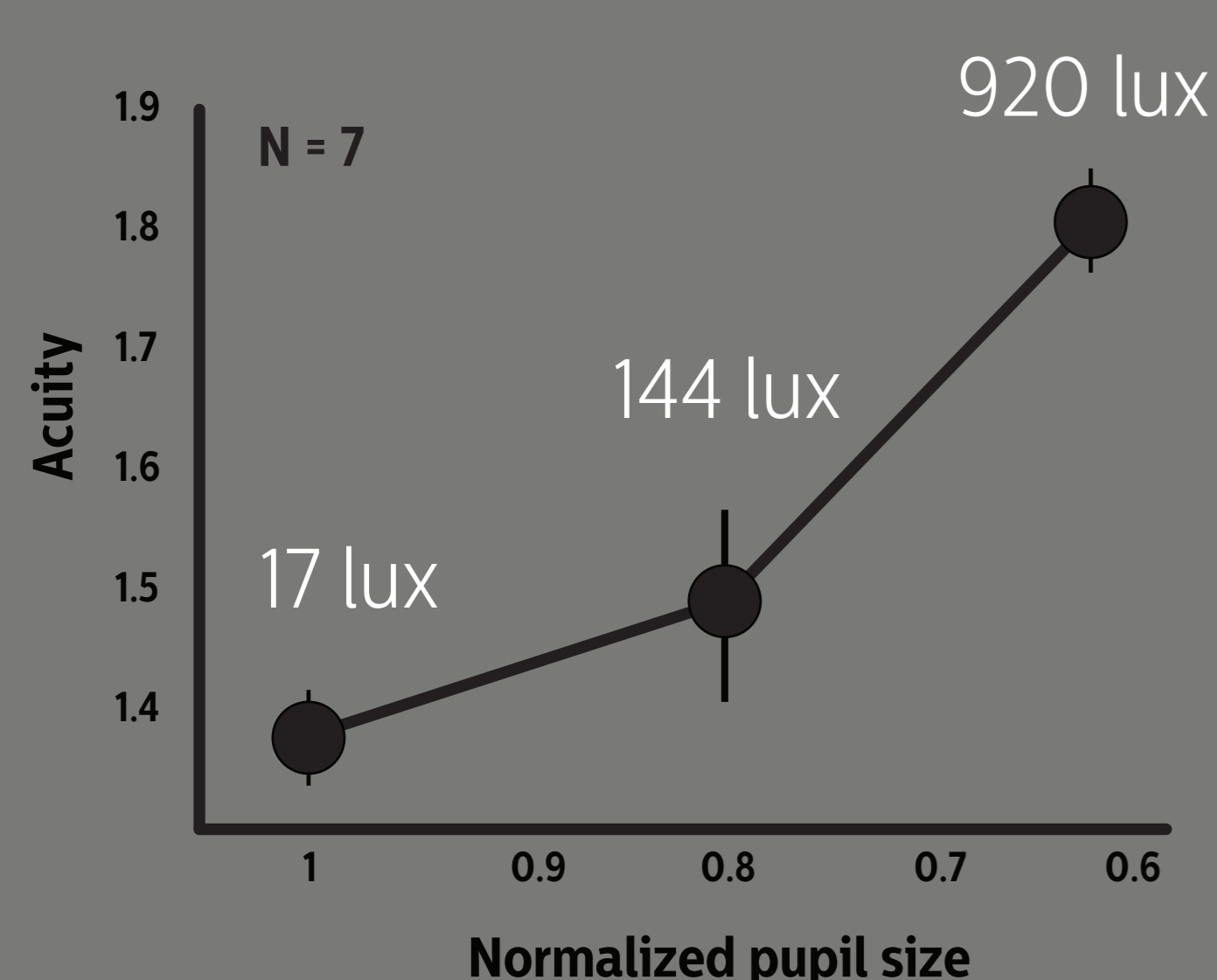
Introduction

One role of the pupil light reflex is to adjust the aperture of the eye to optimise visual acuity over a wide range of luminances (Campbell & Gregory, 1960). By reducing the aperture, optical aberrations and refraction errors of the lens are reduced, resulting in higher visual acuity. The pupil light reflex not only depends on illumination level, but also on wavelength, showing a larger sensitivity to shorter wavelengths.

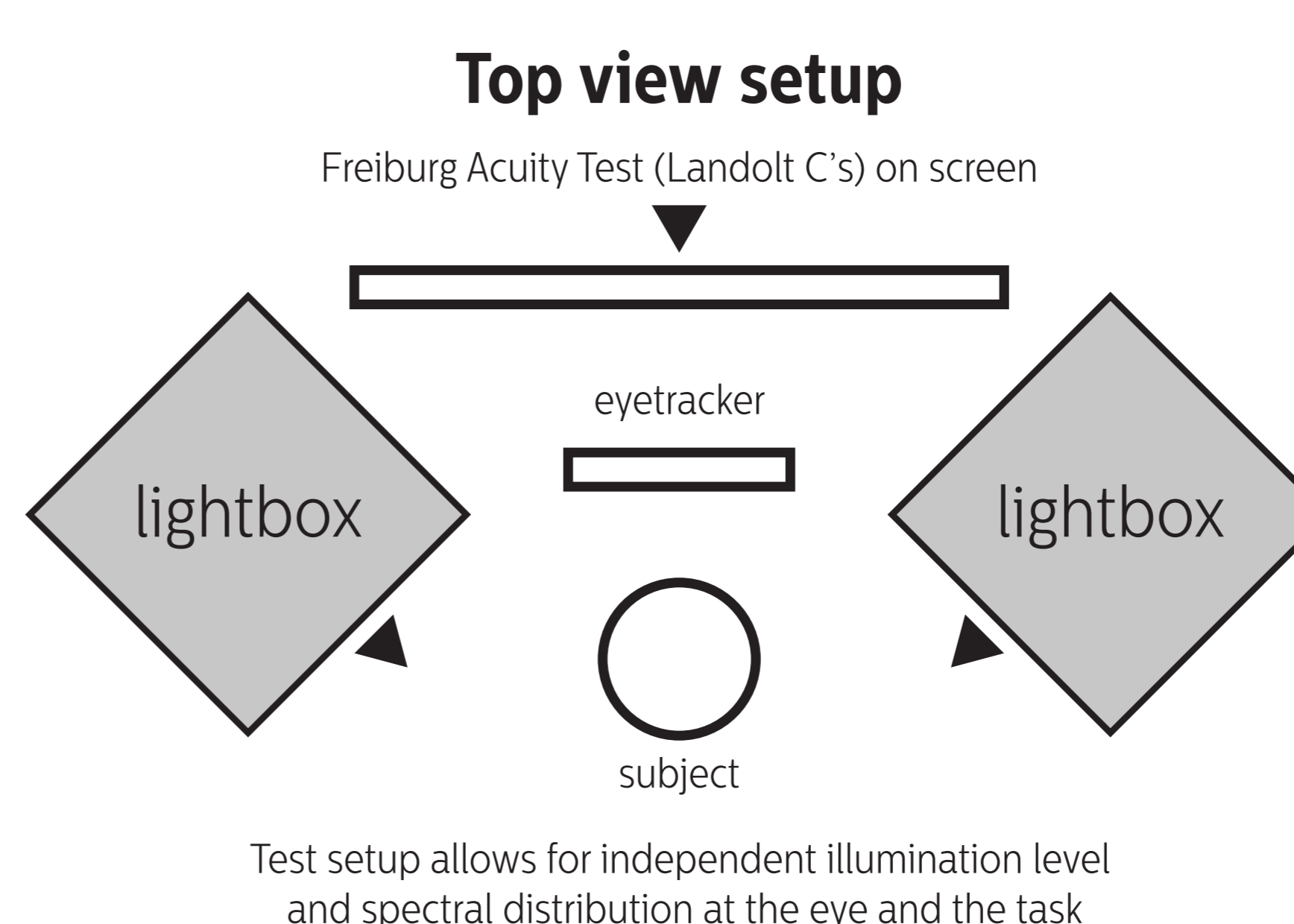
In two experiments we investigated how pupil size, spectral composition and visual acuity are related.

Experiment 1

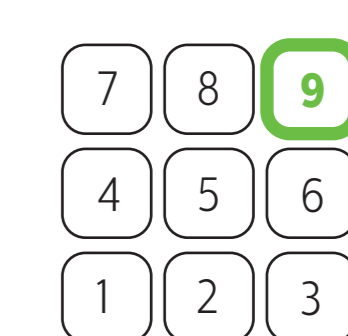
Light condition: 4000K CCT
Illuminance: 17, 144, 920 lux at eye
Trials: 48, one session
Distance to screen: 2 meters



~40% smaller pupil leads to ~30% increase in acuity ($p < 0.01$)



Freiburg Acuity Test

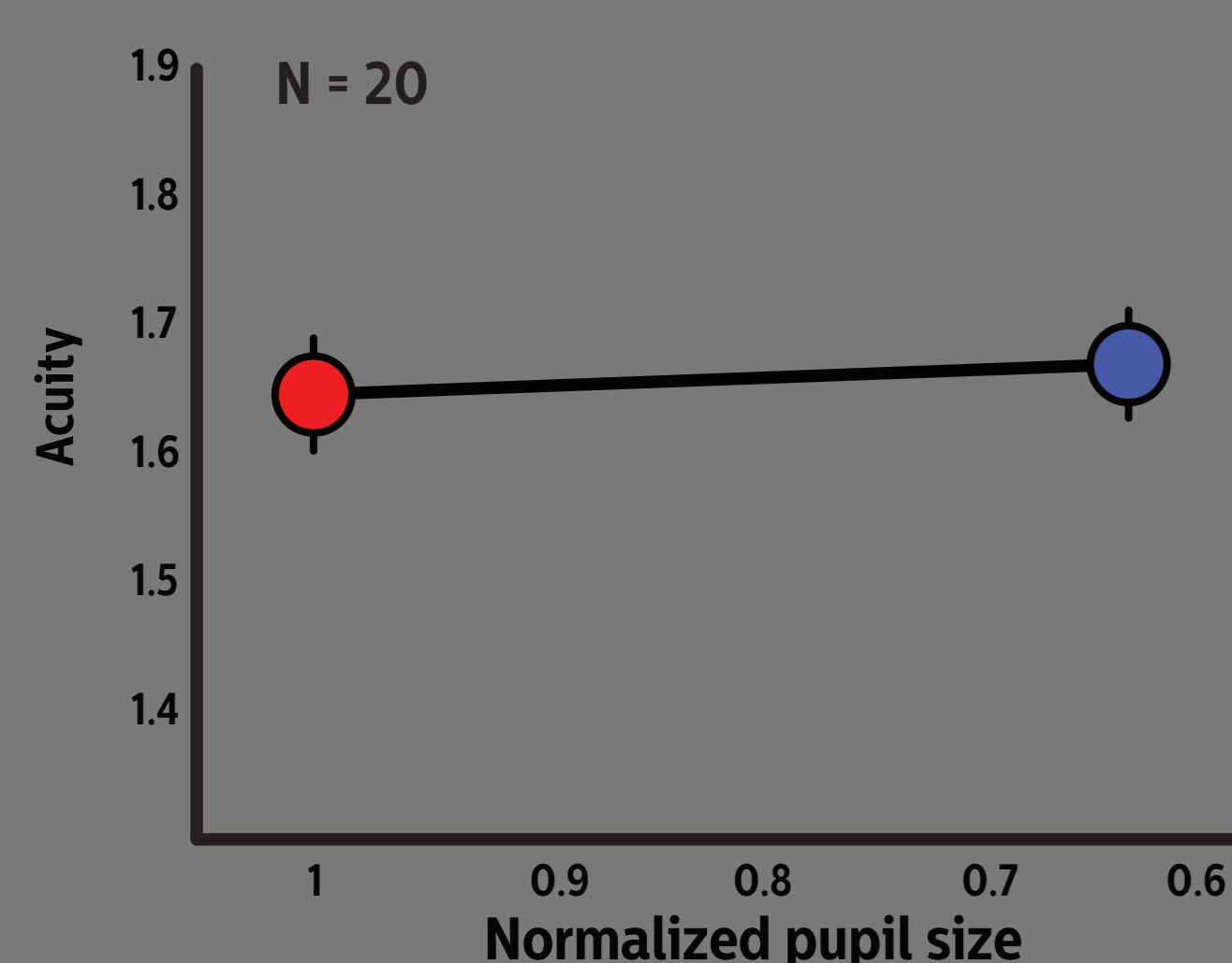


response on keypad

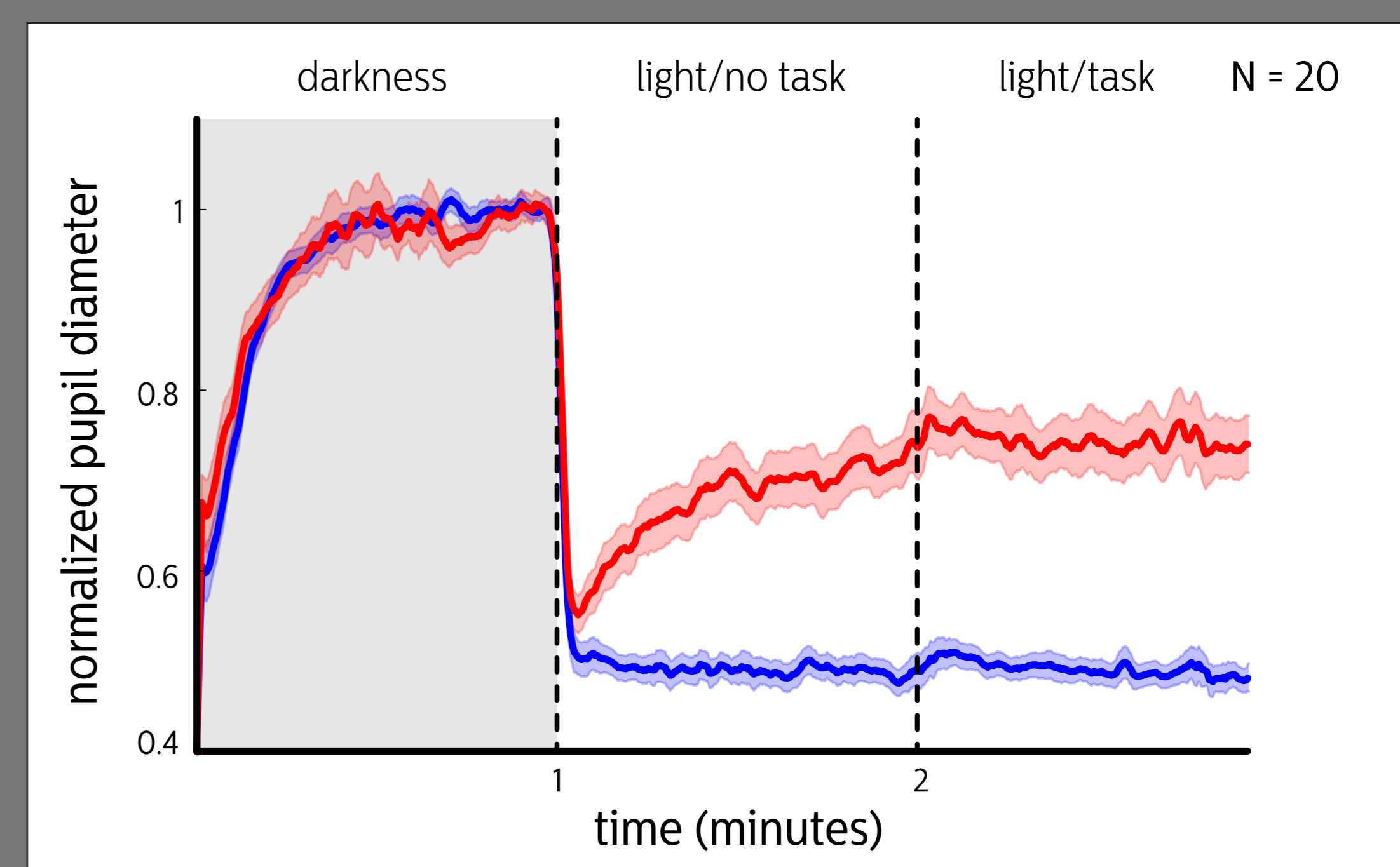


Experiment 2

Light condition: Monochromatic red/blue light
Illuminance: 38 lux at eye
Trials: 42 per session, three sessions
Distance to screen: 2.7 meters



~40% smaller pupil does not (!) improve acuity



Conclusion

Using broadband white light at various illumination levels (17, 144 and 920 lux at eye level, 4000K CCT), we found substantial effects of pupil size on visual acuity. However, when using monochromatic blue and red light, a comparable change in pupil size did not lead to increased visual acuity, even though pupil size was ~40% smaller in the blue vs the red condition. Our results suggest that even though pupil size can be reliably decreased with identical lux levels at the eye, visual acuity does not necessarily improve.