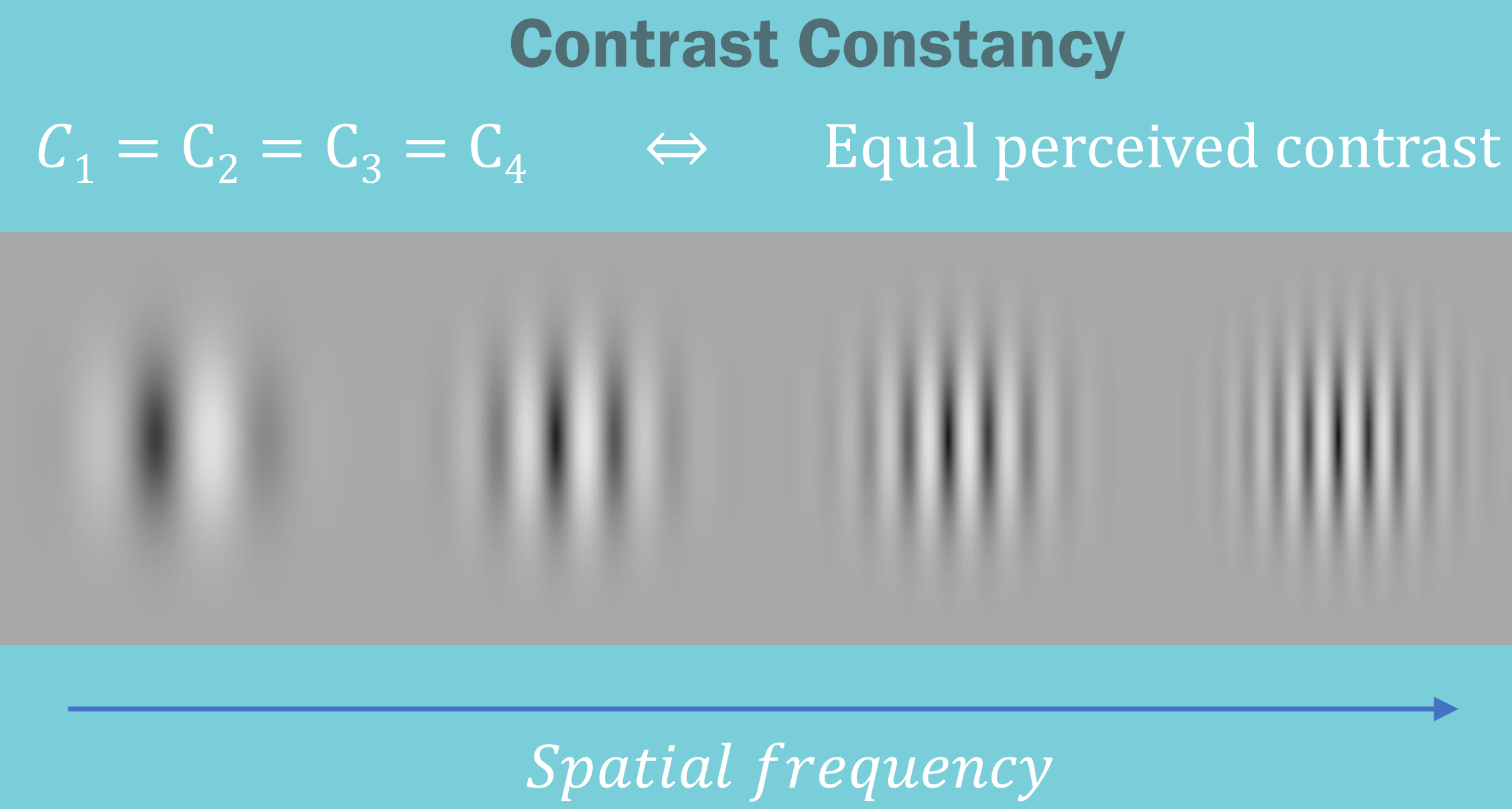


Background

Contrast constancy holds over

- Spatial frequency ^{1,2}
- Retinal eccentricity ³
- Chromatic directions ⁴
- Luminance ^{1,5}



Kulikowski's contrast constancy model:

$$C_1 - C_{1t} = C_2 - C_{2t}$$

“ Two suprathreshold stimuli are perceived equal in contrast when the differences between their physical contrasts and threshold contrasts are equal. ”

1. Kulikowski, J. J. (1976). *Vision Research*, 16(12), 1419-1431.
2. Georgeson, M. A., & Sullivan, G. D. (1975). *The Journal of physiology*, 252(3), 627-656.
3. Cannon, M. W. (1985). *JOSA A*, 2(10), 1760-1768.
4. Tiippana, K., et al. (2000). *Vision Research*, 40(16), 2159-2165.
5. Peli, E., et al. (1991). *JOSA A*, 8(8), 1352-1359.

Methodology

Observers

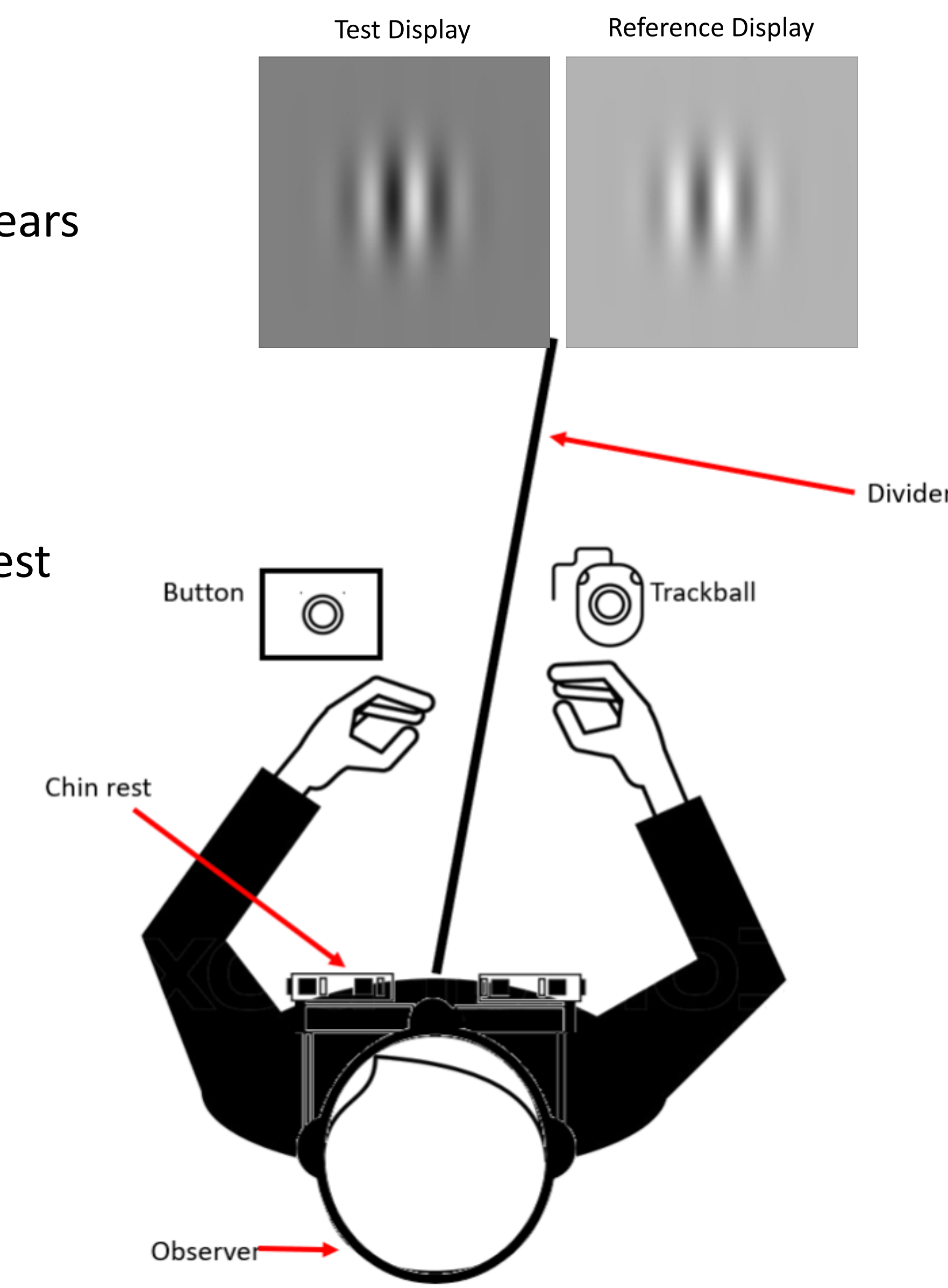
- Color normal observers
- 27 participants; mean age: 28 years

Stimuli

- Reference stimuli: 200 cd/m², 0.5, 2, and 4 cpd, in 3 color directions
- Test stimuli: Each reference stimulus matched with equivalent HDR test stimuli at 0.02, 0.2, 2, 20, 200, and 2000 cd/m²

Psychophysical Task

- Test stimuli displayed on an HDR screen at multiple luminance levels; reference stimuli displayed on a SDR screen at a fixed luminance level
- Observers adjust the contrast of test stimuli haploscopically such that the two contrasts appear similar



Deviation from constancy in contrast matching over a wide range of luminances

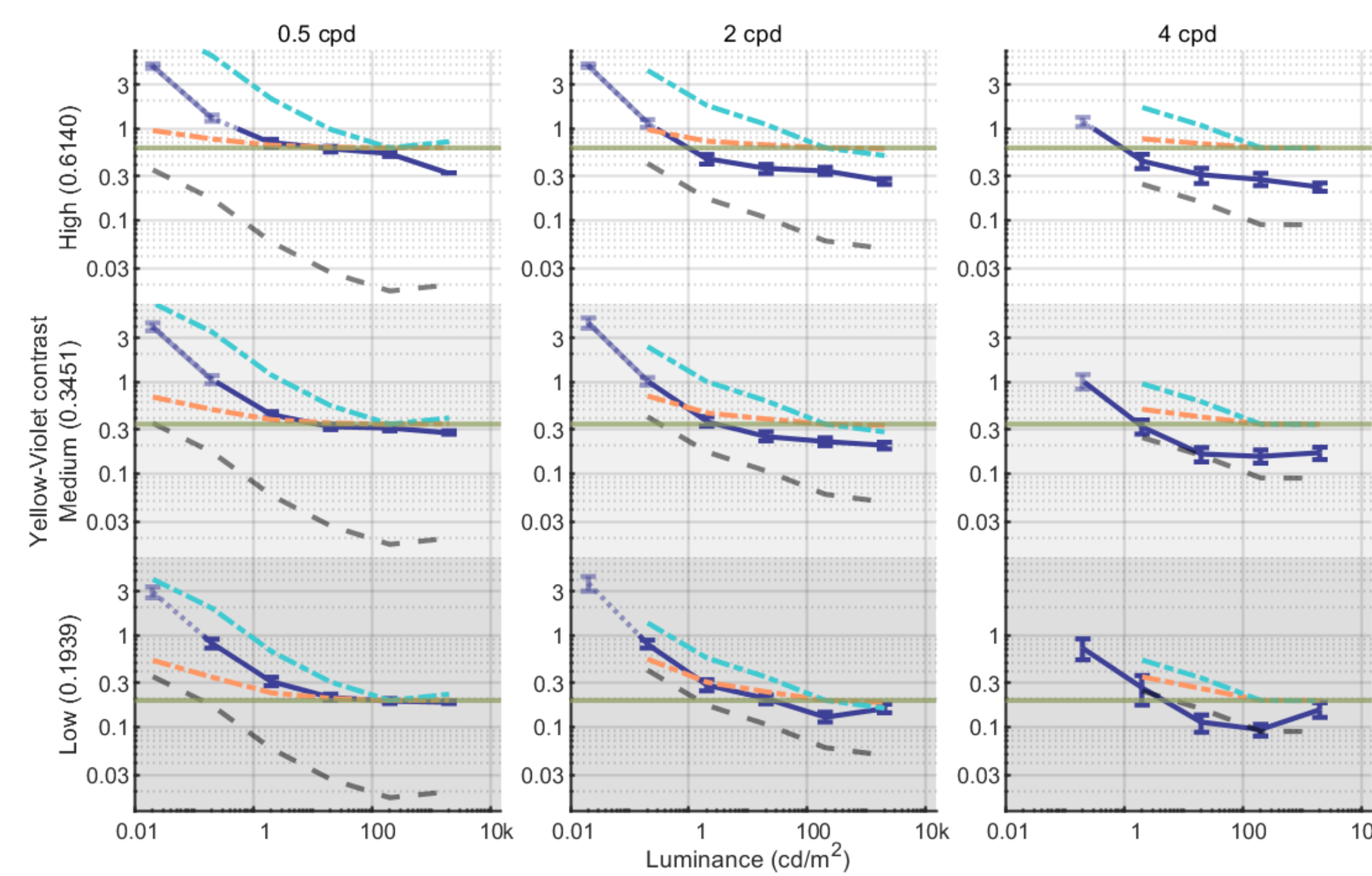
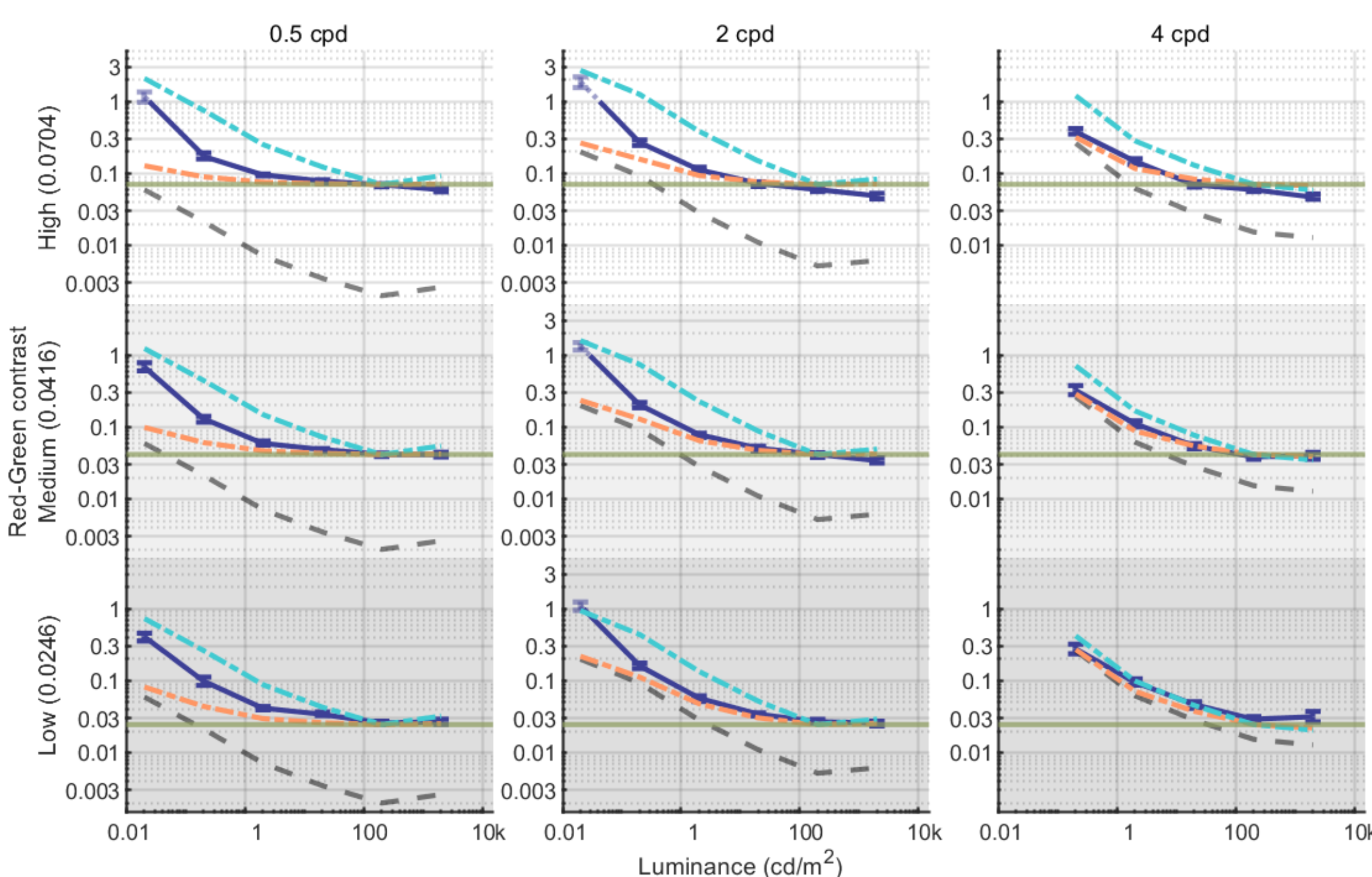
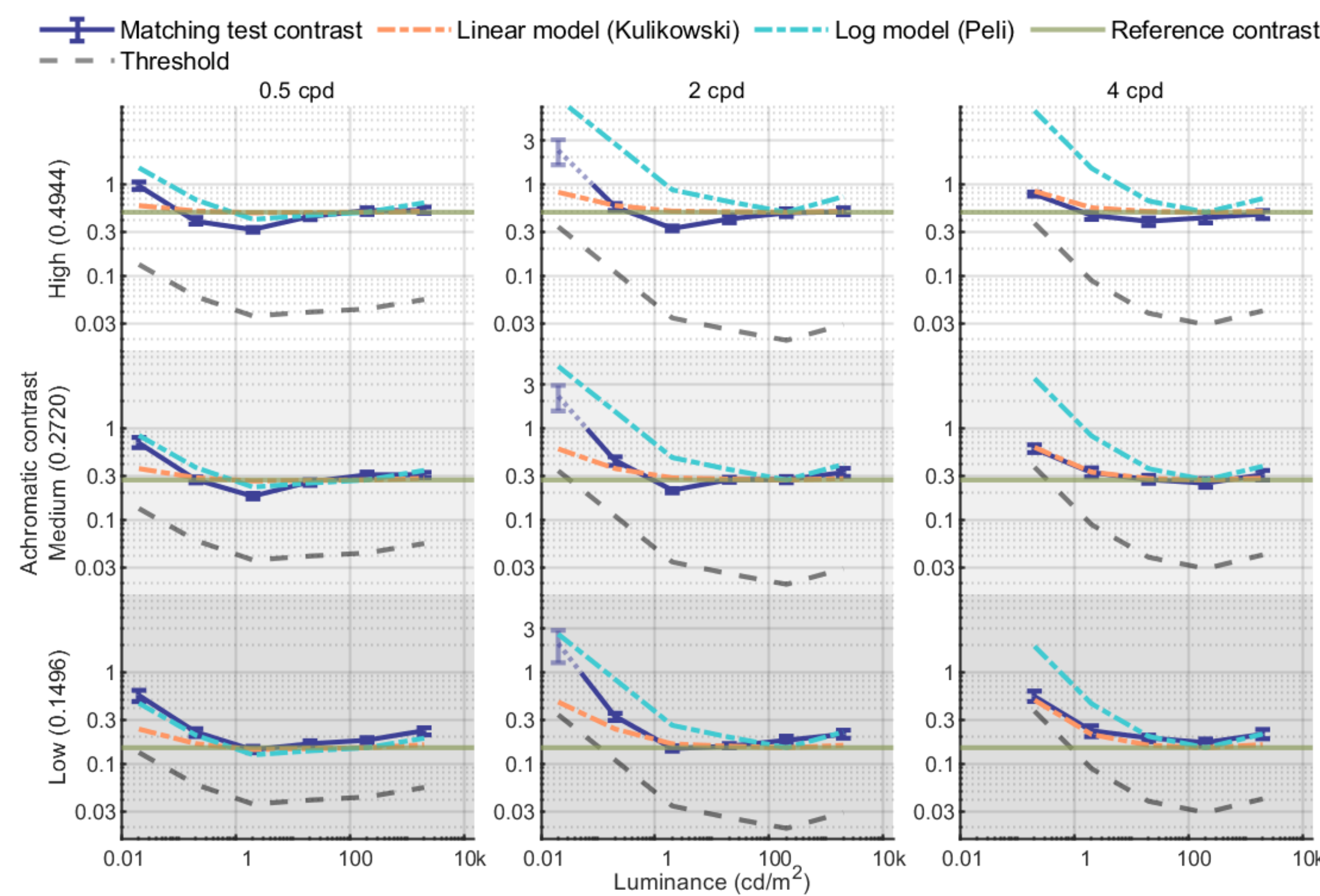


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Results



• Contrast constancy does not hold over large luminance levels

• Kulikowski's model predicts higher frequency achromatic and red-green contrast matching well

• Contrast constancy holds for higher suprathreshold levels

• Lower contrast match required for mesopic high contrast, low frequency stimuli

• Chromatic contrast match is harder to obtain at low luminances

• Peli's model can predict achromatic low frequency contrast matches but can not predict chromatic low frequency matches

Conclusions

• Contrast constancy is maintained over limited photopic range

• Contrast matching is not completely independent of luminance

• Threshold and suprathreshold contrast vision are governed by different mechanisms

• Low and high spatial frequency suprathreshold contrasts relate with threshold contrasts differently

• Chromatic gratings' matches are not predicted by simple threshold difference formulae

Findings