### **EFFECT OF AGEING ON SPATIOCHROMATIC CONTRAST VISION**

## **Contrast Sensitivity** (Threshold vision)



#### Observers

- Color normal observers
- 20 young participants; mean age: 33 years
- 20 older participants: mean age: 65 years

### Psychophysical task

- 4AFCQUEST-based detection task
- Viewing distance: 91 cm
- Display size: 12.5 x 9.4 visual degrees

Stimuli

Fixed-cycle Gabor patches, spatial frequencies: 0.5, 1, 2, 4, and 6 cpd modulated along (1) Black-white; (2) Red-green; (3) Lime-Violet directions at 0.02, 0.2, 2, 20, 200, 2000, and 7000 cd/m<sup>2</sup>



**FINDINGS** 

- Age-dependent decline in achromatic contrast sensitivity (Fig. 1, row 1) becomes larger with increasing spatial frequency.
- Chromatic contrast sensitivity declines with age for luminance levels up to 20 cd/m2 for all spatial frequencies (Fig. 1, rows 2, 3).
- Measurement variations (error bars in Fig. 1) are higher for older age group as individual variability becomes more pronounced with advancing age.
- Highest differences between achromatic sensitivities of the two age groups is recorded in mesopic range.

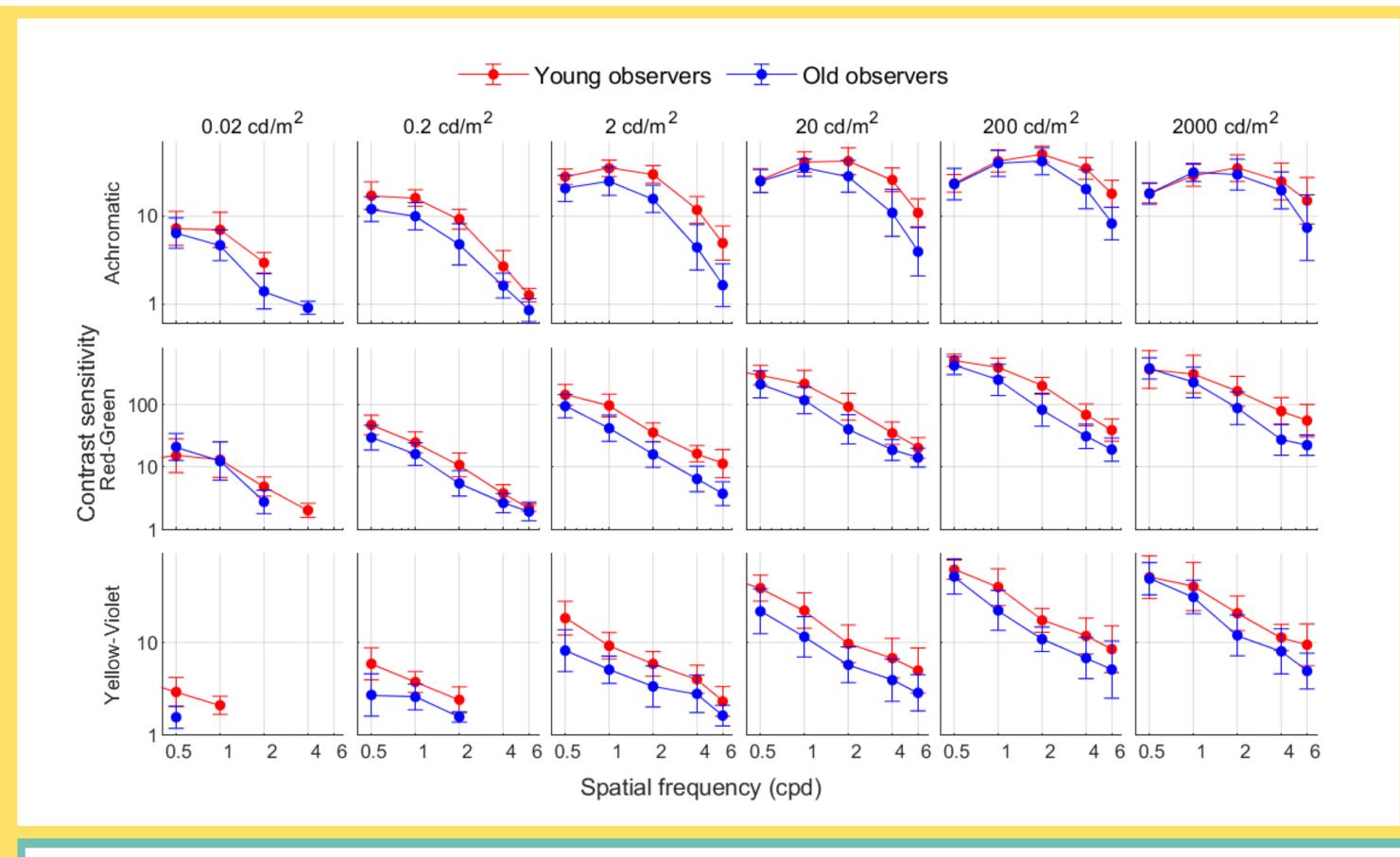
# Ageing affects threshold vision at low luminances and high spatial frequencies.

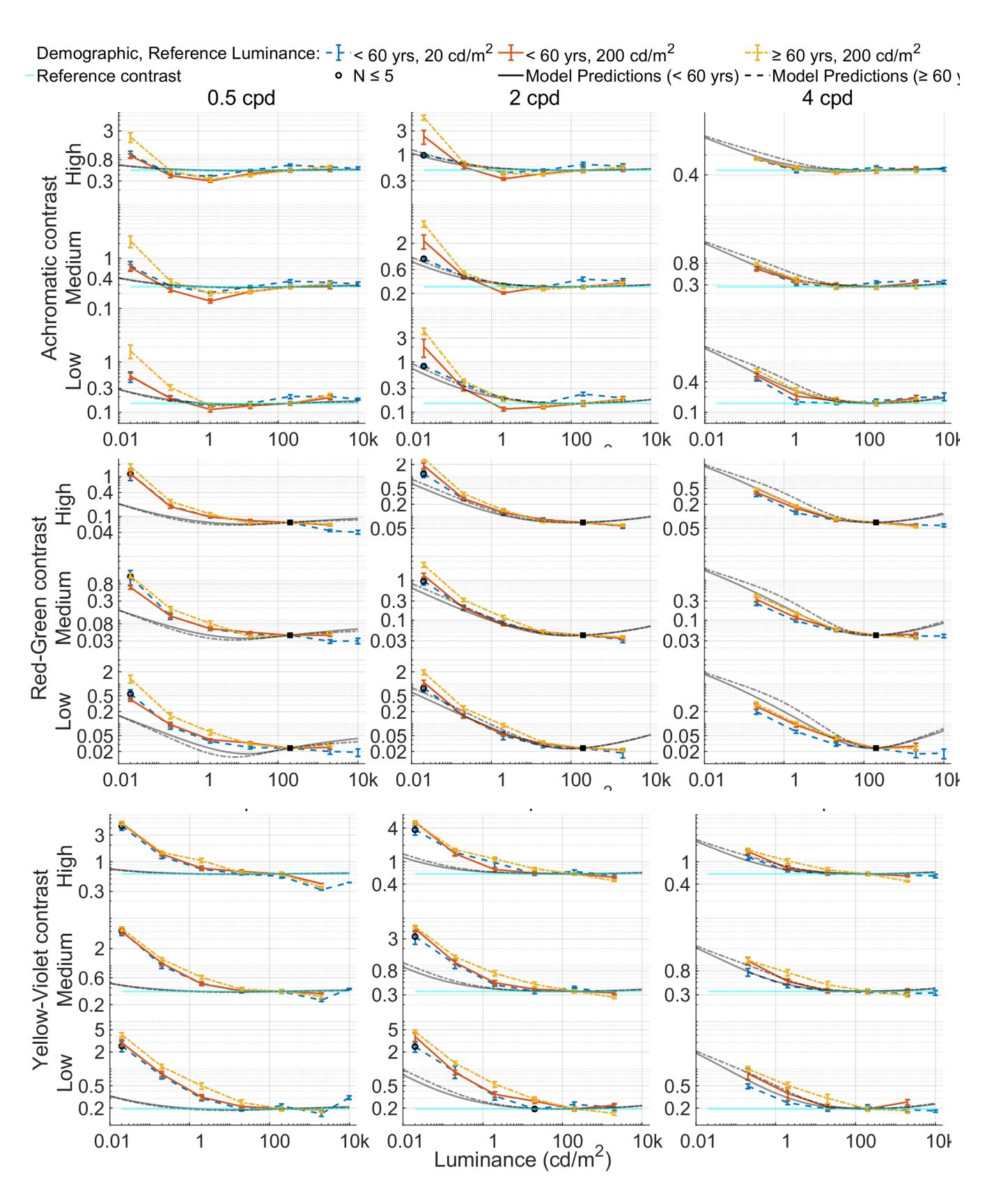


This research has been supported by: EPSRC EP/P007503

Owsley, C., Sekuler, R., and Siemsen, D.. "Contrast sensitivity throughout adulthood." Vision research 23.7 (1983): 689-699.







Ashraf, M., Wuerger, S., Kim, M., Saunderson, H., Martinović, J., Mantiuk, R; Spatio-chromatic contrast sensitivity across the life span: interactions between age and light level in high dynamic range. Journal of Vision 2020;20(11):1286. Abstract for V-VSS 2020.



Kulikowski, J. J. (1976). Effective contrast constancy and linearity of contrast sensation. Vision Research, 16(12), 1419–1431.

## **Contrast Matching** (Suprathreshold vision)

#### Observers

- Color normal observers
- 27 younger participants; mean age: 28 years
- 20 older participants: mean age: 65 years

### 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 haplo-scopically such that the two contrasts appear similar

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Test contrasts at different luminance levels matched with the same reference stimulus are plotted as a contour of matching contrasts (Fig. 2).

### FINDINGS

- little differences.

# Ageing has little Impact on suprathreshold photopic contrast vision.

Delahunt, P. B., Okajima, K., Werner, J. S., & Hardy, J. L. (2005). Senescence of spatial chromatic contrast sensitivity II Matching under natural viewing conditions. Journal of the Optical Society of America A.







Stimuli

(younger group), 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/m<sup>2</sup>

Reference stimuli: 200 cd/m<sup>2</sup>

(older group), 200 & 20 cd/m<sup>2</sup>

• Despite physiological changes with age in human visual system, contrast matching curves from older and younger observers show

• Human visual system compensates for age-related changes with changes in neural mechanisms at suprathreshold levels.

> Werner, J. S., Delahunt, P. B., and Hardy, J. L. "Chromatic-spatial vision of the aging eye." Optical review 11.4 (2004): 226-234.