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# Do oculomotor adaptations to a volume scotoma provide functional benefits for binocular vision?

Concetta F. Alberti , Peter J. Bex

Department of Psychology, College of Science, Northeastern University, Boston, MA

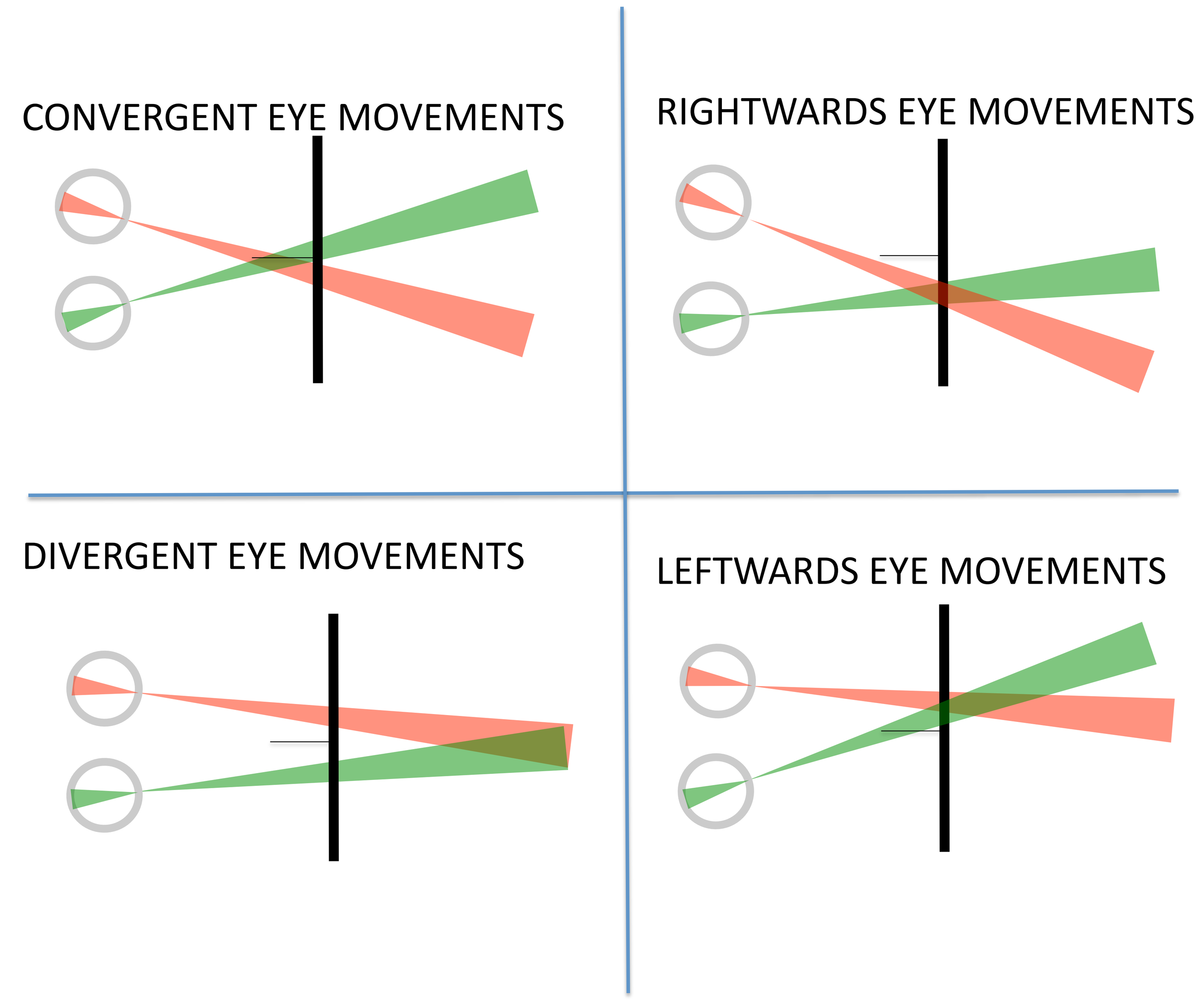
## Purpose

People with Central Field Loss (CFL) typically have asymmetric monocular scotomata.

The volume of the binocular scotoma (Arditi, 1988) depends on vergence. Binocular eye movements can adjust the projection of a volume scotoma and modify the retinal disparity of targets (Alberti et al, ARVO 2015). We assess how such adaptations affect binocular contrast sensitivity in the peripheral visual field.

We simulated binocular CFL with independent monocular scotomas in normally-sighted observers.

We manipulated stereoscopic disparity and calculated the contrast sensitivity function for band-pass filtered letters presented in corresponding (left or right) or non-corresponding (front or behind) retinal positions with respect to the binocular fixation on the screen.



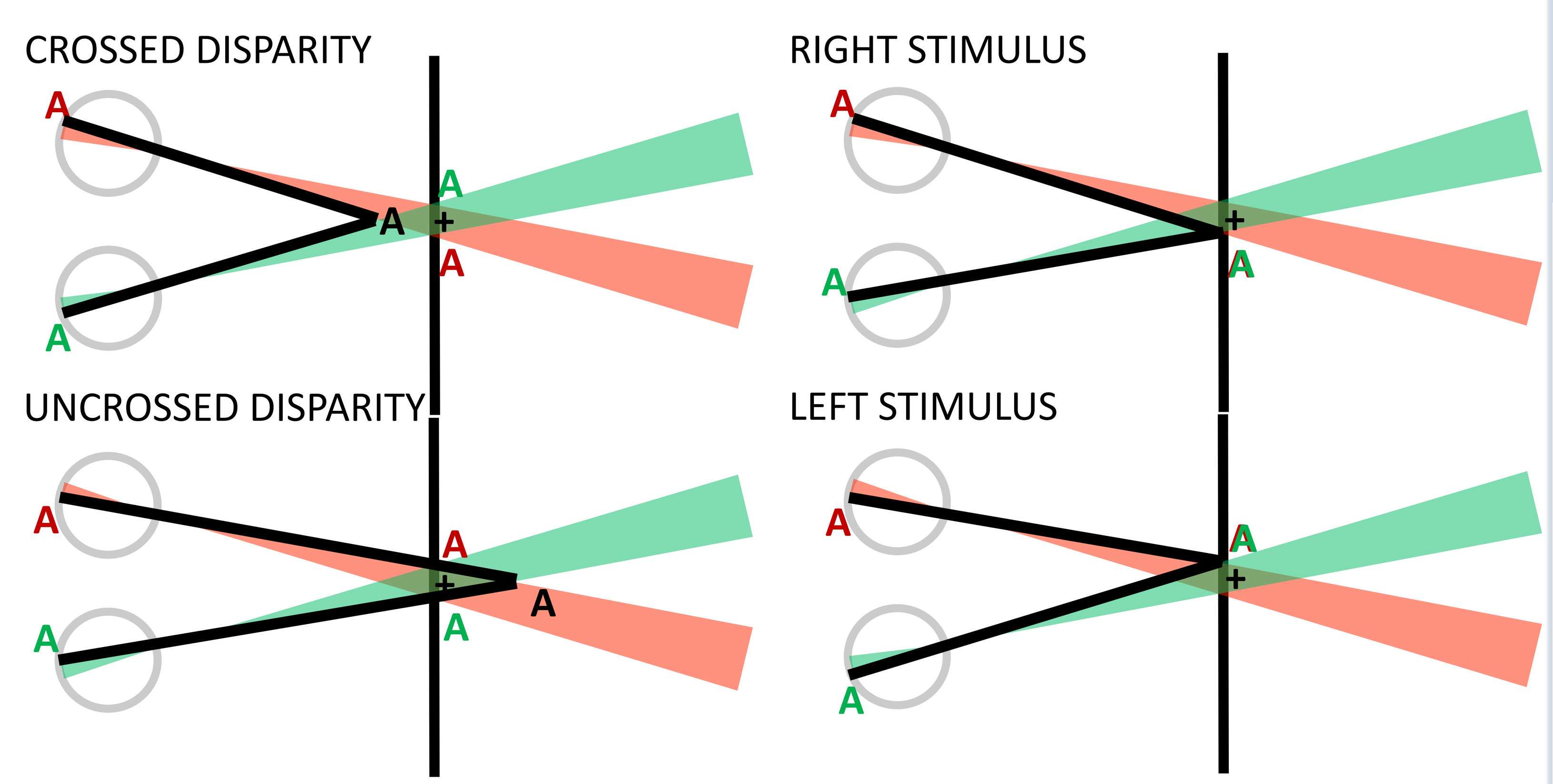

## Methods

**Scotoma**: Gaze-Contingent foveal binocular scotomata were simulated with Gaussian-windowed Pink Noise (σ=0.5°).

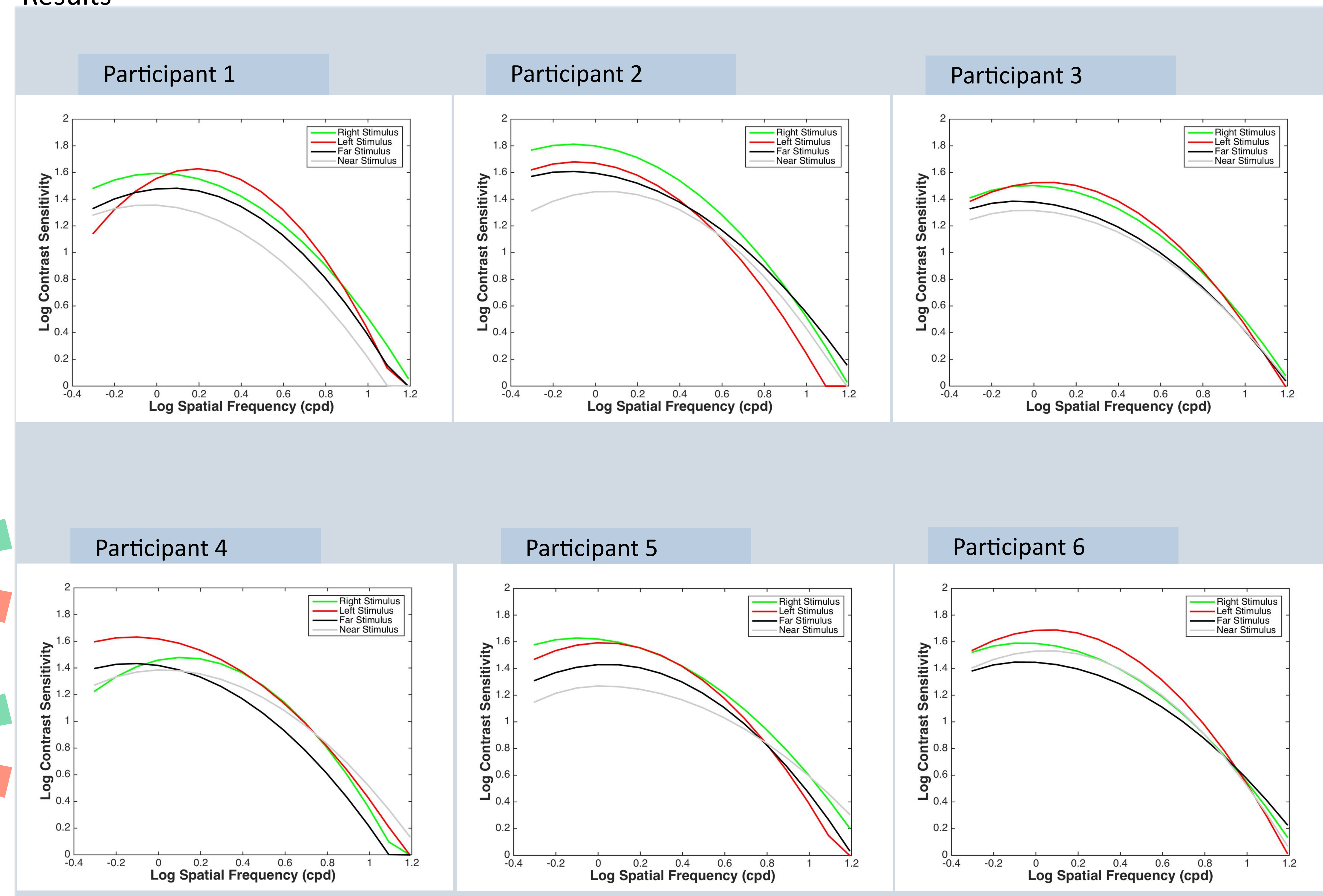
**Simulation**: The scotomata were presented at the fovea of each eye independently using nVidia shutter glasses (72Hz per eye) and a Eyelink II eyetracker (500Hz per eye).

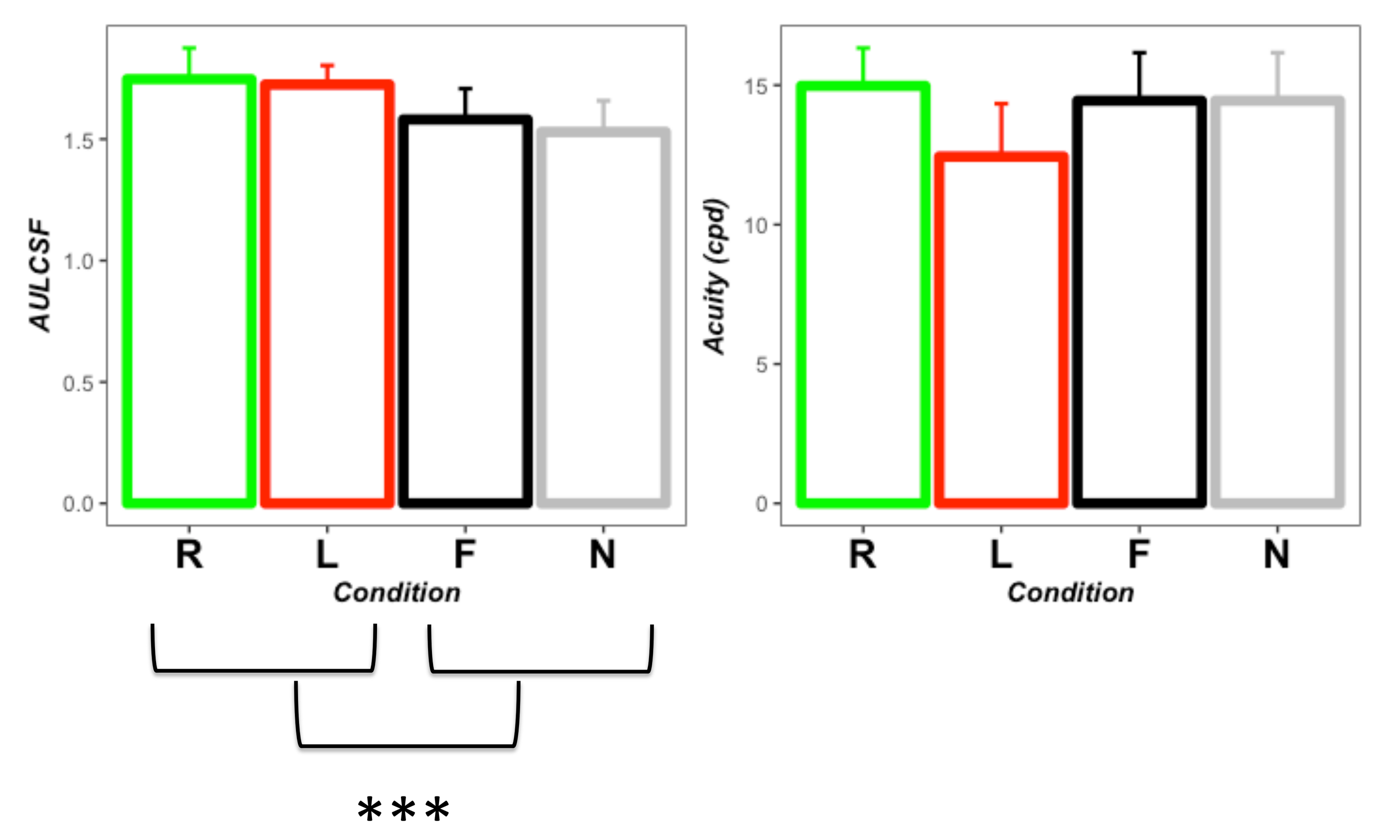
**Task**: 26AFC letter identification with spatial frequency and contrast controlled by the quickCSF method (Lesmes et al, 2010). Horizontal disparity (±0.25 letter widths) was varied in randomly interleaved trials. Nonius rectangle was added to ease fusion of two white dots.

**Participants**: 6 normally-sighted volunteers.




## Results




Peak Contrast Sensitivity (CS) is higher when the stimulus projects onto corresponding retinal positions (p<0.001)

Area Under the logCSF (AULCSF) is larger when the stimulus projects onto corresponding retinal positions (p<0.001).

CSF Acuity (the highest spatial frequency letter identifiable at full contrast) did not significantly vary with interocular correspondence.

## Conclusions

- In the peripheral visual field, binocular contrast summation requires spatially aligned stimuli and is reduced for disparity-defined targets.
- Oculomotor adaptations that shift the location of a volume scotoma may assist fixation control, but are not associated with functional benefits in contrast sensitivity.

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Correspondence: conce.alberti@gmail.com

## References:

- Alberti C.F., Bex, P. (2015). Compensatory strategies for independent binocular scotomas in simulated CFL. ARVO Abstract.
- Arditi A. (1988). The volume visual field: A basis for functional perimetry. Clinical Vision Sciences 3, 173–183.