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Compensatory strategies for independent binocular scotomas in simulated CFL

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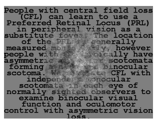
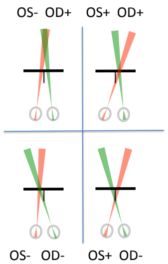
Purpose





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

The volume of the binocular scotoma (Arditi, 1988) and the location of the binocular Preferred Retinal Locus (PRL) (Kabanarou et al., 2006) are dependent on:

-the locations of the two monocular scotomas

-the monocular directions of gaze

Conventional monocular perimetry ignores binocular eye movements.

We simulated binocular CFL with independent monocular scotomas in normally-sighted observers to examine binocular visual function and oculomotor control.

Methods

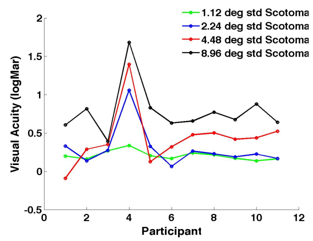
Scotoma: A Gaze-Contingent binocular scotoma was simulated with Gaussian-windowed Pink Noise (σ= 1.12 – 2.24 – 4.48 – 8.96° between-blocks).

CFL simulation: The scotoma was presented at the fovea of each eye using nVidia shutter glasses (72Hz per eye) and a Eyelink II eyetracker (500Hz per eye).

Task: 50 trials Single Sloan Letter Acuity with size controlled by a staircase.

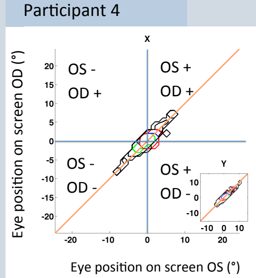
Participants: 11 normally-sighted volunteers, two experts, 9 naïve.

Results



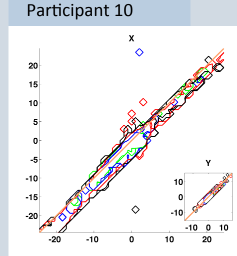
Visual Acuity decreases for larger scotomas sizes.

Participant 4

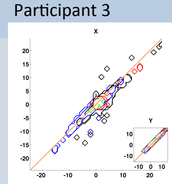


Conjugate

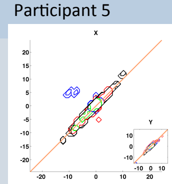
Participant 10



Participant 3

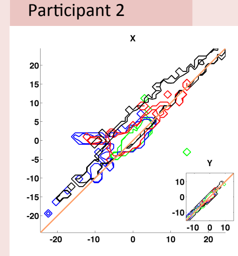


Participant 5

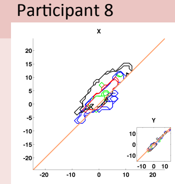


Diverging

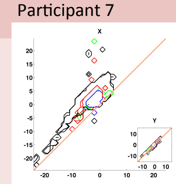
Participant 2



Participant 8



Participant 7



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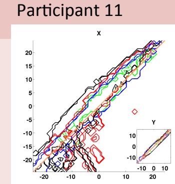
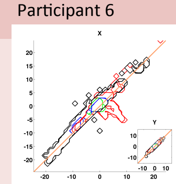
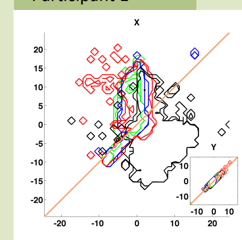


Participant 6

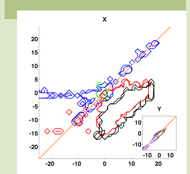


Diverging and Converging

Participant 1



Participant 9



Conclusions

- Binocular oculomotor adaptations to independent monocular scotomas are idiosyncratic and depend on the size of the scotoma.
- Observers use a mixture of Conjugate, Convergent and Divergent binocular eye movements to move the binocular scotoma away from the target.
- These adaptations are spontaneous and cannot be assessed with monocular systems.

References:

- Arditi A. (1988). The volume visual field: A basis for functional perimetry. Clinical Vision Sciences 3, 173–183.
- Kabanarou S.A., Crossland M.D., Bellmann C., Rees A., Culham L.E., Rubin G.S. (2006). Gaze changes with binocular versus monocular viewing in age-related macular degeneration. Ophthalmology, 113 (12) 2251-2258.

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