Nystagmus Network

FIGHT FOR SIGHT
The Eye Research Charity

Motion and Shape Perception in Infantile Nystagmus Syndrome

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Estd: 2018

Motion perception in INS

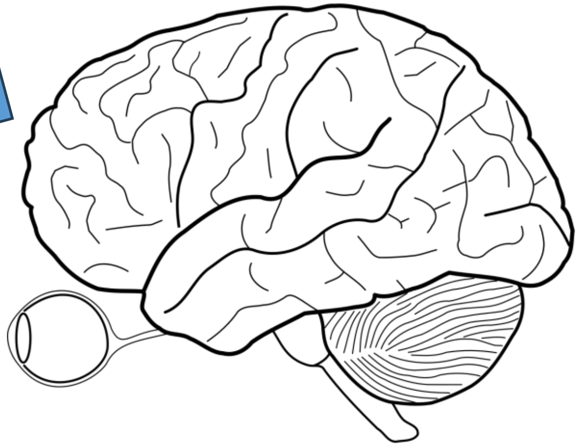
- INS – abnormal eye movement in early development
- Poor motion sensitivity in INS – only few studies (Dai et al., 2022; Neveu et al., 2009)
- Visual enviroment – full of motion, different speeds – locomotion – tasks

Possible mechanisms of deficit in INS

- Retinal blur – due to excessive eye movements

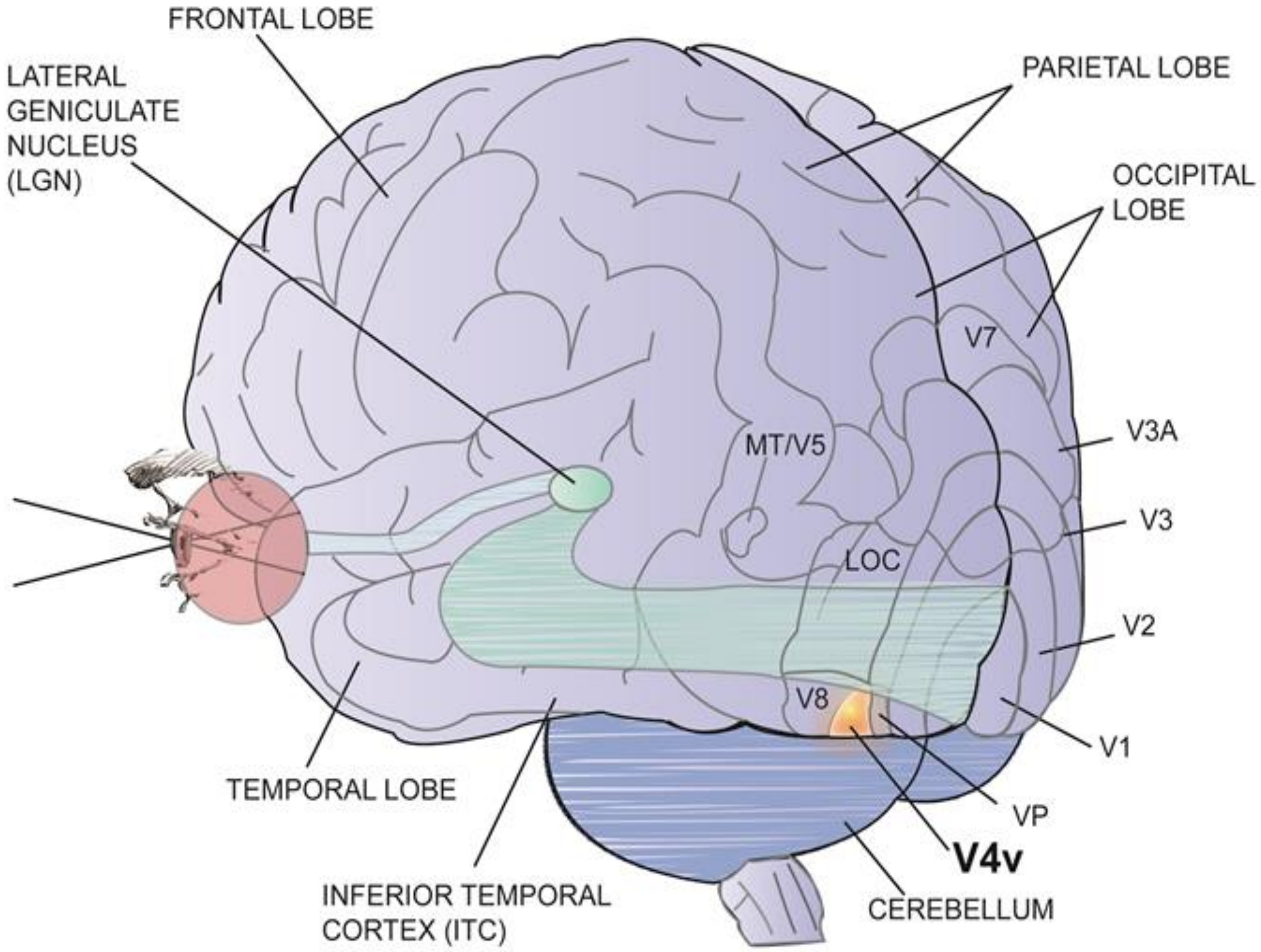
- No difference in scale of deficit in horizontal vs vertical meridians (Dai et al., 2022; Neveu et al., 2009)

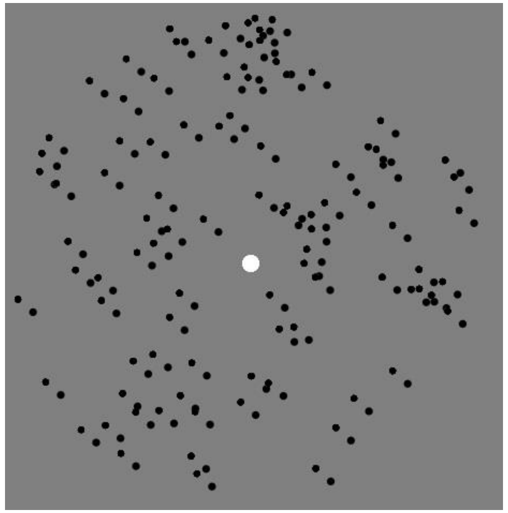
- Deficits present at null point (Dai et al., 2022)



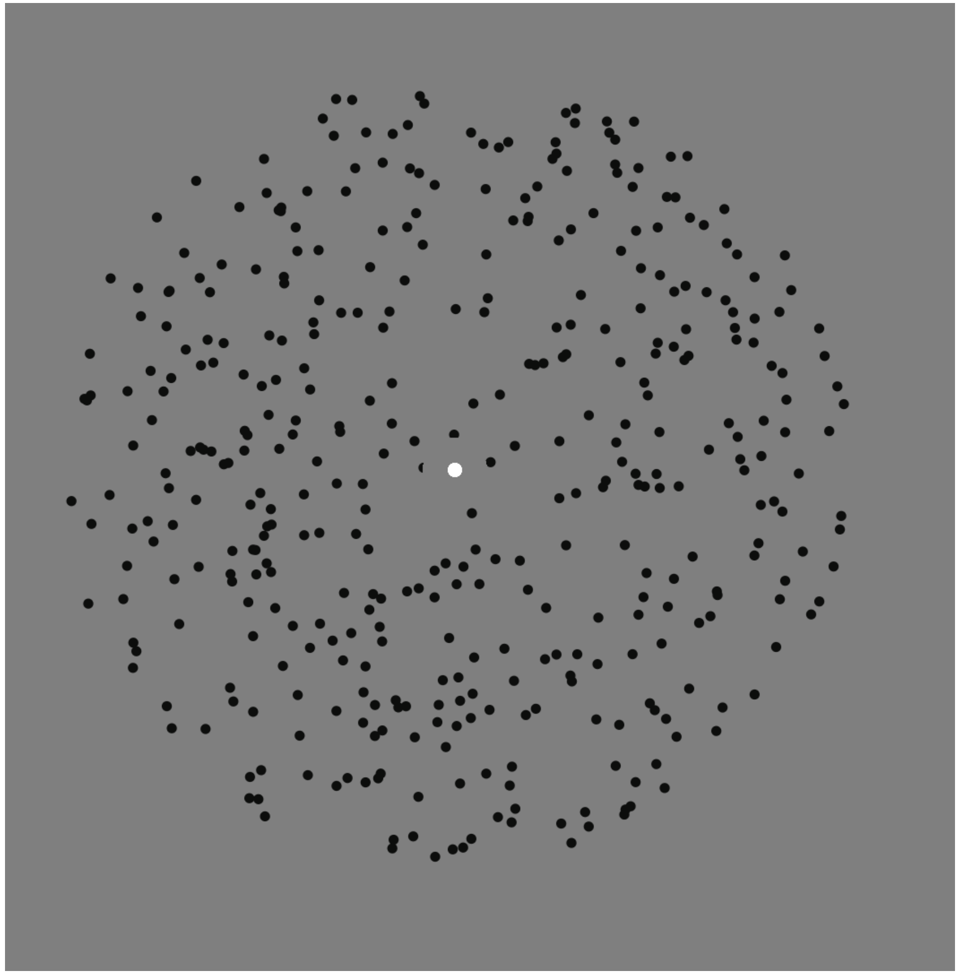
Motion & Form processing

global form

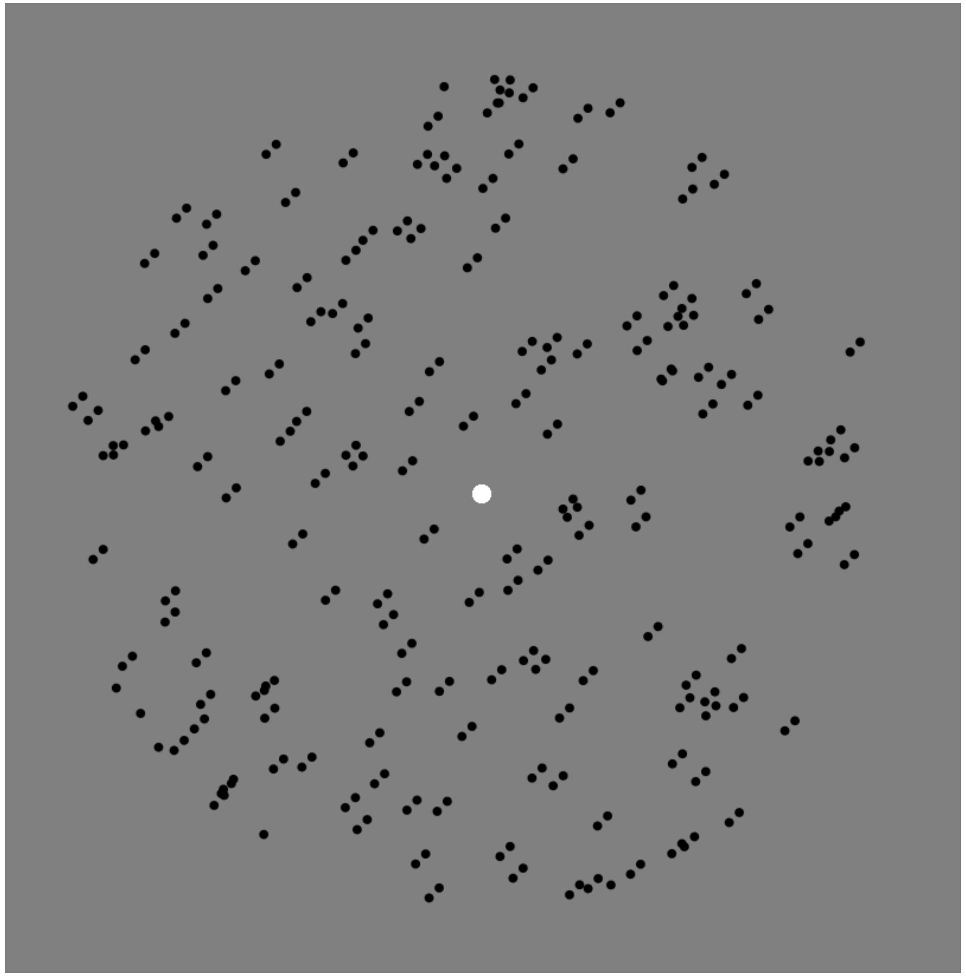




Current study: stimuli



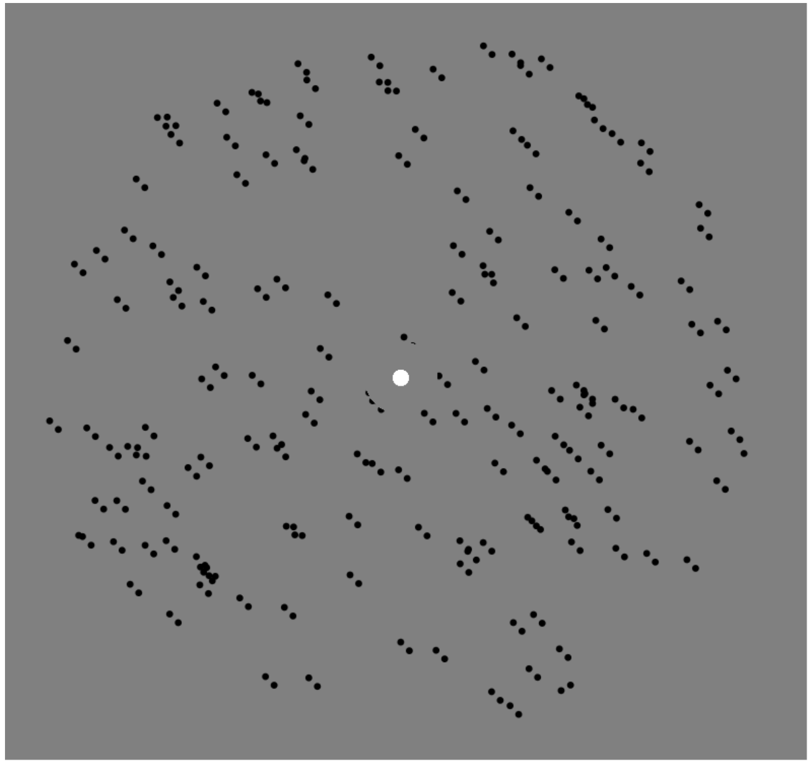
Motion perception: RDK



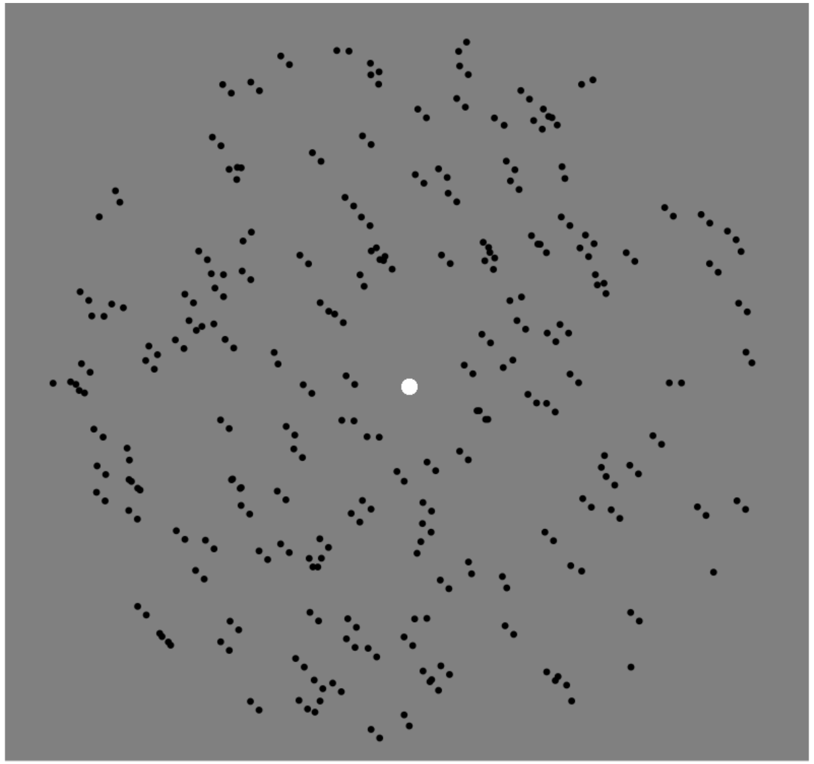
Form perception: Glass patterns

Current study: coherence threshold paradigm

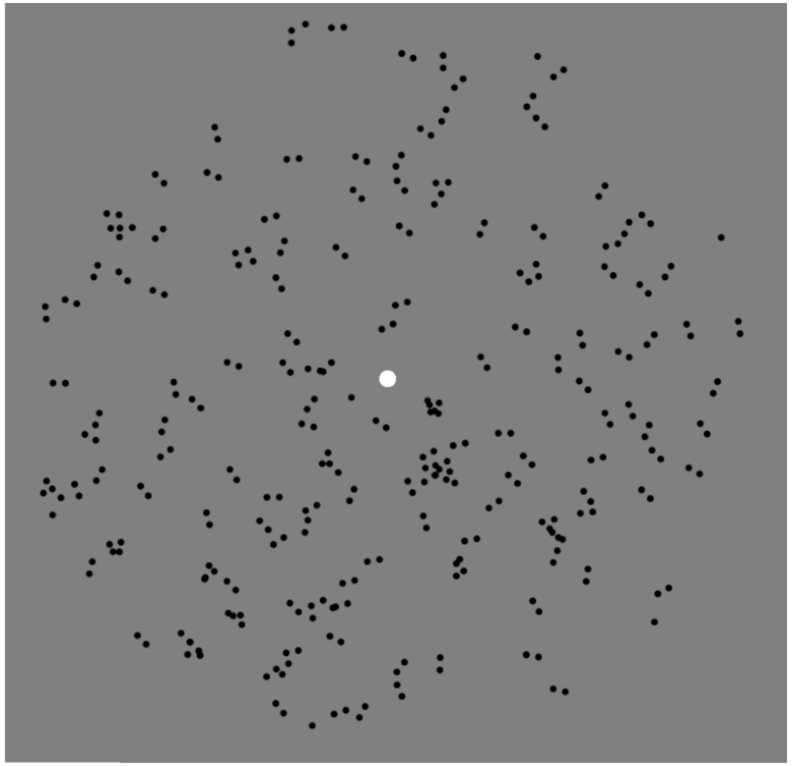
- Most commonly used experiment to study motion perception



100% coherence



50% coherence

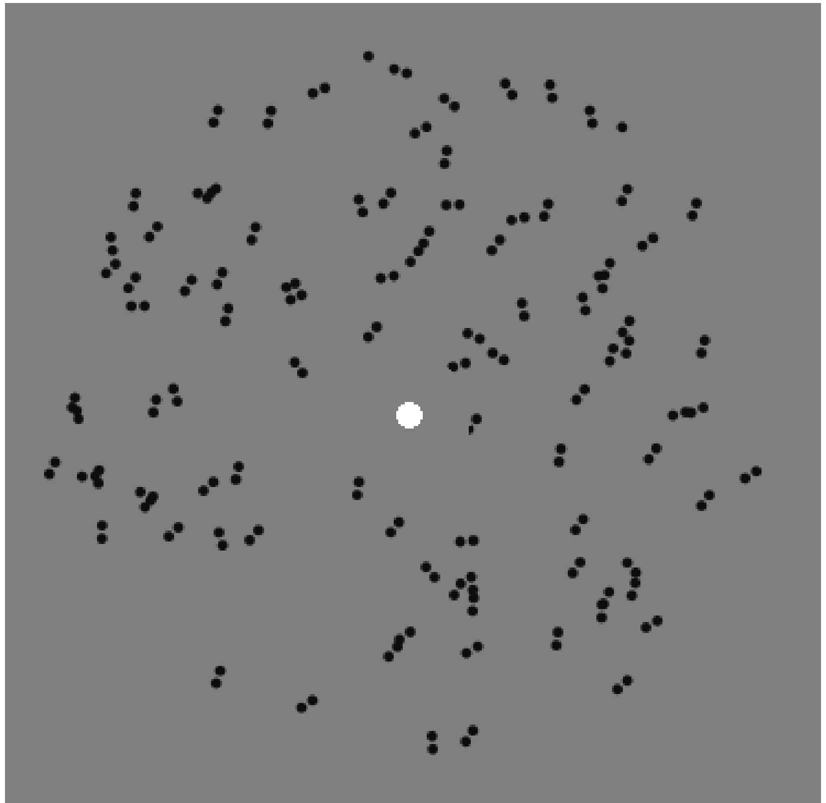


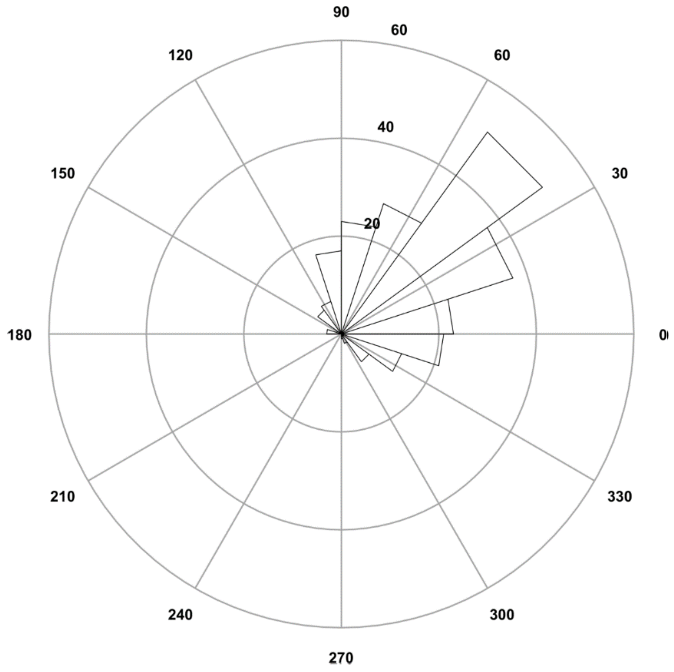
10% coherence

Current study: equivalent noise paradigm

- Coherence paradigm - cannot separate interaction at local/global stages of processing
  - Equivalent noise paradigm (Barlow, 1957; Pelli, 1980) to separate the effect of local *vs*. global processing

  - Thresholds @ 5 external noise levels (0°,5°,10°,20°,45°)

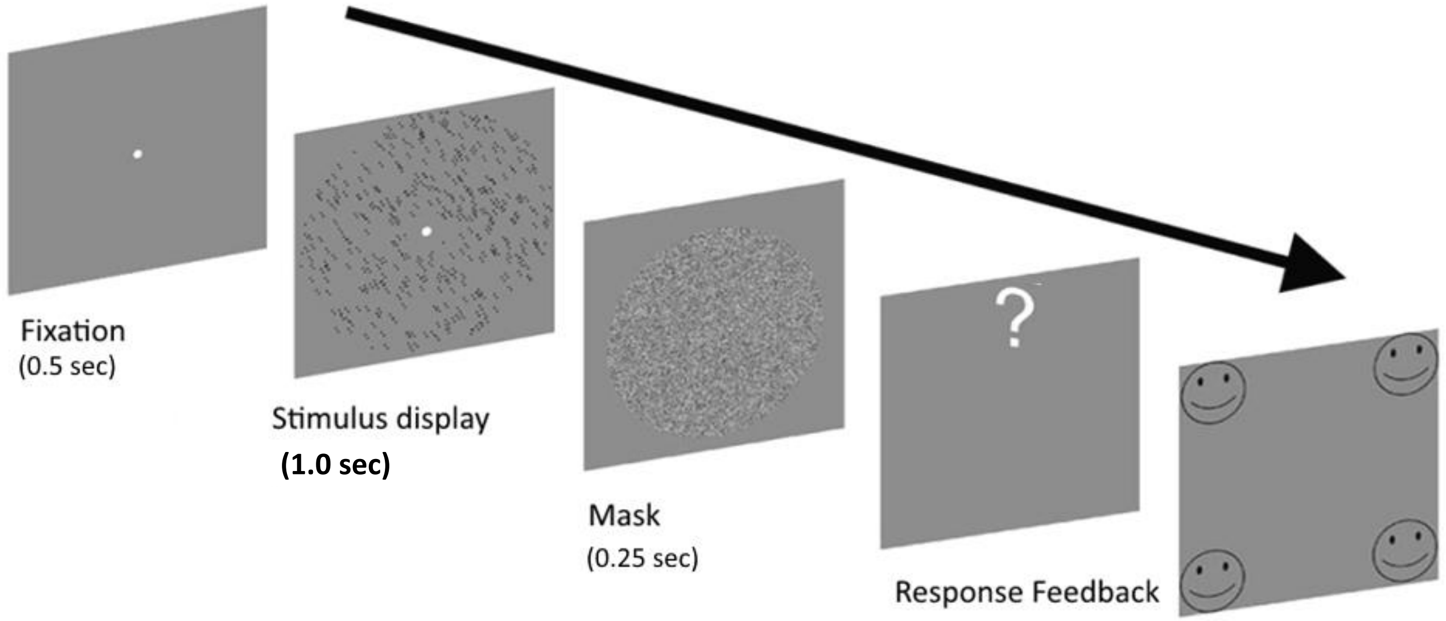




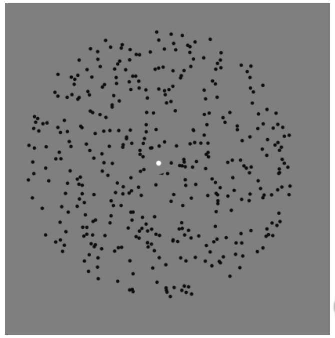
$\mu = 45°$, $\sigma = 45°$

Methods: participants

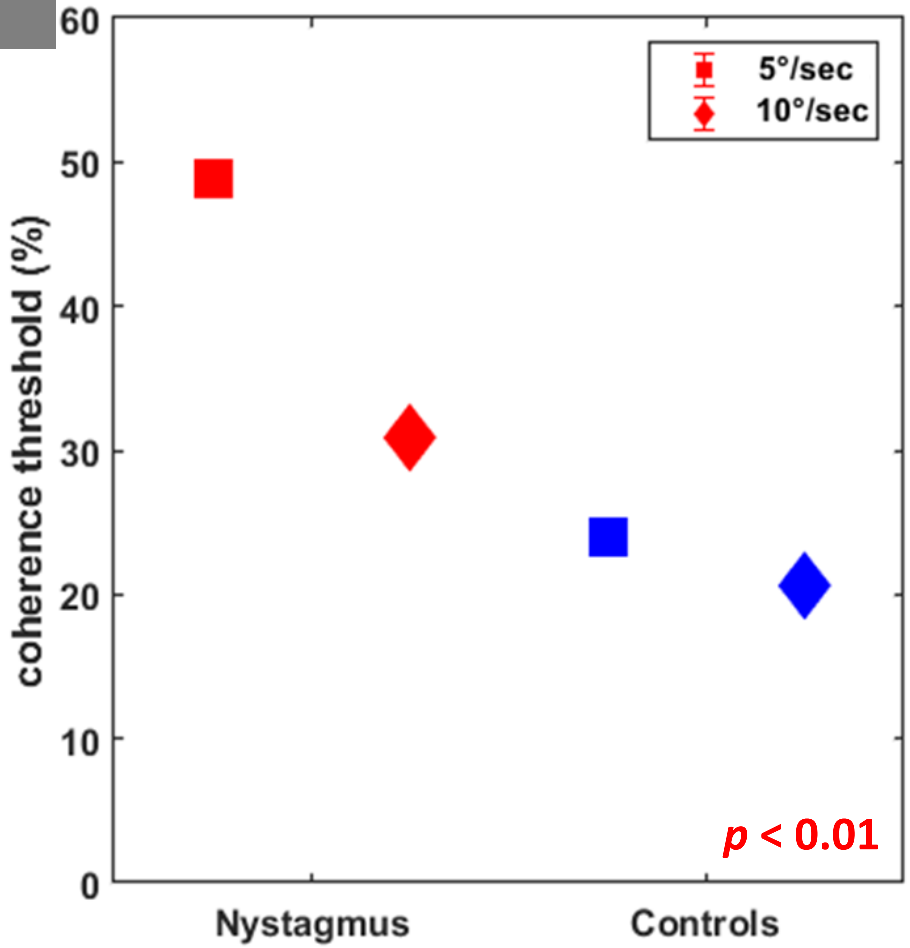
- 30 participants with INS (14.84 years ± 4.84), 30 age matched controls
- INS: idiopathic = 20, albinism = 8, congenital cataract = 2
- VA (log MAR): INS = 0.69 (±0.27), controls = 0.007 (±0.06), p <0.001
- Stereoacuity (secs of arc): INS = 141.67 (±121.09), controls = 14.67 (±7.98), p <0.001



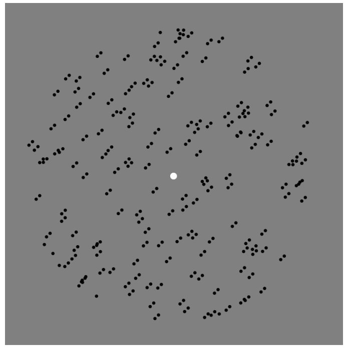
Results: Coherence thresholds

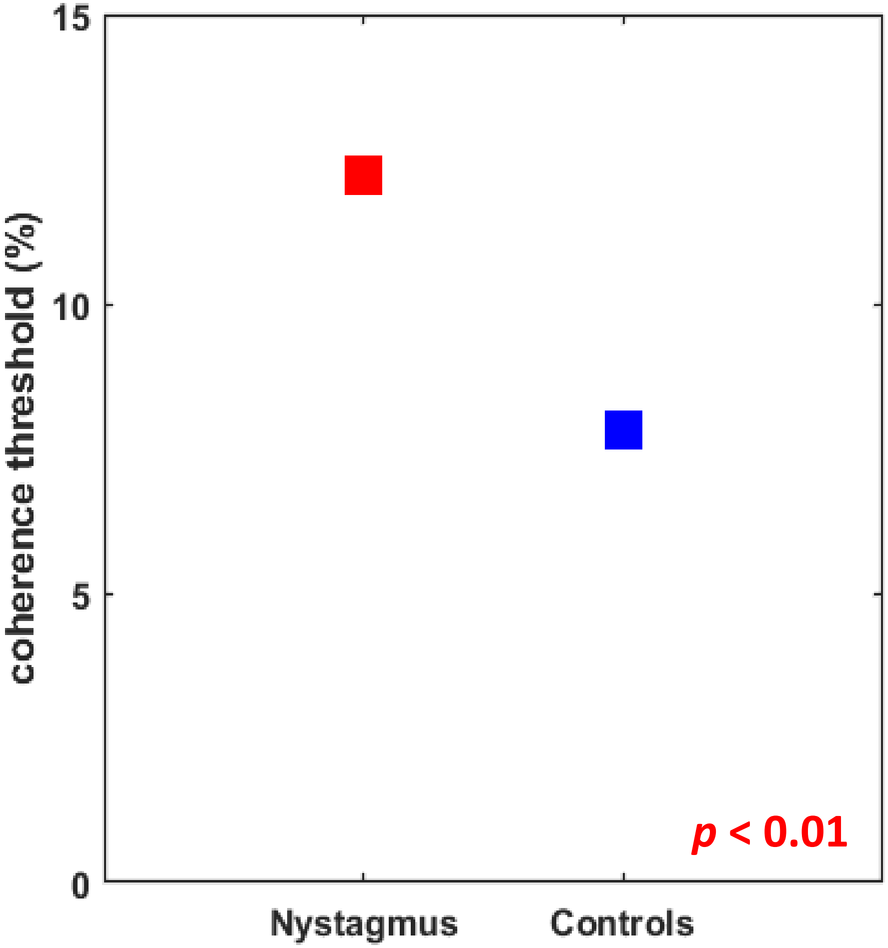


RDK

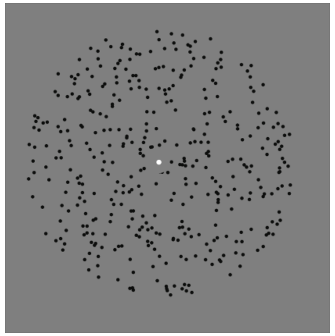


Glass patterns

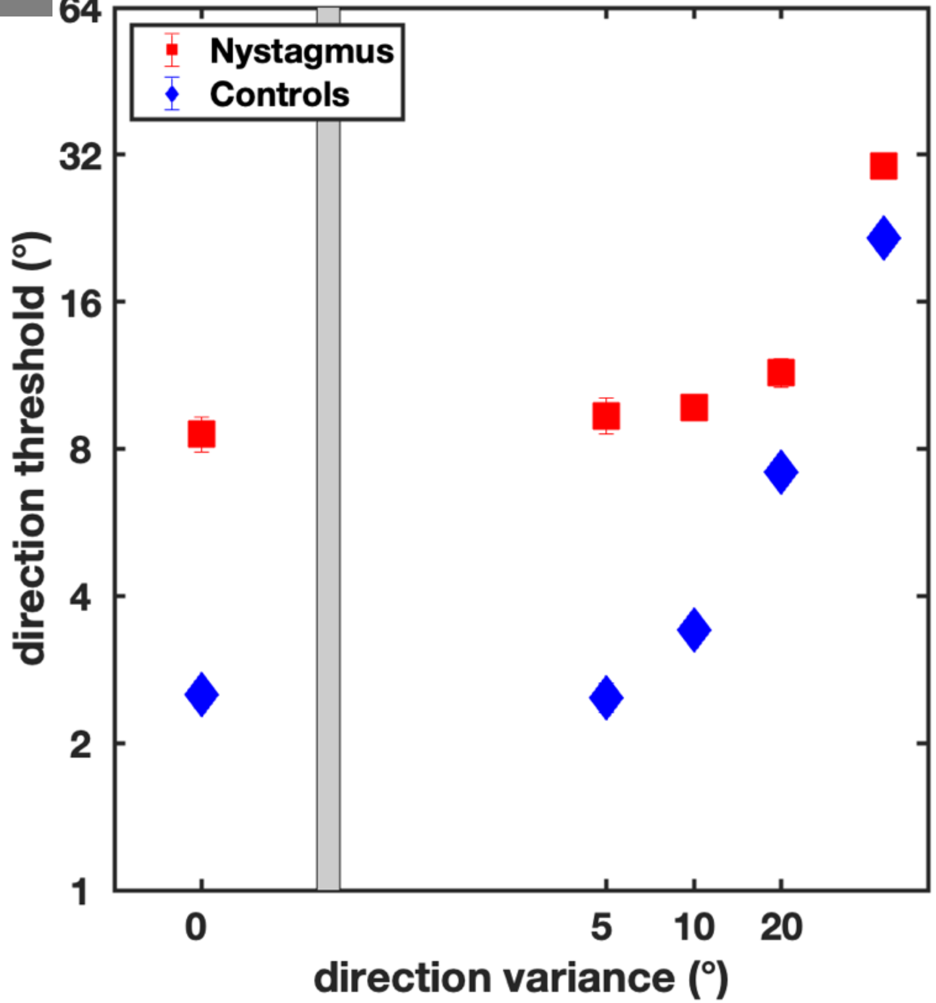




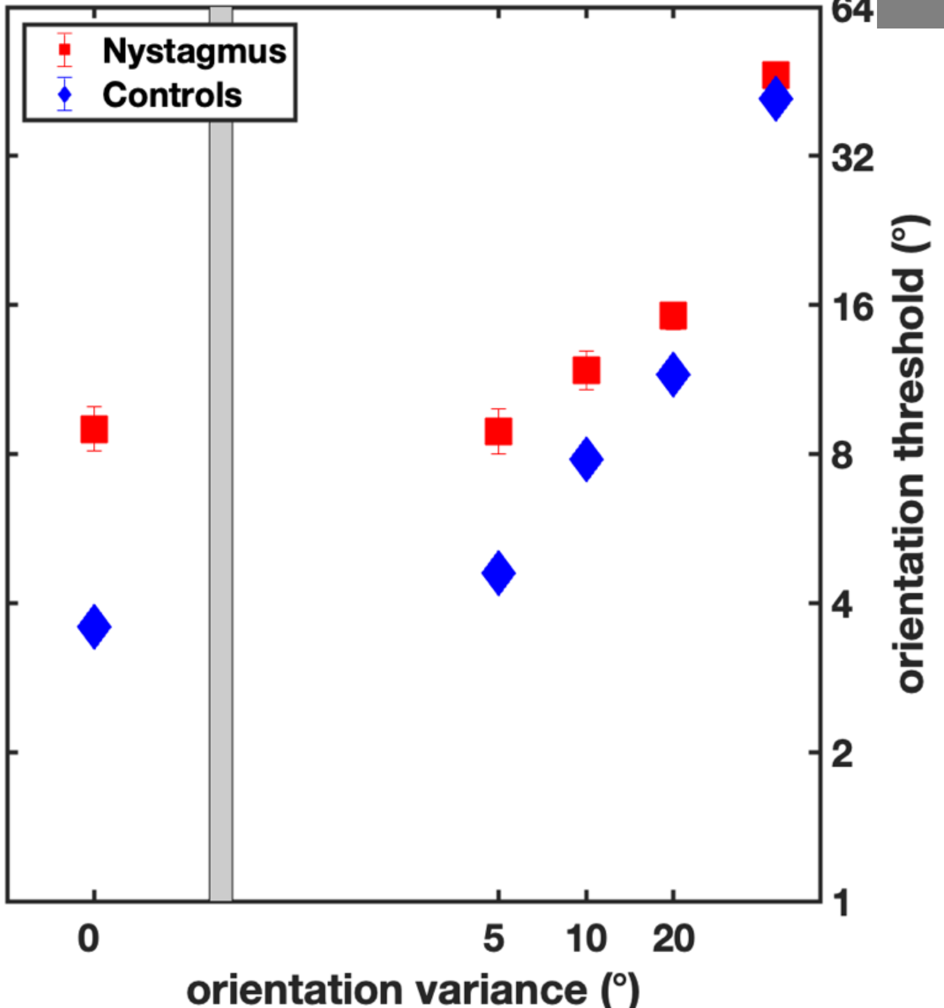
Results: Equivalent noise

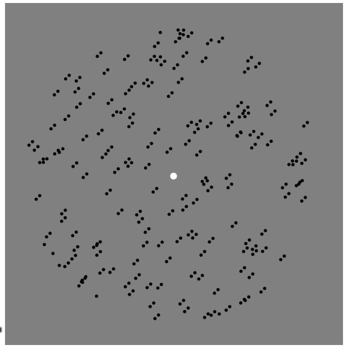


RDK

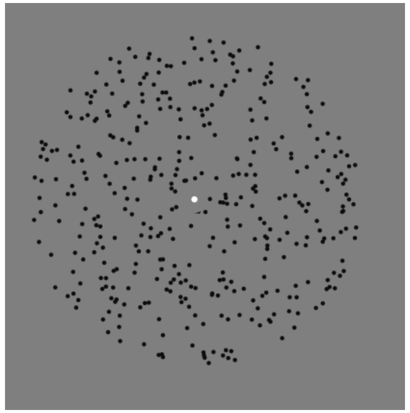


Glass patterns

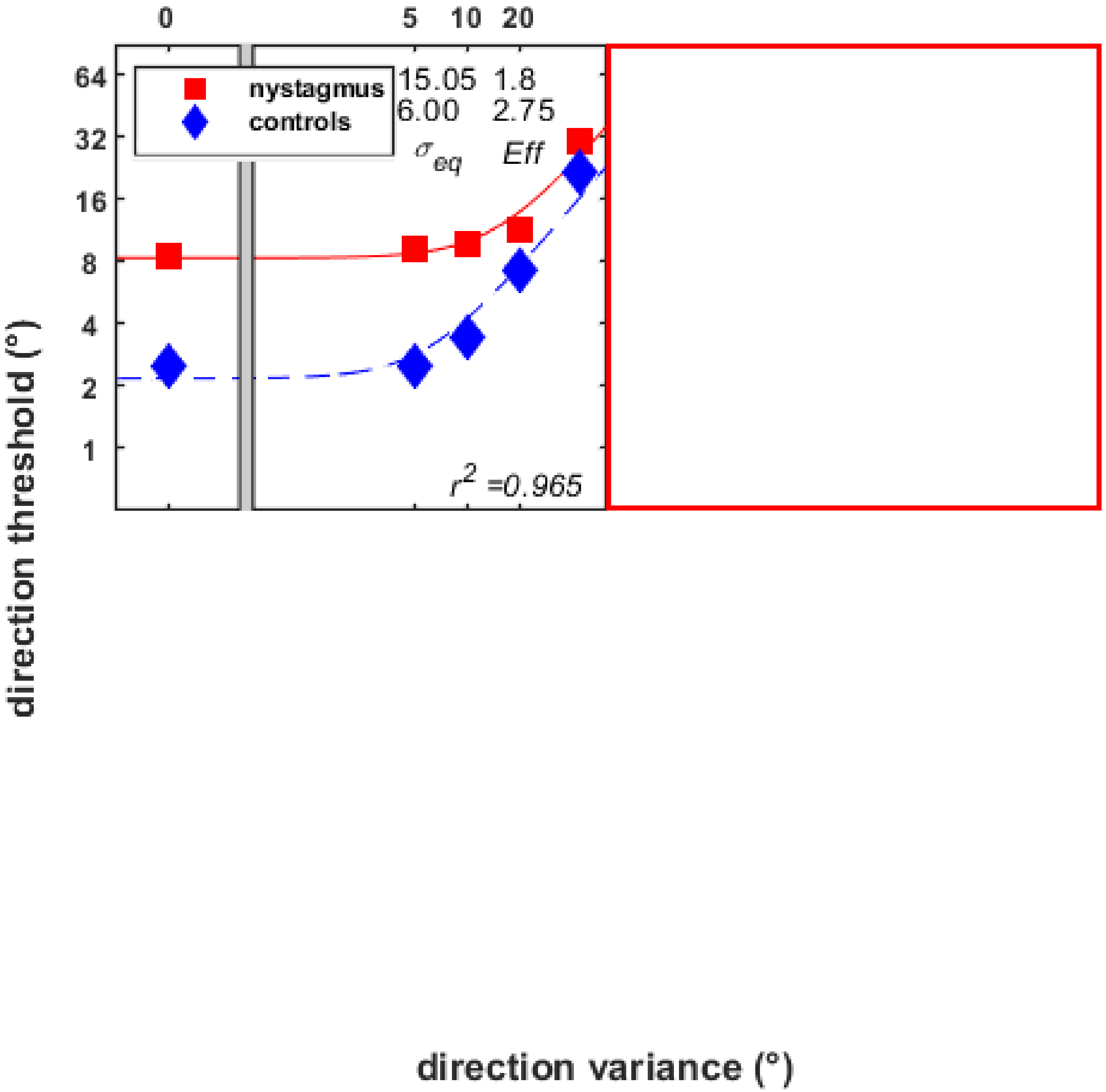




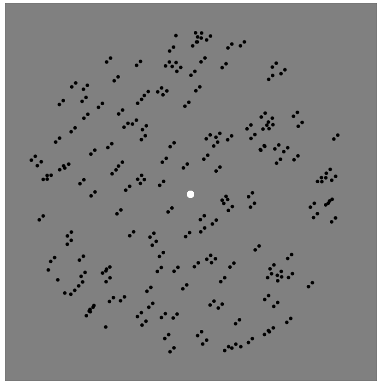
Results: Nested modelling, RDK



$$\tau_{obs} = \sqrt{\frac{\sigma_{eq}^2 + \sigma_{ext}^2}{Eff}}$$



Results: Nested modelling, Glass pattern



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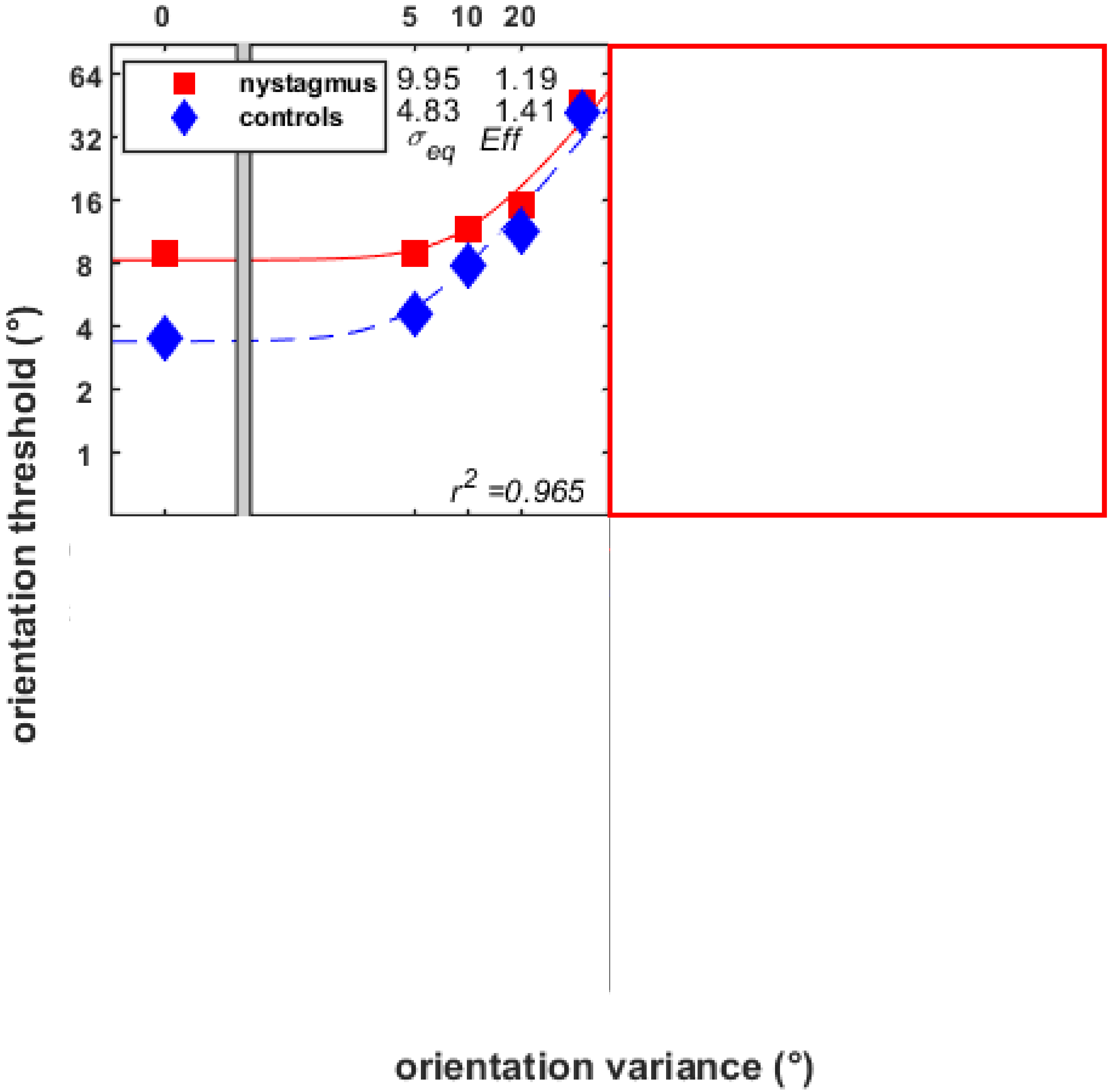
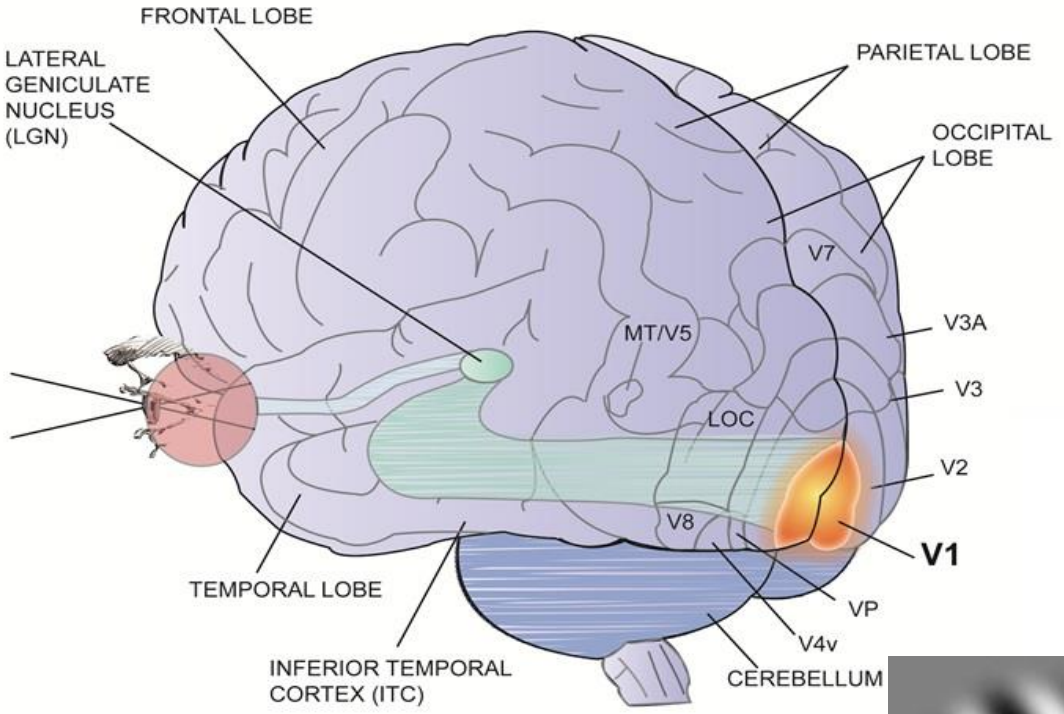


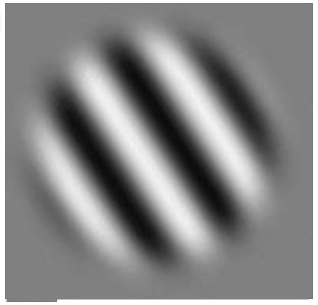
Internal noise & sampling efficiency

local motion/form

Internal noise

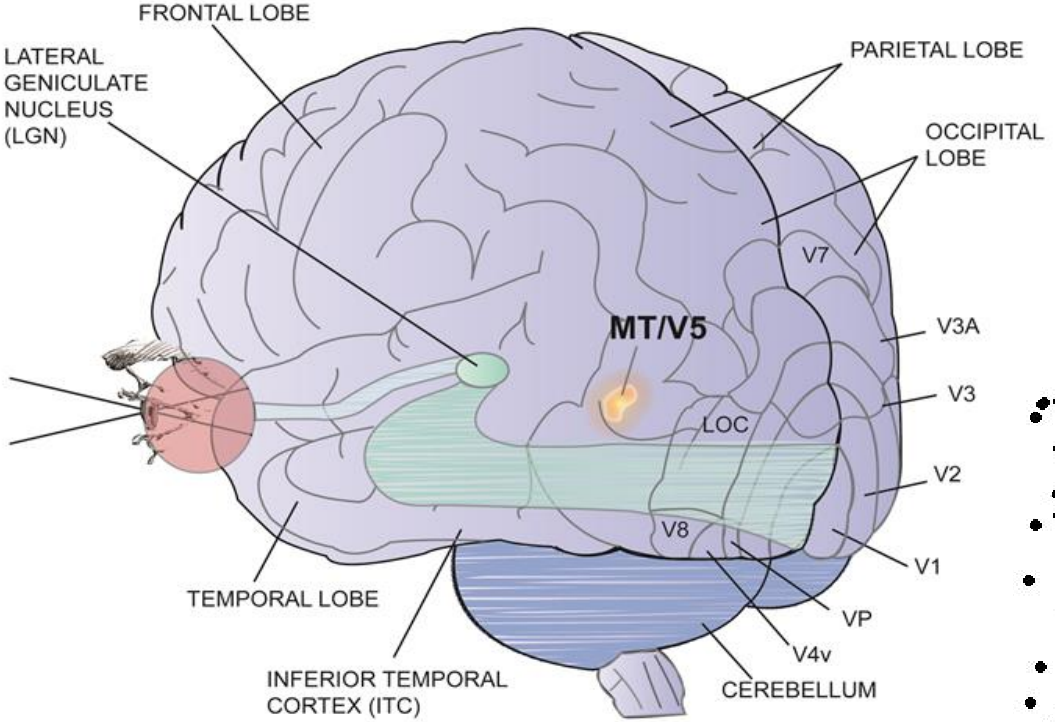
- Related to local factors s/a retinal blur
- Local processing – motion of few dots / orientation of few dot pairs
- Receptive field of V1

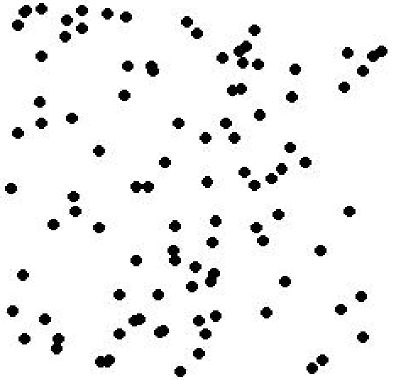



Orientation

Internal noise & sampling efficiency

global motion





Sampling efficiency

- Related to global factors – summation of local element – direction of whole pattern
- Larger receptive field of MT/V4

Summary

- Both motion and form sensitivity are reduced in INS.
- The difference in performance is mainly related to increased internal noise within the INS visual system.
- The sampling efficiency may also be reduced in INS.
- These results show involvement of higher cortical deficits in INS, similar to amblyopia.
- ?? Opportunity to improve visual functions in INS as in amblyopia ?

What next?

- Perceptual learning (PL) as a treatment for INS based on motion stimuli

- PL – improvement in visual functions as a result of visual training by performing repeated task

- Improvement in visual functions in amblyopia and other visual conditions

OPTOMETRY and VISION SCIENCE
Journal of the American Academy of Optometry

Articles & Issues | Collections | Topics of Interest | For Authors | Journal Info

Outline
Images

REVIEW

Efficacy of perceptual learning in low vision: A systematic review and meta-analysis

Park, Adela S. Y. PhD[1*]; Wong, Ginny H. T MSc[1]; Tan, Ken W. S. PhD[1]; Cheung, Blossom W. S. BSSc[1]; Oremus, Mark PhD[2]; Cheong, Allen M. Y. PhD[1,3]; Thompson, Benjamin PhD[1,4,5*]

ELSEVIER
Vision Research
Volume 49, Issue 21, 29 October 2009, Pages 2535-2549

Minireview

Perceptual learning as a potential treatment for amblyopia: A mini-review

Dennis M. Levi [a], Roger W. Li [a b]

Journal of Optometry 15 (2022) 3–34
ELSEVIER
Journal of Optometry
www.journalofoptometry.org

REVIEW

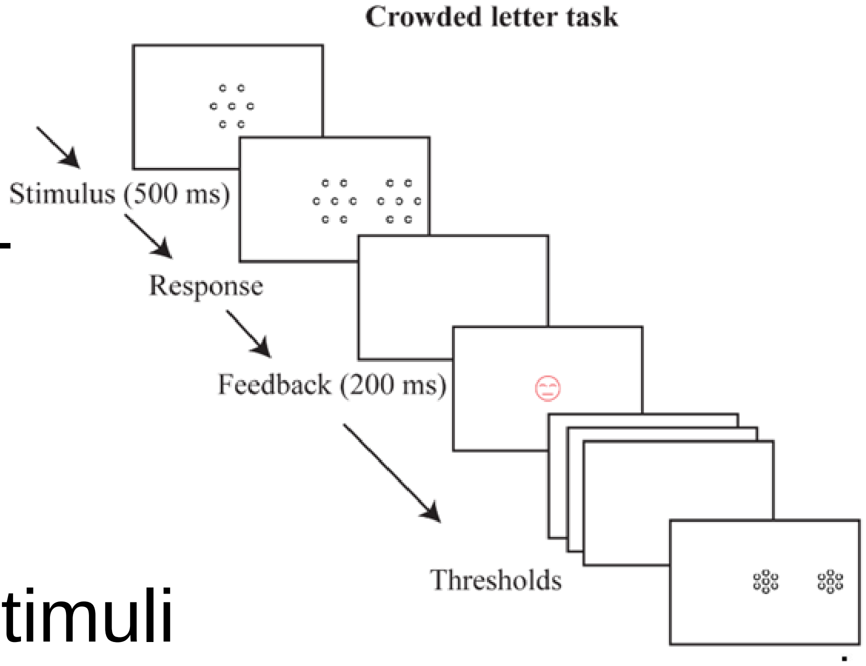
An updated review about perceptual learning as a treatment for amblyopia

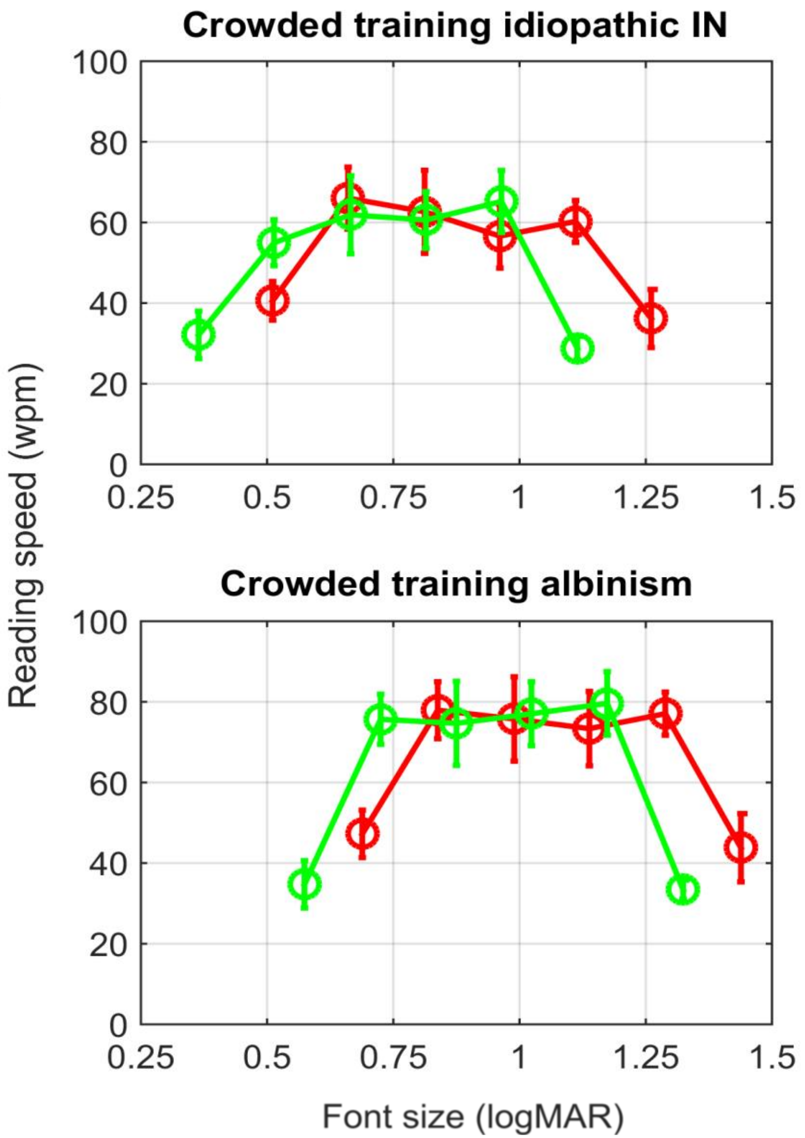
Antonio Rodán*, Elena Candela Marroquín, Laura C. Jara García

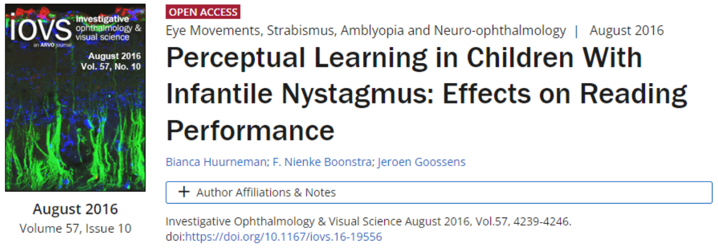
PL in Nystagmus

- Binocular treatment – avoids patching, eye movements

- Tasks with complex stimuli (motion/colour) better for PL tasks

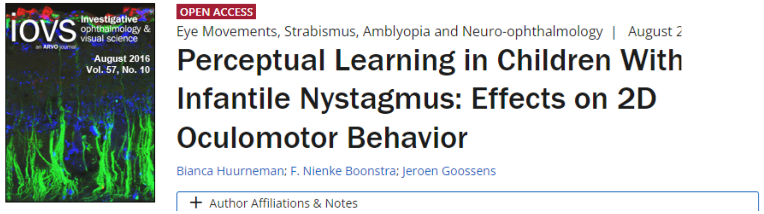






August 2016
Volume 57, Issue 10

OPEN ACCESS
Eye Movements, Strabismus, Amblyopia and Neuro-ophthalmology | August 2016
Perceptual Learning in Children With Infantile Nystagmus: Effects on Reading Performance
Bianca Huurneman; F. Nienke Boonstra; Jeroen Goossens
+ Author Affiliations & Notes
Investigative Ophthalmology & Visual Science August 2016, Vol.57, 4239-4246.
doi:https://doi.org/10.1167/iovs.16-19556



OPEN ACCESS
Eye Movements, Strabismus, Amblyopia and Neuro-ophthalmology | August 2
Perceptual Learning in Children With Infantile Nystagmus: Effects on 2D Oculomotor Behavior
Bianca Huurneman; F. Nienke Boonstra; Jeroen Goossens
+ Author Affiliations & Notes

Our study

- PL in INS – using moving stimuli

Do you or someone you know have nystagmus???

Perceptual Learning for Nystagmus

WE ARE NOW RECRUITING!!!

Who are we?

Dr Mahesh Joshi

Dr Asma Zahidi

For more information, please contact:
mahesh.joshi@plymouth.ac.uk
asma.zahidi@plymouth.ac.uk

Who are we looking for?

- Anyone between 18 and 35 years old
- Diagnosed with Infantile Nystagmus

What will you be doing?

- Complete vision tests on computer at the University of Plymouth / University of West England (UWE Bristol) to assess how well you can see static and moving letters and static dots
- Complete vision training at home for 1hr/day, 3 days a week over a period of 4 week

Travel Expenses

We will be paying your travel expenses to Plymouth up to £50.

A study by:

UNIVERSITY OF PLYMOUTH
Faculty of Health

In collaboration with:

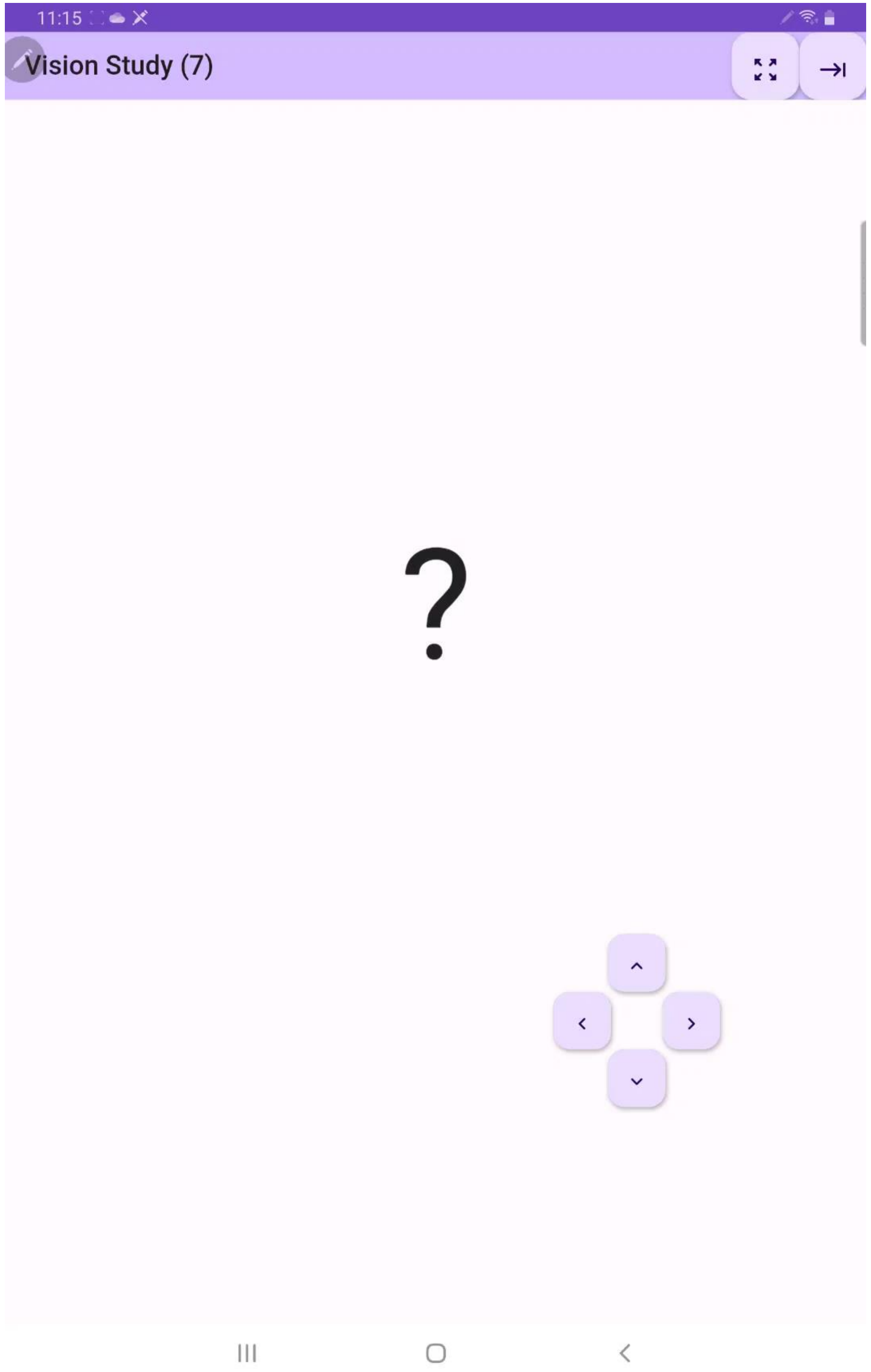
CARDIFF UNIVERSITY PRIFYSGOL CAERDYDD

UWE Bristol University of the West of England

Funded by:

FIGHT FOR SIGHT

Nystagmus Network



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University of Plymouth, UK

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References

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2. Neveu MM, Jeffery G, Moore AT, Dakin SC. Deficits in local and global motion perception arising from abnormal eye movements. Journal of Vision 2009;9:9-9.

3. Pelli, D. G. (1981). Effects of Visual Noise. PhD, Cambridge University.

4. Barlow, H. B. (1957). "Increment thresholds at low intensities considered as signal/noise discriminations." J Physiol 136(3): 469-488.

5. Joshi, M. R., Simmers, A. J. and Jeon, S. T. (2021). "The interaction of global motion and global form processing on the perception of implied motion: An equivalent noise approach." Vision Research 186: 34-40.

6. Levi, D. M. and Li, R. W. (2009). "Perceptual learning as a potential treatment for amblyopia: A mini-review." Vision Research 49(21): 2535-2549.

7. Park, A. S. Y., G. H. T. Wong, K. W. S. Tan, B. W. S. Cheung, M. Oremus, A. M. Y. Cheong and B. Thompson (2024). "Efficacy of perceptual learning in low vision: A systematic review and meta-analysis." Optom Vis Sci 101(6): 305-320.

8. Huurneman, B., F. N. Boonstra and J. Goossens (2016). "Perceptual Learning in Children With Infantile Nystagmus: Effects on Reading Performance." Investigative Ophthalmology & Visual Science 57(10): 4239-4246.

9. Huurneman, B., F. N. Boonstra and J. Goossens (2016). "Perceptual Learning in Children With Infantile Nystagmus: Effects on 2D Oculomotor Behavior." Investigative Ophthalmology & Visual Science 57(10): 4229-4238.

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your
ATTENTION!
ANY QUESTIONS?