Perceptual learning improves motion perception in patients with macular degeneration

Célia Michaud, Cynthia Faurite, Jade Guenot, Victor Vattier, Maxime Rosito, Robin Baurès, Yves Trotter, Vincent Soler, Carole Peyrin, Benoit Cottereau

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01 MACULAR DEGENERATION

Macular degeneration (MD): progressive degeneration of the central part of the retina.

Leading cause of **blindness** in people over 65 years. About 200 million people affected in the world.

Symptoms

- Emergence of a black spot (‘**scotoma**‘) in central vision
- Line distortion
- Overall decreased in visual acuity

MD patients need to rely on the **peripheral** part of their retina for perceiving their visual environment. The disease affects some visual functions (e.g., face recognition or reading) while other like **motion** perception could be preserved[1,2].

Perceptual learning is a learning method based on the **repetition** of a task that induces brain plasticity and thus **long-term improvement** of a perception skill.

02 RESEARCH PROJECT

The main objective of this study is to explore whether **perceptual learning,** a promising rehabilitation strategy, can be used to improve the patients’ ability to perceive **motion**. To do so, we compare performances before and after training in a motion direction discrimination task.

In addition, we want to determine whether the effect of perceptual learning in this case can be **transferred** to a more **complex** visual motion task (multiple object tracking or MOT), which involves spatial attention and recruits higher-order brain areas.

03 METHODS

Pre-tests
RDKs (1 training run + 3 runs)
MOT (2 conditions, 60 trials each)

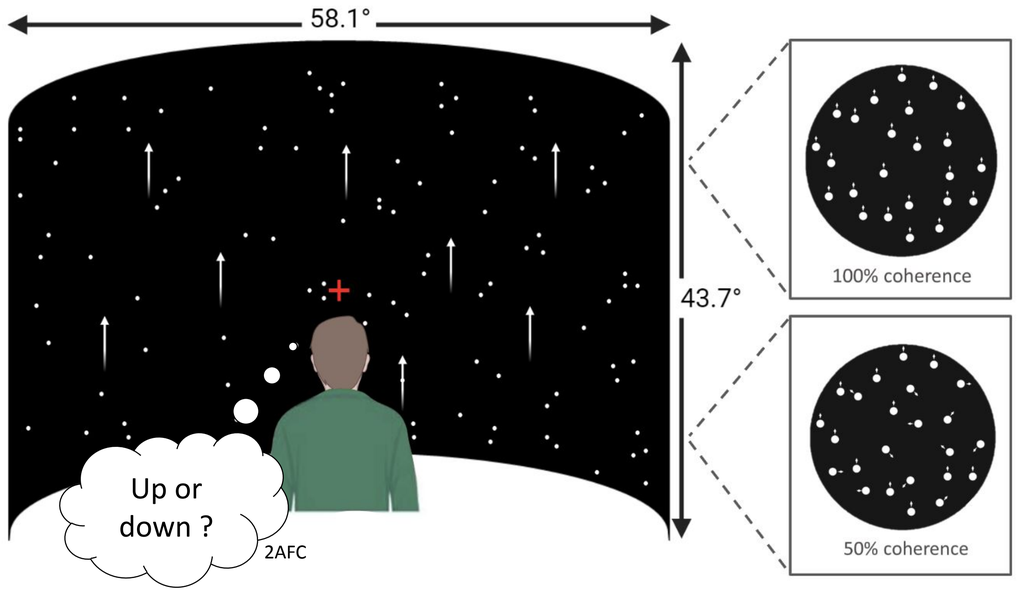
→

Perceptual learning
RDKs (3 runs)
3 sessions/week during 4 weeks

→

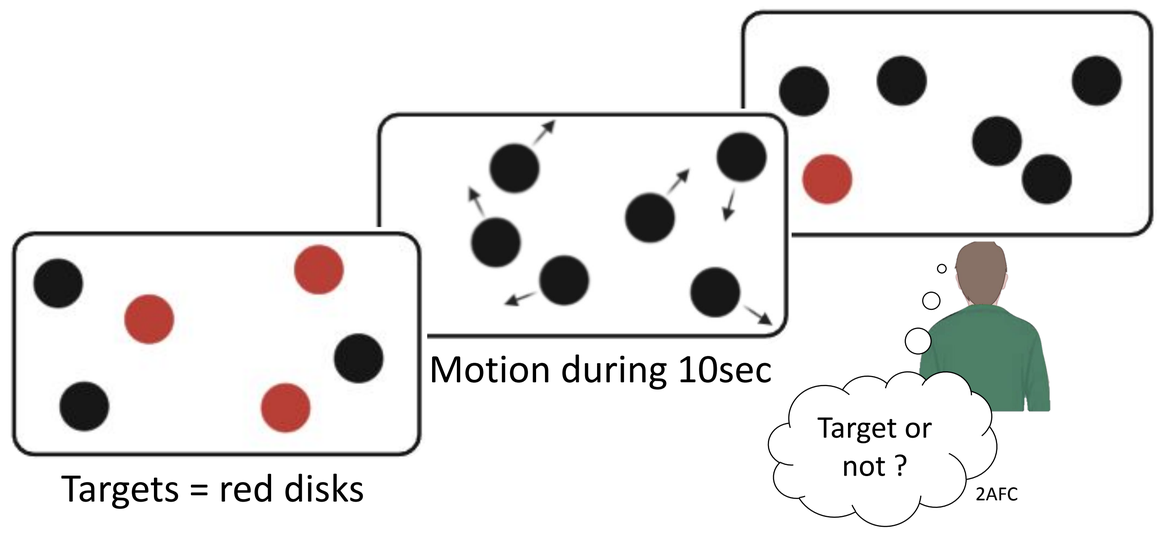
Post-tests
RDKs (3 runs, 64 trials each)
MOT (2 conditions, 60 trials each)

Random Dots Kinematograms (RDKs) — **9 MD patients** (50 - 81 y.o.)



Motion coherence discrimination thresholds were estimated using an adaptative Bayesian procedure.

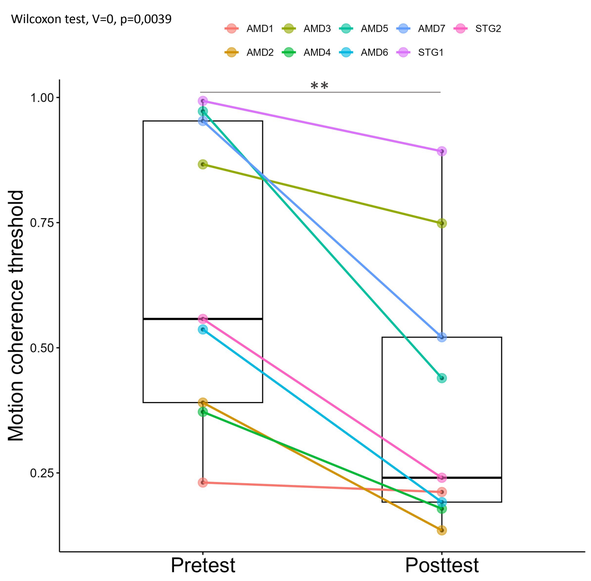
Multiple Object Tracking (MOT) — **6 MD patients** (66 - 81 y.o.)



Percentage of correct answers were obtained in two conditions, with either 3 targets among 6 disks or 4 targets among 8 disks

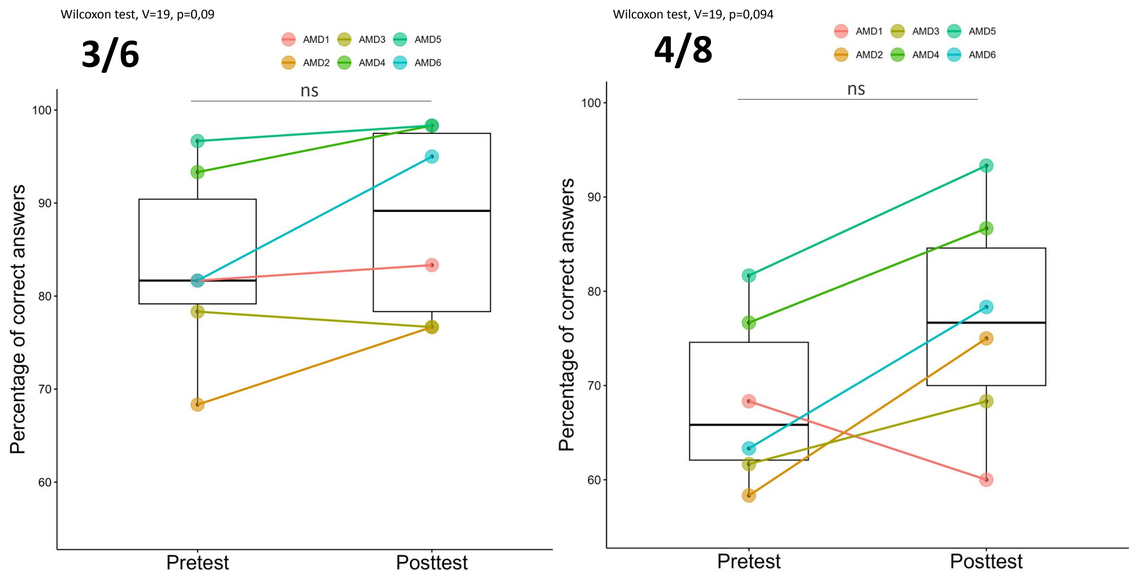
04 RESULTS

Random Dots Kinematograms (RDKs)



Motion coherence thresholds decreased after perceptual learning for every participant.
Mean improvement rate :
41,2 % ± 7,9 % (S.E.M).

Multiple Object Tracking (MOT)



Percent of correct answers increased in at least one condition for each participant. 2 patients had higher scores in only one condition.
Mean improvement rate : 9,5 % ± 4,3 % (S.E.M).

$$\text{Improvement rate} = \left(\frac{PostTests\ results - PreTests\ results}{PreTests\ results}\right) \times 100$$

05 CONCLUSION

Perceptual learning **improves motion perception** in patients with MD. There seems to be no transfer of the effects of the training to more complex tasks even if more participants are required to confirm this conclusion.

These results are preliminary but open interesting perspectives for new visual learning therapies in MD patients.

REFERENCES
1. Shanidze, N., & Verghese, P. (2019). Motion perception in central field loss. *Journal of Vision*, *19*(14), 20.
2. Guénot, J., Trotter, Y., Fricker, P., Cherubini, M., Soler, V., & Cottereau, B. R. (2022). Optic Flow Processing in Patients With Macular Degeneration. *Investigative Ophthalmology & Visual Science*, 63(12), 21.