Perceptual learning improves motion perception in patients with age-related macular degeneration

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Résumé

Age-related macular degeneration (AMD) is the leading cause of blindness in people over 65 years. This disease is typically characterized by a progressive loss of central vision in both eyes which is irreversible and has a dramatic impact on the patients' quality of life. A promising readaptation strategy for patients is to train their peripheral vision, which remains functional, in order to diminish their visual impairments. Here, we explore whether perceptual learning can be used to improve the patients' ability to perceive motion, an important visual function that relies on both central and peripheral vision. Participants (4 AMD patients with an absolute scotoma in both eyes, aged between 66 and 82) performed 12 training sessions of about an hour and spread over 4 weeks. During each of these sessions, they had to report the motion direction (either upward or downward) of a translating pattern defined from dynamic random-dot kinematograms (RDKs) projected on a large screen (58.1∘ x 43.7∘). Motion coherence discrimination thresholds were estimated using an adaptive Bayesian procedure. We calculated the improvement rate for each participant using the formula ((post-test result - pre-test result)/pre-test result)*100. This reduces the disparities between participants. All participants improved their performances with the training (mean improvement rate in post-tests: 34.8 percent +/- 12.2 percent of standard error), which suggests that perceptual learning is indeed efficient in this case.
In order to determine whether these effects generalized to untrained and more complex visual motion tasks, we characterized the performances of the patients on multiple object tracking (MOT) before and after the training on translational motion. In this task, several identical moving disks were presented on the screen. Some of them (either 3/6 or 4/8) were designated as targets while the remaining served as distractors. Patients had to monitor the positions of the targets during 10s trials. Analyses showed that tracking performances were generally improved after the training (mean improvement rate in post-tests: 7.2 percent +/- 4.6 percent of standard error, 2 patients had higher scores in all the conditions while the two others had higher scores in only one condition).

Although these preliminary results will have to be confirmed from measurements in a bigger cohort, they suggest that perceptual learning is an effective tool to improve motion perception in AMD patients and that the effects of training on a simple motion discrimination task might transfer to more complex tasks.

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Mots-Clés: Macular Degeneration, Perceptual learning, motion perception, AMD