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Repairing stroke-related spatial neglect—researchers study how prism goggles rewire the brain

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A team of researchers at Dalhousie University is making and testing "prism goggles" as a means of helping people recover from the post-stroke phenomenon known as hemi-spatial neglect.

Hemi-spatial neglect almost always occurs on the left and can affect over half of the people who have had a stroke on the right side of their brain.

"People with left-sided hemi-spatial neglect literally do not perceive or respond to the world on the left side of their body or visual field," says Dr. Gail Eskes, a clinical neuropsychologist and professor in the departments of Psychiatry and Psychology & Neuroscience at Dalhousie University. "Many people with spatial neglect bump into objects and people on their left, leave the food on the left side of their plate, do not perceive the left side of a clock, that kind of thing—it's very disabling."

Dr. Eskes and her team have partnered with Eyes On Optometry in Halifax to create high-quality optical prism goggles as a potential treatment.

"For people with left-sided hemi-spatial neglect, training with the prism goggles shifts the visual space to the left, so now they can perceive the left half of their world, as well as the right," Dr. Eskes says. "Getting daily doses of the therapy helps to retain their new, properly balanced visual orientation to the world."

Healthy volunteers in Dr. Eskes' studies have also found the goggles shift their visual field to the left—but it shifts back to centre once they stop using the goggles.

"It goes to show that the brain wants to stay in alignment," Dr. Eskes notes.

She and her collaborators are examining the brainwave patterns of stroke survivors and healthy volunteers to learn how the brain adapts its perception to guide behaviour in response to the prism-goggle training. They're using techniques such as EEG (electroencephalograhy), which records brainwaves, and ERP (event-related potentials), which records brainwaves as they respond to various stimuli.

"We want to identify both the conscious and unconscious learning mechanisms the brain uses as it adapts to the prisms, while also learning more about the phenomenon of neglect," Dr. Eskes says. "We suspect that the unconscious mechanisms, the ones that automatically help to align what the eyes see with the body's movements in space, are the most important to cultivate. A better understanding of these brain mechanisms will help us to develop better prism interventions."

As part of her larger "Cognitive Repair Kit," funded by ACOA's Atlantic Innovation Fund, Dr. Eskes is working with Dr. Anne-Sophie Champod (a former postdoctoral fellow in her lab, now assistant professor at Acadia University), to develop a tablet-based computer game that integrates with the prism goggles from Eyes on Optometry. Their goal is to provide stroke survivors with a portable rehabilitation tool they can use at home.

"It uses a touch screen that requires users to touch moving targets on the bullseye, training and retraining their hand-eye coordination again and again, while wearing the prism goggles, to build the neural pathways

required to permanently shift the alignment of the visual field and the body," Dr. Eskes explains. "We are now preparing to test the game in clinical trials with the stroke team at the Nova Scotia Arthritis and Rehabilitation Centre."

Provided by Dalhousie University