Brain training works, but just for the practiced task, say researchers

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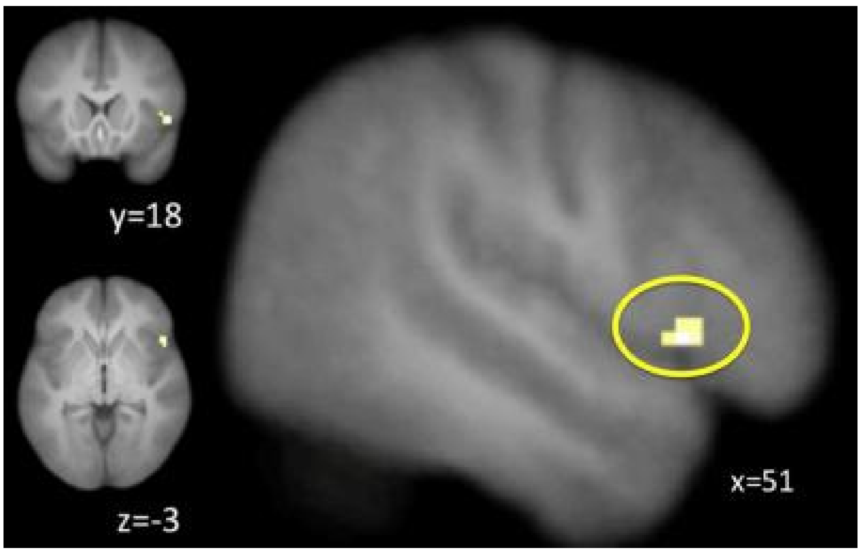

Changes resulting from training are highlighted in the brain's right frontal gyrus (yellow), based on an fMRI study of subjects in experiments at the University of Oregon. Pre-task training was found to work just for the challenge at hand. Credit: Elliot Berkman

Search for "brain training" on the Web. You'll find online exercises, games, software, even apps, all designed to prepare your brain to do better on any number of tasks. Do they work? University of Oregon psychologists say, yes, but "there's a catch."

The catch, according to Elliot T. Berkman, a professor in the Department of Psychology and lead author on a study published in the

Jan. 1 issue of the *Journal of Neuroscience*, is that training for a particular task does heighten performance, but that advantage doesn't necessarily carry over to a new challenge.

The training provided in the study caused a proactive shift in inhibitory control. However, it is not clear if the improvement attained extends to other kinds of executive function such as working memory, because the team's sole focus was on inhibitory control, said Berkman, who directs the psychology department's Social and Affective Neuroscience Lab.

"With training, the brain activity became linked to specific cues that predicted when inhibitory control might be needed," he said. "This result is important because it explains how brain training improves performance on a given task—and also why the performance boost doesn't generalize beyond that task."

Sixty participants (27 male, 33 females and ranging from 18 to 30 years old) took part in a three-phase study. Change in their brain activity was monitored with functional magnetic resonance imaging (fMRI).

Half of the subjects were in the experimental group that was trained with a task that models inhibitory control—one kind of self-control—as a race between a "go" process and a "stop" process. A faster stop process indicates more efficient inhibitory control.

In each of a series of trials, participants were given a "go" signal—an arrow pointing left or right. Subjects pressed a key corresponding to the direction of the arrow as quickly as possible, launching the go process. However, on 25 percent of the trials, a beep sounded after the arrow appeared, signaling participants to withhold their button press, launching the stop process.

Participants practiced either the stop-signal task or a control task that didn't affect inhibitory control every other day for three weeks. Performance improved more in the training group than in the control group.

Neural activity was monitored using functional magnetic resonance imaging (fMRI), which captures changes in blood oxygen levels, during a stop-signal task. MRI work was done in the UO's Robert and Beverly Lewis Center for Neuroimaging. Activity in the inferior frontal gyrus and anterior cingulate cortex—brain regions that regulate inhibitory control—decreased during inhibitory control but increased immediately before it in the training group more than in the control group.

The fMRI results identified three regions of the brain of the trained subjects that showed changes during the task, prompting the researchers to theorize that emotional regulation may have been improved by reducing distress and frustration during the trials. Overall, the size of the training effect is small. A challenge for future research, they concluded, will be to identify protocols that might generate greater positive and lasting effects.

"Researchers at the University of Oregon are using tools and technologies to shed new light on important mechanisms of cognitive functioning such as executive control," said Kimberly Andrews Espy, vice president for research and innovation and dean of the UO Graduate School. "This revealing study on brain training by Dr. Berkman and his team furthers our understanding of inhibitory control and may lead to the design of better prevention tools to promote mental health."

Co-authors with Berkman were Lauren E. Kahn and Junaid S. Merchant, doctoral students in psychology. Internal UO faculty research awards supported the project.

The findings are in line with a growing body of studies that are exploring the impact of brain-training programs. Recent research has been covered by various media outlets, including The Observer (UK), the Motley Fool and ABC News.

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