Brain fitness program study reveals visual memory improvement in older adults

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A commercial brain fitness program has been shown to improve memory in older adults, at least in the period soon after training. The findings are the first to show that practicing simple visual tasks can improve the accuracy of short-term, or "working" visual memory. The research, led by scientists at UCSF, is also one of the first to measure both mental performance and changes in neural activity caused by a cognitive training program.

In the study, healthy older participants trained on a computer game designed to boost visual perception. After ten hours of training, they not only improved their perceptual abilities significantly, but also increased the accuracy of their visual working memory by about ten percent - bringing them up to the level of younger adults. Few brain training programs have been subjected to such rigorous research evaluation to reveal such a transfer of benefits, the researchers say.

Working memory is the ability to hold information in mind for brief periods. It is essential to accomplish immediate tasks, such as engaging in conversation with several people.

If improvements in a simple perception skill can transfer to a higher level function such as memory, as this research found, then other interventions might further improve brain function in aging people, the scientists say.

The researchers recorded participants' brain activity before and after the

visual perception training, and found a direct link between improved performance and changes in brain activity. After the training, activity had decreased in a key brain area involved in processing visual input. The people who improved the most in the visual training showed the biggest drop in neural activity - as if the brain didn't have to work as hard to take in information.

The research is being published in the journal PLoS One on July 14, 2010.

"This confirms our understanding that the brains of older adults, like those of young people, are 'plastic' - the brain can change in response to focused training," said Adam Gazzaley, MD, PhD, director of the Neuroscience Imaging Center at UCSF and senior author of the research paper. Gazzaley is associate professor of neurology, physiology and psychiatry at UCSF.

"The study shows that perceptual improvements with simple discrimination training can transfer to improved working memory in older adults, and it also shows that this increase in memory accuracy is linked to changes at the neural level."

There are many brain fitness programs being marketed, but there has been little rigorous testing and evaluations of their effectiveness, Gazzaley said.

"We zeroed in on one specific regimen, and we can see that at least with this approach, some brain fitness program claims may be warranted."

Gazzaley's team worked with researchers at Posit Science Corp., a producer and promoter of brain fitness programs. Posit Science was co-founded by Michael Merzenich, PhD, a leader in brain plasticity research and an emeritus professor at UCSF. Posit Science funded the

research.

Memory improvement was measured about one week after the visual perception training ended. The scientists did not assess how long the memory improvement might last beyond that period without continued training.

A further test showed that if participants had to multi-task during the memory testing, they did not receive the memory boost from the previous perception training. Gazzaley hopes that more studies can lead to ways to help people improve their ability to mentally process simultaneous tasks - a skill that declines in many older adults.

The study involved two sets of 15 healthy adults from age 60 to 89. One group participated in the training. The second group served as the control, taking the memory tests but not the visual perception training. No participants had dementia, but the group showed a range of mental fitness typical of an aging population. The average age was 72. Most were college educated, middle class people.

People in both groups were given a baseline working memory test consisting of watching dots move across the computer screen, followed by a short delay and then re-testing to see if they remembered exactly in which direction the dots had moved. The memory test was given to both groups again after the experimental group had participated in ten hours of visual perception training. This training challenged players to discriminate between different shapes of sine waves, or S-shaped patterns, moving across the screen.

The training program was designed so that as a participant's skill level improved, the task became progressively harder. The drills lasted 40 minutes, and were given three to five times a week for three to five weeks. All trained participants improved their ability to distinguish

between the two different moving shapes.

Scientists measured participants' brain activity by electroencephalography, or EEG, during the memory tests, both before and after the visual training. People were fitted with caps consisting of non-invasive electrodes that measure electrical activity caused by neurons firing in the cerebral cortex, the site of higher cognitive functions.

The research team focused on brain activity known to be involved in processing visual information, in a region called the visual association cortex located near the back of the brain. Neurons at this site generate an internal representation of what is seen, Gazzaley said. The research team found that as peoples' visual perception improved, activity generated by this region decreased.

"This suggests that the brain processed the visual input more efficiently," Gazzaley said. "So, we find for the first time that improved perceptual learning transfers to improved working memory performance, and that this improvement may well be explained by changes in neural activity. This gives us direction for developing even better interventions to improve brain function in older adults."

When asked if older adults would have to continue these repetitive drills in order to maintain improved memory, Gazzaley says, "Well, I like to keep physically fit. I work out almost every day, and I know that if I stopped, I would get out of shape. Maybe it's the same with the brain. You've got to continue to work it."

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