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Scientists report promising new direction for cognitive rehabilitation in the elderly

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Research has found that declines in temporal information processing (TIP), the rate at which auditory information is processed, underlies the progressive loss of function across multiple cognitive systems in the elderly, including new learning, memory, perception, attention, thinking, motor control, problem solving, and concept formation. In a new study, scientists have found that elderly subjects who underwent temporal training improved not only the rate at which they processed auditory information, but also in other cognitive areas. The study is published in the current issue of *Restorative Neurology and Neuroscience*.

"Our study showed for the first time significant benefits of temporal training on broad aspects of cognitive function in the elderly. The results were long-lasting, with effects confirmed 18 months after the training," says lead investigator Elzbieta Szelag, Professor, Head of Laboratory of Neuropsychology, Nencki Institute of Experimental Biology (www.nencki.gov.pl), and Warsaw School of Social Sciences and Humanities (www.swps.pl), Warsaw, Poland.

Thirty subjects between 65 and 75 years of age were randomly assigned to three groups. One group received temporal training using Fast ForWord Language® (FFW), a program comprised of several computer games designed to improve memory, attention, and sequencing abilities. The program was developed to help children who have trouble reading, writing, and learning. The second group participated in non-temporal training by playing common computer games. The third group, the control, underwent no training.

Prior to the training, all of the subjects went through a number of tests to measure their cognitive functioning. Two tasks assessed TIP by measuring sequencing abilities. Specifically, at which inter-stimulus-interval subjects could identify the order of two stimuli presented in rapid sequence, i.e. which of two tones was higher or lower, or whether they heard a sound in the right or left ear first. Three aspects of attention were assessed: the ability to sustain attention over a longer period of time (vigilance), the ability to pay attention to multiple processes (divided attention), and the ability to maintain a high level of attention in anticipation of a test stimulus (alertness). Short-term memory was assessed with tests to evaluate working memory span, the ability to match complex patterns, and the ability to recognize a pattern seen earlier.

Each subject in the temporal training group started with exercises from the basic module of FFW. When they reached 100% complete for each exercise, they moved onto an intermediate program, and then an advanced program. They trained for an hour a day, four days a week, for eight weeks. The non-temporal training group played computer games such as Solitaire or Internet games such as Mahjong for the same amount of time. The control group received no training but was tested before and after the eight-week period.

At the end of the training period, cognitive functioning was re-assessed. Prior to training, no significant differences were found among the three groups. After the training, improved temporal information processing was found on the tone task in the temporal training group. It was accompanied by improvements in some aspects of attention and short-term memory. In contrast, the non-temporal training group's attentional and memory resources scores remained at the pre-training level, while only the second measure of temporal information processing improved. Changes in the control group were nonsignificant.

The temporal training group was tested again 18 months after the training completion. The positive effects remained stable. TIP, divided attention, matching complex patterns, and working memory span remained at a similar level as in the post-training assessment. Although vigilance of attention declined from the post-training assessment, for all measures the results were not worse than in the pre-training assessment. "Although FFW does not train other cognitive functions directly, attention and short-term memory resources were necessary to perform the training tasks correctly," explain Professor Szelag and Dr Skolimowska. "To succeed in the FFW games, the temporal skills had to be accompanied by efficient basic cognitive processes."

Professor Szelag concludes, "These results show a new impact of temporal training on age-related cognitive decline in the senior population. Moreover, they foster a greater understanding of the relationships between timing and cognition, and they show new possibilities for the application of temporal training." On the basis of these results the Laboratory of Neuropsychology has recently initiated an innovative rehabilitation computer program that addresses improvement of a broad range of cognitive functions in children and adults.

More information: “Cognitive functioning in elderly can be ameliorated by training in temporal information processing,” by Elzbieta Szelag and Justyna Skolimowska. *Restorative Neurology and Neuroscience*, 30:5 (September 2012). DOI: 10.3233/RNN-2012-120240
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