Medical Xpress

Researchers investigate technique to accelerate learning

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Researchers at the Texas Biomedical Device Center (TxBDC) at The University of Texas at Dallas have been awarded a contract worth up to $5.8 million from the Defense Advanced Research Projects Agency (DARPA) to investigate a novel approach to accelerate the learning of foreign languages.

The contract is part of DARPA's Targeted Neuroplasticity Training (TNT) program, which seeks to advance the pace and effectiveness of a specific kind of learning—cognitive skills training—through precise activation of peripheral nerves, which in turn can strengthen neural connections in the brain.

"Military personnel are required to utilize a wide variety of complex perceptual, motor and cognitive skills under challenging conditions," said Dr. Robert Rennaker, Texas Instruments Distinguished Chair in Bioengineering, director of the TxBDC and chairman of the Department of Bioengineering.

"Mastery of these difficult skills, including fluency in foreign language, typically requires thousands of hours of practice," said Rennaker, who served in the U.S. Marine Corps.

DARPA's TNT program aims to develop an optimized strategy to accelerate acquisition of complex skills, which would significantly reduce the time needed to train foreign language specialists, intelligence analysts, cryptographers and others.

Rennaker and his colleagues at the TxBDC will focus on developing an approach that uses vagus nerve stimulation (VNS) during training to specifically reinforce neural networks that are involved in learning a particular task.

VNS is an FDA-approved method for treating various illnesses, such as depression and epilepsy. It involves sending a mild electric pulse through the vagus nerve in the neck. When stimulated, the vagus nerve affects the brain, where it boosts the release of chemicals called neuromodulators. These chemicals facilitate synaptic plasticity, a process in which the connections between brain cells change and strengthen during learning.

"Imagine you're struggling to learn something new, like multiplication tables or how to hit a golf ball. When you get it right, when that light bulb comes on, this system is being activated," Rennaker said. "By stimulating the vagus nerve during the learning process, we're artificially releasing these chemicals to enhance those connections active during learning."

In the DARPA project, the aim is to accelerate learning of foreign languages by stimulating the vagus nerve during specific tasks.

"DARPA is approaching the study of synaptic plasticity from multiple angles to determine whether there are safe and responsible ways to enhance learning and accelerate training for skills relevant to national security missions," said Doug Weber, TNT program manager at DARPA.

Over the past several years, researchers at the TxBDC have developed techniques to pair VNS with traditional rehabilitation to enhance recovery from an injury, an innovation they call Targeted Plasticity Therapy (TPT). In preliminary clinical studies, their technique has been

shown to restore movements, reduce pain, increase feeling, improve memory and possibly speed up learning.

"This new project is focused on understanding if TPT can be used to accelerate learning in non-injured individuals," Rennaker said. "If successful, this approach could benefit not only those that need to rapidly learn a new language but also those with learning impediments or conditions such as autism or brain injuries."

Dr. Michael Kilgard, Margaret Fonde Jonsson Professor in the School of Behavioral and Brain Sciences and associate director of the TxBDC, is the principal investigator.

"We believe that we will be able to substantially increase the rate of language learning. With VNS, we may be able to improve on the brain's natural ability to learn," Kilgard said. "We're trying to march forward and make new technologies that aren't currently available. I think it's exciting."

In addition to Rennaker and Kilgard, other co-principal investigators on the project are Dr. Seth Hayes, assistant professor in the Department of Bioengineering; Dr. Sven Vanneste, associate professor in the School of Behavioral and Brain Sciences; and Dr. Diana Easton, clinical professor in the Erik Jonsson School of Engineering and Computer Science. Also participating are Dr. Jane Wigginton from UT Southwestern Medical Center and Dr. Beverly Wright from Northwestern University.

Provided by University of Texas at Dallas