Medical Xpress

Soldiers' helmets could control brain activity with ultrasound

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(Lower left) A ballistic helmet fitted with four ultrasound transducers and (lower right) another functional prototype for achieving human brain stimulation using a single element transducer, as well as a list of potential applications relevant to the defense industry. Image credit: Tyler Lab.

(PhysOrg.com) -- One of DARPA's latest pursuits of cutting-edge research involves a neurotechnology lab at Arizona State University that specializes in ultrasonic brain stimulation. By implementing the technology in soldiers' helmets, DARPA hopes to provide advantages to US troops by enhancing cognitive abilities; improving long-term alertness; and reducing stress, anxiety, and pain.

The research lab is run by neuroscientist William Tyler, who has been investigating non-invasive approaches to brain stimulation for many

years. Some of the applications of brain stimulation include treating neurological diseases such as Parkinson's and depression, as well as enabling the development of brain-computer interfaces.

As Tyler explains in a recent blog post, two of the biggest challenges in brain stimulation are achieving high spatial resolution (for precise control of brain circuitry) and deep penetration (for reaching all parts of the brain). Currently, some brain stimulation techniques require surgically implanting electrodes to achieve these goals, and non-surgical techniques tend to lack in one or both areas. But Tyler has developed a noninvasive technique in which “transcranial pulsed ultrasound” can remotely stimulate brain circuits without the need for surgery. The pulsed ultrasound approach can provide a spatial resolution that is about five times greater than other non-surgical techniques and can reach deep-brain circuits to the same depth as surgical techniques.

With the new grant from DARPA, the lab is now turning its attention toward developing applications for US soldiers. Instead of using the technology to repair damaged brain circuits, the researchers are exploring how ultrasound can affect healthy brain circuits. They have developed working and conceptual prototypes of ballistic helmets embedded with ultrasound transducers and microcontroller devices. One of the most important applications may be minimizing the effects of a traumatic brain injury (TBI), as Tyler explained to Wired.

“The really damaging part of a TBI isn’t the initial injury,” he said. “It’s the metabolic damage, the free radicals and the swelling that are happening in the hours afterward. If you can flick your remote and trigger an immediate intervention, you’d be curbing what might otherwise be lifelong brain damage.”

More information: via: Armed With Science and Wired