Computer-brain link helps 'locked in' people chat, surf web
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One participant, a musician, even played a bit of Beethoven's "Ode to Joy" on a digital piano interface.

"The tablet became second nature to me, very intuitive," one of the participants said in the study. "It felt more natural than the times I remember using a mouse."

Three paralyzed subjects had a 100-electrode implant placed into the motor regions of the brain, with a thin bundle of wires leading to a plug fixed to the skull, Nuyujukian said. The implant is about the size of a large pea, or a baby aspirin.

Two of the participants in this latest study had weakness or loss of movement of their arms and legs due to amyotrophic lateral sclerosis (ALS, also known as Lou Gehrig's disease), a progressive disease affecting the nerves in the brain and spine that control movement. The third participant was paralyzed due to a spinal cord injury.

The implant monitors brain patterns and feeds them into a computer algorithm, which decodes the thoughts and translates them into wireless signals, researchers said. Those signals are sent to the tablet, allowing subjects to control the device.

"If you think back to the old one-button computer mouse of yesteryear, that's the signal we are able to extract from the brain," Nuyujukian said. "It's the equivalent of a cursor velocity and a one-button click."

It usually takes about 5 to 10 minutes to calibrate the system to accurately translate a person's brain waves into cursor movements, Nuyujukian said.

"The participant is instructed to imagine moving the cursor to the right or the left or up or down while the cursor is actually making that movement automatically," he said. "It turns out that simply imagining making that movement is very similar to
the patterns of neural activity that occur when one actually makes this movement."

Subjects are able to make up to 22 point-and-click selections per minute while using a variety of apps, and type up to 30 characters per minute using standard e-mail and text apps.

"Participants can control these on day one. That is possible, and we have shown that," Nuyujukian said. "That's not to say there is no benefit to practice. Our participants definitely feel more comfortable and capable with these systems after a week or two of actually practicing it."

The project is a collaboration that included researchers from Brown University, Massachusetts General Hospital and Stanford. The findings were published Nov. 21 in the journal PLOS ONE.

Last year, this same research group published a paper in which they were assessing the same patients' ability to type words using their thoughts, said Dr. Thomas Oxley, a clinical instructor and director of innovation strategy at Mount Sinai Hospital Health System's department of neurosurgery in New York City.

"They've now gone beyond that to demonstrate that this system can e-mail, text message and surf the internet, amongst other things," said Oxley, who wasn't involved with the study. "Those seem to be the three most-used applications in this group."

The researchers have further honed their system by integrating other useful "smart" computer technologies, Oxley said.

For example, the paralyzed people's typing speed underwent a "big jump primarily because they utilized predictive text, and it made a big difference in the patient's capacity to usefully utilize the system and interact with their social network," Oxley said.

This latest advance is the culmination of 15 years of research into brain patterns of movement, built on top of decades of previous neuroscience, Nuyujukian said.

The system could transform the lives of people with "locked-in syndrome," whose paralysis has robbed them of the ability to speak, Oxley said.

"That's so exciting for patients who've lost the capacity to speak, to be able to communicate with their loved ones again," Oxley said.

However, it will be years before the technology reaches the point where it becomes widely available, Nuyujukian said.

"The final device needs to be something that's fully implantable, that needs to be miniaturized. It cannot be a giant stack of computers and a giant cart. That's not a clinical device," Nuyujukian said. "It needs to be something that is just as accessible and easy to use as many of the other implantable technologies that we have for interacting with the brain, like deep brain stimulators or cochlear implants."

"This isn't something that will be clinically available, say, next year," Nuyujukian noted.


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