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NEURAL REPAIR AND REHABILITATION

Implant helps patient with incomplete locked-in syndrome

A brain–computer interface (BCI) that uses an implanted electrode array has enabled a patient with incomplete locked-in syndrome to communicate effectively. Results in the new study also demonstrate the importance of on-screen keyboard design in such interfaces.

Existing BCIs designed to facilitate communication for people with locked-in syndrome are based on EEG or electrocorticography, and have had limited success. The new study—part of the BrainGate Neural Interface System pilot clinical trial at the Massachusetts General Hospital, in collaboration with Brown University and Providence VA Medical Center, USA—introduces an interface that uses an implanted microelectrode array.

"Our objective was to demonstrate that an intracortical neural interface system can enable someone with a severe physical disability to effectively communicate using neural point-and-click cursor control," explains lead author Daniel Bacher.

The investigators evaluated one individual with incomplete locked-in syndrome, who had a microelectrode array implanted into her motor cortex 5 years prior to the study.

> "...typing speeds ... were considerably faster than speeds reportedly achieved with EEG-based systems"

The investigational BrainGate system presented the participant with an on-screen keyboard, and she learned to control a cursor by imagining that she was moving a computer mouse with her hand. She could then 'click' to select letters by imagining that she was squeezing her hand. Two keyboard layouts were used, one based on the standard QWERTY layout, and the other was the BrainGate Radial Keyboard, a circular keyboard with eight multi-character keys.

With both keyboards, the patient achieved typing speeds that were considerably faster than speeds reportedly achieved with EEG-based systems. However, the radial keyboard enabled faster typing than did the QWERTY keyboard, highlighting the importance of the user interface in the design of BCIs.

Use of the radial keyboard was efficient enough to enable the participant to conduct an online conversation via Google Chat. Furthermore, when the interface was combined with text-to-speech conversion software, the participant was also able to have a face-to-face conversation.

"This study demonstrates for the first time that a person with incomplete locked-in syndrome can communicate in real-time using point-and-click control derived from intracortical neural activity," says Bacher. "It also shows that improvements in keyboard design can enhance the utility of BCI-driven point-and-click communication systems."

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