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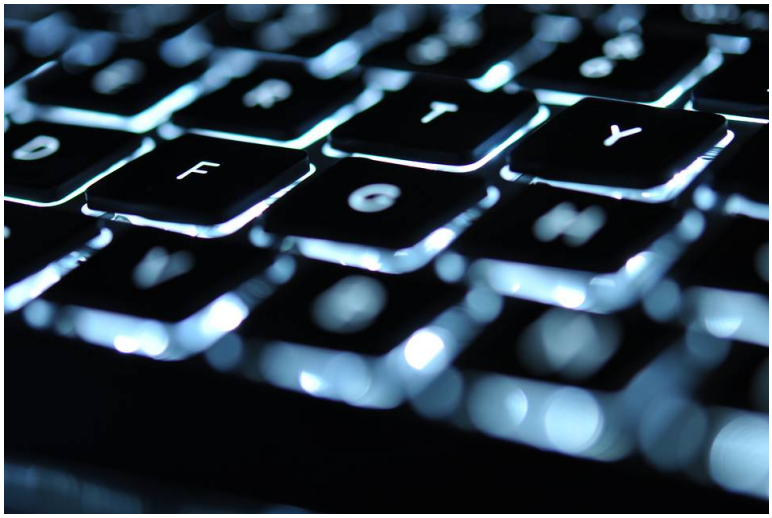
Could We Type Just With Brain Waves?

Stanford researchers got a monkey to type the equivalent of 12 words a minute through a brain-computer interface



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By **DANIEL AKST**

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For years, scientists have been striving to find ways for people to control objects with nothing more than their brain waves. Success would open the door to all kinds of possibilities, such as enabling communication for a person who is entirely paralyzed.

Advances in computer technology are helping, but one big hurdle is that reading people's minds isn't just difficult, it's also slow. Now researchers at Stanford University have managed to get two rhesus macaques to control a computer with nothing more than brain signals at a surprisingly fast rate—fast enough to

suggest that a similar system, adapted for humans, could make reasonably prompt communications possible for people who are otherwise unable to move.

The Stanford scientists implanted tiny sensors—each the size of a baby aspirin—in the motor cortex area of the monkeys' brains, then trained the animals to control a wireless computer cursor by means of an infrared bead at the end of one of their fingers. During training, the monkeys had to point to a particular color every time that it appeared in a grid on screen in order to get a reward.

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Thanks to the implanted sensors, the researchers could detect the voltage patterns of the brain signals associated with the monkeys' arm movements. In effect, the scientists could read the monkeys' minds, at least with respect to how they moved the cursor.

When the computer was shifted to reading brain signals instead of infrared inputs, the monkeys still moved their arms—and still controlled the cursor, this time because the computer could read their brain patterns and put the cursor where the monkeys intended. (In earlier experiments, the process even worked when the monkeys' arms were restrained.) When the scientists assigned invisible letters to the spaces in the grid and flashed the colors through them to spell words (much as you might spell words on the keypad of a phone), they were able to measure how quickly the monkeys were "typing."

Of course, the monkeys were just clicking on the color as it moved through the grid, but each click was associated with a letter. (The sequences were drawn from "Hamlet" or, in another trial, from a newspaper article.) Measured this way, one of the monkeys was typing the equivalent of 12 words a minute —entirely by means of brain signals. The other monkey approached a rate of 8 words a minute.

"These represent the highest known achieved communication rates" using a brain-computer interface to obtain control signals, the scientists wrote in a new paper on their research. They add that a human figuring out what to say might be slower. On the other hand, the monkeys were just clicking colors and therefore lacked the benefit of an autocomplete feature enabling the system to predict what the user is going to type.

What accounts for the relatively brisk speed recorded in these tests? Paul Nuyujukian and Krishna Shenoy, two of the Stanford scientists responsible for the study, credit the sophisticated algorithms, or instructions, that they and their team created to enable the computer to respond more quickly to the monkeys' brain signals. Dr. Nuyujukian and Dr. Shenoy are now testing these algorithms with humans. They also hope to develop effective brain sensors that work wirelessly, thus obviating the need for wires emerging from a patient's skull.

"A Nonhuman Primate Brain-Computer Typing Interface," by Paul Nuyujukian, Jonathan C. Kao, Stephen I. Ryu and Krishna V. Shenoy, Proceedings of the IEEE (Sept. 12)