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Moving Mountains With the Brain, Not a Joystick

By ANNE EISENBERG

STILL using a mouse, keyboard, joystick or motion sensor to control the action in a video game? It may be time to try brain power instead.

A new headset system picks up electrical activity from the brain, as well as from facial muscles and other spots, and translates it into on-screen commands. This lets players vanquish villains not with a click, but with a thought.

Put on the headset, made by Emotiv Systems in San Francisco, and when a giant boulder blocks the path in a game you are playing, you can levitate it — not by something as crude as a keystroke, but just by concentrating on raising it, said Tan Le, Emotiv's president. The headset captures electrical signals when you concentrate; then the computer processes these signals and pairs a screen action with them, like lifting a stone or repairing a falling bridge.

The headset is the consumer cousin of brain-computer interfaces developed in research labs and used, for example, by monkeys who manipulate prosthetic arms with thoughts. The monkeys' intentions are detected by sensors, translated into machine language and used to move the arm. In general, some interfaces use sensors implanted directly in the brain; others use electrode-studded caps.

For humans, Emotiv plans to have its noninvasive, wireless EPOC headset ($299) on sale in time for Christmas, Ms. Le said. With 16 sensors that lightly touch the head, it uses a standard technology, electroencephalography, or EEG, to pick up electrical signals from the scalp's surface and convert them to actions that control or enhance what happens on screen.

To help players master the art of moving on-screen objects solely through concentration, the headset will come bundled with a game, set on a magical mountain, that includes practice exercises, said Geoffrey Mackellar, Emotiv's research and development manager. "You clear the mind," he said, and then do 30 to 40 seconds of training, by concentrating, for instance, on visualizing a block lifting from the earth. "On the first or second attempt, you can lift it at will."

Other, harder challenges follow. In constant feedback, he said, the machine learns more about how users think just as users grow more skillful at concentrating.

Many game developers are incorporating the EPOC's biofeedback abilities into their applications, Ms. Le said.

The system doesn't just lift boulders. It can also detect some of a player's facial expressions and emotional

responses: smile, frown or wink, for instance, and an avatar on screen can do so, too. Grow bored during a battle, and the system can detect ennui and supply a few dragons, or change the music. The device tracks a total of about 30 responses.

A chip inside the headset collects the signals and sends them wirelessly to a receiver plugged into a U.S.B. port of the computer, where most of the processing occurs, Dr. Mackellar said.

The sleek Emotiv headset is a version of the EEG cap used for decades to record brain electrical activity, said Nathan Fox, a professor of human development at the University of Maryland.

“There can be as many as 256 electrodes at one time in a cap,” he said. ‘The placement corresponds in some rough approximation to brain areas that are underneath the scalp.”

Medical-grade EEG caps are used in research to eavesdrop on the brain as it plans motion and to translate these plans, for example, into cursor actions on a screen so paralyzed people can control a computer to write messages.

The Emotiv headset, too, taps the power of the mind, as well as using feedback from muscles, Dr. Mackellar said.

“We definitely read brain waves — no doubt about it — but we also read other things,” he said. “In classical EEG, movements of the face and muscles are regarded as noise. But we use some of it, rather than discard it.”

Anton Nijholt, a professor of computer science at the University of Twente in the Netherlands who does research on innovative interfaces for games, looks forward to the extra means of interaction that EEG headsets will provide. But he doesn’t think that all consumers will be able to use them to raise mountains.

“Not all people are able to display the mental activity necessary to move an object on a screen,” he said. “Some people may not be able to imagine movement in a way that EEG can detect.”

So far, Dr. Mackellar said, all 200 testers of the headset had indeed been able to move on-screen objects mentally.

ANOTHER headset, the Neural Impulse Actuator ($169), just released by the OCZ Technology Group in Sunnyvale, Calif., has three sensors in a headband that pick up electrical activity primarily from muscles and convert it into commands, said Michael Schuette, vice president for technology development. Players of shooting games, for instance, may use eye movement to trigger a shot, shaving milliseconds off of their response time and sparing their hands.

The exact source of the electrical activity the headset is picking up may not be important, said Dr. Jonathan Wolpaw, chief of the laboratory for nervous system disorders at the Wadsworth Center of the New York State Department of Health in Albany. He uses EEG caps as part of brain-computer interfaces for severely paralyzed people. His systems record brain activity alone, but for a consumer game device, a cap that picks up a mixture of brain and muscle activity may be acceptable.

“In a lot of these commercial uses, people don’t care if the activity is coming from the brain or forehead

muscles," he said. "It doesn't matter to them so long as they can play the game."

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