Invention enables severely disabled people to communicate and steer a wheelchair by sniffing

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A unique device based on sniffing -- inhaling and exhaling through the nose -- might enable numerous disabled people to navigate wheelchairs or communicate with their loved ones. Sniffing technology might even be used in the future to create a sort of 'third hand,' to assist healthy surgeons or pilots.

Developed by Prof. Noam Sobel, electronics engineers Dr. Anton Plotkin and Aharon Weissbrod and research student Lee Sela in the Weizmann Institute's Neurobiology Department, the new system identifies changes in air pressure inside the nostrils and translates these into electrical signals. The device was tested on healthy volunteers as well as quadriplegics, and the results showed that the method is easily mastered. Users were able to navigate a wheelchair around a complex path or play a computer game with nearly the speed and accuracy of a mouse or joystick.

Sobel: 'The most stirring tests were those we did with locked-in syndrome patients. These are people with unimpaired cognitive function who are completely paralyzed - 'locked into' their bodies. With the new system, they were able to communicate with family members, and even initiate communication with the outside. Some wrote poignant messages to their loved ones, sharing with them, for the first time in a very long time, their thoughts and feelings.' Four of those who participated in the experiments are already using the new writing system, and Yeda

Research and Development Company, Ltd., - the technology transfer arm of the Weizmann Institute - is investigating the possibilities for developing and distributing the technology.

Sniffing is a precise motor skill that is controlled, in part, by the soft palate - the flexible divider that moves to direct air in or out through the mouth or nose. The soft palate is controlled by several nerves that connect to it directly through the braincase. This close link led Sobel and his scientific team to theorize that the ability to sniff - that is, to control soft palate movement - might be preserved even in the most acute cases of paralysis. Functional magnetic resonance imaging (fMRI) lent support to the idea, showing that a number of brain areas contribute to soft palate control. This imaging revealed a significant overlap between soft palate control and the language areas of the brain, hinting to the scientists that the use of sniffing to communicate might be learned intuitively.

To test their theory, the researchers created a device with a sensor that fits on the nostril's opening and measures changes in air pressure. For patients on respirators, they developed a passive version of the device, which diverts airflow to the patient's nostrils. About 75% of the subjects on respirators were able to control their soft palate movement to operate the device. Initial tests, carried out with healthy volunteers, showed that the device compared favorably with a mouse or joystick for playing computer games. In the next stage, carried out in collaboration with Prof. Nachum Soroker of Loewenstein Hospital Rehabilitation Center in Raanana, quadriplegics and locked-in patients tested the device.

One patient who had been locked in for seven months following a stroke learned to use the device over a period of several days, writing her first message to her family. Another, who had been locked in since a traffic accident 18 years earlier wrote that the new device was much easier to use than one based on blinking. Another ten patients, all quadriplegics, succeeded in operating a computer and writing messages through

sniffing.

In addition to communication, the device can function as a sort of steering mechanism for wheelchairs: Two successive sniffs in tell it to go forward, two out mean reverse, out and then in turn it left, and in and out turn it right. After fifteen minutes of practice, a subject who is paralyzed from the neck down managed to navigate a wheelchair through a complex route - sharp turns and all - as well as a non-disabled volunteer.

Sniffs can be in or out, strong or shallow, long or short; and this gives the device's developers the opportunity to create a complex 'language' with multiple signals. The new system is relatively inexpensive to produce, and simple and quick to learn to operate in comparison with other brain-machine interfaces. Sobel believes that this invention may not only bring new hope to severely disabled people, but it could be useful in other areas, for instance as a control for a 'third arm' for surgeons and pilots.

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