

Mind Power

Owen Collumb was paralysed in 1993, when he was 21 years old.

A tire on his motorbike blew out and he fell into a ravine, breaking a single bone in his spine. When he recovered, he couldn't move his legs and could control only the biceps in his arms.

He spent years in assisted living before petitioning to move to his own place in Dublin, Ireland, with the help of some home aides.

In the summer of 2024, Collumb flew to Bath in the UK to train for the Cybathlon, an international competition run every four years to encourage the development of assistive technologies. The competition, hosted in Switzerland by the university ETH Zurich, consists of eight races for teams and their pilots (which is what the primary competitors, with varying disabilities, are called), each targeting different innovations, such as arm prostheses, leg prostheses and vision assistance.

Collumb, who is now 54, has participated in the Cybathlon since its first iteration in 2016 as a pilot in the competition's most abstract category: brain-computer interfaces. Imagine staring at a cursor at the centre of your computer and willing it to move to the right. A brain-computer interface, which allows humans to control computers with just their minds, can turn that willing into action. As someone who lacks almost all ability to move his body, a brain-computer interface could allow Collumb to play video games, use the Internet and direct his wheelchair himself.

Collumb's team is led by Damien Coyle, a professor of neurotechnology at the University of Bath and the director of the university's Institute for the Augmented Human. Coyle is best known for building brain-computer interfaces with electroencephalography or EEG, which uses electrodes placed on the scalp to measure brain activity. The idea is to see which areas of the brain spark to life when, to use the example again, someone wills a cursor to the right, and to link this activity to computer commands that push the cursor to the right. It's not far removed from how our bodies work naturally.

Electrodes on the scalp are easy to use and cheap, but they are often clumsy, having to track impulses through fluid, bone, skin and hair. The

Oliver Whang on the man who can make the cursor move just by thinking about it

alternative is to use an implant. Neuralink, a brain implant company founded by Elon Musk, has a valuation of around \$9 billion; Precision Neuroscience, a competitor, has a valuation of around \$500 million. But such procedures, which involve opening the skull and placing a monitor on the surface of the brain, are invasive and expensive.

The brain is noisy, has natural variations and can be insurmountably difficult to decipher just by looking at it. AI has helped. Specialised programs are able to pick out patterns from data sets too large for humans to process and, from brain activity, can decode inten-

tions better than before. However, it is still not absolutely foolproof.

Relying on increasingly accurate EEG readers and AI classifiers, Collumb and Coyle have improved since the first competition, where they placed fourth. But so have others. During their training session in the summer of 2024, the two sat together in front of a large monitor; a skintight hat with 32 honeycomb-like electrodes was wrapped around Collumb's head.

Attila Korik, a Hungarian scientist, sat nearby, staring at his own screen. He began calibrating the brain-computer interface, asking Collumb to try moving different parts of

his body while watching measurements of the voltage pulsing through the electrodes. Collumb's head jerked to the side, his hands lifting minutely off his wheelchair. Sweat dripped down his cheek.

There were six tasks for Collumb to complete, including pushing a virtual key into a virtual door handle and filling a virtual cup with virtual water. Three other teams — two from Italy and one from Pittsburgh — were also online, competing asynchronously. Time ticked by. Collumb missed a few cues, his eyes squinting slightly with effort. Korik put his head in his hands. The team finished in just under eight minutes. Collumb's

face was pale and waxy. He came in second place.

The winner, an American team headed by a pilot named Phillip McKenzie, who has an implanted electrode, completed the same challenge in nearly half the time. The result foretold the outcome of the actual competition, in October of that year: Collumb finished fourth overall. McKenzie came in first, completing every task perfectly, in record time.

In most cases, implants do provide higher degrees of control than surface EEGs. Brain activity is much easier to interpret when it's clear which specific regions are active. Ceci Verbaarschot, a neuroscientist at the University of Pittsburgh, US, who led the research for the winning Cybathlon team, said that the difference between invasive and noninvasive brain-computer interface methods was like the difference between using a mouse to move a cursor on a screen and moving the cursor directly, without a physical intermediary.

Because of the intricacy of the electrical data from implants, classifiers can be highly specified, capturing intended movement to the level of a single finger flutter. Many people with implants report being able to navigate virtual movement similarly to how they used to navigate physical movement.

Late this summer, nearly a year after the Cybathlon, Collumb said that he still hadn't gotten the implant, and that he was leaning against it. He was content with what he could do now. "Competing is one thing," he said. "And then life, and living, and possibilities of giving me more choice and control of my life is another thing."

He added, "An implant onto my brain cell, I don't see it necessarily benefiting my life."

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TECH CARE: Owen Collumb was paralysed after a motorcycle accident in 1993. This headgear can read his brainwaves and help control a virtual avatar

