Mind over matter for people with disabilities

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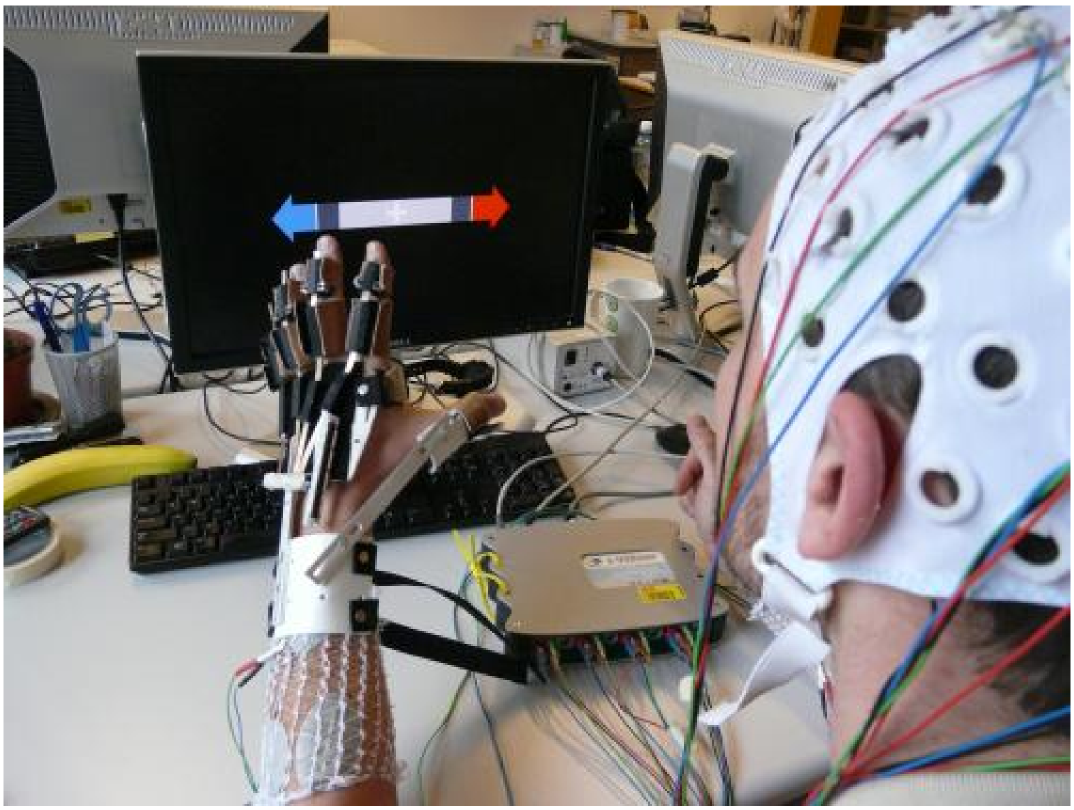

TOBIphoto4. Credit: TOBI project

People with serious physical disabilities are unable to do the everyday things that most of us take for granted despite having the will – and the brainpower – to do so. This is changing thanks to European projects such as TOBI (Tools for Brain-Computer Interaction). People with limited mobility can write emails and even regain control of paralysed limbs through thought alone.

TOBI received EUR 9 million in EU research funding to develop practical technology for brain-computer interaction to improve the quality of life of people like 20-year-old Francesco and 53-year-old Jean-Luc.

Jean-Luc Geiser suffered a stroke which left him completely paralysed and unable to speak.

Thanks to TOBI, Jean-Luc was able to communicate by typing email messages via a computer cursor controlled through his brain waves. 'Participating in this project allowed me to see that I can still be useful to society' he said in a statement read by his sister at the project's final workshop.

'There are many people suffering from different levels of physical disability who cannot control their body but whose cognitive level is sufficiently high,' said project coordinator José del R. Millán, a professor at the Ecole Polytechnique Fédérale de Lausanne. 'We want them to be part of our society.'

In contrast to similar experiments which usually involved able-bodied patients or invasive brain implants, TOBI broke new ground by developing non-invasive prototypes. By using inexpensive and readily available equipment, the project could also achieve a great deal in a relatively short time.

Brain power in practice

TOBI involved at least three kinds of brain-to-computer dialogue which meant paralysed patients could communicate and even move.

The first involved sending brain signals to a computer cursor via electrodes attached to a cap worn on the head. Simply by thinking about what they wanted to type, patients could remotely control the computer cursor to surf the web and write emails and texts.

In the second experiment, patients sent brain signals to control a small robot with video, audio and obstacle-detection sensors. They could then use the robot to take a 'virtual' walk around the hospital or even hook up with loved ones in different places.

Other patients were able to regain control of their paralysed limbs just by thinking about moving them. This was done using computer software designed to detect a patient's intention to perform a certain motor function. In some cases, intensive training and rehabilitation helped them to keep that control even after the electronics were removed.

Throughout the project, researchers relied on patient feedback to fine-tune the technology they were working with. The users became part of the research team.

'There was no black magic,' said Professor Millán. 'We listened to the feedback of all the patients to correct design mistakes and made any changes right away. We also took into consideration the feedback of professional end users who worked with the patients in hospital.' Many patients also got a sense of satisfaction from feeling part of something important, even those unable to continue past the first initial experiments.

A ray of hope

The project ended last year and the systems are still being tested and further developed. Some of the equipment is being used at clinics and hospitals which are TOBI partners.

Health-care professionals have also run many of the brain-to-computer interactions independently or with little remote assistance from researchers and tests have been carried out in homes, outside the well-controlled laboratory conditions.

'Altogether, this is proof of the degree of robustness and possibilities of today's brain-computer interaction (BCI) technology,' said Professor Millán. 'Hopefully our research will encourage further work in this field to improve the lives of disabled patients with healthy, functioning brains.'

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