Scientists read out arm movements from brain's surface

Method opens door for low-risk brain machine interfaces

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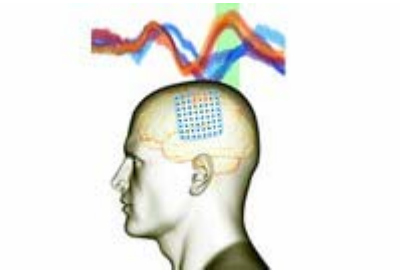

Caption: see Press Release / Source: BCF/Universität Freiburg

Interfaces between the brain and a computer could be the key to a more independent life for patients with severe paralysis: Devices that transform the mere thought of a movement into a command for a robotic arm or a cursor on a screen. Scientists from the University of Freiburg and Imperial College London now utilized for the first time the brain activity associated with an arm movement recorded from the surface of the brain to steer

a cursor in real-time. **Tomislav Milekovic** and his colleagues report these findings in the latest edition of the Journal of Neural Engineering.

Surprisingly for the scientists, electrodes covering an area of only two square centimetres were sufficient to decode the movement signal. As a result, brain-machine interfaces could be implemented with small, easily implantable electrode arrangements. The current study describes the decoding of two movement directions. For the authors, the next step is to use finer electrodes and a longer training period to decipher movements in any direction and also more complex movement patterns. This will be a significant research component in BrainLinks – BrainTools, the University of Freiburg's newly awarded Cluster of Excellence.

The scientists received the permission to conduct an experiment from epilepsy patients who had electrodes placed on the brain temporarily for diagnostic purposes. The test persons used a joystick to move a dot on a screen either to the left or to the right, while the scientists measured the activity in the brain region responsible for movements. Thus, the computer could learn to correctly read out the brain activity. When the subjects moved the joystick in a second test run, the decoded activity itself was used to control the dot's movement. Despite the short duration of training, due to the patients' medical treatment, the movement direction was decoded correctly in up to 86 percent of the test runs.

Of special importance, state the scientists, is the kind of electrodes used in the approach developed in Freiburg. The measuring sensors are not implanted into the brain, as was the case up to now. Instead, they are only placed onto the brain surface. Thus, the risk of injuring the brain is greatly reduced, although an operation is still necessary. Another advantage of this novel method is that the signals won't change over time – a phenomenon caused by tissue reactions when electrodes protrude into the brain.

Image caption:
A small fraction of electrodes (red dots) in a grid (blue) placed on the brain's surface was sufficient for the computer to distinguish (in the green time interval) brain activity during a movement to the right (red curves) and to the left (blue curves). BCF/University of Freiburg

Original publication:
T Milekovic, J Fischer, T Pistohl, J Ruescher, A Schulze-Bonhage, A Aertsen, J Rickert, T Ball and C Mehring (2012) An online brain–machine interface using decoding of movement direction from the human electrocorticogram. J. Neural Eng. 9 046003 http://iopscience.iop.org/1741-2552/9/4/046003

German Press Release

Contact:
Prof. Dr. Ad Aertsen
Institute of Biology / Bernstein Center Freiburg
ph.: 0761/203-2718
fax: 0761/203-2860
email: ad.aertsen@biologie.uni-freiburg.de