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New non-invasive method for brain research

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Neuroscientists at the University of Tübingen have become the first to record neuromagnetic activity in the millisecond-by-millisecond range while the brain of a human subject was under stimulation by electric current. Electric brain stimulation has successfully been used in the treatment of neurological and psychiatric disorders for many decades. However it remained unclear precisely what happens while electric currents are applied to the human brain, because stimulation-dependent interference impeded reliable direct recording or reconstruction of the brain's electric activity.

Dr. Surjo R. Soekadar, neuroscientist at the University Hospital Tübingen and first author of the study, plans to use the novel method to advance established brain stimulation techniques and to develop novel strategies to treat neuropsychiatric disorders, such as stroke, depression and chronic pain. The new method was developed in a collaborative effort between the University of Tübingen and the National Institutes of Health (NIH) in the United States and is published in the current edition of *Nature Communications*.

In contrast to previously used methodologies – in which indirect measures of neural activity, such as oxygenation or changes in cerebral blood flow, were measured during electrical brain stimulation – the newly developed method allows assessment of the direct stimulation effects on the electric activity of the human brain. This is achieved by using specific mathematical algorithms similar to those used in sonar technology and in hand-free speaking systems, and stimulation electrodes that let neuromagnetic activity pass undistorted.

This research now answers many basic research questions related to basic functionalities of the brain, for example, the role of brain oscillations, which were discovered in the 1920s but whose role remains unclear. While a link between electric brain oscillations and disorder-related symptoms or behavior was identified relatively early, scientists could not explain specifically how they relate. The newly developed method promises important new insights concerning this matter. Also, the electric stimulation can now be tuned directly to the activity of the individual brain or applied simultaneously during the use of a brain-machine interface or neurofeedback system. The researchers expect these new insights will have a large impact on the development of revolutionary treatment strategies for neuropsychiatric disorders.

More information: Surjo, R. et al. In vivo assessment of human brain oscillations during application of transcranial electric currents, *Nature Communications* (2013). www.nature.com/naturecommunications, DOI: 10.1038/ncomms3032

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