tACS and the modulation of visuospatial attention in healthy subjects

Christoph Herrmann
Department of Psychology, University of Oldenburg, Germany

Transcranial alternating current stimulation (tACS) is a non-invasive brain stimulation method that allows to modulate oscillatory brain activity. In order to pass a sinusoidal current through the brain, two or more stimulation electrodes are attached to the scalp. This current then interferes with endogenous brain oscillations which have been shown to be correlated with various cognitive processes such as, for example, spatial attention. In a first study, we were able to demonstrate that up-regulating temporal gamma oscillations uni-laterally with 47 Hz tACS resulted in improved performance for contra-lateral targets in an auditory spatial attention paradigm. In contrast, up-regulating temporal alpha activity uni-laterally with 10 Hz tACS decreased the performance for contralaterally presented targets. In a second study, we replicated these results for a visual spatial attention task with occipital tACS. We found a significant, differential effect of alpha- and gamma-tACS on endogenous (top-down) spatial attention but not on exogenous (bottom-up) attention. The effect was specific to tACS applied to the left hemisphere. Our results indicate a causal role of alpha- and gamma-oscillations for top-down (endogenous) orientation of spatial attention. Therefore, tACS may be a treatment option in stroke patients with hemi-spatial neglect.