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Effects of transcranial electrical stimulation on human motion detection

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Transcranial electrical stimulation (TES) has been widely used for both clinical and basic neuroscience research purposes. Although its behavioral effects are evident from prior reports, our current understanding of the neural mechanisms that produce these effects in the intact human brain is very limited. We investigated the acute effects of transcranial alternating current stimulation (tACS, 0.5mA, 10Hz) on motion processing by stimulating over the relatively well explored human visual motion processing area, hMT+. We used a random dot kinematogram (RDK) stimulus presented at varying coherence to estimate the motion direction discrimination thresholds. We used a standard adaptation design with 4s of coherently moving dots as the 'adaptor' stimulus, followed by 1s of dots with varying coherence as a 'test' stimulus to measure the motion aftereffect. The storage of the motion aftereffect was estimated by delaying the presentation of the 'test' stimulus after the 'adaptor' by a fixed blank period of 4s. First, we found no evidence for a direct effect of TES over hMT+ on motion direction discrimination thresholds. Second, we found that TES reduced motion aftereffects when applied over the hMT+ area that was contralateral to the adaptor, but not when the stimulation was ipsilateral. Third, TES did not produce a significant extinction of storage when applied in the storage phase, between the 'adaptor' and the 'test' stimuli. This shows that changes in adaptation induced by TES only produced significant behavioral effects when the neurons were also driven by visual input. This suggests that TES could be targeted at cortical neuronal populations in an activity dependent manner.

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