

Selective Effect of Occipital Alpha Transcranial Alternating Current Stimulation in Perception and Working Memory

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Abstract : Rhythmic activity in different frequencies could subserve distinct functional roles during visual perception and visual mental imagery. In particular, alpha band activity is thought to play a role in active inhibition of both task-irrelevant regions and processing of non-relevant information. In the present blind placebo-controlled study we applied alpha transcranial alternating current stimulation (tACS) in the occipital cortex both during a basic visual perception and a visual working memory task. To understand if the role of alpha is more related to a general inhibition of distractors or to an inhibition of task-irrelevant regions, we added a non visual distraction to both the tasks. Sixteen adult volunteers performed both a simple perception and a working memory task during 10 Hz tACS. The electrodes were placed over the left and right occipital cortex, the current intensity was 1 mA peak-to-baseline. Sham stimulation was chosen as control condition and in order to elicit the skin sensation similar to the real stimulation, electrical stimulation was applied for short periods (30 s) at the beginning of the session and then turned off. The tasks were split in two sets, in one set distractors were included and in the other set, there were no distractors. Motor interference was added by changing the answer key after subjects completed the first set of trials. The results show that alpha tACS improves working memory only when no motor distractors are added, suggesting a role of alpha tACS in inhibiting non-relevant regions rather than in a general inhibition of distractors. Additionally, we found that alpha tACS does not affect accuracy and hit rates during the visual perception task. These results suggest that alpha activity in the occipital cortex plays a different role in perception and working memory and it could optimize performance in tasks in which attention is internally directed, as in this working memory paradigm, but only when there is not motor distraction. Moreover, alpha tACS improves working memory performance by means of inhibition of task-irrelevant regions while it does not affect perception.

Keywords : alpha activity, interference, perception, working memory

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