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**The role of the primary somatosensory cortex in the visual short-term retention of body-related information: a TMS study.**

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**Background.** The primary somatosensory cortex (S1), once thought to be only modality-specific, is involved in higher level functions like emotion recognition (4) and motor learning by observation (3). S1’ functions may extend even to memory: some theories speculate that these areas may be involved not only in the perception of intrinsic features of the percept but also in the retention of that information. In a recent EEG study, Galvez-Pol suggested that the neural responses of somatosensory cortices to visually perceived body-related information probably reflected their involvement in short-term memory (STM) (2).

**Aim**. The present experiment looks for causal evidence that S1 is implicated in the retention of visual information that may be salient for this cortical area 1. To this purpose we interfered with S1 activity by means of repetitive Transcranial Magnetic Stimulation (rTMS) during a STM task where body-related information had to be retained.

**Methods.** Eighteen healthy volunteers took part in a three sessions within-subjects experiment. The STM task (i.e., *delayed match-to-sample* task) consisted in the rapid presentation of two lateralized arrays, each one depicting three body-related stimuli (i.e., pictures of hands in different position, taken from previous literature2). In the task, half of the trials were identical and half were different for only one stimulus. In each session, every subject performed the task with and without rTMS, with the latter condition serving as a baseline. The rTMS protocol consisted in a train of 3 TMS-pulses (at 10 Hz frequency, fixed intensity of 60% of the maximum stimulator output) delivered after 200 ms from the offset of the first array (i.e. during the retention phase). As control sites for rTMS effects, we stimulated two other cortical areas: the dorsolateral prefrontal cortex (dlPFC; an area commonly activated during working memory tasks) and the lateral occipital cortex (lOC; an area activated in feature-based analysis of visual stimuli). Only the right hemisphere was targeted.

**Results**. We analyzed the sensitivity detection index (d') in the STM task through a 2 X 3 repetitive-measures ANOVA with the within-subjects factors “Condition” (baseline/rTMS) and “Area” (S1/dlPFC/lOC). We found a significant interaction between these two factors (p=0.036). Planned comparisons revealed an improvement of subjects’ performance in the STM task only when rTMS is delivered over S1 (vs. baseline, p<0.001).

**Conclusions**. Our results demonstrate that rTMS over S1 applied during the execution of a visual STM task improves performance, suggesting that S1 may be involved in visual STM when body-related stimuli had to be retained. These results shed light on the involvement of sensory cortices in contributing to retention of information in memory (2),showing that their recruitment is driven by the intrinsic features of the percept rather than by the sensory modality in which objects are presented.

**References**

(2) Galvez-Pol, A., Calvo-Merino, B., Capilla, A., & Forster, B. (2018). Persistent recruitment of somatosensory cortex during active maintenance of hand images in working memory. NeuroImage, 174(March), 153–163.

(3) McGregor, H. R., Cashaback, J. G., & Gribble, P. L. (2016). Functional plasticity in somatosensory cortex supports motor learning by observing. Current Biology, 26(7), 921-927.

(4) Sel, A., Forster, B., & Calvo-Merino, B. (2014). The emotional homunculus: ERP evidence for independent somatosensory responses during facial emotional processing. Journal of Neuroscience, 34(9), 3263-3267.