Continuous theta-burst stimulation of parietal cortex alters representational structure of occipital stimulus representations in visual working memory

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Persistent elevated activity in parietal cortex and decodable mnemonic representation in occipital cortex have been consistently observed during working memory maintenance and have thus been a major focus of working memory research. Recent work has suggested that persistent elevated activity in parietal cortex reflects demands of context binding, and that BOLD activity in parietal cortex, multivariate decoding accuracy of stimulus identity in occipital cortex, and behavioral memory precision are all inter-related (Gosseries, Yu, et al., 2018). In the current study, we sought to causally examine the relationship between parietal function and mnemonic representations in occipital cortex using continuous theta-burst stimulation (cTBS). Participants performed a delayed-recall (a.k.a., "-estimation") task on motion directions of load 1, 2, and 3. Each participant underwent a baseline session (no cTBS), two IPS-stimulation sessions (cTBS on IPS), and two MT-stimulation sessions (cTBS on MT). We used multivariate pattern analysis (MVPA) to examine the stimulus representations in occipital voxels with strongest sample-driven activity. Replicating previous findings, the remembered motion direction could be decoded in all three load conditions during the delay period, and decoding accuracy decreased with increasing memory load. This pattern was observed in all conditions, with or without cTBS, except that decoding accuracy for load 3 in the IPS-stimulation condition dramatically dropped to baseline in the middle of the delay period, a result suggesting that perturbation of IPS function impacted stimulus representation in occipital cortex at high loads. Moreover, when the classifier was trained on the baseline condition and tested on the cTBS conditions, or vice versa, most of the decoding performance returned to baseline. This failure in cross-condition decoding suggested a change in representational structure of stimulus representations in occipital cortex when cTBS was applied. These results together suggest a causal role of IPS in controlling stimulus representations in occipital cortex in visual working memory, particularly in conditions that put a heavy demand on context binding, an operation that may be governed by parietal salience maps.