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Driving Hebbian plasticity in temporo-occipital back-projections improves visual perception of emotions

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Introduction: The posterior superior temporal sulcus (pSTS) and early visual cortices (V1/V2) form a reciprocal network crucial for decoding emotional facial expressions. While recursive processing models underscore the significance of feedback connections, the causal impact of pSTS-to-V1/V2 back-projections on emotion perception remains underexplored. This study investigates whether tailoring cortico-cortical paired associative stimulation (ccPAS) to the specific dynamics of cortico-cortical interactions between pSTS and V1/V2 can enhance emotion recognition.

Methods: First, we used TMS-EEG co-registration to determine propagation time from pSTS to V1/V2. Based on this timing, we designed a ccPAS protocol to enhance pSTS-to-V1/V2 back-projections via Hebbian plasticity. Through behavioral and neurophysiological experiments, we tested ccPAS effects on resting-state physiology, facial expression recognition, and event-related potentials (ERPs) to emotional faces.

Results: ccPAS specifically tailored to neural communication timing from pSTS to V1/V2 selectively increased the strength of pSTS-to-V1/V2 connectivity. This enhancement correlated with improved participants' ability to recognize facial expressions under challenging conditions, without affecting gender discrimination tasks. Additionally, ERPs revealed increased amplitude of the P1 component, localized over V1/V2. No significant effects were observed in control conditions, underscoring the importance of precise timing and directionality in ccPAS protocols.

Conclusions: Our findings provide causal evidence that targeted modulation of the pSTS-to-V1/V2 pathway enhances emotion recognition performance. These results demonstrate that ccPAS can selectively strengthen effective connectivity between brain regions through Hebbian-like associative plasticity. Our work advances the understanding of how cortico-cortical pathways contribute to perception and showcases ccPAS as a promising neuromodulation technique for enhancing brain network communication and function

If you're submitting a symposium talk, what's the symposium title?

Dissecting the Social Brain with Neurostimulation: Mapping Connectivity, Plasticity, and Individual Differences

If you're submitting a symposium, or a talk that is part of a symposium, is this a junior symposium?

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