

Creating Colored Letters: The Neural Basis of Induced Color Qualia

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ABSTRACT

Perceptual training can induce color qualia that resemble developmental synesthesia, a condition hypothesized to build upon implicit cross-modal associations present in the general population. This study investigated the neuroplastic origin of these induced experiences and the role of pre-existing mappings in their formation. Using functional magnetic resonance imaging (fMRI) and dynamic causal modeling (DCM), we assessed changes in effective connectivity after intensive associative training in two groups: one choosing their associations (Autonomy), and a yoked control. Contrary to our primary hypothesis, training did not modulate task-dependent top-down connections. Instead, we found significant long-term plastic changes in the network's intrinsic architecture, specifically a decrease in endogenous connectivity from the inferior parietal lobule (IPL) to V4 and a strengthening of the IPL's local self-inhibition. These effects were driven exclusively by the Autonomy group. Our findings suggest that the consolidation of cross-modal associations relies on the reorganization of the brain's baseline endogenous connectivity. This highlights the critical role of pre-existing implicit associations in driving potent, long-term neural plasticity, offering a potential mechanism relevant to developmental accounts of synesthesia.

Keywords: *Implicit associations; Effective connectivity; Color qualia; Perceptual plasticity; Synesthesia*