

The Impact of Social Belief on the Neurophysiology of Learning and Memory

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How does belief in the social status of an instructor providing performance-based feedback impact learning and subsequent memory representation? In two experiments, we measured physiological and neural correlates of episodic and incremental learning to elucidate the impact of social vs. non-social feedback. In Experiment 1, skin conductance (SC) was acquired while subjects engaged in a two-phase learning and generalization task. In the first phase, subjects learned face-scene associations using trial-and-error feedback. In the second phase, subjects were probed to generalize what they learned to novel stimulus combinations. Belief in the presence of a social other was manipulated by embedding the learning phase in an interaction with a virtual instructor, who provided performance-based feedback in the form of animated affirmations or rebukes. One group was informed that the instructor was computer-controlled (Agent), while the other was informed that the instructor was experimenter-controlled (Avatar). Importantly, all other aspects of the task were held constant except for this belief manipulation. Analyses of SC and behavioral performance revealed (a) higher SC in the Avatar vs. Agent group during learning, and (b) a correlation between learning-phase changes in SC and subsequent generalization (Agent, $r^2=.30$; Avatar, $r^2=.32$). Multiple regression revealed superior generalization in the Avatar vs. Agent group ($p=.003$) when controlling for SC, revealing that social belief facilitates episodic encoding that supports later generalization. In Experiment 2, an independent group of subjects underwent functional MRI scanning while performing the same learning and generalization task. Initial fMRI analyses revealed learning-phase changes in striatal activation, as well as greater activity in ventral striatum and hippocampus during correct relative to incorrect trials. Moreover, midbrain and prefrontal regions displayed a greater learning-phase change in activation in the Avatar relative to Agent group, suggesting that social belief may impact memory by modulating reward processes during feedback-based learning.

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