



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



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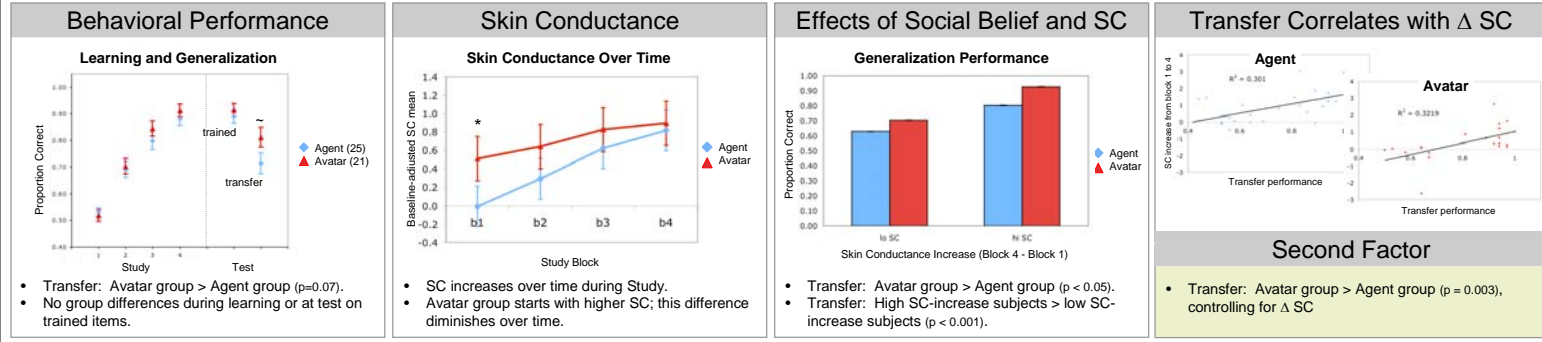
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Background

How does belief in the social status of an instructor providing performance-based feedback impact learning and subsequent memory representation?

- Learning is enhanced when subjects believe that a virtual character with whom they are interacting is controlled by a human as opposed to a computer¹.
- The medial temporal lobes support flexible episodic learning - the ability to generalize experiences to new stimuli or contexts²⁻³.
- The basal ganglia support incremental, feedback-based learning of stimulus-response associations, that are relatively inflexible⁴⁻⁶.
- Both memory systems are modulated by midbrain activity⁷, and may be influenced by social belief, feedback value, and arousal⁸⁻¹⁰.

Experiment 1: Physiological Correlates of Learning

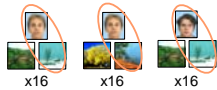


Methods

Acquired Equivalence paradigm

Subjects learn that two stimuli are equivalent (i.e., lead to the same outcome), and then are tested to see whether they generalize that equivalence to a novel situation.

Phase 1: Feedback-based stimulus-outcome learning



Phase 2: Test of trained associations and generalization



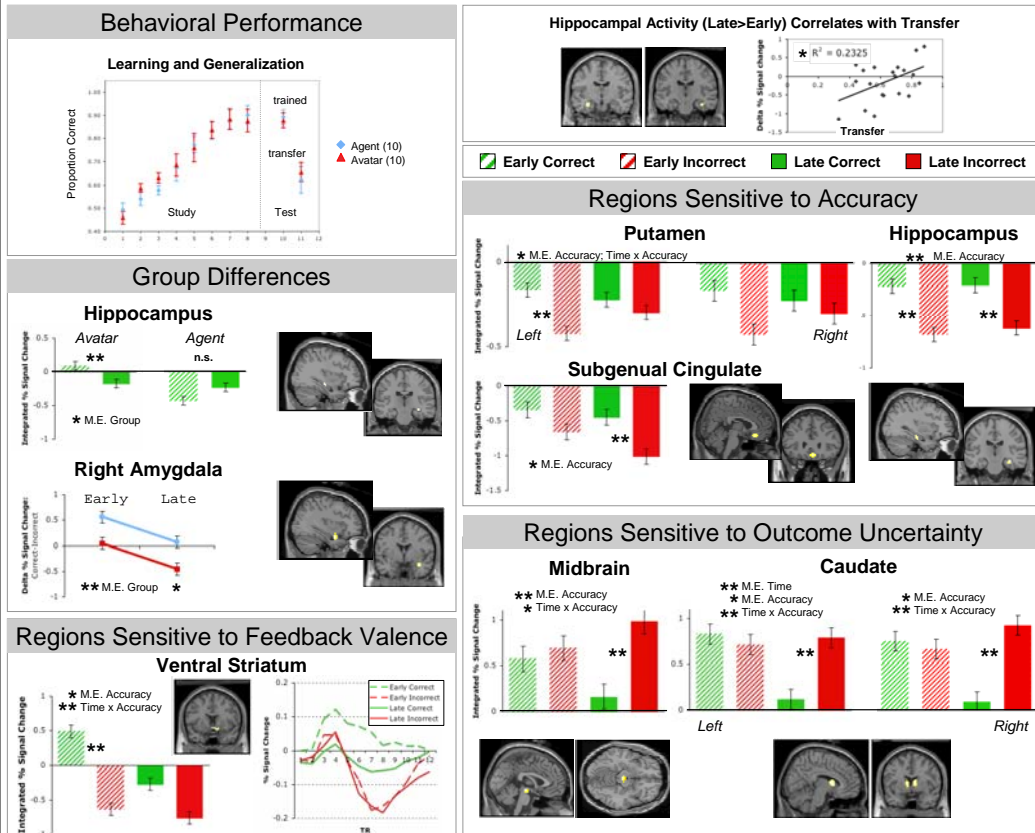
Feedback delivered by a virtual human



Social manipulation

- Agent group: Feedback provided by computer
- Avatar group: Feedback provided by human

Experiment 2: Neural Correlates of Learning



Conclusions

- Subjects who believed they were participating in social learning were better able to generalize acquired knowledge to novel situations.
- Skin conductance increases during learning were predictive of generalization, suggesting that arousal is related to the acquisition of flexible conjunctive representations.
- When controlling for SC-increase, the difference in generalization between groups was more evident, suggesting that arousal is not the only factor affecting generalization.
- fMRI results show distinct networks of regions that track performance (hippocampus, putamen, subgenual cingulate), outcome uncertainty (midbrain, caudate) and outcome valence (ventral striatum).
- Right hippocampus and right amygdala show different patterns of activity in the social (Avatar) and nonsocial (Agent) groups.

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