THE BRAIN'S VALUATION CIRCUIT CAN COMPUTE SUBJECTIVE VALUE WITHOUT CONSCIOUS AWARENESS

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Background: Neuroeconomic models propose that the anterior ventral striatum (aVS) and ventromedial prefrontal cortex (vmPFC) encode subjective value (SV) signals that guide value-based decision-making. However, the degree to which conscious awareness is required for SV computations remains unclear. Current theories assume that subliminal information is limited to rudimentary reward processing within subcortical structures, whereas complete SV integration in the prefrontal cortex requires conscious awareness. We challenged this view by testing whether subliminal SV computations also can operate within prefrontal valuation areas.

Aims: We investigated whether subliminal stimuli can evoke SV-related neural activity in aVS and vmPFC. Specifically, we tested (i) whether facial attractiveness is automatically encoded without conscious awareness, and (ii) whether subliminal probabilities can be integrated with conscious reward magnitudes into SV during risky choice.

Methods: Two fMRI studies were conducted. In Study 1 (n = 29), faces were rendered unseen using continuous flash suppression during a face-identification task, followed by post-scan attractiveness ratings. In Study 2 (n = 29), participants performed a risky choice task where reward magnitudes were consciously presented but probability cues were rendered unseen using attentional blink. Both studies incorporated trial-wise subjective and objective awareness measures and analyzed behavioral and neural data.

Results: In Study 1, unseen faces automatically elicited SV-related signals in both aVS and vmPFC, with a similar neural code as SV from seen faces in vmPFC. In Study 2, unseen probabilities were integrated with seen reward magnitudes into a common SV code within these same regions. Across studies, subliminal stimuli modulated reaction times but not overt choice, indicating indirect behavioral influence.

Conclusions: These findings demonstrate that the brain's core valuation network, including aVS and vmPFC, computes SV even without conscious awareness. Subliminal valuation therefore extends beyond subcortical mechanisms to cortical integration stages in vmPFC, revealing neural pathways through which subliminal information can bias everyday decisions and inform theories of consciousness and value-based choice.

Keywords: Subliminal, Subjective value, Beauty, Risk, fMRI

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