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Presentation Abstract

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Title:	Expected value of information overlaps with reward circuits in humans
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Abstract:	The ability to identify useful information, and selectively extract it, is critical for perception and cognition alike. For instance, to discriminate between object categories, the visual system must direct the eyes' gaze to useful features. What are the neural substrates of assessment of features' relative expected information value? We trained 10 subjects on a probabilistic categorization task in which simulated plankton stimuli are classified as either species A or B, using experience-based learning. Subjects classified randomly sampled specimens, and received immediate feedback. Each plankton specimen has two two-state features (open or connected claw; dotted or non-dotted eye) that probabilistically predict the species. The more- and less- useful features, if viewed individually, lead to 85% and 60% accuracy, respectively. Since all combinations of features occur in both species, 100% accuracy is not possible. Following behavioral training, subjects participated in an event-related fMRI experiment in which they were cued to anticipate more- or less-useful information. Anticipation of information was induced by first presenting an obscured version of the high- or low-usefulness feature, such that subjects could not yet categorize the stimulus or prepare a specific motor response. The specific form of the feature (e.g. dotted eye) was then revealed, allowing categorization. Finally, subjects received feedback on whether their classification was accurate, which was probabilistic

according to environmental probabilities.
During the obscured feature presentation stage, subjects knew whether the subsequently obtained information would lead to 85% or 60% classification accuracy. In this stage presentation of the more-useful obscured feature, versus the less-useful obscured feature, led to greater activation in the ventral striatum (nucleus accumbens), amygdala/hippocampus, and cerebellar vermis. Positive versus negative feedback led to greater activation in the ventral striatum, orbitofrontal cortex/ventromedial prefrontal cortex, bilateral posterior cingulate cortex, bilateral intraparietal sulcus, and right posterior insula. Negative versus positive feedback led to greater activation in the anterior insula, anterior cingulate cortex, and dorsolateral prefrontal cortex.
These results show that the expectation of information leading probabilistically to classification accuracy, in addition to food and money, activates brain structures that are part of the reward system.

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REWARD

VENTRAL STRIATUM

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