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Should I stay or should I go? Neural mechanisms of strategic decision making

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A new study demonstrates that when faced with a difficult decision, the human brain calls upon multiple neural systems that code for different sorts of behaviors and strategies. The research, published by Cell Press in the May 28th issue of the journal *Neuron,* provides intriguing insight into the mechanisms that help the human brain rise to the formidable challenge of adaptive decision making in the real world.

"When faced with a complex decision, many individuals engage in simplifying strategies, such as choosing based on the probability of a positive outcome," explains senior study author Dr. Scott Huettel from the Brain Imaging and Analysis Center at Duke University. "Although we now know much about how the brain encodes specific decision factors like risk and reward, much less is known about the brain selects among multiple strategies for managing the computational demands of a complex decision-making task."

To distinguish brain regions that predict specific choices from those areas that predict an individual's preferred strategy, Dr. Huettel and colleagues used behavioral tests and functional magnetic resonance imaging (fMRI) to study participants engaging in a complex risky choice task. The task involved economic gambles with multiple outcomes ranging from large monetary losses to large monetary gains. Subjects chose between different ways of changing the gambles: they could maximize the best possible gain, minimize the worst possible loss, or increase the overall probability of winning.

Choices that maximized gains or minimized losses were predicted by fMRI activation in the ventromedial prefrontal cortex or anterior insula, respectively, whereas probability-maximizing choices were associated with activation in the parietal and lateral prefrontal cortices. However, individuals differed in their strategic bias: some people were very focused on gains and losses, while others were very focused on the probability of winning.

Whether an individual expressed these biases in a particular decision was predicted by activation in the dorsomedial prefrontal cortex, which exhibited functional connectivity to the regions associated with specific choices. Further, the intrinsic strategic bias of each person—whether they were focused on rewards or probabilities—was predicted by an independent measure of how strongly their brain responded to unexpected gains and losses.

Importantly, decision parameters estimated using traditional economic models of risky choice were poor predictors of choices in this new experimental paradigm, supporting the idea that individuals indeed engaged in simplifying strategies. "Our findings indicate that the neural mechanisms of choice reflect more than competition between decision variables; they additionally involve strategic influences that guide decisions differently across individuals," offers Dr. Huettel.

Source: Cell Press (news : web)