

The science of decisions

November 18 2010, by Mark Wolverton, UPenn

You may not realize it, but you just made a decision: namely, to read (or at least start to read) this article. Why? What process just occurred in your brain to cause you to be reading this sentence right now? How and why did you make that decision at that moment? That's what Joe Kable, Assistant Professor of Psychology, wants to know. He studies the neurological and psychological workings of choice. "What are the processes that are going on in the brain while people are making decisions; what are the computations that are being performed in different areas of the brain during decision-making?" he asks. "That's something that neuroscientists can study using techniques of neuroscience."

One of those techniques is functional MRI (fMRI), which can show in real time the [blood flow](#) variations to different parts of the brain that are associated with increased or decreased activity in those areas. By placing test subjects in an MRI scanner and then presenting them with carefully-constructed tasks involving decision making, Kable is able to observe the ensuing [physical activity](#) inside the brain. "fMRI gives us probably the best combination of spatial and temporal resolution in a human being to get a measure of the neural activity that's occurring during a psychological process," Kable says.

To ensure that his experimental subjects take things seriously, Kable ties the decisions they make to actual rewards (i.e., money)—which also helps him to study how the subjective value people place on the consequences and payoffs of their choices can vary among individuals. Kable explains, "One kind of decision that I study is an impulsive

decision with regard to the future. I give people a choice: do you want \$20 dollars now or \$30 in a month? Some people really want the money today, and other people are willing to wait for the larger amount of money in the future. Those differences between the people who are willing to wait and those who aren't are related to differences in how the striatum and the prefrontal cortex are active during these decisions."

Kable observes that the range of individual differences involving such choices can be huge. "There are some individuals who will take 21 dollars in two months over 20 dollars today, and there are others who will take 20 dollars today over 150 dollars in two months," he notes. There also seems to be at least some indication that personality type plays a factor in how someone makes such a decision. "Of the subjects that I've studied, the person who was most patient was a medical resident and was planning toward the future, and the subject who was most impatient was someone who sent me pictures of their skydiving expedition when they were done with the experiment."

Sometimes posing a question in a different way or in a different context can affect a person's decision-making processes and change their minds. Kable says, "One of the things we want to know is, when you change your mind, does that change how those areas are active? We're running fMRI experiments to see how that reorganizes the brain network involved in decision making."

While fMRI can demonstrate associations between [neural activity](#) and behavior, it can't quite establish a direct cause-and-effect link. For that, Kable is using other techniques, such as transcranial direct current stimulation, in which a weak electrical current is applied between electrodes placed on the head. "You can make an area more excited or less excited, and if doing that alters the decisions that people make, you have evidence that that brain region is playing a causal role," says Kable.

Even with such powerful tools at his disposal and the insights they've already granted, Kable admits that much work remains to be done.

"There's more than enough just to understand the decisions people make and the conditions that lead to those decisions, so adding the additional degree of difficulty of linking that to the underlying neurobiology means I'll be busy for a while," he says with a laugh. "I don't think that we'll have this problem solved completely anytime soon." Which means that the exact reasons for your choice of reading material are likely to remain somewhat mysterious—at least for now.

Provided by University of Pennsylvania

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