

Researchers determine region of the brain necessary for making decisions about economic value

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Neuroeconomic research at the University of Pennsylvania has conclusively identified a part of the brain that is necessary for making everyday decisions about value. Previous functional magnetic imaging studies, during which researchers use a powerful magnet to determine which parts of a subjects brain are most active while doing a task, have suggested that the ventromedial frontal cortex, or VMF, plays an evaluative role during decision making.

Now, Joseph Kable, an assistant professor of psychology in Penn's School of Arts and Sciences, has demonstrated the causal relationship

between the VMF and such decisions.

"When you're doing functional imaging and looking at the relationship between [brain activity](#) and a decision," Kable said, "you don't know that the [brain](#) activity is causally important in that decision. They could be correlated for different reasons."

Kable and his colleagues, which included Penn undergraduate Khoi Vo and researchers from McGill University, addressed the limitations of imaging studies by recruiting experimental subjects who had suffered damage to that part of their brains, often from strokes, [aneurysms](#) or [brain tumors](#).

"People with damage to their ventromedial [frontal cortex](#) should be less able to choose things that are most valuable and they should be less consistent in their choices," Kable said.

"That's exactly what we found."

Their research was published today in The [Journal of Neuroscience](#).

Kable's experiment involved a simple questionnaire, where people with and without VMF damage were asked to pick between groupings of juice boxes and chocolate bars, based on which they liked more.

The subjects were sequentially given 11 sheets of paper, which listed two or more groups they could choose. As an incentive for them to pick the one they truly wanted more, the researchers promised to give each subject one of the 11 groups he or she selected at the end of the experiment. The subjects were also able to pick what kind of juice and chocolate they preferred before the experiment began.

While there were no price tags on any of the items, the grouped items on

each sheet had a fixed value relative to one another and the total amount that could be spent. A subject could pick between a group with six juice boxes and two chocolate bars, a group with three juice boxes and three chocolate bars and a group with no juice boxes and four chocolate bars, implying that the chocolate was three times as expensive as the juice.

Crucially, the relative values and amount that could be spent changed between each of the 11 sheets. By choosing in the different contexts and being given an opportunity to review and change their previous selections, the subjects revealed how much they preferred one item to another.

"We wanted to give people the best chance possible to be consistent," Kable said. "But on the flip side we didn't want to make it obvious how you would be consistent."

Consistency was key. If subjects made selections that contradicted their previously revealed preference, it indicated they couldn't properly assign a value to the items they were presented with. For example, a subject who chose no juices and two chocolates rather than six juices and no chocolates should not then choose two juices and no chocolates over no juices and six chocolates.

"Most of the control group didn't make any inconsistent choices, and all but one of the people who have VMF damage made at least one," Kable said. Many of the subjects with VMF damage made multiple inconsistent choices.

The strength of the findings of this kind of neuroeconomic experiment opens the door to more complex experiments dealing with real monetary value and to investigations into other parts of the [brain](#) that are associated with economic decision making.

Provided by University of Pennsylvania

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