Money motivates memory, study finds

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Money talks, but it might also help people remember: A team of Stanford scientists has shown for the first time that motivation—in the form of a reward—gets the brain ready to learn.

"Rather than simply reacting to the world, we preferentially remember what we care about or are excited by," said R. Alison Adcock, a visiting researcher at Stanford and post-doctoral fellow at the University of California-San Francisco. "This is important because it suggests the brain prepares to store important information."

Adcock and her colleagues, whose findings appear in the May 3 issue of *Neuron*, examined the link between the brain's reward circuits, which drive motivation, and its memory system, which facilitates learning. By using a medical imaging technique called functional magnetic resonance imaging, or fMRI, researchers can measure changes in brain signals and pinpoint the origins of such activity. This investigation shows for the first time that brain activity can predict what people will remember—even before the experience they will remember occurs.

For the study, subjects were given a list of pictures to remember for a test the following day. Prior to seeing the images, the subjects were told how much money they would get for recognizing each of them correctly. As a result, subjects were better able to recall the more valuable pictures.

"The data hint that getting people excited should enhance learning—even if the excitement is not strictly related to the material being learned,"

Adcock said.

For example, she said, in advertising, potential rewards are often displayed alongside a product. These might not only draw attention to the product, as long assumed, but also ensure that consumers remember more about it. "We could make use of similar principles in education," she added.

"We investigated which areas of the brain are active before a learner ever sees the item to be remembered," said Brian Knutson, an assistant professor of psychology at Stanford. "So we can predict what they will remember before they ever even see it." Knutson is a co-author of the Neuron study, "Reward-Motivated Learning: Mesolimbic Activation Precedes Memory Function," along with researchers Arul Thangavel of UC-San Francisco, and Susan Whitfield-Gabrieli and John D.E. Gabrieli of the Massachusetts Institute of Technology.

"Many prior imaging studies have examined motivation or memory," Gabrieli said. "But this shows how motivation can set up the brain to learn."

Effective educators know to highlight crucial ideas and concepts and guide their students to the ones that are the most important. This finding, says Knutson, could influence the way teachers dispense knowledge.

Adcock and Knutson said they are planning future studies that will continue to explore how positive emotions affect memories and why people have difficulty unlearning troublesome behavior, such as addiction. Aside from monetary incentives for learning, "intangible incentives," such as social approval or internal drive, will also be examined as potential motivators for learning, Knutson said.

"We see many things, but only remember a few things," John Gabrieli

said. "The more we understand the motivation to learn in the brain, the more we might be able to figure out how we can harness that motivation."

Source: Stanford University, by Aditi Risbud