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Brain scan foretells who will fold under pressure

Tests on high-stakes math problems identify key regions of neural activity linked to choking

By Laura Sanders

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CHICAGO — As any high school senior staring down the SAT knows, when the stakes are high, some test-takers choke. A new study finds that activity in distinct parts of the brain can predict whether a person will remain cool or crumble under pressure.

The results, presented April 1 at the annual meeting of the Cognitive Neuroscience Society, offer some great new clues that may help scientists understand how the brain copes with stressful situations, says psychologist Thomas Carr of Michigan State University in East Lansing. "Sometimes you come across a study you wish you'd done yourself," he says "This is such a study."

In the study, Andrew Mattarella-Micke and Sian Beilock, both of the University of Chicago, had volunteers perform math problems, some easy, some hard, while undergoing a functional MRI scan. These two-step calculations were designed to tap into a person's working memory: Participants had to hold an intermediate number in mind to correctly calculate the final answer.

After volunteers had performed about 25 minutes of low-stakes math, the researchers ratcheted up the pressure. Participants were told that their performance had been monitored the whole time, and if they improved, they would get 60 bucks instead of the 30 they had been promised. In addition to raising the financial stakes, the researchers added social pressure, too. They told volunteers that if the participants failed to improve, a teammate would lose money.

Extra pressure didn't interfere with people's performance on the easy questions. On the hard questions, accuracy dropped by about 10 percent on average. But individually, some people were able to handle the pressure better than others.

Activity in brain regions that have been linked to working memory predicted choking, Mattarella-Micke said. In particular, higher activity in two regions—the intraparietal sulcus and the inferior frontal junction—meant that a person was less likely to crumble. "The more you engage these regions, the less you'll choke," Mattarella-Micke said.

A third brain area, called the ventromedial prefrontal cortex, or vmPFC, often behaves in sync with these two regions. This synchronous behavior was another predictor of who was going to choke under pressure, the team found. The weaker the link between activity in the vmPFC and the other two regions, the less likely a person would choke.

This result makes sense, says psychologist Florin Dolcos of the University of Illinois at Urbana-Champaign. The vmPFC deals with emotions, so taking that region out of the equation might help people stay focused on the math. "I think this is actually a really interesting phenomenon, and I'm surprised we don't know more about it."

Slightly different brain systems might be involved in athletic choking, where working memory might not be as important as brain processes that control motor activity, Mattarella-Micke said.

SUGGESTED READING :

N. Bascom. Brainy ballplayers. Science News, Vol. 181, January 14, 2012, p. 22. Available online:

B. Bower. The write stuff for test anxiety. Science News, Vol. 179, February 12, 2011, p. 9. Available online:

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A. Mattarella-Micke and S. Beilock. Individual differences in frontoparietal activity and connectivity predict high-stakes choking. 19th Annual Cognitive Neuroscience meeting, Chicago, Illinois. Abstract available: