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Negative thoughts, not overthinking, spur 'choking' on tough math tests

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People who crack under pressure on tough cognitive tasks like solving math problems can blame distracting thoughts that lead them to focus too little on the task at hand, according to research in December's *Journal of Experimental Psychology: General* (Vol. 133, No. 4).

Miami University of Ohio psychology professor Sian Beilock, PhD, Michigan State University professor Thomas Carr, PhD, and students Catherine Kulp, of the University of Michigan, and Lauren Holt, also of Miami of Ohio, investigated whether distracting thoughts or overthinking hinders performance in stressful situations requiring working memory.

The researchers tested 80 undergraduates--none math majors--on modular arithmetic: true-or-false math questions that involve the combination of basic subtraction and division.

Researchers divided participants into low- and high-pressure groups. Students answered three 24-question blocks, divided into working-memory questions that were either high- or low-demand.

Before the third block, researchers presented the high-pressure group with a scenario designed to create three common sources of pressure: monetary incentives, peer pressure and social evaluation. Specifically, high-pressure participants were told their performance would be videotaped so that local math teachers could study students' performance. Researchers also paired students with others who the researchers falsely said had already improved their score by 20 percent. If participants could also improve by 20 percent, both students would receive five dollars. The low-pressure group took the third block without these stipulations.

Researchers found no difference between groups on questions demanding little working memory. However, the high-pressure group scored worse on high-demand questions and reported significantly greater anxiety and pressure than their low-pressure counterparts.

The findings contrast with previous research by Beilock and Carr on well-learned motor skills, such as golf putting, suggesting people choke because pressure causes them to overthink each step in a learned, routine task that doesn't require much thinking to begin with. In this study the opposite is true, Beilock says. Since the task required a lot of attention and memory resources, thinking too much about performance was not detrimental. However, on difficult cognitive tasks such as math problem-solving, individuals seem to choke on high-demand questions because external pressures create distracting thoughts that co-opt working memory, leaving

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participants without enough cognitive resources to answer high-demand questions successfully.

The results indicate yet another way people can choke, which varies by context, note the researchers.

"Depending on the task or situation, there are multiple ways that skills can fail under pressure," Beilock explains, adding that mentally tough tasks that require a lot of attention and working memory resources are harmed when step-by-step consideration is eliminated, while the opposite seems to be true for well-learned routine tasks that run largely outside of conscious control. "How a quarterback chokes when passing a football might differ from someone choking during a math test."

The environment also can affect performance--an implication for schools, Beilock says. "The results indicate that performance in high-stakes testing situations may just be a function of how people perform in pressure situations and not a reflection of their knowledge," she notes.

--M. GREER

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