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SCIENCE JOURNAL

By SHARON BEGLEY



Studies Take Measure Of How Stereotyping Alters Performance

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It's a good bet that even cavemen noticed that emotions can impair your ability to think and perform at your best. Anxiety or fear during a mammoth hunt probably meant roots and berries for dinner.

Noticing, however, isn't the same as understanding. After years of studying situations such as choking under pressure or succumbing to "stereotype threat" (in which you perform worse if you're reminded that your sex, race or age group tends to muffle the test you're about to take), scientists are learning how emotion combines in the brain with memory, attention and other cognitive skills to make your spear miss the mammoth.

At the annual meeting of the American Association for the Advancement of Science last weekend, researchers gave the lie to the belief that brain structures that think and ones that feel emotions are walled off from the other. Instead, emotion and cognition mingle. Activity in a particular brain region reflects the integration of cognition and emotion, explained Jeremy Gray of Yale University, and it isn't so simple as pleasant emotions being good for thinking and negative ones impairing it.

Instead, the mingling brings surprising results. In one study, Prof. Gray and colleagues had volunteers watch a comedy video. Then the volunteers tried to keep three words in mind (they saw three words in a row, and when they saw a fourth they mentally deleted the first word and indicated whether the deleted word was the same as the new word; for lock-river-ladle-key, the answer is no). Feeling amused improved verbal working memory; the volunteers got more answers right. But it made spatial memory -- tested with faces -- worse.

Horror videos had an opposite effect. The mild anxiety they induced improved spatial memory but hurt verbal memory. Why the switch? Maybe when our ancestors felt threatened, it behooved them to remember what their allies looked like or how to hide -- spatial tasks -- rather than to talk their way out of it. In this case, natural selection would sculpt brains so that anxiety sharpens spatial ability. An explanation for the amusement-memory connection is up for grabs.

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A curious thing about emotions and thought is that stars are at greater risk for tripping up than also-rans, finds research psychologist [Sian Leah Beilock](#) of the University of Chicago, who organized the AAAS session. She studies how performance pressure affects the ability to do math in your head, which requires ample "scratch-pad" memory. Under pressure, good mental mathematicians choke more than math dunces. The reason seems to be that the first group owes its prowess to excellent scratch-pad memory. Pressure wipes out this advantage.

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How? The first study to use brain imaging to probe stereotype threat provides some clues. Maryjane Wraga of Smith College followed the usual script for stereotype threat, comparing (in this case) how women do on a test of spatial ability when they are reminded of the girls-are-spatially-challenged stereotype. Female volunteers were shown a Tetris-like shape and asked, if they stood behind an object to the right, what would they see?

Some of the 54 were told that women do better on this than men because they're better at taking others' perspectives (questionable); others read that men do better (true). Reprising what piles of other studies have found, women reminded of the negative sex stereotype did worse than the other women, making 14% more errors.

An fMRI brain scan showed why. Women in the "girls can't do geometry" group had higher activity in a region called the right orbital gyrus, the site of social knowledge such as stereotypes, and in the anterior cingulate, home to negative emotions such as anger and sadness. They had lower activity in high-order visual areas and in regions that handle complex working memory. Anxiety triggered by stereotype threat, it seems, can quash activity in brain regions that do spatial reasoning.

Strikingly, 90% of the women said the instructions -- women are good, or bad, at spatial math -- didn't influence them. "That shows how powerful the effect is," says Prof. Wraga, whose study was just published in the journal *Social Cognitive and Affective Neuroscience*. "Even if you say the stereotype is rubbish, it has an effect on an unconscious level."

Educators have been skeptical that stereotype threat, although amply documented in psychology labs, matters in real life. To see if it does, scientists had students in a college calculus class take a "practice" test. Women who were told the test is gender-neutral got, on average, 3.6 answers right, compared with 2.6 for men. Women reminded of the "girls can't do math" stereotype got 3.13 right, Joshua Aronson of New York University and colleagues will report in the *Journal of Applied Developmental Psychology*.

Speaking of the real world, a study about to be published examined the effect of the "what is your sex?" question that appears on standardized tests. If it were moved from the top of the Advanced Placement calculus AB test to the end, 4,700 more girls in a typical year (out of about 80,000 female students who take it) would score high enough to receive AP credit.

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