

Why we screw up when the heat is on

Psychologist **Sian Beilock** has investigated what happens in the brain when our performance crumbles under pressure. She talked to **Tiffany O'Callaghan** about what it takes to stay on form under stress, and why being smarter can be more hindrance than help

What made you want to research what you've called "the science of why people screw up"? Everyone asks me if I'm doing "me-search" instead of research, trying to figure out how I perform. Some of that is probably true. I have always been interested in how people perform at exceptional levels, in the classroom or on the playing field, and why I could excel in some situations but at other times fail to put my best foot forward. A lot of scientists were asking questions about how people get good at what they do, but there was less work looking at why people fail when the pressure is on.

This phenomenon is known as "choking": what does this mean exactly? Choking isn't just poor performance; we all have ups and downs. Choking is performing worse than your skill level dictates or than you have performed in the past because you now find the situation stressful.

What is going on when we are under pressure? Working memory is our mental scratch pad, the cognitive horsepower that allows us to focus on things that are relevant to solving a problem or task, and to ignore less relevant things. In stressful situations, the ability of working memory to direct attention to what's relevant is compromised. A computer is a good analogy. If you're running lots of

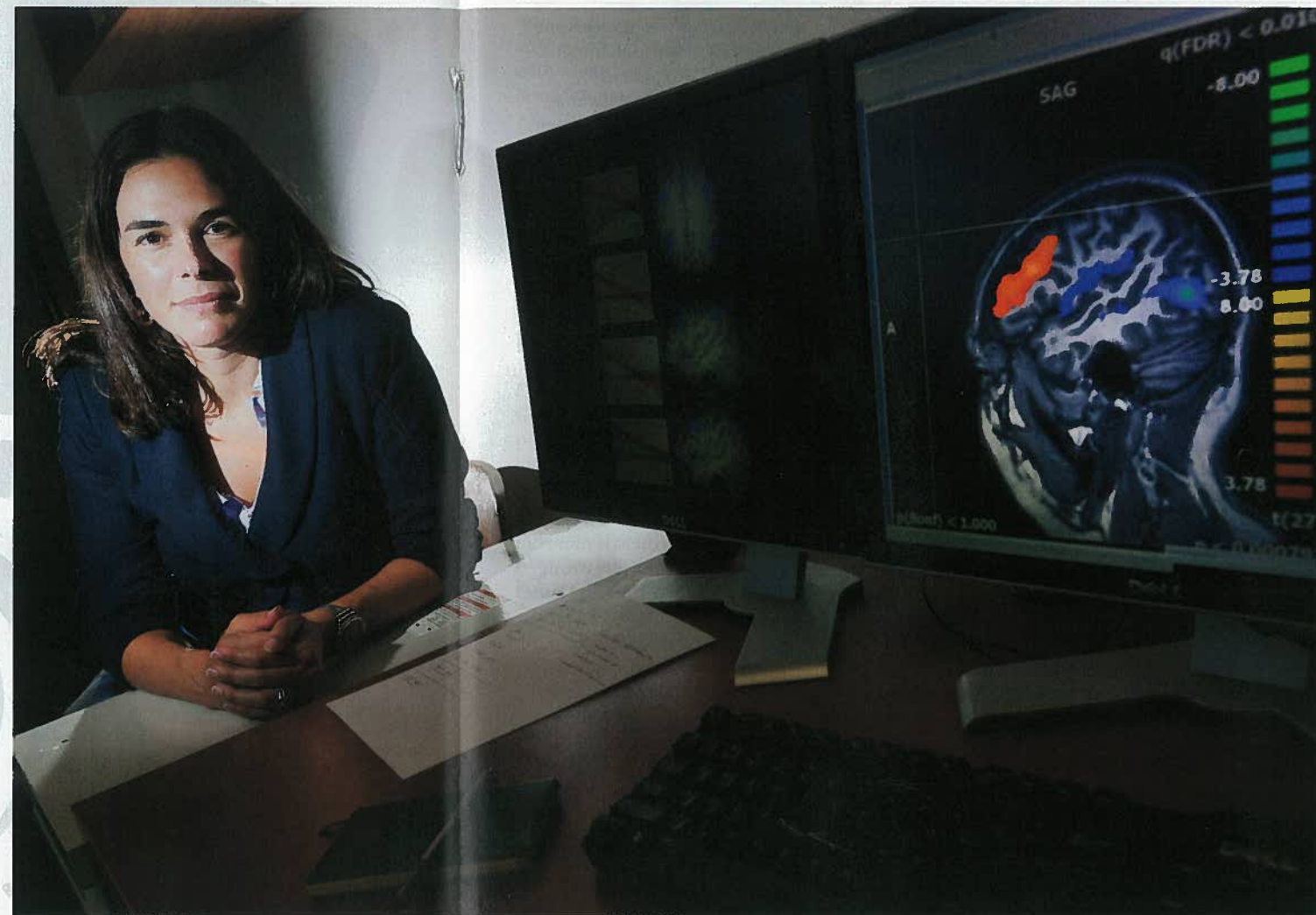
programs at once, everything slows down. If you add worry to the mix, the attention needed to focus on the task can go awry.

You say people with more cognitive horsepower may be more likely to fail. How so? We all have this idea that more intelligence is always better, but I have shown that it's the people with the most working memory who are most susceptible to poor performance.

We had people do mathematics problems that could be solved by working through a complicated algorithm, or by using a shortcut. In low-stress situations with lots of time, those with more working memory were likely to use the algorithm, while those with less were likely to see the shortcut. Under stress, people with more cognitive horsepower suffered because the pressure taxed their working memory. For people with less working memory – who were relying on shortcuts that didn't tax their cognitive system in the same way – pressure didn't have a negative impact.

Those with more cognitive horsepower are also folks who tend to over-think and analyse. We found that over-thinking can be detrimental, that it's better if an activity you have performed thousands of times runs on autopilot.

How can you avoid worry? Won't trying to brush it aside only make it worse? There are a variety of solutions. Getting people to write about their worries before they take a test or give a big presentation can really help. This seems counter-intuitive because writing down fears about what you are about to do might make them more noticeable. But, back to the computer metaphor, writing about your



worries almost "downloads" them so they are less likely to pop up and impact your performance. This is especially true for students who are habitually anxious about tests. In a recent paper we showed that writing about thoughts and feelings for 10 minutes before a test boosted scores from B- to B+.

You have shown that simple things, like presenting a mathematical problem vertically or horizontally, can make a difference. Although our brain is a general capacity system, some resources are devoted to verbal information and some to spatial information. When we're doing two things at once that tap a similar pool of resources, we may not have enough to go around. Often, when you are doing math problems, you hold intermediate steps in your head – you talk to yourself in your head. Since worries tend to be very verbal, they compete for that limited pool of resources.

A mathematical problem presented horizontally... 32 - 17 = ??
demands more of the brain's verbal resources than the same problem presented vertically... 32 - 17 = ??

When we got students to solve math problems and tap a pool of resources devoted to visualisation or solving problems spatially, worries were less likely to have an impact.

How did you find out that paying less attention can improve performance? When we have practised a speech to perfection, or taken hundreds of golf shots, performing well involves paying less attention rather than more. This idea that concentrating harder will help doesn't pan out. We put skilled golfers on our putting green and ratcheted up the stress by everyone watching

them, or putting money at stake. If the golfers were distracted by listening for a specific word from a list we played, they performed better than if we had them think about their swing.

Why is it that athletes often can't explain how they accomplish some amazing feat? I always joke that the reason athletes thank God or their mother is because they can't tell you what they just did. As we become more skilled at activities, particularly in athletics, we rely less on conscious awareness so it's hard to remember how we did what we did.

What types of distraction are best? Singing a song or counting backwards by threes can prevent you from attending to the details of your performance. You prevent yourself thinking about how your wrist is positioned, or your knees bent – all the things that should run outside conscious awareness.

Sian Beilock uses some of the techniques she has analysed to help her perform under pressure

Has your research produced other surprises? We've been very interested in how anxiety around mathematics develops. We have just found that first-grade girls (5 to 6-year-olds) underperform when they have teachers who are anxious about mathematics. So our fears and anxieties can not only have implications for our performance but seem to rub off on others. This is really important in education, where we are trying to instill confidence.

What does your most recent research show about how specific types of pressure affect performance? We have started to explore separate components of stress. Often there are multiple types: all eyes are on you, a scholarship is on the line, and so on. Different aspects have different impacts. For example, when all eyes are on you, you may consciously monitor every aspect of what you are doing. This brings up something pretty interesting: a supportive audience can cause you to focus and analyse your performance in a way that disrupts it.

You have also found out something new about negative stereotypes. One of the powerful things about this is that we don't have to endorse a stereotype to fall prey to its effects. The problem is that we are worried someone else believes it, which is not under our control. This idea of performing down to someone else's expectations can be really important. One striking thing is that not only do you not have to believe it, but the people who have the most invested in what they are doing – such as a woman who likes mathematics – have most to lose, because by possibly confirming the stereotype, it says something important about their identity.

How is performing under pressure distinct from having ability? I would say performing under pressure is a skill itself. We are not born able to succeed in stressful situations. My research shows we can understand why people perform poorly, and develop tools to help us perform at our best.

How do you perform under pressure? I never was the one who aced the test and there have definitely been situations where I haven't performed at my best under stress. But I have learned a lot of the tools I talk about, and I certainly practise performing under stress – whether giving talks or talking to reporters. ■