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PERFORMANCE STUDIES

Why some people choke and others panic

There was a moment, in the third and deciding set of the 1993 Wimbledon final, when Jana Novotna seemed invincible. She was leading 4-1 and serving at 40-30, meaning that she was one point from winning the game, and just five points from the most coveted championship in tennis. She had just hit a backhand to her opponent, Steffi Graf, that skimmed the net and landed so abruptly on the far side of the court that Graf could only watch, in flat-footed frustration. The stands at Center Court were packed. The Duke and Duchess of Kent were in their customary place in the royal box. Novotna was in white, poised and confident, her blond hair held back with a headband--and then something happened. She served the ball straight into the net. She stopped and steadied herself for the second serve--the toss, the arch of the back--but this time it was worse. Her swing seemed halfhearted, all arm and no legs and torso. Double fault. On the next point, she was slow to react to a high shot by Graf, and badly missed on a forehand volley. At game point, she hit an overhead straight into the net.

Instead of 5-1, it was now 4-2. Graf to serve: an easy victory, 4-3. Novotna to serve. She wasn't tossing the ball high enough. Her head was down. Her movements had slowed markedly. She double-faulted once, twice, three times. Pulled wide by a Graf forehand, Novotna inexplicably hit a low, flat shot directly at Graf, instead of a high crosscourt forehand that would have given her time to get back into position: 4-4. Did she suddenly realize how terrifyingly close she was to victory? Did she remember that she had never won a major tournament before? Did she look across the net and see Steffi Graf--Steffi Graf!--the greatest player of her generation?

On the baseline, awaiting Graf's serve, Novotna was now visibly agitated, rocking back and forth, jumping up and down. She talked to herself under her breath. Her eyes darted around the court. Graf took the game at love; Novotna, moving as if in slow motion, did not win a single point: 5-4, Graf. On the sidelines, Novotna wiped her racquet and her face with a towel, and then each finger individually. It was her turn to serve. She missed a routine volley wide, shook her head, talked to herself. She missed her first serve, made the second, then, in the resulting rally, mis-hit a backhand so badly that it sailed off her racquet as if launched into flight. Novotna was unrecognizable, not an élite tennis player but a beginner again. She was crumbling under pressure, but exactly why was as baffling to her as it was to all those looking on. Isn't pressure supposed to bring out the best in us? We try harder. We concentrate harder. We get a boost of adrenaline. We care more about how well we perform. So what was happening to her?

At championship point, Novotna hit a low, cautious, and shallow lob to Graf. Graf answered with an unreturnable overhead smash, and, mercifully, it was over. Stunned, Novotna moved to the net. Graf kissed her twice. At the awards ceremony, the Duchess of Kent handed Novotna the runner-up's trophy, a small silver plate, and whispered something in her ear, and what Novotna had done finally caught up with her. There she was, sweaty and exhausted, looming over the delicate white-haired Duchess in her pearl necklace. The Duchess reached up and pulled her head down onto her shoulder, and Novotna started to sob.

Human beings sometimes falter under pressure. Pilots crash and divers drown. Under the glare of competition, basketball players cannot find the basket and golfers cannot find the pin. When that happens, we say variously that people have "panicked" or, to use the sports colloquialism, "choked." But what do those words mean? Both are pejoratives. To choke or panic is considered to be as bad as to quit. But are all forms of failure equal? And what do the forms in which we fail say about who we are and how we think? We live in an age obsessed with success, with documenting the myriad ways by which talented people overcome challenges and obstacles. There is as much to be learned, though, from documenting the myriad ways in which talented people sometimes fail.

"Choking" sounds like a vague and all-encompassing term, yet it describes a very specific kind of failure. For example, psychologists often use a primitive video game to test motor skills. They'll sit you in front of a computer with a screen that shows four boxes in a row, and a keyboard that has four corresponding buttons in a row. One at a time, x's start to appear in the boxes on the screen, and you are told that every time this happens you are to push the key corresponding to the box. According to Daniel Willingham, a psychologist at the University of Virginia, if you're told ahead of time about the pattern in which those x's will appear, your reaction time in hitting the right key will improve dramatically. You'll play the game very carefully for a few rounds, until you've learned the sequence, and then you'll get faster and faster. Willingham calls this "explicit learning." But suppose you're not told that the x's appear in a regular sequence, and even after playing the game for a while you're not aware that there is a pattern. You'll still get faster: you'll learn the sequence unconsciously. Willingham calls that "implicit learning"--learning that takes place outside of awareness. These two learning systems are quite separate, based in different parts of the brain. Willingham says that when

you are first taught something--say, how to hit a backhand or an overhead forehand--you think it through in a very deliberate, mechanical manner. But as you get better the implicit system takes over: you start to hit a backhand fluidly, without thinking. The basal ganglia, where implicit learning partially resides, are concerned with force and timing, and when that system kicks in you begin to develop touch and accuracy, the ability to hit a drop shot or place a serve at a hundred miles per hour. "This is something that is going to happen gradually," Willingham says. "You hit several thousand forehands, after a while you may still be attending to it. But not very much. In the end, you don't really notice what your hand is doing at all."

Under conditions of stress, however, the explicit system sometimes takes over. That's what it means to choke. When Jana Novotna faltered at Wimbledon, it was because she began thinking about her shots again. She lost her fluidity, her touch. She double-faulted on her serves and mis-hit her overheads, the shots that demand the greatest sensitivity in force and timing. She seemed like a different person--playing with the slow, cautious deliberation of a beginner--because, in a sense, she was a beginner again: she was relying on a learning system that she hadn't used to hit serves and overhead forehands and volleys since she was first taught tennis, as a child. The same thing has happened to Chuck Knoblauch, the New York Yankees' second baseman, who inexplicably has had trouble throwing the ball to first base. Under the stress of playing in front of forty thousand fans at Yankee Stadium, Knoblauch finds himself reverting to explicit mode, throwing like a Little Leaguer again.

Panic is something else altogether. Consider the following account of a scuba-diving accident, recounted to me by Ephimia Morphew, a human-factors specialist at nasa: "It was an open-water certification dive, Monterey Bay, California, about ten years ago. I was nineteen. I'd been diving for two weeks. This was my first time in the open ocean without the instructor. Just my buddy and I. We had to go about forty feet down, to the bottom of the ocean, and do an exercise where we took our regulators out of our mouth, picked up a spare one that we had on our vest, and practiced breathing out of the spare. My buddy did hers. Then it was my turn. I removed my regulator. I lifted up my secondary regulator. I put it in my mouth, exhaled, to clear the lines, and then I inhaled, and, to my surprise, it was water. I inhaled water. Then the hose that connected that mouthpiece to my tank, my air source, came unlatched and air from the hose came exploding into my face.

"Right away, my hand reached out for my partner's air supply, as if I was going to rip it out. It was without thought. It was a physiological response. My eyes are seeing my hand do something irresponsible. I'm fighting with myself. Don't do it. Then I searched my mind for what I could do. And nothing came to mind. All I could remember was one thing: If you can't take care of yourself, let your buddy take care of you. I let my hand fall back to my side, and I just stood there."

This is a textbook example of panic. In that moment, Morphew stopped thinking. She forgot that she had another source of air, one that worked perfectly well and that, moments before, she had taken out of her mouth. She forgot that her partner had a working air supply as well, which could easily be shared, and she forgot that grabbing her partner's regulator would imperil both of them. All she had was her most basic instinct: get air. Stress wipes out short-term memory. People with lots of experience tend not to panic, because when the stress suppresses their short-term memory they still have some residue of experience to draw on. But what did a novice like Morphew have? I searched my mind for what I could do. And nothing came to mind.

Panic also causes what psychologists call perceptual narrowing. In one study, from the early seventies, a group of subjects were asked to perform a visual acuity task while undergoing what they thought was a sixty-foot dive in a pressure chamber. At the same time, they were asked to push a button whenever they saw a small light flash on and off in their peripheral vision. The subjects in the pressure

chamber had much higher heart rates than the control group, indicating that they were under stress. That stress didn't affect their accuracy at the visual-acuity task, but they were only half as good as the control group at picking up the peripheral light. "You tend to focus or obsess on one thing," Morpew says. "There's a famous airplane example, where the landing light went off, and the pilots had no way of knowing if the landing gear was down. The pilots were so focussed on that light that no one noticed the autopilot had been disengaged, and they crashed the plane." Morpew reached for her buddy's air supply because it was the only air supply she could see.

Panic, in this sense, is the opposite of choking. Choking is about thinking too much. Panic is about thinking too little. Choking is about loss of instinct. Panic is reversion to instinct. They may look the same, but they are worlds apart.

Why does this distinction matter? In some instances, it doesn't much. If you lose a close tennis match, it's of little moment whether you choked or panicked; either way, you lost. But there are clearly cases when how failure happens is central to understanding why failure happens.

Take the plane crash in which John F. Kennedy, Jr., was killed last summer. The details of the flight are well known. On a Friday evening last July, Kennedy took off with his wife and sister-in-law for Martha's Vineyard. The night was hazy, and Kennedy flew along the Connecticut coastline, using the trail of lights below him as a guide. At Westerly, Rhode Island, he left the shoreline, heading straight out over Rhode Island Sound, and at that point, apparently disoriented by the darkness and haze, he began a series of curious maneuvers: He banked his plane to the right, farther out into the ocean, and then to the left. He climbed and descended. He sped up and slowed down. Just a few miles from his destination, Kennedy lost control of the plane, and it crashed into the ocean.

Kennedy's mistake, in technical terms, was that he failed to keep his wings level. That was critical, because when a plane banks to one side it begins to turn and its wings lose some of their vertical lift. Left unchecked, this process accelerates. The angle of the bank increases, the turn gets sharper and sharper, and the plane starts to dive toward the ground in an ever-narrowing corkscrew. Pilots call this the graveyard spiral. And why didn't Kennedy stop the dive? Because, in times of low visibility and high stress, keeping your wings level--indeed, even knowing whether you are in a graveyard spiral--turns out to be surprisingly difficult. Kennedy failed under pressure.

Had Kennedy been flying during the day or with a clear moon, he would have been fine. If you are the pilot, looking straight ahead from the cockpit, the angle of your wings will be obvious from the straight line of the horizon in front of you. But when it's dark outside the horizon disappears. There is no external measure of the plane's bank. On the ground, we know whether we are level even when it's dark, because of the motion-sensing mechanisms in the inner ear. In a spiral dive, though, the effect of the plane's G-force on the inner ear means that the pilot feels perfectly level even if his plane is not. Similarly, when you are in a jetliner that is banking at thirty degrees after takeoff, the book on your neighbor's lap does not slide into your lap, nor will a pen on the floor roll toward the "down" side of the plane. The physics of flying is such that an airplane in the midst of a turn always feels perfectly level to someone inside the cabin.

This is a difficult notion, and to understand it I went flying with William Langewiesche, the author of a superb book on flying, "Inside the Sky." We met at San Jose Airport, in the jet center where the Silicon Valley billionaires keep their private planes. Langewiesche is a rugged man in his forties, deeply tanned, and handsome in the way that pilots (at least since the movie "The Right Stuff") are supposed to be. We took off at dusk, heading out toward Monterey Bay, until we had left the lights of the coast behind and night had erased the horizon. Langewiesche let the plane bank gently to the left.

He took his hands off the stick. The sky told me nothing now, so I concentrated on the instruments. The nose of the plane was dropping. The gyroscope told me that we were banking, first fifteen, then thirty, then forty-five degrees. "We're in a spiral dive," Langewiesche said calmly. Our airspeed was steadily accelerating, from a hundred and eighty to a hundred and ninety to two hundred knots. The needle on the altimeter was moving down. The plane was dropping like a stone, at three thousand feet per minute. I could hear, faintly, a slight increase in the hum of the engine, and the wind noise as we picked up speed. But if Langewiesche and I had been talking I would have caught none of that. Had the cabin been unpressurized, my ears might have popped, particularly as we went into the steep part of the dive. But beyond that? Nothing at all. In a spiral dive, the G-load--the force of inertia--is normal. As Langewiesche puts it, the plane likes to spiral-dive. The total time elapsed since we started diving was no more than six or seven seconds. Suddenly, Langewiesche straightened the wings and pulled back on the stick to get the nose of the plane up, breaking out of the dive. Only now did I feel the full force of the G-load, pushing me back in my seat. "You feel no G-load in a bank," Langewiesche said. "There's nothing more confusing for the uninitiated."

I asked Langewiesche how much longer we could have fallen. "Within five seconds, we would have exceeded the limits of the airplane," he replied, by which he meant that the force of trying to pull out of the dive would have broken the plane into pieces. I looked away from the instruments and asked Langewiesche to spiral-dive again, this time without telling me. I sat and waited. I was about to tell Langewiesche that he could start diving anytime, when, suddenly, I was thrown back in my chair. "We just lost a thousand feet," he said.

This inability to sense, experientially, what your plane is doing is what makes night flying so stressful. And this was the stress that Kennedy must have felt when he turned out across the water at Westerly, leaving the guiding lights of the Connecticut coastline behind him. A pilot who flew into Nantucket that night told the National Transportation Safety Board that when he descended over Martha's Vineyard he looked down and there was "nothing to see. There was no horizon and no light.... I thought the island might [have] suffered a power failure." Kennedy was now blind, in every sense, and he must have known the danger he was in. He had very little experience in flying strictly by instruments. Most of the time when he had flown up to the Vineyard the horizon or lights had still been visible. That strange, final sequence of maneuvers was Kennedy's frantic search for a clearing in the haze. He was trying to pick up the lights of Martha's Vineyard, to restore the lost horizon. Between the lines of the National Transportation Safety Board's report on the crash, you can almost feel his desperation:

About 2138 the target began a right turn in a southerly direction. About 30 seconds later, the target stopped its descent at 2200 feet and began a climb that lasted another 30 seconds. During this period of time, the target stopped the turn, and the airspeed decreased to about 153 KIAS. About 2139, the target leveled off at 2500 feet and flew in a southeasterly direction. About 50 seconds later, the target entered a left turn and climbed to 2600 feet. As the target continued in the left turn, it began a descent that reached a rate of about 900 fpm.

But was he choking or panicking? Here the distinction between those two states is critical. Had he choked, he would have reverted to the mode of explicit learning. His movements in the cockpit would have become markedly slower and less fluid. He would have gone back to the mechanical, self-conscious application of the lessons he had first received as a pilot--and that might have been a good thing. Kennedy needed to think, to concentrate on his instruments, to break away from the instinctive flying that served him when he had a visible horizon.

But instead, from all appearances, he panicked. At the moment when he needed to remember the

lessons he had been taught about instrument flying, his mind--like Morpheus's when she was underwater--must have gone blank. Instead of reviewing the instruments, he seems to have been focussed on one question: Where are the lights of Martha's Vineyard? His gyroscope and his other instruments may well have become as invisible as the peripheral lights in the underwater-panic experiments. He had fallen back on his instincts--on the way the plane felt--and in the dark, of course, instinct can tell you nothing. The N.T.S.B. report says that the last time the Piper's wings were level was seven seconds past 9:40, and the plane hit the water at about 9:41, so the critical period here was less than sixty seconds. At twenty-five seconds past the minute, the plane was tilted at an angle greater than forty-five degrees. Inside the cockpit it would have felt normal. At some point, Kennedy must have heard the rising wind outside, or the roar of the engine as it picked up speed. Again, relying on instinct, he might have pulled back on the stick, trying to raise the nose of the plane. But pulling back on the stick without first levelling the wings only makes the spiral tighter and the problem worse. It's also possible that Kennedy did nothing at all, and that he was frozen at the controls, still frantically searching for the lights of the Vineyard, when his plane hit the water. Sometimes pilots don't even try to make it out of a spiral dive. Langewiesche calls that "one G all the way down."

What happened to Kennedy that night illustrates a second major difference between panicking and choking. Panicking is conventional failure, of the sort we tacitly understand. Kennedy panicked because he didn't know enough about instrument flying. If he'd had another year in the air, he might not have panicked, and that fits with what we believe--that performance ought to improve with experience, and that pressure is an obstacle that the diligent can overcome. But choking makes little intuitive sense. Novotna's problem wasn't lack of diligence; she was as superbly conditioned and schooled as anyone on the tennis tour. And what did experience do for her? In 1995, in the third round of the French Open, Novotna choked even more spectacularly than she had against Graf, losing to Chanda Rubin after surrendering a 5-0 lead in the third set. There seems little doubt that part of the reason for her collapse against Rubin was her collapse against Graf--that the second failure built on the first, making it possible for her to be up 5-0 in the third set and yet entertain the thought I can still lose. If panicking is conventional failure, choking is paradoxical failure.

Claude Steele, a psychologist at Stanford University, and his colleagues have done a number of experiments in recent years looking at how certain groups perform under pressure, and their findings go to the heart of what is so strange about choking. Steele and Joshua Aronson found that when they gave a group of Stanford undergraduates a standardized test and told them that it was a measure of their intellectual ability, the white students did much better than their black counterparts. But when the same test was presented simply as an abstract laboratory tool, with no relevance to ability, the scores of blacks and whites were virtually identical. Steele and Aronson attribute this disparity to what they call "stereotype threat": when black students are put into a situation where they are directly confronted with a stereotype about their group--in this case, one having to do with intelligence--the resulting pressure causes their performance to suffer.

Steele and others have found stereotype threat at work in any situation where groups are depicted in negative ways. Give a group of qualified women a math test and tell them it will measure their quantitative ability and they'll do much worse than equally skilled men will; present the same test simply as a research tool and they'll do just as well as the men. Or consider a handful of experiments conducted by one of Steele's former graduate students, Julio Garcia, a professor at Tufts University. Garcia gathered together a group of white, athletic students and had a white instructor lead them through a series of physical tests: to jump as high as they could, to do a standing broad jump, and to see how many pushups they could do in twenty seconds. The instructor then asked them to do the tests a second time, and, as you'd expect, Garcia found that the students did a little better on each of the tasks the second time around. Then Garcia ran a second group of students through the tests, this

time replacing the instructor between the first and second trials with an African-American. Now the white students ceased to improve on their vertical leaps. He did the experiment again, only this time he replaced the white instructor with a black instructor who was much taller and heavier than the previous black instructor. In this trial, the white students actually jumped less high than they had the first time around. Their performance on the pushups, though, was unchanged in each of the conditions. There is no stereotype, after all, that suggests that whites can't do as many pushups as blacks. The task that was affected was the vertical leap, because of what our culture says: white men can't jump.

It doesn't come as news, of course, that black students aren't as good at test-taking as white students, or that white students aren't as good at jumping as black students. The problem is that we've always assumed that this kind of failure under pressure is panic. What is it we tell underperforming athletes and students? The same thing we tell novice pilots or scuba divers: to work harder, to buckle down, to take the tests of their ability more seriously. But Steele says that when you look at the way black or female students perform under stereotype threat you don't see the wild guessing of a panicked test taker. "What you tend to see is carefulness and second-guessing," he explains. "When you go and interview them, you have the sense that when they are in the stereotype-threat condition they say to themselves, 'Look, I'm going to be careful here. I'm not going to mess things up.' Then, after having decided to take that strategy, they calm down and go through the test. But that's not the way to succeed on a standardized test. The more you do that, the more you will get away from the intuitions that help you, the quick processing. They think they did well, and they are trying to do well. But they are not." This is choking, not panicking. Garcia's athletes and Steele's students are like Novotna, not Kennedy. They failed because they were good at what they did: only those who care about how well they perform ever feel the pressure of stereotype threat. The usual prescription for failure--to work harder and take the test more seriously--would only make their problems worse.

That is a hard lesson to grasp, but harder still is the fact that choking requires us to concern ourselves less with the performer and more with the situation in which the performance occurs. Novotna herself could do nothing to prevent her collapse against Graf. The only thing that could have saved her is if--at that critical moment in the third set--the television cameras had been turned off, the Duke and Duchess had gone home, and the spectators had been told to wait outside. In sports, of course, you can't do that. Choking is a central part of the drama of athletic competition, because the spectators have to be there--and the ability to overcome the pressure of the spectators is part of what it means to be a champion. But the same ruthless inflexibility need not govern the rest of our lives. We have to learn that sometimes a poor performance reflects not the innate ability of the performer but the complexion of the audience; and that sometimes a poor test score is the sign not of a poor student but of a good one.

Through the first three rounds of the 1996 Masters golf tournament, Greg Norman held a seemingly insurmountable lead over his nearest rival, the Englishman Nick Faldo. He was the best player in the world. His nickname was the Shark. He didn't saunter down the fairways; he stalked the course, blond and broad-shouldered, his caddy behind him, struggling to keep up. But then came the ninth hole on the tournament's final day. Norman was paired with Faldo, and the two hit their first shots well. They were now facing the green. In front of the pin, there was a steep slope, so that any ball hit short would come rolling back down the hill into oblivion. Faldo shot first, and the ball landed safely long, well past the cup.

Norman was next. He stood over the ball. "The one thing you guard against here is short," the announcer said, stating the obvious. Norman swung and then froze, his club in midair, following the ball in flight. It was short. Norman watched, stone-faced, as the ball rolled thirty yards back down the

hill, and with that error something inside of him broke.

At the tenth hole, he hooked the ball to the left, hit his third shot well past the cup, and missed a makable putt. At eleven, Norman had a three-and-a-half-foot putt for par--the kind he had been making all week. He shook out his hands and legs before grasping the club, trying to relax. He missed: his third straight bogey. At twelve, Norman hit the ball straight into the water. At thirteen, he hit it into a patch of pine needles. At sixteen, his movements were so mechanical and out of synch that, when he swung, his hips spun out ahead of his body and the ball sailed into another pond. At that, he took his club and made a frustrated scythelike motion through the grass, because what had been obvious for twenty minutes was now official: he had fumbled away the chance of a lifetime.

Faldo had begun the day six strokes behind Norman. By the time the two started their slow walk to the eighteenth hole, through the throng of spectators, Faldo had a four- stroke lead. But he took those final steps quietly, giving only the smallest of nods, keeping his head low. He understood what had happened on the greens and fairways that day. And he was bound by the particular etiquette of choking, the understanding that what he had earned was something less than a victory and what Norman had suffered was something less than a defeat.

When it was all over, Faldo wrapped his arms around Norman. "I don't know what to say--I just want to give you a hug," he whispered, and then he said the only thing you can say to a choker: "I feel horrible about what happened. I'm so sorry." With that, the two men began to cry.

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