ELEMENTS

THE PARADOX OF LISTENING TO OUR BODIES

Interoception—the inner sense linking our bodies and minds—can confuse as much as it can reveal.

By Jessica Wapner

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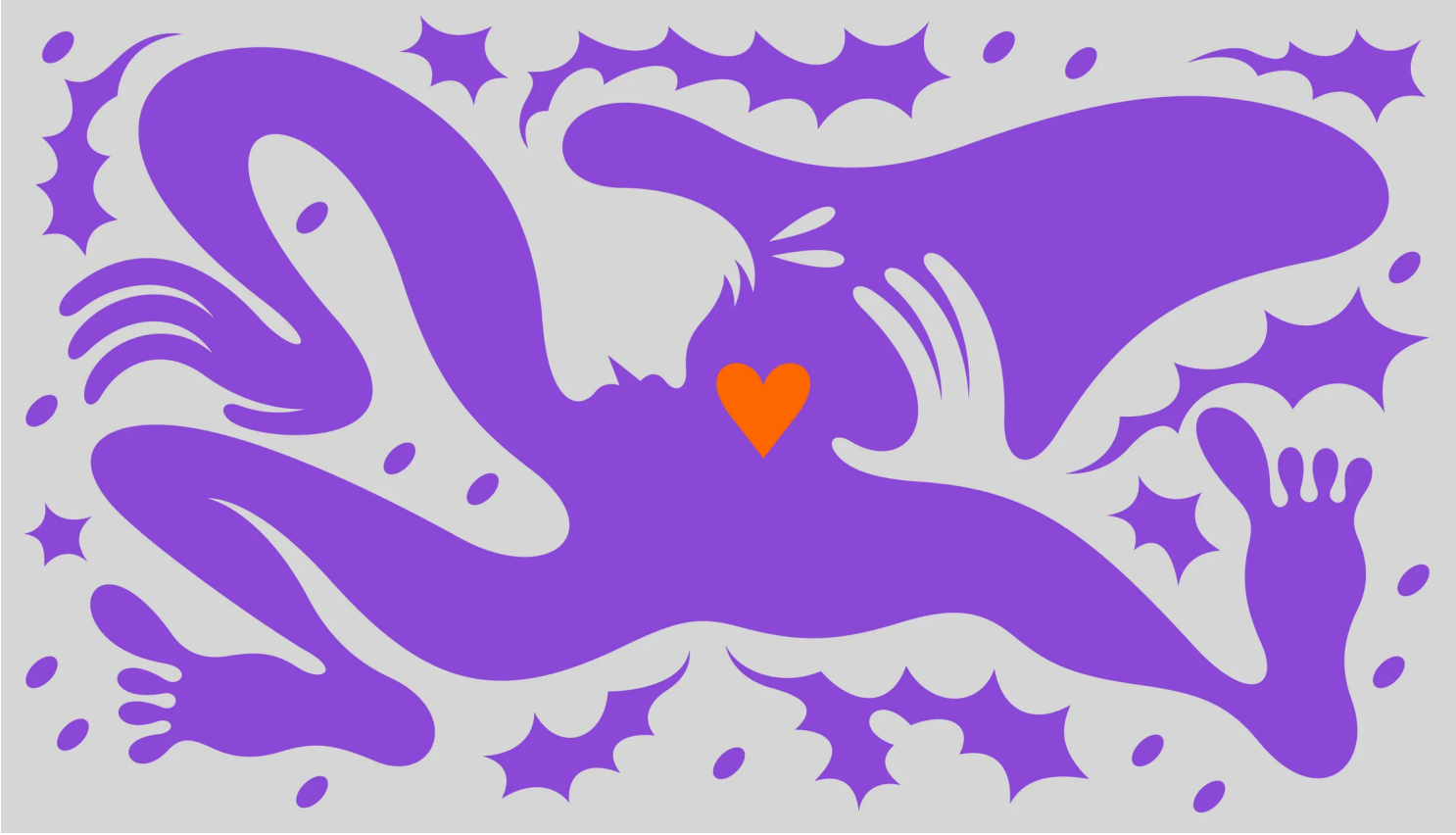

Illustration by Benedikt Luft

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My husband worries a lot about his heart. "I feel something right here," he'll say, pointing to a spot on his chest. I have a hard time knowing how to respond to these reports; unless I'm doing cardio, I'm never aware of my heartbeat, and even then I can't really feel it. After my husband's cardiologist told him that there was nothing wrong with his heart, I figured that his fascination with it was just melodrama, or hypochondria.

Then I read a study by Sarah Garfinkel, a neuroscientist at University College London. Garfinkel monitored the heartbeats of twenty people who'd been diagnosed with autism, and also asked them to count the beats themselves. In a second study with sixty autistic individuals, she played a rhythmic, beeping tone and asked her subjects to say whether it was in synch with their pulses. At first, many people who'd declared themselves "good" at detecting their own heartbeats failed these tasks. But, as the tests went on, they improved. Some of the participants had reported having anxiety, and about a third of them said that, as they became better at detecting their heartbeats accurately, they also felt less anxious. My husband isn't autistic, but he does experience anxiety, and Garfinkel's study made me wonder whether he might be like some of her study participants. Maybe he was wrongly convinced that he was good at feeling his heartbeat, but also able to improve that sense—a change that could ease his worries.

Scientists call our ability to feel what's happening inside our bodies interoception. A portmanteau of "interior" and "reception," it differs from perception, which comes from our five senses, and proprioception, which tells us how we are oriented in space. Interoception is an inner sense having to do with our bodily processes. It can be divided into three rough categories. The first comprises feelings that break through into consciousness based on need; this is how we know when we need to pee or sleep or hydrate, and how we grasp that our hearts are racing after a good jump scare. The second encompasses the unconscious ways in which our brains and bodies communicate; our brains detect high glucose levels in our livers, for example, then release hormones that trigger our metabolisms, and we are unaware

of the process. A vast number of these silent interoceptive processes are going on within us all the time.

The third category of interoception has to do with how our bodies and minds, together, sense and respond to the flow of events. On a recent Zoom call, Tim Dalgleish, a psychologist at the University of Cambridge, told me that the body is constantly delivering a set of signals—changes in our heart rates, breathing, digestion, and so on—that fluctuate along with the events we are encountering. It's tempting to see the flow of information as one-way, from the mind to the body; we might understand an escalating heart rate, say, as a "reaction" to a feeling of nervousness. (An exam is placed on our desks, we grow nervous, and our hearts start racing in response.) But Dalgleish told me that it made more sense to think of the body and mind working synchronously as part of a single "prediction system." "I don't think we are 'reacting' to anything," he said. Instead, we are constantly forecasting what is about to happen, with our bodies and minds contributing to that forecast. "There's a mental component and a bodily component," Dalgleish said. "They both happen at the same time."

When we talk about "listening to our bodies" or "going with our guts," we are often talking about this type of interoception. Close your eyes at any given moment, and you can gauge your over-all mood—good, bad, excited, tired, a bit down, or generally pleased. This mood combines what's going on in your mind with how your organs, muscles, and nerves are embodying the moment. "Interoception is your ability to notice that signal," Dalgleish said.

Not everyone is good at interpreting these interoceptive signals, and our abilities vary with our circumstances. In a 2010 study, Dalgleish and his collaborators asked ninety-two people to play a computer game derived from the Iowa gambling task, a psychological test designed to examine decision-making. The task entailed selecting the correct down-facing card from one of four decks, in hopes that it would match the color of an upturned card. Each correct choice earned the player some money. There were differences among the decks, but the game was designed

so that it was impossible to figure them out within the time allotted. Still, in the course of a hundred turns, three-quarters of the participants got better at selecting the "profitable" deck of cards.

The point of the study was to see whether any bodily changes distinguished the people who improved from the ones who did not. While the subjects played, the researchers measured their heart rates and skin temperatures. They found that predictable bodily changes happened among those who got better at the game. Right before those subjects guessed, their hearts beat faster and their palms became sweaty; then they chose the right card. "People who were good at reading their bodies were the ones who did really well," Dalgleish said. None of the players experienced themselves as being guided by these physical cues. Instead, they just went with their guts.

Why were some players more tuned into these signals than others? In 2022, Garfinkel and a colleague, Chatrin Suksasilp, provided one of the first comprehensive descriptions of how "listening to our bodies" might really work. First, they argued, come the various, often incremental somatic changes that happen continuously; our minds then translate these signals into a single feeling. The accuracy of this process, they wrote, can vary at every step. People with post-traumatic stress disorder, for instance, often experience racing hearts at moments that don't seem to call for them; similar disproportionate responses often arise among people with other mental-health difficulties, or who are chronically stressed. Meanwhile, these signals form an amalgam that is funnelled into certain regions of the brain, such as the insular cortex and the dorsal mid-insula. "Some people have loads of activity in key areas, and other people don't," Garfinkel said—in other words, some people have stronger interoceptive signals.

And yet, even if you're receiving a strong signal from your body, it can be inaccurate. Consistently perfect interoception is impossible: sometimes we listen to our hearts, but they have the wrong message; at other times, the message is right, but we don't hear it. The body itself changes our capacity to listen. Garfinkel

asked me to imagine an athlete who stays in the game while clearly injured: in a hyper-aroused state, she said, a person can become numb to pain. And interoception is complicated by the fact that it's tightly tied to our personal experiences. Whatever happened to us in the past—a dangerous encounter with a stranger, a scary movie that made a big impression, time on the battlefield—alters how our bodies respond in the future. If a person's responses are sufficiently shaped by such experiences, then listening to her body might lead her astray.

Given how easy it is for interoception to go wrong, it's logical to wonder whether we can become better at getting it right. Some researchers are exploring ways to retrain our interoceptive responses. At the Laureate Institute for Brain Research, in Tulsa, Oklahoma, Sahib Khalsa, a psychiatrist, has been taking this approach with people who have eating disorders. Khalsa trained with Antonio Damasio, a neurologist who popularized the notion that our feelings are rooted in our bodies rather than our minds; in particular, Damasio's somatic-marker hypothesis lays out the body-to-brain process by which visceral responses shape our decisions. Khalsa's theory, essentially, is that eating disorders involve, among other things, a cycle of interoceptive mistranslation. A rumbling tummy should stimulate one's appetite, not evoke fear; feeling full should be part of an over-all pleasant state, not turmoil. Eating disorders are complicated, with roots that extend far beyond the question of how good people are at listening to their bodies. But at least one study has found that people with anorexia perform poorly on interoceptive tests.

A therapist providing food-based interoceptive exposure might offer individuals with eating disorders a piece of chocolate in hopes that, over several sessions, that they will learn to taste and swallow it without becoming emotionally distraught. Khalsa works with one application of this therapy. "The goal is for you to learn to eat this without feeling uncomfortable," Khalsa explained. He is also investigating the use of float tanks as a form of interoceptive therapy. In a study he published in

2020, twenty-three women with anorexia floated in sensory-deprivation chambers for ninety minutes at a time, once a week, for four weeks. They reported experiencing heightened awareness of their heartbeats and breathing, but not of their stomachs or digestive systems; many also reported feeling relaxed, energized, serene, and happy. (The study doesn't connect any of these changes to shifts in eating habits.) Khalsa's theory is that the tanks offer a kind of interoceptive training: if you get better at tracking your own heartbeat, you might get better at tracking your appetite as well. "If I followed a meal with a float . . . I could allow my food to digest without the discomfort of fullness," Emily Noren writes, in "Unsinkable," her memoir of overcoming an eating disorder with help from floating. "The float tank was my training wheels for digestion."

Finally, in work published last month in *Nature Communications*, Khalsa is exploring the use of a tiny, motorized capsule that vibrates when it reaches the digestive system. People with eating disorders often complain of feeling full or bloated even when they haven't consumed food; Khalsa thinks that, by practicing sensing the motor, they may be able to retrain their gastrointestinal interoception. The tiny motor creates an opportunity to recognize a real physical sensation in the gut. By distinguishing real from imagined, a person might establish an interoceptive connection that more accurately communicates the state of the body. Last year, Garfinkel and her colleague, Camilla Nord, at the University College Cambridge, published an overview of how interoception might be used to treat many mental-health conditions. They drew on numerous studies elucidating the connection between interoceptive accuracy and emotions. (People who are better at detecting their heartbeats are also better at regulating negative emotions, for example.) The researchers point out that many therapies that are already in use are also a form of interoceptive intervention: for instance, a single dose of citalopram —a selective serotonin reuptake inhibitor prescribed for depression and other mood disorders—enhanced the confidence people had in their correct interoceptive judgments. In other words, they had more insight into what their bodies were doing.

One of the lessons of interoception research, however, is that access and accuracy don't necessarily go together. Just because we have a bad feeling doesn't make it right. It's unwise to assume that increasing people's interoceptive curiosity will solve their problems. It could be that "you're just training them to read a signal that's actually giving them really bad information," Dalgleish said; it can even be useful for someone to be "trained to ignore their body." Garfinkel told me that "people with anxiety and depression attend too much to the body." Data show that people with panic disorders are often hyperaware of their heartbeats. The psychologists Karen Quigley and Lisa Feldman Barrett, who study emotion at Northeastern University, hypothesize that depression stems in part from a "locked-in" brain—a situation in which we fail to account for the possibility that our interoceptive interpretation might be wrong. "If I feel so awful and I can't see an explanation in the outside world, then that might mean that there's something wrong with me," Quigley told me, explaining the mind-set. "There's this kind of closing inward." When such a dynamic is ruling a person's mind, increasing interoceptive awareness isn't going to help. It may help more to learn to let in the external world.

In 1998, two researchers from the University of Pittsburgh conducted a study in which participants sat at a table with one arm hidden beyond a screen. The researchers set out a fake arm in its place, orienting it so that it appeared to have replaced the real arm, then proceeded to lightly stroke the surface of both arms with a paintbrush. Participants reported what came to be known as the rubber-hand illusion: they could feel the brush even as it touched the fake arm. Years later, psychologists from the U.K. and Italy wanted to see how interoception factored into the trick. In the experiment, people who were better at sensing their cardiac rhythms turned out to be less likely to "embody" the rubber hand—that is, to perceive it as their own limb.

Interoception can help us see ourselves more clearly. The paradox is that it may be at its most accurate when it is, in itself, invisible. In 2021, the National Institutes of Health awarded eighteen million dollars to seven five-year projects focussed on the unconscious pathways linking the body and the brain. And, in 2022, the N.I.H. issued a special call for research centered on interoception as part of cancer prevention. Tumors consume an enormous amount of energy; it's possible that, by tapping into the brain's metabolic interoception, we might detect them early. Yet this research concentrates on interoception that is totally unconscious; there is no funding for work investigating whether a person can sense these metabolic changes with her conscious mind. The unconscious signals are often the trustworthy ones. The complications begin when we try to listen in and understand what we're hearing. We're urged, for all sorts of reasons, to listen to our hearts. But a life looking inward isn't necessarily a life well lived. "You don't want to be focussed too much on the body," Garfinkel said. "You want to be focussed on the world." ♦

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