THE ADVENTURE ISSUE

MOUNTAIN Time

They say time flies when you're having fun, and science seems to support that maxim. So why does it feel like the minutes and hours expand when we're immersed in nature?

BY MICHAEL BEHAR

PHOTO ILLUSTRATION BY C.J. BURTON

On a sunny morning in early July, I set off on a solo hike to Sky Pond, a timberline lake in Rocky Mountain National Park. The trail ascends moderately, climbing 1,677 feet over 4.5 miles. Although the route isn't terribly steep—a handful of switchbacks and long draws—it's still demanding. As I climb, my breathing settles into a deep rhythm, coercing oxygen from the thin, high-elevation air. The steady, perpetual motion is strangely hypnotic, like aerobic meditation.

I'm moving along at a decent pace when a large cow elk emerges from the woods and ambles into my path. Its appearance breaks my focus, so I stop to snap a few shots with my iPhone. Because I've never worn a watch, I usually am able to guess the current time or tell you how much of it has elapsed during a given activity. I presume by now it has been nearly four hours since I left the trailhead at Glacier Gorge. But the clock on my phone conveys otherwise: I've been walking for a mere 90 minutes.

Scientists who study such things would say I have a deficiency in something called "subjective time perception," because my internal clock is out of sync with actual, or "objective," time. Curiously, my inability to accurately discern the passage of minutes and hours occurs almost exclusively when I'm in the wilderness. During everyday banalities—shuttling my kids to school, hurrying to appointments, or tackling household chores—time slips by at its normal pace. But when I step into the backcountry, my brain is suddenly suspended in the moment.

I discovered the phenomenon shortly after moving to Colorado in 2006 and committing myself to taking mountain excursions at least once a week. The more I went off the grid, the more time expanded while I was out there. Now, more than a decade later, the effect is as strong as ever. When I'm camping with my family, backpacking with my son, or dayhiking with friends, time *should* fly because, as they say, I'm having fun. But it doesn't. Instead, it's precisely the opposite—the minutes and hours feel mysteriously slow. The sensation is seductive; time is a commodity, and I feel as if I am somehow getting extra for free.

For nearly a century, researchers have subjected human volunteers to poking and prodding and often outlandish psychological tests to determine, among other temporal enigmas, where our internal clock—or, more precisely, our subjective sense of timing—resides in the brain. In the late 1920s, a Frenchman named Marcel François conducted some of the very first experiments on humans that attempted to assess how we calculate time. His methods were unconventional: François employed something called "diathermy." He zapped test subjects with high-frequency electromagnetic currents to raise their core body temperatures, not unlike how a microwave boils water. François' hypothesis was that humans measure time by some sort of physiochemical process, which he figured would accelerate when heated, as is the case with other chemical reactions.

After François had sufficiently nuked his volunteers, he asked them to approximate a rhythm, such as tapping a beat three times per second. Sure enough, the hotter they got, the faster they tapped. A few years later, Hudson Hoagland, an American psychologist, produced similar results after his wife came down with a high fever. She was a musician and, therefore, had impeccable cadence. Hoagland instructed her to estimate when one minute had elapsed while he checked his stopwatch. She signaled him after just 38 seconds. Hoagland repeated the experiment several times while his wife's fever spiked and waned, and her timing hastened and slackened accordingly.

Regarded as the founding fathers of time science, François and Hoagland spawned "one of the most bizarre fields of study ever undertaken by serious experimental psychologists," wrote John Wearden in 2016's *The Psychology of Time Perception*. Believing that time and temperature were somehow linked, researchers seeking to further the field locked volunteers in hot rooms, outfitted them with heated helmets, and asked them to pedal stationary bicycles while submerged in warm water. Alas, neither Hoagland nor François nor any of their protégés could pinpoint a biological mechanism that regulates our internal clocks.

Although their studies may have been a little weird, they weren't necessarily misguided. Rather, it's that these types of experiments are prone to tremendous subjectivity: Not only do we all perceive time differently, but our perceptions vacillate wildly depending on external circumstances. "It's all very complicated," Wearden, an emeritus professor of psychology at Keele University in Britain, says. According to Wearden, we often muddle "duration judgments" (how long something lasted when observed retrospectively) with the speed of a specific event as it's occurring. Duration judgments might include, for example, the impression you get upon returning to your cubicle after a week in the Caribbean: In hindsight, your tropical holiday feels like a blip. That's not the same as guesstimating the length of a particular experience while in the midst of it, which is what I was attempting to do—and failing miserably at—while hiking to Sky Pond.

Time-perception scientists have yet to conduct brain scans on hikers or climbers while they're in the backcountry. Diagnostic tools like electroencephalograms or functional MRIs—which can detect neural activity in real time—would be useful because they can reveal where neurons are firing during specific activities. But those tests still wouldn't tell us a lot about time perception. That's because it's not like other senses, such as speech or sight, which are processed in very specific regions of the brain. "There is no one spot where time is happening," says David Eagleman, a neuroscientist at Stanford University. "It emerges from a whole concert of things that are inseparable."

This past summer I planned outdoor excursions almost every weekend. In late June, shortly after I returned from Great Sand Dunes National Park and Preserve, where I camped with my family for seven days (and it felt like a month), I spoke with Melanie Rudd, a marketing professor with the Bauer College of Business at the University of Houston. Rudd is one of the world's foremost experts on "awe," a uniquely human emotion that can expand our perception of time and make ephemeral experiences seem more enduring.

Awe is unusual because, unlike time perception, it is not culturally dependent. Americans gauge time linearly, confining it to the past, present, or future. Many Asians consider it cyclical and limitless: Existence repeats itself for eternity (which might explain why nobody in India seems to care when their trains are hours late). And then there are the Pirahã, an indigenous Amazonian tribe whose language—which can be whistled, hummed, sung, or spoken—lacks numbers or any concept for representing time. Their life experiences exist entirely in the moment. In contrast, "people's response to awe seems to be pretty consistent," Rudd says. "There is even a universal facial expression for awe—a slightly open mouth, with head tilted up."

Illustrations by Halftone Def Studios

A lot of things can produce awe. Rudd says sublime settings like Sky Pond or the Great Sand Dunes would certainly alter our innate abilities to tell time, and in 2012, she ran a study to try to measure the effect. Rudd asked a group of volunteers to read a short story in which the protagonist climbed the Eiffel Tower to view Paris from above. Next, she administered a written survey to assess their immediate mindsets. Their responses demonstrated that even the act of imagining an awe-inspiring scene had "increased perceived time availability"—they felt less busy and more patient. Rudd explained those findings—as well as the results of the second part of the study, in which participants who read a story that described climbing an unnamed tower and seeing a rather plain view didn't experience effects on their perceptions of time—in an article on the experiment.

"Awe is the feeling of smallness and insignificance," Rudd tells me. "If you're out in nature, I think that would definitely give you a different perception of time than you would have during your daily life." And this perception can linger, even after you get home, if it was truly "a mind-blowing experience," she says. It also doesn't hurt to leave your gadgets behind. "By stripping away technology, you're out in the wilderness without all those things associated with pressure and stress. Our brains cease to accurately keep track of time when there's no option to check it."

Rudd also offers an alternate explanation: mindfulness. "When you are very present-oriented, your brain starts to pay more attention to—and becomes more sensitive to—any changes in emotions, physical sensations, and changes in the surrounding environment," she says. "In the process, you start to encode more of everything; a switch flips and our brains think more time has passed."

"Encode" is just a fancy way of describing how we make and store memories. Mindfulness turns our brains into hyper-perceptive sponges, overwhelming our senses—and time perception is often the first of them to fail. "It has to do with the way time is related to memory," Stanford's Eagleman says. "When we're doing new things and seeing new things—extraordinary things and beautiful things—we lay down more memories and [the experience] seems to have taken longer."

Vertical granite spires flank the northern shoreline of Sky Pond, rising from the aquamarine water like the fangs of a prehistoric seafaring beast. The lake, at 10,887 feet, is tucked into a breathtaking glacial cirque and worthy of a lengthy stopover. So I locate a smooth, flat boulder to relax on and eat a late lunch. Soon I'm caught in the rapture of the moment. *How long have I been sitting here*? I wonder. Easily an hour or more, I suppose. A loud crack from an approaching thunderstorm jolts me to my feet. When I glance at my phone, only 20 minutes have passed, which is somewhat expected now that I'm aware of my predilection for misperceiving time in the backcountry. But it's bewildering, nonetheless.

A few weeks later, I convey the anomaly to Dean Buonomano, a neuroscientist at the University of California, Los Angeles. Buonomano investigates so-called "temporal processing"—how the brain tells time—using electrophysiology and computer models. His findings have led him to conclude that "our sense of timing is really quite horrible" and, furthermore, that my wilderness experiences are broadly atypical. "What you're reporting is different from what most people report," Buonomano says. "When you're on a hike and you look at your clock, you guesstimate that more time has passed. That is the opposite of 'time flies when you're having fun.' Your internal clock seems to speed up in nature."

Buonomano cites research describing how some activities can seemingly slow down time. But these are usually mundane endeavors, such as taking a long airplane flight or waiting in a post office line. "The idea is that people get bored," he says.

This hardly described my head space in late July when I spent three days with my seven-year-old son backpacking in the Holy Cross Wilderness, where we camped for two nights in a wildflower-choked meadow at 11,500 feet, shadowed by snow-clad thirteeners on the Continental Divide. At every moment, I was deeply engaged—with my son and our surroundings. The sights, the sounds, and the smells; we noticed everything and overlooked nothing. On our first morning, I cooked freeze-dried eggs from a pouch. My son devoured them and then declared, "Dad, I can't believe we've only been here one day. It feels like forever!"

Apparently, we were doing it wrong. Normally, when people venture outside their daily routines, they're supposed to experience the so-called "vacation paradox," Buonomano says. It refers to the fact that while on vacation time may seem to fly. There is a neurobiological theory as to why this is. Some scientists believe we have timing devices in our brains—so-called circuits—that tell time. "These devices have nothing to do with actual clocks," he points out. "But the theory is they can accelerate a bit when you have rewarding situations." Scientists speculate that dopamine—produced in the brain's pleasure and reward center—might influence how fast these neural circuits fire. "Dopamine would slow down your internal clock, which is the same as speeding up the external clock, leaving you with the illusion that time is flying."

It's logical from an evolutionary perspective because our brains should encourage us to seek gratification. "But you don't have the vacation paradox," says Buonomano, sounding perplexed. He can't explain why, except noting that my internal clock somehow runs more rapidly. And yet, my condition is not uncommon. An admittedly unscientific survey of my fellow Coloradans indicates that virtually all of them share my sensation when they're in the wilderness—and it's often what compels them to head outdoors in the first place. On two separate occasions this summer, while camping with my family, we had friends drive five-plus hours each way to join us for a couple of nights. The long haul was worth it, they told me, because even a brief stay in the woods felt to them like a week's vacation. It could be our condition is similar to what people often report after undergoing a very intense physical or emotional ordeal. *Time stood still*, claim BASE jumpers, parachutists, and almost anyone facing a life-threatening situation. I wouldn't necessarily lump camping or hiking into that league. But my brain might be more stoked than I suspect and,

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therefore, responding as if I'm leaping off a radio tower in a wingsuit.

I pitch my theory to Eagleman, who swiftly rejects it. He had the same hunch in 2007, when he recruited 13 volunteers to partake in a now-landmark experiment. Eagleman gave each person a wearable wrist-mounted digital screen, which he'd programmed to repeatedly flash varying two-digit numbers. For each participant, he slowly increased the rate at which the numbers appeared on the display. The moment they were unable to identify the two-digit sequence, Eagleman locked in the rate, which established their baseline "visual threshold," as he defined it.

Then came the fun part. At the Zero Gravity Thrill Amusement Park in Dallas, Eagleman had each of his test subjects leap from a 150-foot-tall tower into a net. They were instructed to monitor the numbers on their wrist displays during the free falls and report back. The two-digit sequence flashed in roughly one-thirtieth-of-a-second increments, depending on the person. If our internal clocks truly accelerate during terrifying events, then the jumpers should've gained enhanced "temporal resolution," allowing them to exceed their visual thresholds and easily identify the number sequences that had been unreadable on the ground. As expected, they claimed that time had passed more slowly as they plummeted toward the earth. But nothing about their abilities to read the numbers had changed. Eagleman, who later published the results in a peer-reviewed science journal, wrote, "There is no evidence to support the hypothesis that subjective time as a whole runs in slow motion during frightening events." In other words, you might think time stood still when you skydived last year. But it was merely your own recollection of the event that made it appear to last longer.

Then again, maybe that's the point. Because time is experienced subjectively, it never elapses in my head the same way it does in yours. Which makes me wonder whether it really matters what experiments like Eagleman's tell us. Scientific dogma aside, I plan to embrace anything that adds hours to my day, even if the notion is fanciful. The clocks on our

wrists, on the walls, on our computers, and on our phones govern us—and that isn't healthy. I want more time, or at least I want to feel like there's more of it.

When I confess this to Rudd, she reckons I'm suffering from the "time famine," which ails nearly half of all Americans, according to a 2015 Gallup poll. "It's that feeling that there is too much to do and too little time," Rudd explains. Not surprisingly, it's a relatively recent epidemic. Buonomano says, "Clocks are a Western development. Before we had clocks, people lived by natural time—the sun rising and setting." The first mechanical clocks appeared in the late 1200s, but it wasn't until the 18th century that they became ubiquitous. "The Industrial Revolution was driven by cheap clocks. There was a need to have workers, paid by the hour, in the right place at the right time," Buonomano says.

It's worse now with every manner of digital communication constantly reminding us of the time, which means we're stuck with the famine for the foreseeable future. Thankfully, there are a few techniques to treat our time-starved populace. "I always recommend to people to seek novelty," Eagleman says. Anything that shakes up routine can do the trick. "Whether that's driving a new route home from work every day or brushing your teeth with your other hand—all these things change the impression of how long things are lasting." Those are good suggestions. But I find wilderness adventures—such as climbing Uncompahgre Peak, kayaking the Arkansas River, or backpacking through the Sangre de Cristos—more reliable for getting my time fix. It's a strategy I tested recently in Wyoming, where I traveled with my son to witness the solar eclipse.

On August 21, we drove to Medicine Bow National Forest and positioned ourselves directly in the path of totality at a place called Prairie Dog Hill, which, at 6,400 feet, gave us an unobstructed view. At 10:23 a.m., the moon began creeping over the sun. For the next hour, we gazed upward and waited. Time passed at its normal, or objective, pace. Eighty minutes later, totality descended. The stiff breeze abruptly died, the temperature plummeted, and stars materialized. Vermilion and amber hues saturated the horizon, creating the illusion of a 360-degree sunset girdling the Earth. During those two minutes and 23 seconds, my internal clock ceased, the cosmos stood still, and time was vanquished entirely.

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