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Jamie Beard is
hell-bent on
turning Big Oil into
Big Geothermal.
She has no
time to lose.

BY MARIA STRESHINSKY

Wired Magazine, Monthly Edit

[Fri, 02 Jun 2023]

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May 25, 2023 6:00 AM

The Trillion-Dollar Auction to Save the World

Ocean creatures soak up huge amounts of humanity's carbon mess. Should we value them like financial assets?

ILLUSTRATIONS: ISRAEL G. VARGAS

You are seated in an auction room at Christie's, where all evening you have watched people in suits put prices on priceless wonders. A parade of Dutch oils and Ming vases has gone to financiers and shipping magnates and oil funds. You have made a few unsuccessful bids, but the market is obscene, and you are getting bored. You consider calling it an early night and setting down the paddle. But then an item appears that causes you to tighten your grip. Lot 475: Adult blue [whale](#), female.

What is the right price for this masterwork of biology? Unlike a Ming vase, Lot 475 has never been appraised. It's safe to say that she is worth more than the 300,000 pounds of meat, bone, baleen, and blubber she's made of. But where does her premium come from? She has biological value, surely—a big fish supports the littler ones—but you wouldn't know how to quantify it. The same goes for her cultural value, the reverence and awe she elicits in people: immeasurable. You might conclude that this exercise is futile. Lot 475 is priceless. You brace for the bidding war, fearful of what the people in suits might do with their acquisition. But no paddles go up.

Ralph Chami has a suggested starting bid for Lot 475. He performed the appraisal six years ago, after what amounted to a religious experience on the deck of a research vessel in the Gulf of California. One morning, a blue

whale surfaced so close to the ship that Chami could feel its misty breath on his cheeks. “I was like, ‘Where have you been all my life?’” he recalls. “‘Where have *I* been all my life?’”

Chami was 50 at the time, taking a break from his job at the International Monetary Fund, where he had spent the better part of a decade steadyng markets in fragile places such as Libya and Sudan. “You become fragile yourself,” he says. When he saw the whale, he sensed her intelligence. He thought: “She has a life. She has a family. She has a history.” The moment brought him to tears, which he hid from the others on board.

That evening, Chami fell into conversation with his hosts, who told him the unhappy tale of the seas. The ocean, they explained, has been left to fend for itself. Trapped between borders, largely out of reach of law and order, its abundance is eroding at an alarming rate. The water is warming and acidifying. More than a third of fisheries are overexploited, and three-quarters of coral reefs are under threat of collapse. As for whales, people might love them, might pass laws to ban their slaughter and protect their mating grounds, but people also love all the things that threaten whales most—oil drilled from offshore platforms that pollute their habitat, goods carried by cargo ships that collide with them, pinging sonar signals that disrupt their [songs](#).

Chami had always loved the water. Growing up in Lebanon, he toyed with the idea of becoming an oceanographer before his father told him “in your dreams.” As he heard the researchers’ story, something awakened in him. He sensed that the same tools he had used to repair broken economies might help restore the oceans. Were they not a crisis zone too?

Chami’s hosts sent him scientific papers, from which he learned about the whale’s role in the carbon cycle. She stored as much as 33 tons of carbon in her prodigious body, he calculated, and fertilized the ocean with her iron-rich poop, providing fuel to trillions of carbon-dismantling phytoplankton. This piqued Chami’s interest. In a world economy striving to be greener, the ability to [offset greenhouse-gas emissions](#) had a clearly defined value. It was measured in carbon credits, representing tons of carbon removed from the atmosphere. While the whale herself couldn’t—shouldn’t—be bought

and sold, the premium generated by her ecological role could. She was less like an old painting, in other words, than an old-growth forest.

So what was the whale worth in carbon? It appeared no one had done the calculation. Chami loaded up his actuarial software and started crunching the numbers over and over, until he could say with confidence that the whale would pay dividends with every breath she took and every calf she bore. He concluded that the whale's value to humanity, on the basis of the emissions she helped sequester over her 60-year lifetime, was \$2 million. A starting bid.

For Chami, this number represented more than a burned-out economist's thought experiment. It would allow for a kind of capitalistic alchemy: By putting a price on the whale's services, he believed he could transform her from a liability—a charity case for a few guilt-ridden philanthropists—into an asset. The money the whale raised in carbon credits would go to conservationists or to the governments in whose waters she swam. They, in turn, could fund efforts that would ensure the whale and her kin kept right on sequestering CO₂. Any new threat to the whale's environment—a shipping lane, a deepwater rig—would be seen as a threat to her economic productivity. Even people who didn't really *care* about her would be forced to account for her well-being.

Before he went into finance, Ralph Chami toyed with the idea of becoming an oceanographer.

It was a “win-win-win,” Chami believed: Carbon emitters would get help meeting their obligations to avert global collapse; conservationists would get much-needed funds; and the whale would swim blissfully on, protected by the invisible hand of the market.

What's more, Chami realized, every wild organism is touched by the carbon cycle and could therefore be protected with a price tag. A forest elephant, for example, fertilizes soil and clears underbrush, allowing trees to thrive. He calculated the value of those services at \$1.75 million, far more than the elephant was worth as a captive tourist attraction or a poached pair of tusks. “Same thing for the rhinos, and same thing for the apes,” Chami says. “What would it be if they could speak and say, ‘Hey, pay me, man?’”

Chami's numbers never failed to elicit a reaction, good or bad. He was interviewed widely and asked to value plants and animals all over the world. He gave a TED Talk. Some people accused him of cheapening nature, debasing it by affixing a price tag. Cetacean experts pointed to vast gaps in their understanding of how, exactly, whales sequester carbon. But it seemed to Chami that by saying a blue whale must remain priceless, his detractors were ensuring that it would remain worthless.

In 2020, Chami was invited to participate in a task force about nature-based solutions to climate change whose participants included Carlos Duarte, a Spanish marine biologist at Saudi Arabia's King Abdullah University of Science and Technology. Duarte was widely known in conservation circles as the father of "blue carbon," a field of climate science that emphasizes the role of the oceans in cleaning up humanity's mess. In 2009, he had coauthored a United Nations report that publicized two key findings. First, the majority of anthropogenic carbon emissions are absorbed into the sea. Second, a tiny fraction of the ocean floor—the 0.5 percent that's home to most of the planet's mangrove forests, salt marshes, and seagrass meadows—stores more than half of the carbon found in ocean sediments.

After the task force, the two men got to talking. Duarte told Chami that scientists had recently mapped what he believed to be 40 percent of the world's seagrass, all in one place: the Bahamas. The plant was a sequestration power house, Duarte explained. And around the world, it was under threat. Seagrasses are receding at an average of 1.5 percent per year, killed off by marine heat waves, pollution, development.

Chami was intrigued. Then he did a rough estimate for the worth of all the carbon sequestered by seagrass around the world, and he got more excited. It put every other number to shame. The value, he calculated, was \$1 trillion.

Seagrass has a long history of being ignored. Though it grows in tufted carpets off the coast of every continent but Antarctica, it is a background character, rarely drawing human attention except when it clings to an anchor line or fouls up a propeller or mars the aesthetics of a resort beach. Divers don't visit a seagrass meadow to bask in its undulating blades of green. They come to see the more charismatic creatures that spend time

there, like turtles and sharks. If the seagrass recedes in any particular cove or inlet from one decade to the next, few people would be expected to notice.

When Duarte began studying seagrasses in the 1980s, “not even the NGOs cared” about what was going on in the meadows, he recalls. But he had a unique perspective on unloved environments, having tramped around bogs and swamps since graduate school and gone on dives in the submerged meadows off Majorca. The more he studied the plants, the more he understood how valuable they could be in the fight against climate change.

Seagrasses are the only flowering plants on Earth that spend their entire lives underwater. They rely on ocean currents and animals to spread their seeds (which are, by the way, pretty tasty). Unlike seaweeds, seagrasses not only put down roots in the seabed but also grow horizontal rhizomes through it, lashing themselves together into vast living networks. One patch of Mediterranean seagrass is a contender to be the world’s oldest organism, having cloned itself continuously for up to 200,000 years. Another growing off the coast of Western Australia is the world’s largest plant.

Those massive networks of rhizomes, buried beneath a few inches of sediment, are the key to the seagrasses’ survival. They’re also how the plants are able to put away carbon so quickly—as much as 10 times as fast, Duarte eventually calculated, as a mature tropical rainforest. And yet, no one could be convinced to care. “I nicknamed seagrass the ugly duckling of conservation,” he told me.

Then one day in 2020, Duarte connected with a marine biologist named Austin Gallagher, the head of an American NGO called Beneath the Waves. Gallagher was a shark guy, and the seagrass was largely a backdrop to his work. But his team of volunteers and scientists had spent years studying tiger sharks with satellite tags and GoPro cameras, and they had noticed something in the creatures’ great solo arcs around the Bahamas: The sharks went wherever they could find sea turtles to eat, and wherever the sea turtles went, there were meadows of seagrass. From the glimpses the team was getting on camera, there was a lot of it.

Gallagher knew about Duarte's work on seagrass carbon through his wife, a fellow marine scientist. Together, the two men came up with a plan to map the Bahamian seagrass by fitting sharks with 360-degree cameras. Once they verified the extent of the meadows, Chami would help them value the carbon and organize a sale of credits with the Bahamian government. The project would be unique in the world. While some groups have sought carbon credits for replanting degraded seagrass meadows—a painstaking process that is expensive, uncertain, and generally limited in scale—this would be the first attempt to claim credits for conserving an existing ecosystem. The scale would dwarf all other ocean-based carbon efforts.

The government was eager to listen. The Bahamas, like other small island nations, is under threat from sea-level rise and worsening natural disasters—problems largely caused by the historical carbon emissions of large industrialized nations. In 2019, Hurricane Dorian swept through the islands, causing more than \$3 billion in damage and killing at least 74 people; more than 200 are still listed as missing. For the government, the idea of global carbon emitters redirecting some of their enormous wealth into the local economy was only logical. “We have been collecting the garbage out of the air,” Prime Minister Philip Davis said to a summit audience last year, “but we have not been paid for it.”

The government formalized its carbon credit market last spring, in legislation that envisions the Bahamas as an international trading hub for blue carbon. Carbon Management Limited, a partnership between Beneath the Waves and local financiers, will handle everything from the carbon science to monetization. (The partnership, which is co-owned by the Bahamian government, will collect 15 percent of revenue.) The plans at first intersected with the booming crypto scene in the Bahamas, involving talks to have the cryptocurrency exchange FTX set up a service for trading carbon credits. But after FTX collapsed and its CEO was extradited to face charges in the US, the organizers changed tack. They project that the Bahamian seagrass could generate credits for between 14 and 18 million metric tons of carbon each year, translating to between \$500 million and more than \$1 billion in revenue. Over 30 years, the meadows could bring in tens of billions of dollars. Far from being an ugly duckling, the seagrass would be a golden goose.

Seagrass is the “ugly duckling of conservation,” Carlos Duarte says. He calculated that the plant may put away carbon at 10 times the rate of a mature rainforest.

Duarte sees the project in the Bahamas as a blueprint (pun intended, he says) for a much grander idea that has animated his work for the past two decades: He wants to restore all aquatic habitats and creatures to their preindustrial bounty. He speaks in terms of “blue natural capital,” imagining a future in which the value of nature is priced into how nations calculate their economic productivity.

This is different from past efforts to financialize nature, he emphasizes. Since the 19th century, conservationists have argued that protecting bison or lions or forests is a sound investment because extinct animals and razed trees can no longer provide trophies or timber. More recently, ecologists have tried to demonstrate that less popular habitats, such as wetlands, can serve humanity better as flood protectors or water purifiers than as sites for strip malls. But while these efforts may appeal to hunters or conservationists, they are far from recasting nature as a “global portfolio of assets,” as a Cambridge economist described natural capital in a 2021 report commissioned by the UK government.

Duarte and I first met in the halls of a crowded expo at the 2022 UN Climate Conference in Sharm el-Sheikh, Egypt. He had traveled a short distance from his home in Jeddah, where he oversees a wide array of projects, from restoring corals and advising on regenerative tourism projects along Saudi Arabia’s Red Sea coast to a global effort to scale up seaweed farming (using, yes, revenue from carbon credits). In Egypt, Duarte was scheduled to appear on 22 panels, serving as the scientific face of the kingdom’s plan for a so-called circular carbon economy, in which carbon is treated as a commodity to be managed more responsibly, often with the help of nature.

Chami was there too, wearing a trim suit and a pendant in the shape of a whale’s tail around his neck. He was participating as a member of the Bahamian delegation, which included Prime Minister Davis and various conservationists from Beneath the Waves. They had arrived with a pitch for how to include biodiversity in global discussions about climate change. The

seagrass was their template, one that could be replicated across the world, ideally with the Bahamas as a hub for natural markets.

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The UN meeting was a good place to spread the gospel of seagrass. The theme of the conference was how to get wealthy polluters to pay for the damage they cause in poorer nations that experience disasters such as Hurricane Dorian. The hope was to eventually hammer out a UN agreement, but in the meantime, other approaches for moving money around were in the ether. Since the 2015 Paris Agreement, countries had been forced to start accounting for carbon emissions in their balance sheets. Big emitters were lining up deals with cash-poor, biodiversity-rich nations to make investments in nature that would potentially help the polluters hit their climate commitments. Chami's boss at the IMF had suggested that nations in debt could start to think about using their natural assets, valued in carbon, to pay it off. "All of these poor countries today are going to find out that they're very, very rich," Chami told me.

At a conference where the main message often seemed to be doom, the project in the Bahamas was a story of hope, Chami said. When he gave a talk about the seagrass, he spoke with the vigor of a tent revivalist. With the time humanity had left to fix the climate, he told the audience, "cute projects" weren't going to cut it anymore. A few million dollars for seagrass replanting here, a handful of carbon credits for protecting a stand of mangroves there—no, people needed to be thinking a thousand times bigger. Chami wanted to know what everyone gathered in Egypt was waiting for. "Why are we dilly-dallying?" he asked the crowd. "So much talk. So little action."

One day this past winter, a former real estate developer from Chattanooga, Tennessee, named David Harris piloted his personal jet over the Little Bahama Bank. From his cockpit window, the water below looked like the palette of a melancholic painter. Harris was bound for a weed-cracked landing strip in West End, Grand Bahama, where he would board a fishing boat called the *Tigress*. Harris and his crew—which included his 10-year-

old daughter—would spend the rest of the week surveying seagrass meadows for Beneath the Waves.

They were tackling a great expanse. While the total land area of the Bahamas is a mere 4,000 square miles, the islands are surrounded by shallow undersea platforms roughly 10 times that size. These banks are the work of corals, which build towering carbonate civilizations that pile atop one another like the empires of Rome. When the first seagrasses arrived here about 30 million years ago, they found a perfect landscape. The plants do best in the shallows, closest to the light.

Harris, who speaks with a warm twang and has the encouraging air of a youth baseball coach, had been traveling to the Bahamas for years in pursuit of dives, fish, and the occasional real estate deal. He met Gallagher on a fishing trip and soon began helping with his tiger shark advocacy. That work was an exciting mix of scientific research—including dives alongside the notoriously aggressive animals—and playing host to crews for Shark Week TV programs and their celebrity guests. Eventually, Harris sold his company, retired, and threw himself into volunteering full-time.

He had not expected to spend his days looking at seagrass. But here he was, leading a blue carbon expedition. With help from Duarte, Beneath the Waves had created its shark-enabled seagrass map. The group pulled in a Swedish firm to scan the region using lidar cameras affixed to a small plane, allowing them to peer through the water and, using machine learning, infer from the pixels how dense the meadows were.

Now Harris and his crew were validating the aerial data, a painstaking process that required filming dozens of hours of footage of the seafloor and taking hundreds of sediment cores. The footage was meant to verify the lidar-based predictions that separated the seagrasses from beds of empty sand and algae. The cores would be sent to a lab in a prep school outside Boston, Gallagher's alma mater, where they would be tested for their organic carbon content. When all the data was combined, it would reveal how much carbon the meadows contained.

The *Tigress* was set to autopilot along a straight line, hauling GoPro cameras off the starboard side. From this vantage, the scale of the task was

easy to appreciate. At a lazy 5 knots, each line took about an hour. This patch of sea—one of 30 that Beneath the Waves planned to survey around the banks—would require about 20 lines to cover. Harris’s daughter counted sea stars and sketched them in a journal to justify a few days off from school. Her father surveyed the banks in hopeful search of a shark. At the end of each line, the crew retrieved the cameras, dripping with strands of sargassum, and swapped out the memory cards.

Harris’ crew would eventually present their protocol for assessing the carbon storage potential of seagrass to Verra, a nonprofit carbon registry. Verra develops standards to ensure there’s real value there before the credits are sold. To meet the organization’s requirements, Beneath the Waves must prove two things: first, that the seagrass is actually sequestering carbon at the rates it estimates; second, that the meadows would put away more carbon if they were protected. No one is going to pay to protect a carbon sink that would do fine on its own, the thinking goes. A billion-dollar opportunity requires a commensurate threat.

Harris told me that Beneath the Waves was still in “the exploratory phase” when it came to quantifying threats. They had various ideas—mining near shore, illegal trawl fishing, anchoring, water quality issues. As far as the carbon calculations went, though, Harris and his team felt confident in their approach. Prior to the outing on the *Tigress*, Beneath the Waves had already set up a for-profit company to bring its tools and methods to other blue carbon projects. It was in talks with government officials from across the Caribbean, Europe, and Africa. (Gallagher told me the company would pass the profits back to the nonprofit to continue its advocacy and research.)

Meanwhile, the head of Carbon Management, the scientific and financial partnership behind the project, told me he was pitching the investment to his clients, mostly “high-net-worth individuals” looking to diversify their portfolios while fighting climate change. Oil companies and commodities traders are interested too, he told me, as well as cruise lines and hotels that do business in the Bahamas. The Bahamian government has not yet said how it will allocate the money from the seagrass project. Hurricane recovery and preparedness could be on the list, as could seagrass conservation.

The *Tigress* crew worked until the light began to fade, then headed back to port. Harris said he was happy to be doing his part out on the water. All that money would be a good thing for the Bahamas, he thought, especially as the country planned for a future of bigger storms. In the days after Hurricane Dorian, which hit Grand Bahama with 185-mph winds and heaved the shallow waters of the Banks over the land, Harris had flown to the island to help a friend who had survived by clinging to a tree along with his children. The storm's legacy is still apparent in ways small and large. At a restaurant near the *Tigress'* berth, there was no fresh bread—"not since Dorian," when the ovens were flooded, the waitress told me with a laugh. Then she stopped laughing. The recovery had been slow. The young people and tourists had not come back. The airport had not been repaired. She wondered where her tax dollars were going.

That night, over dinner in the ovenless restaurant, Harris showed me a photo of his vintage Chevy Blazer. He said he hoped the seagrass project would generate enough carbon credits to offset the old gas-guzzler. This was a joke, obviously, but it expressed a deeper wish. The promise of carbon credits is that, wielded in their most ideal form, they will quietly subtract the emissions humans keep adding to the atmospheric bill. Every stroke of a piston, every turn of a jet engine, every cattle ranch and petrochemical plant—every addiction that people can't give up, or won't, or haven't had a chance to yet—could be zeroed out.

For governments, assigning nature a concrete value could take many forms. They could encourage the development of sustainable ecotourism and aquaculture, where the value of the ecosystem is in the revenue it creates. Or they could confer legal rights on nature, effectively giving ecosystems the right to sue for damages—and incentivizing polluters to not damage them. But in Duarte's 30 years of advocating for creatures and plants like seagrasses, politics have gotten in the way of biodiversity protections. Only carbon trading has "made nature investable," he says, at a speed and scale that could make a difference.

That is not to say he loves the system. Carbon credits arose from a "failure to control greed," Duarte says. Beyond that, they are not designed for the protection of nature; rather, they use it as a means to an end. Any plant or

creature that packs away carbon, like a tree or a seagrass meadow—and perhaps an elephant or a whale—is a tool for hitting climate goals. It's worth something. Any creature that doesn't, including those that Duarte loves, like coral reefs, is on its own.

Duarte also worries about “carbon cowboys” trying to make a buck through sequestration projects that have no real scientific basis or end up privatizing what should be public natural resources. Even projects that seem to adhere closely to the market’s rules may fall apart with closer scrutiny. Earlier this year, a few weeks after the *Tigress* sailed, *The Guardian* [published an analysis](#) of Verra’s methodologies that called into question 94 percent of the registry’s rainforest projects. Reporters found that some developers had obtained “phantom credits” for forest protection that ended up pushing destruction one valley over, or used improper references to measure how much deforestation their projects avoided. (Verra [disputes](#) the findings.)

When it comes to carbon arithmetic, trees should be a relatively simple case: addition by burning fossil fuels, subtraction by photosynthesis. The forestry industry has honed tools that can measure the carbon stored in trunks and branches. And yet the math still broke, because people took advantage of imperfect methods.

Seagrass is also more complex than it might seem. After an initial wave of enthusiasm about its carbon-packing powers, increasing numbers of marine biologists expressed concerns when the discussion turned to carbon credits. For one thing, they argue, the fact that seagrass removes CO₂ through water, rather than air, makes the sequestration value of any particular meadow difficult to appraise. In South Florida, a biogeochemist named Bryce Van Dam measured the flow of CO₂ in the air above seagrass meadows. He found that in the afternoons, when photosynthesis should have been roaring and more CO₂ being sucked into the plants, [the water was releasing CO₂ instead](#). This was the result, Van Dam suggested, of seagrass and other creatures that live in the meadows altering the chemistry of the water. (Duarte contends that Van Dam’s premise was flawed.)

Another issue is that, unlike a rainforest, which stores most of its carbon in its trunks and canopies, a seagrass meadow earns most of its keep

belowground. When Sophia Johannessen, a geochemical oceanographer at Fisheries and Oceans Canada, took a look at common assessments of carbon storage in seagrass, she concluded that [many were based on samples](#) that were far too shallow. Though this carbon was considered permanently locked away, the sediment could easily be disturbed by animals or currents. When Johannessen saw the ways that nonprofits and governments were picking up the science as though it were gospel, she was stunned. “I hadn’t known about ‘blue carbon,’ so perhaps it’s not surprising they didn’t know about sediment geochemistry,” she told me.

Chami’s solution to these niggling scientific uncertainties is to focus instead on the global picture: Earth’s seagrass meadows sit atop vast stores of carbon, and destruction has the potential to visit all of them. He likens natural capital to the mortgage market. When a prospective homeowner gets a loan from a bank, the bank then sells the loan, which is swapped and bundled with other loans. Each loan contains unique risks, but the bundled asset controls for that uncertainty. Financiers have no problem with uncertainty, Chami notes; it is the locus of profit. The money they invest gets poured back into the mortgage market, allowing banks to issue more loans. The characteristics of the individual homes and borrowers don’t matter that much. “You can’t scale up when every case is a unique case,” he says. “You need to homogenize the product in order to make a market.” Scale is the bulwark against destruction. One seagrass meadow can be ignored; a seagrass market, which encompasses many meadows and represents a major investment, cannot.

When each ecosystem is treated the same—based on how much carbon it has socked away—the issue of quantifying threats becomes simpler. Chami cites the example of Gabon, which last year announced the sale of 90 million carbon credits based on recent rainforest protections. Skeptics have pointed out that nobody has plans to fell the trees. The government has replied that if it can’t find a buyer for the credits, that may change. In the Bahamas, Prime Minister Davis has invoked a similar idea. Seagrass protection, he has said, could be reframed as a payment to prevent oil companies from drilling in the banks for the next 30 years. Seen one way, these are not-so-veiled threats. Seen another, they reveal a fundamental

unfairness in the carbon markets: Why can't those who are already good stewards of nature's carbon sinks get their credits, too?

The numerous seagrass scientists I spoke with expressed a common wish that Chami's simplified carbon math could be true. Seagrass desperately requires protection. But instead [they kept coming back to the uncertainty](#). Van Dam compares the standard methods for assessing seagrass carbon to judging a business based only on its revenue. To understand the full picture, you also need a full accounting of the money flowing out. You need to trouble yourself with all of the details. This is why the rush to monetize the meadows—and offer justification for additional carbon emissions—worried him. "Now that there's money attached to it," he told me, "there's little incentive for people to say 'stop.'"

A few months after the *Tigress* outing, members of the Bahamian conservation community received invitations to a meeting in Nassau. The invitees included scientists from the local chapter of the Nature Conservancy and the Bahamas National Trust, a nonprofit that oversees the country's 32 national parks, as well as smaller groups. Gallagher kicked off the meeting with a review of what Beneath the Waves had achieved with its mapping effort. Then he came to the problem: He needed data about what might be killing Bahamian seagrass.

This problem wasn't trivial. The government's blue carbon legislation required that the project adhere to standards like Verra's, which meant figuring out how conservation efforts would increase the amount of carbon stored. Beneath the Waves was drawing a meticulous map of the seagrass and its carbon as they exist today, but the group didn't have a meticulous map from five years ago, or 30 years ago, that would show whether the meadows were growing or shrinking and whether humans were the cause.

Gallagher told me he is confident that the multibillion-dollar valuation of the seagrass reflects conservative assumptions. But the plan itself is in the hands of the Bahamian government, he said. Officials have not spoken much about this part of the process, despite early excitement about eye-popping valuations and rapid timelines for generating revenue. (Government officials declined multiple interview requests, referring

WIRED back to Beneath the Waves, and did not respond to additional questions.)

Some of the local conservation groups had received the meeting invitation with surprise. Among many Bahamians I spoke with, frustration had been simmering since Beneath the Waves first proclaimed its seagrass “discovery,” which it described as a “lost ecosystem that was hiding in plain sight.” Many locals found this language laughable, if not insulting. Fishers knew the seagrass intimately. Conservationists had mapped swaths of it and drawn up protection plans. “You’ve had a lot of white, foreign researchers come in and say this is good for the Bahamas without having a dialog,” Marjahn Finlayson, a Bahamian climate scientist, told me. (Gallagher said that as a well-resourced group that had brought the seagrass findings to the government, it only made sense that they would be chosen to do the work.)

It was not clear that any of the groups could offer what Beneath the Waves needed. For one thing, most locals believe the seagrass to be in relatively good condition. There are threats, surely, and interventions to be done, but as Nick Higgs, a Bahamian marine biologist, told me, they likely vary with the immense diversity of the country’s 3,100 islands, rocks, and cays. Higgs gave the example of lobster fisheries—an industry that many people mentioned to me as among the more potentially significant threats to seagrass. His own research found little impact in the areas he studied. But if the fisheries are harming seagrass elsewhere, who will decide their fate from one community to the next? Protecting seagrass is a noble goal, Adelle Thomas, a climate scientist at the University of the Bahamas, told me. The question for Bahamians, she said, is “Do we have the capacity to maintain these things that we’re claiming to protect?” Money alone won’t solve the seagrass’s problems, whatever they might turn out to be.

The creature at the heart of this debate appears to be in a sort of limbo. The prospect of a price has showered attention on seagrass, putting it in the mouths of prime ministers and sparking an overdue discussion about its well-being. Perhaps, if you ask Chami, it has helped people value the plant in other ways too—for how it breaks the force of storms hitting the islands, for the habitat it provides other animals, maybe even for its intrinsic right to go on growing for another 30 million years.

But can the math of the carbon market get it there? On one side of the equation, where carbon is added to the atmosphere, the numbers couldn't be clearer: They're tabulated in barrels and odometers and frequent flier accounts. On the other side, where carbon is subtracted, there is uncertainty. Uncertainty about how carbon moves through a seagrass meadow, or a whale, or an elephant, and how money moves to protect those species. What happens when the equation doesn't balance? More carbon, more heat, more Hurricane Dorians. A gift to polluters. As Finlayson put it, "You're taking something from us, throwing a couple dollars at it, and then you're still putting us at risk."

Chami has faith that the math will balance out in the end. He wants people to care about nature intrinsically, of course. But caring needs a catalyst. And for now, that catalyst is our addiction to carbon. "I'm conning, I'm bribing, I'm seducing the current generation to leave nature alone," he told me. Perhaps then, he said, the next generation will grow up to value nature for itself.

This story was reported with support from the UC Berkeley-11th Hour Food and Farming Fellowship.

Source imagery courtesy of Cristina Mittermeier, Guimoar Duarte (Portrait), Ralph Chami (Portrait), Drew McDougall, Wilson Hayes, Beneath the Waves, Getty Images, and Alamy.

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By [Jason Parham](#)

[Backchannel](#)

May 9, 2023 6:00 AM

Reality TV Saved Me

During the worst year of my life, I needed it more than ever. And I needed to understand why.

Photograph: Shawn Michael Jones

One Thing I was never told about reality TV—and I’m willing to bet you weren’t either—is that it can heal. Nobody tells you it’s a curative medium. What they do tell you about reality TV is everything else: how it’s reductive and superficial, how it’s cultural rot. It’s a circus, they shout. It microwaves the mind to mush.

It’s also the most dominant form of entertainment today. Reality TV has been called a “volume business”; many of us swallow whole seasons in a single sitting. The shows are operatic, polarizing, and unrepentant about what they are—all id and impulse. Name a setup, pastime, premise, gimmick, and it probably exists as a reality TV show.

This article appears in the June 2023 issue. [Subscribe to WIRED](#).
Photograph: Dan Winters

We refuse to look away. Or maybe it’s that we can’t. Perhaps it’s because we’re addicted to spectacle. Or because we demand our pop culture in every color, shape, and size. Everything is primed for content-making. No, seriously—*everything*. Across Instagram and TikTok and YouTube, we optimize our lives for the screen. We enjoy letting other people into our curated worlds and being let into theirs in return. It’s OK to admit it: You are good and truly hooked.

So am I. In the best of times, I watch a fair amount of reality TV. But it was only during this past year—one shot through with heartache, a breakup, and what felt like piled-up grief—that I came to depend on it. In a genre built on stock phrases and digestible tropes, let me offer one more: Reality TV saved me.

Last Spring, I grieved for a lost friend. By August, I grieved for my grandmother who was here and then suddenly wasn't. Weeks after that, I grieved for my relationship with T, one that had cratered right in front of me, one that I'd felt—finally—might not end in what-ifs, or end exactly as it did: with a lingering unanswered voice note. I felt like a bodiless thing outside myself.

Depression rose like a tidal wave, and then pulled me under. I went from working out six days a week to one, if that. Writing, which had always sustained me, felt like a chore. My diet was all over the place. I moved through the day with hesitancy. Present time was bad enough, but what intensified anxiety was the time ahead and unplanned, the tyranny of the minutes that were to come.

In all of this, what emerged was a feeling of inauthenticity. It wasn't as though I felt like a fraud or an imposter, the cheeky buzzwords people of my generation like to fling around. I just wasn't sure how to make it through the sadness this time. I was stuck on replay. I spoke to a professional but kept it a secret from almost everyone I knew. I wasn't ashamed. I just didn't feel like talking about it.

And then I did what I always do: I turned to TV. TV was easy. TV was a constant, a plane with the “ability to transmit and receive and then to apply layers of affection and longing and doubt,” as the media critic George W. S. Trow wrote in 1981.

I make no qualms about my dependency on reality TV. I especially love dating shows. At 37 and chronically single, I would describe my reality as a jumble of failed relationships, mostly trivial one-night stands, and maybe what could have been two or three chances at the kind of real love Mary J. Blige sang about all those years ago.

So I wasn't surprised when my year of grief turned into all-night binges of *Love Island*. But I was surprised by the depth of my need for this distraction. I wanted to understand it. There was one place I had to go.

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Kate Knibbs

It's just shy of noon on a Saturday in October, inside the Javits Center, when I hear a woman make a confession. "I just spilled my wine!" All around me, women and gay men of all ages are drinking wine, waiting in line for wine, searching for wine. They flash big smiles and wear big hair, sporting T-shirts with taglines that snap, "Who gon' check me boo?" The halls are frothing, at times uncontrollably, with people from all corners of the country, and I am not so much here as lost in the crowd—which will peak at around 30,000 attendees by weekend's end. This, in all its Botoxed glow and kitschy maximalism, is BravoCon.

Launched in 1980 as a cable network, Bravo is best known for its *Real Housewives* franchise, the glammed-up lifestyle soaps that follow groups of women in different locales (Orange County, Miami, Atlanta) as they raise kids, fall in and out of love, establish careers, and snipe shade like trained assassins. Once a year, Bravo superfans—"Bravoholics"—convene for a three-day, rosé-tinted reality palooza. Part empowerment summit, part celeb meet-and-greet, BravoCon is a sharp distillation of how reality, as an

entertainment genre and a business, gets manipulated beyond the frame of television. I thought it might give me some insight into my obsession.

How to describe the convention? The whole thing isn't real—it's *too* real. At one point, I witness fans boo *Beverly Hills* Housewife Lisa Rinna, looking every bit the Bond villain in a vibrant tangerine pantsuit, as she crosses the convention floor. At the brand bazaar, I sample a lasagna-flavored Lay's chip (inspired by *New York City* Housewife Dorinda Medley's lasagna) and spot Jake from State Farm (yes, that Jake from State Farm) surrounded by a circle of grinning women, posing for photos as they cheer "One more!" Many of the Housewives have booths set up, hawking their latest products: moisturizers, lip gloss, candles, lube, "camel-toe-proof" underwear, dildos. During one of the scheduled cast discussions, *Potomac* Housewife Karen Huger exclaims, "I am not produced!"

That Saturday morning, before my tour of the convention grounds, and before more than 140 "Bravolebrities" begin sweet-talking fans for the next nine hours, an NBCUniversal rep semi-jokingly tells me that Bravo fandom is "like a cult." I get a taste of that devotion when I remark to a woman from California that the most recent season of *The Real Housewives of Atlanta* is a far cry from the show's pioneering early days. She pauses for a beat, sizes me up. "It's still everything," she says. This is no place for nonbelievers.

Loyalty is a requirement in the Kingdom of Bravo—but not only that. As one development exec behind *Love Is Blind* puts it to me: Fans want to be involved themselves. Sure enough, during a panel with *Potomac*'s Ashley Darby, a young man approaches the mic and confesses, though it comes off more like a brag, that he has had sex with her ex-husband. Darby's divorce was a major plot point last season. The audience lets out a collective gasp. My initial reaction—*Oh shit!*—dissolves in an instant because I can't escape the fact that I secretly love that this is happening.

Which is maybe the point. Which is maybe exactly the point.

This is what makes reality TV so mouthwatering. The pageantry of destruction—a failed marriage, a cringeworthy date, the betrayal of a friend—should perhaps not entice the eyes, yet it is often the sole reason for our

looking. As I watch Darby squirm and then toss it off with a smile, I am struck by an odd feeling. All weekend, my memory on loop, I've been replaying the end of my relationship with T. Yet here I am, amused by the ruin of someone else's, knowing damn well I'd hate for my worst moments to be turned into a public punch line.

Our relationship to reality TV has never been bound by moral purity, or even good manners. "For all its carnivalesque aspects, the genre reflects how steadfastly we cling to simplistic, collective notions about who and what is legitimate and 'real,'" the sociologist Danielle J. Lindermann writes in [True Story: What Reality TV Says About Us](#). "But in doing so, it allows us to poke at these assumptions, revealing the socially constructed natures of what we consider to be 'true,' 'normal,' 'healthy,' 'legitimate,' and 'good.' The genre exposes our conservative reality, but it also exposes *reality itself* to be a social fiction."

At BravoCon, this is especially evident, and it's what I take away. My deeper need for reality TV? It starts with the fact that it makes me feel good about feeling bad.

Photograph: Shawn Michael Jones

Back when I was 14—a piston of arousal—I was instantly horny for *Blind Date*. I loved how primal the show was. The premise was purposefully uncomplicated: Two people go on a date. The result was a zoo of human behavior. Contrast that with *The Real Housewives of Dubai*, Bravo's 11th iteration of the megafranchise. When it premiered last year, the women materialized as precooked avatars, lacking the originality and surprise of their forebears (minus Chanel Ayan; she's a hoot).

This air of performance is typical of the genre today. Every viewer knows it: Events are planned, tensions fluffed, storylines steered. There now exists—it's almost too obvious to point out—a whole industry, from gossip blogs and podcasts to full-on scripted dramas, that tracks behind-the-scenes manipulations on shows like *The Bachelor*. In some cases, cast members are pushed into uncomfortable situations, with minimal concern for their well-being.

A week after BravoCon, I call Michael Montgomery. He's a veteran producer of reality TV, and he tells me, though I don't believe him at first, that in the future the form will no longer hinge on the elaborately crafted drama we have come to expect. All the human error and tart moral knottiness that defines so much of the reality TV we watch will soon be a thing of the past. "I don't feel like there is much of an appetite for conflict anymore," Montgomery says. "People are tired of it."

Montgomery wants to take reality TV into (back to?) a more authentic place. I press him on this. I ask him to define it. Selfishly, I want to know for myself. But I don't say that. That fall day over the phone, I don't show my scars. *What do you mean exactly?* I say instead. Montgomery laughs, as if he's been waiting for someone to ask just these questions.

Montgomery has been involved in everything from morning talk shows and *Celebrity Big Brother* to Sacha Baron Cohen's *Da Ali G Show* and Russia's adaptation of *The Apprentice*. And who could forget the David Hasselhoff travel show? He also spent time at 3 Ball Productions, famous for developing *Bar Rescue* and *Extreme Weight Loss*, among other genre staples. Now, Montgomery wants to reinvent the genre.

This, he tells me, is how Seen came to be. Seen is "a reality show in a dating app's body." I'd heard of it before our call. The app is all about radical transparency; it does away with any last vestige of anonymity. When sifting through potential daters, Montgomery says, Seen does more than "reduce people" to the usual cropped headshot and pared-down bio. It transforms one's profile into a buffet of personal detail. It's primed for the social media age, where "your content is your conversation." Interested in a prospective dater? You can see who they've already matched with, previous text exchanges, even video chats. Nothing is off-limits. "When people first hear about this, they think it sounds crazy," Montgomery says, punctuating the claim with more laughter. "But it's not nearly as scary as it sounds."

PHOTOGRAPHS: SHAWN MICHAEL JONES

Seen isn't just a dating app in the way Tinder and Bumble are, where the end goal, more often than not, is for two people to make a genuine connection, or at the very least hook up. Seen is a means to a more efficient

reality TV landscape. The app works as an incubator for Montgomery's slew of potential reality shows—"dater-tainment," he's tagged them. If you sign up to be featured on a prospective show and clear a casting process, you're a "verified dater."

"There was a natural connection between dating apps and some sort of machine that would generate reality stories for us," Montgomery says. Reality TV, to him, is a dinosaur stuck in the past. He wants the old ways to die. He wants to shepherd in what he calls the "reactive" format. The future "lies in plugging into a lot of the user-generated content that's out there. And plugging into it in a way that gives producers the ability to track multiple stories in real time."

I express skepticism. Montgomery, who is 52, is quick to shoot back. "You're not the first." Still, I want to hear more. Maybe what he is attempting to pull off is, in a way, the beginning of a turning point in how the genre is produced, in determining the stories told. He wants the genre to be more than a gimmick or a ploy for attention. "When you make reality shows," he says, "quite often talent will turn to you behind the camera and go, 'Hey, what do you want me to do next?' The moment talent does that, you understand that in their head, they are being directed down a storyline by the producer and director. That was a symptom of the old format."

At the moment, Seen averages 5,000 monthly active users, most of whom are based in San Diego, where Montgomery is testing the market. (Last year he launched a casting event there called 500 First Dates.) He says he hopes to raise \$10 million in funding by the end of this year and shoot 150 to 200 episodes, which will live on an ad-funded streaming channel as proof of concept. He's in discussions with various big-name streamers. "Our mission," Montgomery emphasizes, "is for it to be authentic and uplifting."

I understand his vision, I think. Some version of Montgomery's scheme probably *is* the future of reality TV. But I also wonder whether Montgomery gets something about that word wrong. *Authenticity* doesn't mean what it used to. It's different for everybody now.

In the 1960S, the political historian Daniel J. Boorstin predicted the rise of influencers, suggesting that individuals would become famous simply for

their “well-knownness.” In *The Image*, he theorized that people were finding less relevance in facts. What would soon matter was the “convenience” of a given fact to a person’s own story, to their own life. Today, enjoying reality TV is a matter of your subjective view, the convenience of what you choose to buy into or not. If a nice woman from California still thinks *Real Housewives* is “everything,” so be it. It no longer matters how believable a storyline or character is, but instead who it is real to.

In season 3 of the American version of *Love Island*, a love triangle between housemates becomes a focal point of the show. Basically, Cashay liked Cinco and Cinco liked Cashay, so they “coupled” (show lingo for “they shared a bed”) until the next recoupling ceremony; remaining single contestants are booted from the villa. But Trina also liked Cinco. And hearing that Trina liked him, Cinco realized he liked her. So they became a couple. Attempting to move on, Cashay coupled with Charlie, which only made Cinco, who was coupled with Trina, miss Cashay even more.

During that recoupling ceremony, the camera freezes on Cinco, and what he cannot bring himself to utter in that moment—“I miss you, Cash, and I want you back”—is unnervingly clear. I recognized it. I knew it. It’s in everything he doesn’t say. I saw his mind do that familiar thing, rewinding back, back, back to that before place. It’s the same place I go when I want to remember the best of what T and I shared. What I imagined Cinco asked himself that night was the same thing I’d ask myself the week following our split: *What if I hadn’t gotten afraid? What if I hadn’t messed up?*

In moments like these—the messiest moments—reality TV is realest to me. For all those hours and days and weeks on my couch, as my world fell apart, I wasn’t just looking for those moments. I was reaching for them. For the recognition, the mess, the permission to let go. And the more I reached, the lighter I felt.

The thing about reality, on TV as in life, is that it’s only predictable until it isn’t. Maybe that’s what Montgomery was getting at when he kept using the word *authenticity*. To truly capture it, you can’t engineer control. You must accept the loss of it.

These days, my depression doesn't feel as stifling. I still encounter the occasional fog, but it isn't as dense. I see reality TV for what it is. In this space, one's drama and grief don't carry the baggage of shame but arc toward a kind of redemption. Not all fluff and sunshine, but something, yes, realer. In this ending, redemption is accepting things for what they are and moving forward in a way that acknowledges the weight of what happened without losing sight of who I can still be.

Some mornings, when I decide to work from home, I turn on *Watch What Happens Live*. It's Bravo's reality TV talk show, hosted by Andy Cohen, about reality TV. It plays in the background as I scroll Twitter, check emails, "make" coffee in my Keurig. Where is this new place I find myself in, this reality I'm both making up and giving in to all at once? It's not so bad. Maybe it's a total mess. I kinda like it.

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[Maria Streshinsky](#)

[Backchannel](#)

May 4, 2023 6:00 AM

Where to Find the Energy to Save the World

Jamie Beard is pouring everything into a singular vision: Tap into the awesome potential of geothermal power in Texas, and beyond. She has no time to lose.

Photograph: Dan Winters

jamie beard was worried. She was at the wheel of a black Toyota Prius, multitasking at 80 mph down the Hardy Toll Road out of George Bush Intercontinental Airport. Just before picking me up, she had been interviewed for a national TV news show. Now, swerving through lanes, she was running through various shit scenarios: What if something she said pisses off one of the [oil](#) and gas executives she had come to adore, or one of her fellow [climate activists](#)?

As she was ruminating and driving, a Ford F-150 with tires higher than the Prius is tall squeezed by us in the fast lane, so close that Jamie gripped the wheel tight to keep the little car steady. One side of her hair was buzz-cut; the other was a bob. It, like the rest of her, was steady and roiling at the same time. “Welcome to Texas,” she hollered. A grin spread across the small oval face that makes her look more 24 than 44, and she turned her attention to our destination: “Just wait until you see the Woodlands. The cops patrol the streets on white horses!”

The Woodlands is a self-described master-planned destination about 30 miles north of downtown Houston, developed in the 1970s by George Mitchell. A Texas legend. He’s the guy who made it financially viable to

fracture rock and extract natural gas from shale. Now, nearly 50 years on, the suburb is a bonanza of luxury homes, hotels, woods, condominiums, and fountains with musical water shows—and offices of some of the biggest oil and gas companies in the world. Big Oil Palooza. As we sped closer to our hotel, home base for this whirlwind trip, Jamie started rolling through our tightly packed schedule of meetings with current and former oil industry folks: drillers, startup founders, geologists, CEOs at multinational corporations. When she took a breath, I asked her about the new Earth-piercing technologies that she was excited about. And I asked her about fracking. Then she remembered her worries. And got anxious again.

The anxious energy, the worries, they were because Jamie—an [energy](#) lawyer and entrepreneur and lifelong environmentalist (“the kind that would have chained myself to a tree”)—was desperate not to screw up the delicate plans she’d been orchestrating for the past six years. They’re big. Too big, and she knew it. But she was certain that if she could put in all the days and hours and minutes she could possibly spare, and if she could [get the right people talking](#) to each other and help raise the money for a bunch of startups and better tech, she might, just might, just *maybe* help harness all those people to actually, fabulously, fairly [cleanly](#) solve [the world’s energy needs](#). Yeah.

So Jamie talked fast. She didn’t waste time. As we walked to dinner near the Woodlands Waterway Marriott, her sentences piled up: “We can’t sit around and twiddle thumbs and try to have working groups and retreats with environmental organizations and oil and gas. There’s just no time for that shit. It’s going to have to get on an exponential curve now. *Now.*” The word came out as if shot from a cannon: Now!

Sage Geosystems used a Nabors F-35 drilling rig at its geothermal test site in Starr County, Texas. It can drill to about 25,000 feet and lift and suspend 1 million pounds.

Photograph: Dan Winters

I met Jamie at a TED conference in August 2021, where she [gave a talk](#) called “The Untapped Energy Source That Could Power the Planet.” As she paced the stage, her sentences, tinged with a gentle Southern drawl, rose up,

then softened, then lifted again with enthusiasm: “What we’re talking about here is a pivot from hydrocarbons to heat,” she said. She talked about this awesome abundant green resource, and how we (right now!) have this mighty industry that knows how to get it. She was also, for sure, making some people in the room squirm at the thought of sleeping with the enemy. She seemed undaunted: “If we want to turn the ship, we recruit the sailors.”

After the conference, we talked, then started emailing, her energy ricocheting out of my inbox. *Ping!* She invited me to meet her in Texas. Come see! I was tempted. “I wish, but my life is too complicated,” I told her. Husband, cancer, medical appointments. He and I were on year four of what we’d been told might just be two.

Within minutes she responded, “My life is complicated too.” She attached a picture of herself lying on a floor, reading a book to her young son. He looked like he was in a hospital gown. “I hear you,” she wrote.

This article appears in the June 2023 issue. [Subscribe to WIRED](#). Photograph: Dan Winters

So there I was in Texas—while my husband was at home sorting his morning and nighttime meds. And Jamie was racing through the world with the relentless intensity of a person whose life, the minute they slow down, will be consumed with personal trauma, and the only viable thing to do was to run fast at something that matters enough to dull the existential ache inside. For Jamie, that meant harnessing the heat from below the Earth’s surface in the form of [geothermal energy](#). And she was hell-bent to start in the heart of the hydrocarbon industry, the kingdom of crude, Texas.

If you’re not one of the half million people on an airplane or 10 astronauts in space at this very moment, you are standing on a giant nuclear ball. There’s a truly monstrous source of heat below our feet. For a long time, people have been gathering that heat and using it to warm nearby buildings or turn turbines that generate electricity. [Iceland](#) gets about two-thirds of its energy—and nearly 100 percent of its heat—from geothermal sources. The city of Boise, Idaho, uses geothermal to warm some downtown buildings, and it has for more than a century. The first geothermal power plants built in the United States, put online in 1960, can send about 835 megawatts of

electricity onto the California grid in a place called the Geysers. That kind of geothermal power—which a lot of engineers call hydrothermal, and which the folks in Texas call “your grandma’s geothermal”—is harvested in places where tectonic plates have left fissures. Those fissures offer easy pathways for steam to rise to the Earth’s surface. This easy energy, grandma’s, is only a tiny fraction of what’s possible.

What Jamie was aiming to do is the hard part: create geothermal *everywhere*. That meant figuring out how to corral the heat [from all of the dry rock below ground](#). That heat could provide a reliable, abundant, always flowing source of power. No need for the sun to shine or the wind to blow. No need for batteries to store it all. And it wouldn’t be geopolitically volatile, subject to complicated supply chain disruptions.

Jamie was living in a crisis already. She was not deterred. To her, there are problems in everything big. being afraid of them helps nobody, and the climate doesn’t have time.

There were, of course, hurdles. Big hurdles. Just a few: (1) Investment. Like most big energy projects, geothermal demands huge up-front funding, but the federal government hasn’t provided consistent support like it did with solar, wind, even fossil fuels. And private markets didn’t want to touch it. (2) Information, even the basics. We don’t know enough about the conditions below the surface—exactly what kind of rock is where, how hot it is, what kind of pressure it’s under—and what drilling methods to use. (3) Salability. Given the costs of the tech and construction for a geothermal power plant, it isn’t yet obvious that an operator could sell the electricity at a reasonable price.

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Rhett Allain

This is to say, the financials have been driving stakes into the heart of geothermal projects for years. “Early return on investment is miserable—half of the investors would be dead before they made money on it,” Tony Pink, a VP at a drilling company, told me.

Add to all that, a lot of the people who are in powerful enough positions and care deeply about the health of the planet might have to get on board with something else: hydraulic fracturing. *Fracking?* Forcing cracks into subterranean rocks to get at the heat inside. Forget it. The word brings worries about contamination from chemicals pushed into and out of the Earth (lead, salt, acid, more) and “seismicity,” or earthquakes. Then, talk about geothermal with lawyers and bureaucrats and all they can think of are the regulations you need to write, legal issues to parse.

But Jamie was living in a crisis already. She was not deterred. To her, there are problems in everything big. Being afraid of them helps nobody, and [the climate doesn't have time.](#)

the words that pour from Jamie form their own little electrical charges: enthusiasm, exclamation, expletive. (“Have you heard this whole narrative about oil rig electrification? That’s fucking greenwashing. Don’t give me that shit. Right?”) She was born in Georgia, raised in southern Alabama. In undergrad at Appalachian State University, she got a degree in industrial technology, focusing on alternative energy. By 2004, after chapters as a climate activist and rock-climbing instructor, she was living in Massachusetts, getting a law degree at Boston University. After that, she took a job at a giant law firm in the environment and energy department. She thought she’d be able to make a difference as an insider. Turns out, not so much. On April 20, 2010, the Deepwater Horizon rig exploded, killing 11 workers and spilling 4 million barrels of oil into the Gulf of Mexico. Jamie watched the live feed of the spill for a week from her comfortable

office. Big Oil hired companies like the one she was working at for its defense. She resigned.

Around the same time, Jamie met an engineer (“You know, crazy mad-scientist dude”) who’d invented a new kind of ultracapacitor—a device for storing and delivering energy, like a battery but with different guts. He was starting a company. She signed up. Early on, the idea was to use ultracapacitors in electric vehicles. They also happened to work well in extreme conditions—like when a hulking drill is boring into intense heat, pressure, and violence underground. Jamie started spending a lot of time on oil and gas rigs in Canada, Denver, West Texas.

One day, while reading about green energy technologies, she came across [a report](#) from MIT and the US Department of Energy called *The Future of Geothermal Energy*. It made the case that we could vastly expand our use of heat from the core of the Earth. She was riveted: You could power the entire country 2,000 times over. Wow. But something else really stuck for her, she says. “This is a set of engineering problems? And then energy is *solved*? Holy shit, we should do this.”

“It was a little bit pie-in-the-sky,” she admits, “pretty moonshot.” She kept working with the ultracapacitor, getting out in the oil field. And she moved to Texas. It just so happened that the industry was in the thick of the shale boom, and engineers were working to quickly iterate. Jamie saw engineers refine, say, directional drilling technology that could shave thousands of dollars off every foot to grind. She realized she was now alongside the very people who could make geothermal everywhere happen. “I was like, dude, it’s going to need to be the oil and gas industry.” So Jamie quit the ultracapacitor.

She was also excited because she was pregnant.

She convinced the University of Texas at Austin to hire her into a role as the director of an entrepreneurship center. She went after a \$1 million grant from the Department of Energy for the school to start a program focused on geothermal—and got it. She called it [the Geothermal Entrepreneurship Organization](#), or GEO. Her aim was to build a thriving geothermal

ecosystem within the oil and gas industry. Texans already had all the skills: They were engineers, geologists, rig operators, oil-field roughnecks.

The future seemed so *possible*.

when her son was a few weeks old, Jamie knew something was very wrong. He cried for days. He would quiet for an hour, then cry again. She just sensed he was in pain. For two years, doctors handed her a litany of possible diagnoses, including that it was in her head. Finally, she found a neurologist who—maybe just to get this intense single mother out of the office—offered to do a genetic test.

Her son had a metabolic disorder called [mucopolysaccharidosis](#) (MPS) type II, or Hunter syndrome. That meant he was missing a snippet of DNA that codes for an enzyme necessary to break down cellular waste. He'd inherited the deletion from her. "His cells just get progressively damaged," she told me over dinner, glancing away. "They're not able to take the trash out." His organs were being slowly destroyed. Her son's version of the disease was both rare and severe. "Maybe one in a million," she said. She found out he probably had about 10 years to live.

When she managed to calm her boy, get him to sleep, or have a nanny help out, Jamie started interviewing doctors and reading everything she could about MPS. Then she came across a paper out of Japan, a study of stem cell transplants on MPS II kids. Doctors had rebuilt the children's immune systems. "Kill your blood factory, replace it with a new one," Jamie explained. Duke University was doing a related study.

By the time her son was 3, the damage done to his organs was profound. He was never going to be verbal; his development essentially stopped somewhere around 18 months, and then started declining. The transplant, docs explained, had a 10 or 15 percent fatality rate. Step one was basically destroying the patient's entire immune system with chemotherapy. Jamie's choices were excruciating: Go for the fences and do a science experiment, or watch him die for 10 years. Jamie went for the fences. She packed up her things in Texas. Her son became one of the first MPS II kids in the US to undergo the transplant.

For every detail Jamie told me, I could see pain. But she also spoke in technical, clinical terms—language I recognized from my husband’s years in and out of hospitals. During the six months Jamie and her son lived in the Duke hospital, she became habituated to speaking in crisis terms and moving at crisis velocity.

In the between moments—between doctor appointments, treatments, finding food her son would eat—Jamie kept her mind from spiraling into despair by calling anyone in Texas who would talk to her about a geothermal future. She’d met the former CTO of Halliburton at a conference. She called him. He told her to call Lance Cook, a former VP of technology and chief scientist at Shell. Geothermal sparked Lance’s curiosity. Jamie kept calling. The kind of geothermal she was after was spectacularly expensive. He got used to saying to Jamie, “That’ll never work.” Each time she hung up, she’d go read more, talk to more Texans. Then she’d call Lance again.

After a while, after talking to so many people, she ran up against a roadblock: The folks in oil and gas didn’t want to be the first to talk about geothermal; they were nervous about jumping in. So to get them talking to one another, and publicly, Jamie turned her energy to planning a five-day virtual conference, and she invited everyone, including experts from grandma’s geothermal. She put a lot of different people on panels together. She called it [Pivot2020: Kicking Off the Geothermal Decade](#). She hoped 1,000 people would log in; 4,000 showed up. A year later she did it again. 14,000 people. Folks were now talking, publicly.

for our second night in Texas, Jamie invited a bunch of former oil guys to meet us at the Baja Cantina and Fiesta, perched above a man-made waterway in the Woodlands. We ordered piles of nachos and quesadillas and wings and beers. As the guys (yeah, they were all guys) showed up, it became clear they had met at the Pivot conference. Now they were working in geothermal startups. Jamie was helping them however she could: advice, chasing grants and other funding sources, contacts, data, information.

As the beers arrived, I asked the engineers and scientists, why geothermal? [For climate change](#), sure. For other reasons too. Spencer Bohlander, a former deep-water drilling engineer and a company man (who designs

wells), expanded: “Our entire world is about heat. Bring heat up. Use it. Power something.” He added, “It’s a no-brainer.” (Jamie yelled from the far end of the table: “Don’t burn shit to make heat. Just use heat for heat.”)

The guys chimed in to lay out the two hefty ideas the industry was chasing: “closed loop” and “enhanced geothermal systems” (EGS in the vernacular).

Spencer explained: Closed loop pretty much means drilling pipes straight into hot, dry rocks, then circulating fluid down and up the pipes. The rocks heat the pipes, and the liquid absorbs the heat from the pipes. (And no fracking!)

Simon Todd, a baby-faced, curly-haired Irishman and geologist who’d been at BP for 25 years, worked at a company called Causeway GT that was pursuing closed-loop systems for perhaps the most obvious idea: direct-use heating. His company aimed to tap right into the hot rock below large industrial buildings or regions—a big data center, a military base—to heat and cool those spaces. (Kind of like massive, available-anywhere versions of the geothermal heat pumps that some people use to heat their homes.)

Nice. And these systems are straightforward enough to build. But models and tests were showing that wellbores generally didn’t have enough surface area to collect the necessary heat. Which could mean deeper, longer drills. Deeper rocks, though, can be dauntingly hard, and the intense temperatures down there will melt a lot of stuff. You could end up drilling as slowly as 6 feet a day, and you might be going tens of thousands of feet deep—even 60,000. At the high end, that could cost \$40,000 or more a foot.

That leaves us with EGS. The method depends on fracking: You bore a hole (first down, then usually horizontally too) and force pressurized fluid into the rock. The rock cracks, creating fissures. Then you fill the fissures with more fluid, which picks up heat from the rock. Now, when you switch your pumps on, your system is circulating liquid through a much bigger surface area—not a loop, but a reservoir. But again, fracking means environmental and political resistance, and no one yet knows if EGS can work commercially.

So what would it take? “Money,” Spencer said. “And not just money but guaranteed money.” Jamie nodded vigorously. The others backed him up. Money to get through the hurdles, to test and fine-tune the tech, to build the power plants. To get things going so the costs can come down. Leon Vanstone, a British scientist whose company was trying to improve drilling into hard rock, added, “Money and certainty.”

In her relentlessness to get this industry off the ground, Jamie had been beating on the doors of multinational oil-field-services companies like Nabors and Baker Hughes—the very companies that had been improving hydraulic fracturing—to get them to help. They had started to throw funding at some of these projects. But considering the massive up-front costs, it wasn’t yet enough.

The sketch of the whisk got Lance thinking about how you might be able to build a geothermal system with just one well. And that would change everything about the price tag. Lance looked at the drawing and thought, “Holy shit. We can do this.”

As the beers drained and the nachos got soggy, the guys, now kind of deflated, reinforced the point: Without the promise of, say, government investment to absorb the riskier startup costs, it was hard to see a thriving future.

On our walk along the waterway back to the hotel, Jamie told me how, back in the ’70s and ’80s, the feds had maddeningly started and stopped research in geothermal—even creating demonstration projects just outside of Houston. “The federal government R&D for geothermal is in total maybe \$100 to \$200 million,” she said. “Solar and wind get billions.” You had people fighting for crumbs. “And venture capital won’t engage.” Now agitated, she added: “You have fucking fusion startups that have been doing the same thing for 10 years and getting a billion dollars. If you had a billion for geothermal, you’d have so much. Then you’d get on a learning curve. From there it’s a snowball.”

Jamie understood that the budding industry was making decisions from a place where the baseline was bad. But failure wasn’t in her lexicon. “To really cut into world energy demand by 2050 means there can’t be friction

points,” she says. “There can’t be frack bans. There can’t be lawsuits. There can’t be half-assed geothermal projects. It literally needs to just go.”

Before Jamie’s son had the stem cell transplant, the doctors warned her how vulnerable he’d be as he recovered. Any infection could be dire, deadly. Not long after the treatment, in the hospital, a problem with his feeding tube caused an infection. Then his chemotherapy left him with serious respiratory issues. For weeks he struggled to breathe, so much so that instructions for how to resuscitate him were taped to his crib. To push her fears from her mind, Jamie, lying on an air mattress beside the crib, would pencil out drawings for how she thought an enhanced geothermal system might work.

One day she sent Lance Cook some of the sketches. One of them looked like a whisk. Another was drawn on a postcard promoting a program for kids with cancer. By now, Lance had been pretty used to, well, accommodating Jamie. (“It was that or *Tiger King*,” he joked, “and she wasn’t annoying.”) But that day, when he looked at the lateral lines and loops she had sketched, he saw something else. With all other EGS proposals he’d seen, the idea was to build two wells, one to pump fluid in and the other to get it out, with an expanse of hot rock in between. The drawing got Lance thinking about how, with geothermal, heat could be gathered from all around a wellbore. A bunch of loops through the rock, all emerging from and converging back to the same place. (The fracked reservoir is a whisk-ish shape.) This meant you might be able to do it with just *one* well. And that would change everything about the price tag. Lance looked at the drawing and realized, “Holy shit. We can do this.”

As he thought about it all, he called an old Shell colleague, Lev Ring. At the time, the Russian-born physicist and engineer was running a software company. Lev told me the call went like this (please imagine this with an elegant, discernible Russian accent): “Lance said, ‘Who cares about your software company, OK? I met this lady. You really need to talk to her.’” So Lev did. And the two guys decided to start a company.

Jamie, ecstatic, added them to the list of new geothermal enthusiasts she was hell-bound to support. Her first quest: help them raise money. Venture capital wasn’t interested. Wall Street wasn’t interested. She went after

climate philanthropy. Chris Anderson, of TED, leaped in with support from Virya, his climate impact fund. Nabors, the multinational drilling company, gave Lance and Lev a cheap lease for office space and \$9 million. Now the two needed the right engineer, someone with a lot of drilling experience. They needed Cindy Taff.

Cindy is an unprepossessing, unflappable mechanical engineer who was born near Dallas and grew up moving around oil country. Her dad was a geophysicist with Mobil Oil, and when she was about 10, the family settled in New Orleans. She stayed local for college—Louisiana State. She got a job at Shell and as a young drilling engineer ended up working for Lance. She loved it. She stayed at Shell for more than three decades, the last seven years as VP of “unconventionals.” Cindy also happened to have managed the drilling of wells all across a region that was super promising for geothermal: southern Texas. When Lance and Lev asked her to come work with them, she lined up her retirement paperwork.

Cindy Taff, 61, has been working in drilling since pretty much right after college. She’s known around southern Texas as a badass.

Photograph: Dan Winters

As soon as that was done, the trio set about building the company. They often hopped on the phone with Jamie. They also often heard strange noises in the background. From time to time, someone would ask her where she was. Jamie finally let slip that she was at a hospital, and she told them a little bit about her son. Cindy, Lance, and Lev happened to be in search of a name for their new company. Now, it was obvious to them: It had to be her son’s name.

Jamie protested. Then she cried. And she was scared. She slipped into her energetic anxieties: What if someone thought she was on the payroll? Or playing favorites? She sent them a list of other names. She felt she had to remain neutral in her support for all her geothermal projects. She was also frightened for a more superstitious reason: “What if they fail?”

Right, right. We hear you. But the trio was adamant. The new company would be named Sage, Sage Geosystems.

the gulf coast of Texas has, for a very long time, been dotted with oil and gas wells. That means we actually know a lot about the conditions below the surface there. In the '70s, when the feds were exploring geothermal resources, they ran a bunch of programs along the state's southern border. They shuttered them in 1992, but the reports that came from those projects left behind a pile of data. It pointed at two counties—Hidalgo and Starr, down in the very tip of Texas—as damn promising. The subsurface conditions, sedimentary rock (so not that hard) with a good amount of heat, were ripe for geothermal, the report said. Which is why, early on a Friday afternoon, Jamie and I left Houston on an hour-long flight toward the Rio Grande and disembarked at McAllen International Airport, 5 miles from the Mexican border.

Back when Cindy was at Shell, she'd helped build a gas well 19,000 feet deep on the Rancho Santa Fe, a truly sprawling windswept property where prized Akaushi beef cattle roam. The well was one of the deepest around. ("They found gas, but it was too expensive to bring it up, so they dumped the project," she tells me. "They probably spent \$10 million.") Cindy knew Rancho Santa Fe was a perfect location to see whether their ideas about doing EGS with a single well could actually work.

Saturday morning, Jamie and I followed Cindy, Lance, and Lev in Cindy's F-150 (her other car is a Prius) out of McAllen, about 45 minutes along flat, flat, flat roads past miles (and miles) of massive wind turbines. When we turned in to the ranch, a guy at the gates made us promise to drive under 10 mph to avoid hitting the prized cattle. About a mile along, towering over all the sagebrush around, was a tall black rig, thumping out a consistent, clanging beat.

By then, drillers, derrick men, and roustabouts working for Sage Geosystems had dropped new pipes down to 11,200 feet. The team took me on a walk around the site, hard hats and steel-toe boots and fireproof coveralls on, a light rain falling. If their plans worked, Cindy and Lev said, wells like this could be drilled in a lot of places, without a very big footprint. Their aim was to build a system and plant that could supply, at first, 3 megawatts of power—enough to power about 3,100 typical homes for a year. Once they made sure it worked, they'd go for 50 megawatts.

A few weeks later, the engineers pumped fluid down into the wells to try to get a big enough, workable reservoir. When I called Cindy to see how it went, she was nearly giddy. The frack had been a success. It created a reservoir “10 times what we expected,” Cindy said, laughing. The team ran fluid through the fracture to confirm it was all connected. (It was.) And their seismic monitors held steady; no earthquakes. It was super good news—not just for Sage, but for a small constellation of people who were deeply, emotionally invested in geothermal in this tip of Texas.

because of the promising conditions in Starr and Hidalgo Counties, Jamie had been helping a handful of people there. The Sage team, of course. The public utility manager for the city of McAllen, who desperately wants to build a geothermal plant for his city. She’d been talking to Dario Guerra, a local water engineer who had been preaching the gospel of geothermal for years. One person she hadn’t met, though, was James McAllen.

So, late in the afternoon, Jamie and I headed about an hour northwest from the city of McAllen to the 50,000-acre San Juanito Ranch, widely known as McAllen Ranch. We were buzzed through an inconspicuous gate, and James—thin, tall, with an ivory cowboy hat on his head—strode up to meet us, a big smile on his face. We made our way to the ranch headquarters: the Rock House, a low-slung stone building that’s more than a century old. Yep. James’ great-great-grandfather gave the town its name. The ranch has worked cattle and horses since before Texas was a state. But, he explained, there’s no more profit in cattle.

The McAllen family ranch includes a cattle farm and a hunting lodge. But James McAllen’s central focus is the stewardship of the place for his heirs, so now he wants to build a geothermal plant there.

Photograph: Dan Winters

“My job is to see how we can get this ranch down the road for the next 100 years,” he said. “And we aren’t going to do that with livestock.” Instead the family looks to every single resource, “from the sun to the wind to the grass to the dirt to the gravel.” About five years ago, James and a partner installed an array of solar panels. The ranch happens to share a property line with an

energy substation, and they now sell power back to the electric company. He was planning to build four more solar arrays.

But one of his nephews, who was studying at UT Austin, had recently called him up. “Hey, you know, Uncle Jim,” the kid said, “I just had a class about geothermal. And McAllen Ranch was all over it.” Turns out, in the late ’70s, when the government was looking for places to test out geothermal, they had approached James’ dad to see whether he wanted to work with them on a demonstration plant. “It was kind of science fiction technology,” James explained. So, no.

After his nephew’s call, James got to thinking. He talked to the utility company he sells solar to; they were excited by the prospect of buying geothermal energy, because it’s a baseload—always available—source. So he called his friend Dario Guerra (the very same), and Dario told James about the Sage crew and their work nearby. Pretty soon, Cindy and Lev and Lance showed up for dinner with bottles of tequila. Within a few weeks, James signed a joint-venture agreement with the team: He’d work on raising the \$27 million or so they’d need, and Sage would begin planning for wells on the ranch.

Jamie had been sitting a bit quiet, for her, on the far side of the table as James told us this whole story. But during a pause, she busted in with enthusiasm. “Wait. Is your nephew in petroleum engineering?” she asked. “That class exists because of GEO!” she exclaimed—GEO being the program she had started at the university. “I feel like I’m in a simulation,” she said. The kid’s professor was the first instructor Jamie had recruited to UT.

Jamie is, of course, just one of a group of evangelists, people who don’t have clear job titles like CEO or director, but who—while they can—are on relentless missions to try to make something better, something livable happen.

On our last morning in Texas, I found Jamie in the dining room of the hotel, some cereal and yogurt on the table in front of her. She was watching a video of her boy. Tears on her cheeks. She handed me her phone so I could see Sage. He was at a table eating breakfast. He’s a gorgeous child: wide

smile, fabulous curly dark hair. He communicates via sweet grunts and laughs. She missed him. But she was also crying because she was exhausted and overwhelmed. That's because after seeing how far Sage Geosystems had come, and meeting James McAllen, it was sinking in that after all the hours and days and minutes she'd spent pushing this project along, the quest for geothermal had taken on a life of its own.

When I got home from the Texas trip, my husband and I had to face new test results, and horrible conversations with our doctors. Then he had the first of two major surgeries. In the moments between ER visits and desperate phone calls, I filled up as much space in my mind as I could to keep my thoughts off of the inconceivable. But as the scaffolding of the life we had built began to shudder, facing the simple requirements of getting through a day became hard. Then harder still.

When Jamie got home, she left the GEO program at the university. It didn't need her anymore. She'd been living back in Boston for a while now, closer to her parents, but Sage wasn't doing too well. He'd had multiple brain surgeries. He would only eat a few things. She moved across town to get him into a school where he (and she) might get better support.

When Sage was sleeping or at school, or when a nanny was giving her a break, Jamie threw even more of herself at geothermal everywhere. She scrapped for more climate philanthropy and launched a program called [Project InnerSpace](#)—to chase missing subsurface data and more accurate maps, to start a competition to focus engineers on the lingering tech problems, to spread geothermal globally. And she turned to publishing [a huge report](#) about the state of geothermal in Texas.

Then, things took a strange turn: When the Inflation Reduction Act was signed in August 2022, it finally—*finally*—offered good tax-based incentives for geothermal projects. Companies could now get a 30 percent tax credit for their projects, maybe even more. If the equipment were made in the US, they could add another 10 percent. Great, amazing! But the law wasn't really set up for geothermal; it was built much more for solar and wind. Which meant it had terrific incentives for the holy grail of solar and wind—[energy storage](#).

It also happened that for many months, Cindy and Lev and Lance had been wondering whether the reservoirs they were creating underground could be, essentially, pressurized storage tanks. Use the excess energy from the grid to fill it up with fluid; when you release the fluid, turbines turn. “Same well design, and same power plants,” Cindy said. Months later, she added, test results showed that they could, in some scenarios, rival the cost of lithium-ion batteries. Sage was diversifying.

Right, nothing happens in a straight line. But there was one conversation I kept remembering from the trip in Texas that seems worth mentioning. Over Italian food, Cindy and Lance and Lev started talking about their kids, all adults now. Their children, they said, were *finally* proud of them, proud of their work. Lance’s kids joked that they could, for the first time, tell people what their father did for a living. Cindy said her 23-year-old daughter knew there was no future in oil and gas. In fact, Cindy’s daughter is now a mechanical engineer working at Sage, using technology that was born out of her mother’s and grandfather’s industry for [wind and solar storage](#), and for a geothermal future.

of course it’s delicious to think the industry that’s been at the heart of such a massive problem, a massive accomplice, could be transformed into a massive solution. No one is that naive; Wall Street is too powerful.

But things are certainly different than when Jamie started. For sure, the thing that she glimpsed when she was at the ultracapacitor startup was coming true: The oil field had accomplished so much that could get us closer to geothermal everywhere. Some big oil companies—Chevron, Shell, Ecopetrol—started in-house programs. And the feds doubled their funding to leverage tech and workforce from the oil and gas industry to expand geothermal. The report Jamie was working on, a 15-chapter, 350-page collaboration between five Texas universities, the International Energy Agency, and a bunch of other organizations, laid out a hopeful picture of how to scale geothermal in coming years. All of it was, in part, because of every hour she put in, every call she made, every dollar she raised.

Jamie is, of course, just one of a group of evangelists, people who don’t have clear job titles like CEO or director, but who—while they can—are on relentless missions to try to make something better, something livable

happen. At that Italian dinner in Texas, when she left the table for a moment, Dario Guerra told me, “Four years ago, when I tried to push this, there wasn’t a Jamie. Four years makes a huge difference.”

Cindy added, “There’d be none of this without Jamie.”

This past fall, Jamie came through San Francisco, trying to raise more money. On a dark, wet night, we met for dinner before she got on a red-eye back across the country—she wanted to be home to take Sage to school. She seemed more exhausted than ever. Tears came easy. The new school district wasn’t working out too well. Sage had never been around other kids. He was struggling. His needs were so intricate that even the complex care department at Boston Children’s Hospital would soon tell her Sage was too complicated for them.

By then, my husband’s cancer had taken the turn I’d dreaded for four years. I lost him. Finding strength to just get through a few hours or a day, much less do any work at all, became excruciating. From that vantage, as I watched Jamie move through the night, I worried about what seemed true: Maybe it was going to take the kind of driving, roiling energy she uses to be able to breathe in a heartbreakin world to do the really big things. The things that really need to be done.

Before she got into a taxi, she told me once more that she thinks Sage’s illness is probably still terminal. I understand, deeply. We need to temper hope in the face of a scary and maybe inevitable future. And we need the energy of that fear, too.

Jamie Beard’s hair and makeup by Pepper Pastor. This article appears in the June 2023 issue. [Subscribe now.](#)

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May 2, 2023 6:00 AM

The Untold Story of the Boldest Supply-Chain Hack Ever

The attackers were in thousands of corporate and government networks. They might still be there now. Behind the scenes of the SolarWinds investigation.

Play/Pause Button



Illustration: Tameem Sankari

Steven Adair wasn't too rattled at first.

It was late 2019, and Adair, the president of the [security](#) firm Volexity, was investigating a digital security breach at an American think tank. The intrusion was nothing special. Adair figured he and his team would rout the attackers quickly and be done with the case—until they noticed something strange. A *second* group of hackers was active in the think tank's network. They were going after email, making copies and sending them to an outside server. These intruders were much more skilled, and they were returning to the network several times a week to siphon correspondence from specific executives, policy wonks, and IT staff.

This article appears in the June 2023 issue. [Subscribe to WIRED](#). Photograph: Dan Winters

Adair and his colleagues dubbed the second gang of thieves “Dark Halo” and booted them from the network. But soon they were back. As it turned out, the hackers had planted a [backdoor](#) on the network three years earlier—

malicious code that opened a secret portal, allowing them to enter or communicate with infected machines. Now, for the first time, they were using it. “We shut down one door, and they quickly went to the other,” Adair says.

His team spent a week kicking the attackers out again and getting rid of the backdoor. But in late June 2020, the hackers somehow returned. And they were back to grabbing email from the same accounts. The investigators spent days trying to figure out how they had slipped back in. Volexity zeroed in on one of the think tank’s servers—a machine running a piece of software that helped the organization’s system admins manage their computer network. That software was made by a company that was well known to IT teams around the world, but likely to draw blank stares from pretty much everyone else—an Austin, Texas, firm called SolarWinds.

Adair and his team figured the hackers must have embedded another backdoor on the victim’s server. But after considerable sleuthing, they couldn’t find one. So they kicked the intruders out again and, to be safe, disconnected the server from the internet. Adair hoped that was the end of it. But the incident nagged at him. For days he woke up around 2 am with a sinking feeling that the team had missed something huge.

They had. And they weren’t the only ones. Around the time Adair’s team was kicking Dark Halo out of the think tank’s network, the US Department of Justice was also wrestling with an intrusion—one involving a server running a trial version of the same SolarWinds software. According to sources with knowledge of the incident, the DOJ discovered suspicious traffic passing from the server to the internet in late May, so they asked one of the foremost security and digital forensics firms in the world—Mandiant—to help them investigate. They also engaged Microsoft, though it’s not clear why. (A Justice Department spokesperson confirmed that this incident and investigation took place but declined to say whether Mandiant and Microsoft were involved. Neither company chose to comment on the investigation.)

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According to the sources familiar with the incident, investigators suspected the hackers had breached the Justice Department server directly, possibly by exploiting a vulnerability in the SolarWinds software. The Justice Department team contacted the company, even referencing a specific file that they believed might be related to the issue, according to the sources, but SolarWinds' engineers were unable to find a vulnerability in their code. After weeks of back and forth the mystery was still unresolved, and the communication between investigators and SolarWinds stopped. (SolarWinds declined to comment on this episode.) The department, of course, had no idea about Volexity's uncannily similar hack.

As summer turned to fall, behind closed doors, suspicions began to grow among people across government and the security industry that something major was afoot. But the government, which had spent years trying to improve its communication with outside security experts, suddenly wasn't talking. Over the next few months, "people who normally were very chatty were hush-hush," a former government worker says. There was a rising fear among select individuals that a devastating cyber operation was unfolding, he says, and no one had a handle on it.

In fact, the Justice Department and Volexity had stumbled onto one of the most sophisticated cyberespionage campaigns of the decade. The perpetrators had indeed hacked SolarWinds' software. Using techniques that investigators had never seen before, the hackers gained access to

thousands of the company's customers. Among the infected were at least eight other federal agencies, including the US Department of Defense, Department of Homeland Security, and the Treasury Department, as well as top tech and security firms, including [Intel](#), [Cisco](#), and [Palo Alto Networks](#)—though none of them knew it yet. Even Microsoft and Mandiant were on the victims list.

After the Justice Department incident, the operation remained undiscovered for another six months. When investigators finally cracked it, they were blown away by the hack's complexity and extreme premeditation. Two years on, however, the picture they've assembled—or at least what they've shared publicly—is still incomplete. A full accounting of the campaign's impact on federal systems and what was stolen has never been provided to the public or to lawmakers on Capitol Hill. According to the former government source and others, many of the federal agencies that were affected didn't maintain adequate network logs, and hence may not even know what all was taken. Worse: Some experts believe that SolarWinds was not the only vector—that other software makers were, or might still be, spreading malware. What follows is an account of the investigation that finally exposed the espionage operation—how it happened, and what we know. So far.

on November 10, 2020, an analyst at Mandiant named Henna Parviz responded to a routine security alert—the kind that got triggered anytime an employee enrolled a new phone in the firm's multifactor authentication system. The system sent out one-time access codes to credentialed devices, allowing employees to sign in to the company's virtual private network. But Parviz noticed something unusual about this Samsung device: It had no phone number associated with it.

She looked closely at the phone's activity logs and saw another strange detail. The employee appeared to have used the phone to sign in to his VPN account from an IP address in Florida. But the person didn't live in Florida, and he still had his old iPhone enrolled in the multifactor system. Then she noticed that the Samsung phone had been used to log in from the Florida IP address at the same time the employee had logged in with his iPhone from his home state. Mandiant had a problem.

The security team blocked the Samsung device, then spent a day investigating how the intruder had gotten into the network. They soon realized the issue transcended a single employee's account. The attackers had pulled off a Golden SAML attack—a sophisticated technique for hijacking a company's employee authentication system. They could seize control of a worker's accounts, grant those accounts more privileges, even create new accounts with unlimited access. With this power, there was no telling how deep they had burrowed into the network.

On November 17, Scott Runnels and Eric Scales, senior members of Mandiant's consulting division, quietly pulled together a top-tier investigative team of about 10, grabbing people from other projects without telling managers why, or even when the employees would return. Uncertain what the hunt would uncover, Runnels and Scales needed to control who knew about it. The group quickly realized that the hackers had been active for weeks but had evaded detection by “living off the land”—subverting administration tools already on the network to do their dirty deeds rather than bringing in their own. They also tried to avoid creating the patterns, in activity logs and elsewhere, that investigators usually look for.

The Mandiant team was facing a textbook example of a supply-chain hack—the nefarious alteration of trusted software at its source.

But in trying to outsmart Mandiant, the thieves inadvertently left behind different fingerprints. Within a few days, investigators picked up the trail and began to understand where the intruders had been and what they had stolen.

On Friday morning, November 20, Kevin Mandia, Mandiant's founder and CEO, clicked out of an all-hands meeting with 3,000 employees and noticed that his assistant had added a new meeting to his calendar. “Security brief” was all it said. Mandia, a 52-year-old former Air Force intelligence officer who still sports taper-cut military hair two decades after leaving service, was planning to get an early start on the weekend, but he dialed into the call anyway. He expected a quick update of some kind. Five minutes into the conversation, he knew his weekend was shot.

Many of the highest-profile hacks of the past two decades have been investigated by Mandia's firm, which he launched in 2004. Acquired by FireEye in 2013, and again last year by Google, the company has threat hunters working on more than 1,000 cases annually, which have included breaches at Google, Sony, Colonial Pipeline, and others. In all that time, Mandiant itself had never suffered a serious hack. Now the hunters were the hunted.

The intruders, Mandia learned, had swiped tools his company uses to find vulnerabilities in its clients' networks. They had also viewed sensitive information identifying its government customers. As his team described how the intruders had concealed their activity, Mandia flashed back to incidents from the early days of his career. From 1995 to 2013, while in the Air Force Office of Special Investigations and in the private sector, he had observed Russian threat actors continuously testing systems, disappearing as soon as investigators got a lock on them. Their persistence and stealth made them the toughest adversaries he'd ever faced. Now, hearing about the activity inside his own network, he "started getting pattern recognition," he later told a conference audience. The day after getting the unsettling news of the breach, he reached out to the National Security Agency (NSA) and other government contacts.

While Mandia conferred with the government, Charles Carmakal, the CTO of Mandiant Consulting, contacted some old friends. Many of the hackers' tactics were unfamiliar, and he wanted to see whether two former Mandiant colleagues, Christopher Glycer and Nick Carr, had seen them before. Glycer and Carr had spent years investigating large, sophisticated campaigns and had tracked the notorious hackers of the SVR—Russia's foreign intelligence agency—extensively. Now the two worked for Microsoft, where they had access to data from many more hacking campaigns than they had at Mandiant.

Carmakal told them the bare minimum—that he wanted help identifying some activity Mandiant was seeing. Employees of the two companies often shared notes on investigations, so Glycer thought nothing of the request. That evening, he spent a few hours digging into the data Carmakal sent him,

then tapped Carr to take over. Carr was a night owl, so they often tag-teamed, with Carr passing work back to Glycer in the morning.

The two didn't see any of the familiar tactics of known hacking groups, but as they followed trails they realized whatever Mandiant was tracking was significant. "Every time you pulled on a thread, there was a bigger piece of yarn," Glycer recalls. They could see that multiple victims were communicating with the hackers Carmakal had asked them to trace. For each victim, the attackers set up a dedicated command-and-control server and gave that machine a name that partly mimicked the name a real system on the victim's network might have, so it wouldn't draw suspicion. When Glycer and Carr saw a list of those names, they realized they could use it to identify new victims. And in the process, they unearthed what Carmakal hadn't revealed to them—that Mandiant itself had been hacked.

It was a "holy shit" moment, recalls John Lambert, head of Microsoft Threat Intelligence. The attackers weren't only looking to steal data. They were conducting counterintelligence against one of their biggest foes. "Who do customers speed-dial the most when an incident happens?" he says. "It's Mandiant."

As Carr and Glycer connected more dots, they realized they had seen signs of this hack before, in unsolved intrusions from months earlier. More and more, the exceptional skill and care the hackers took to hide their tracks was reminding them of the SVR.

Video: Tameem Sankari

back at mandiant, workers were frantically trying to address what to do about the tools the hackers had stolen that were designed to expose weak spots in clients' defenses. Concerned that the intruders would use those products against Mandiant customers or distribute them on the dark web, Mandiant set one team to work devising a way to detect when they were being used out in the wild. Meanwhile, Runnels' crew rushed to figure out how the hackers had slipped in undetected.

Because of the pandemic, the team was working from home, so they spent 18 hours a day connected through a conference call while they scoured logs

and systems to map every step the hackers took. As days turned to weeks, they became familiar with the cadence of each other's lives—the voices of children and partners in the background, the lulling sound of a snoring pit bull lying at Runnels' feet. The work was so consuming that at one point Runnels took a call from a Mandiant executive while in the shower.

Runnels and Scales briefed Mandia daily. Each time the CEO asked the same question: How did the hackers get in? The investigators had no answer.

On December 8, when the detection tools were ready and the company felt it had enough information about the breach to go public, Mandiant broke its silence and released a blockbuster [statement](#) revealing that [it had been hacked](#). It was sparse on details: Sophisticated hackers had stolen some of its security tools, but many of these were already public, and there was no evidence the attackers had used them. Carmakal, the CTO, worried that customers would lose confidence in the company. He was also anxious about how his colleagues would react to the news. “Are employees going to feel embarrassed?” he wondered. “Are people not going to want to be part of this team anymore?”

What Mandiant did not reveal was how the intruders got in or how long they had been in the company’s network. The firm says it still didn’t know. Those omissions created the impression that the breach was an isolated event with no other victims, and people wondered whether the company had made basic security errors that got it hacked. “We went out there and said that we got compromised by a top-tier adversary,” Carmakal says—something every victim claims. “We couldn’t show the proof yet.”

Mandiant isn’t clear about exactly when it made the first discovery that led it to the source of the breach. Runnels’ team fired off a barrage of hypotheses and spent weeks running down each one, only to turn up misses. They’d almost given up hope when they found a critical clue buried in traffic logs: Months earlier, a Mandiant server had communicated briefly with a mysterious system on the internet. And that server was running software from SolarWinds.

SolarWinds makes dozens of programs for IT administrators to monitor and manage their networks—helping them configure and patch a lot of systems at once, track performance of servers and applications, and analyze traffic. Mandiant was using one of the Texas company’s most popular products, a software suite called Orion. The software should have been communicating with SolarWinds’ network only to get occasional updates. Instead it was contacting an unknown system—likely the hackers’ command-and-control server.

Back in June, of course, Mandiant had been called in to help the Justice Department investigate an intrusion on a server running SolarWinds software. Why the pattern-matchers at one of the world’s preeminent security firms apparently didn’t recognize a similarity between the two cases is one of the lingering mysteries of the SolarWinds debacle. It’s likely that Runnels’ chosen few hadn’t worked on the Justice case, and internal secrecy prevented them from discovering the connection. (Mandiant declined to comment.)

Runnels’ team suspected the infiltrators had installed a backdoor on the Mandiant server, and they tasked Willi Ballenthin, a technical director on the team, and two others with finding it. The task before him was not a simple one. The Orion software suite consisted of more than 18,000 files and 14 gigabytes of code and data. Finding the rogue component responsible for the suspicious traffic, Ballenthin thought, would be like riffling through *Moby-Dick* for a specific sentence when you’d never read the book.

But they had been at it only 24 hours when they found the passage they’d been looking for: a single file that appeared to be responsible for the rogue traffic. Carmakal believes it was December 11 when they found it.

The file was a .dll, or dynamic-link library—code components shared by other programs. This .dll was large, containing about 46,000 lines of code that performed more than 4,000 legitimate actions, and—as they found after analyzing it for an hour—one illegitimate one.

The main job of the .dll was to tell SolarWinds about a customer’s Orion usage. But the hackers had embedded malicious code that made it transmit

intelligence about the victim's network to *their* command server instead. Ballenthin dubbed the rogue code "Sunburst"—a play on SolarWinds. They were ecstatic about the discovery. But now they had to figure out how the intruders had snuck it into the Orion .dll.

This was far from trivial. The Orion .dll file was signed with a SolarWinds digital certificate, which was *supposed* to verify that the file was legitimate company code. One possibility was that the attackers had stolen the digital certificate, created a corrupt version of the Orion file, signed the file to make it look authentic, then installed the corrupt .dll on Mandiant's server. Or, more alarmingly, they might have breached SolarWinds' network and altered the legitimate Orion .dll source code *before* SolarWinds compiled it—converting the code into software—and signed it. The second scenario seemed so far-fetched that the Mandiant crew didn't really consider it—until an investigator downloaded an Orion software update from the SolarWinds website. The backdoor was in it.

The implication was staggering. The Orion software suite had about 33,000 customers, some of whom had started receiving the hacked software update in March. That meant some customers might have been compromised for eight months already. The Mandiant team was facing a textbook example of a [software-supply-chain attack](#)—the nefarious alteration of trusted software at its source. In a single stroke, attackers can infect thousands, potentially millions, of machines.

In 2017 hackers had sabotaged a software supply chain and delivered malware to more than 2 million users by compromising the computer security cleanup tool [CCleaner](#). That same year, Russia distributed the malicious [NotPetya worm](#) in a software update to the Ukrainian equivalent of TurboTax, which then spread around the world. Not long after, Chinese hackers also used a software update to slip a backdoor to thousands of [Asus customers](#). Even at this early stage in the investigation, the Mandiant team could tell that none of those other attacks would rival the SolarWinds campaign.

it was a Saturday morning, December 12, when Mandia called SolarWinds' president and CEO on his cell phone. Kevin Thompson, a 14-year veteran of the Texas company, was stepping down as CEO at the end of the month.

What he was about to hear from Mandia—that Orion was infected—was a hell of a way to wrap up his tenure. “We’re going public with this in 24 hours,” Mandia said. He promised to give SolarWinds a chance to publish an announcement first, but the timeline wasn’t negotiable. What Mandia didn’t mention was that he was under external pressure himself: A reporter had been tipped off about the backdoor and had contacted his company to confirm it. Mandia expected the story to break Sunday evening, and he wanted to get ahead of it.

Thompson started making calls, one of the first to Tim Brown, SolarWinds’ head of security architecture. Brown and his staff quickly confirmed the presence of the Sunburst backdoor in Orion software updates and figured out, with alarm, that it had been delivered to as many as 18,000 customers since the spring of 2020. (Not every Orion user had downloaded it.) Thompson and others spent most of Saturday frantically pulling together teams to oversee the technical, legal, and publicity challenges they faced. They also called the company’s outside legal counsel, DLA Piper, to oversee the investigation of the breach. Ron Plesco, an attorney at Piper and former prosecutor with forensic expertise, was in his backyard with friends when he got the call at around 10 pm.

Plesco beelined to his home office, arrayed with whiteboards, and started sketching out a plan. He set a timer for 20 hours, annoyed by what he felt was Mandia’s arbitrary deadline. A day was nowhere near enough to prepare affected customers. He worried that once SolarWinds went public, the attackers might do something destructive in customers’ networks before anyone could boot them out.

The attackers had infected thousands of networks but only dug deep into a tiny subset of them—about 100. The main goal appeared to be espionage.

The practice of placing legal teams in charge of breach investigations is a controversial one. It puts cases under attorney-client privilege in a manner that can help companies fend off regulatory inquiries and fight discovery requests in lawsuits. Plesco says SolarWinds was, from the start, committed to transparency, publishing everything it could about the incident. (In interviews, the company was mostly forthcoming, but both it and Mandiant withheld some answers on the advice of legal counsel or per government

request—Mandiant more so than SolarWinds. Also, SolarWinds recently settled a class action with shareholders over the breach but still faces a possible enforcement action from the Securities and Exchange Commission, making it less open than it might otherwise be about events.)

In addition to DLA Piper, SolarWinds brought on the security firm CrowdStrike, and as soon as Plesco learned this, he knew he wanted his old friend, Adam Meyers, on the case. The two had known each other for decades, ever since they'd worked on incident response for a defense contractor. Meyers was now the head of CrowdStrike's threat intelligence team and rarely worked investigations. But when Plesco texted him at 1 am to say "I need your help," he was all in.

Later that Sunday morning, Meyers jumped on a briefing call with Mandiant. On the call was a Microsoft employee, who told the group that in some cases, the hackers were systematically compromising Microsoft Office 365 email accounts and Azure cloud accounts. The hackers were also able to bypass multifactor authentication protocols. With every detail Meyers heard, the scope and complexity of the breach grew. Like others, he also suspected the SVR.

After the call, Meyers sat down in his living room. Mandiant had sent him the Sunburst code—the segment of the .dll file that contained the backdoor—so now he bent over his laptop and began picking it apart. He would remain in this huddled position for most of the next six weeks.

at solarwinds, shock, disbelief, and “controlled chaos” ruled those first days, says Tim Brown, the head of security architecture. Dozens of workers poured into the Austin office they hadn't visited in months to set up war rooms. The hackers had compromised 71 SolarWinds email accounts—likely to monitor correspondence for any indication they'd been detected—so for the first few days, the teams communicated only by phone and outside accounts, until CrowdStrike cleared them to use their corporate email again.

Brown and his staff had to figure out how they had failed to prevent or detect the hack. Brown knew that whatever they found could cost him his job.

One of the team's first tasks was to collect data and logs that might reveal the hackers' activity. They quickly discovered that some logs they needed didn't exist—SolarWinds didn't track everything, and some logs had been wiped by the attackers or overwritten with new data as time passed. They also scrambled to see whether any of the company's nearly 100 other products were compromised. (They only found evidence that Orion was hit.)

Around midmorning on Sunday, news of the hack began to leak. Reuters [reported](#) that whoever had struck Mandiant had also breached the Treasury Department. Then around 5 pm Eastern time, *Washington Post* reporter Ellen Nakashima [tweeted](#) that SolarWinds' software was believed to be the source of the Mandiant breach. She added that the Commerce Department had also been hit. The severity of the campaign was growing by the minute, but SolarWinds was still several hours from publishing its announcement. The company was obsessing over every detail—a required filing to the Securities and Exchange Commission got so heavily lawyered that Thompson, the CEO, quipped at one point that adding a single comma would cost \$20,000.

Around 8:30 that night, the company finally published a blog post announcing the compromise of its Orion software—and emailed customers with a preliminary fix. [Mandiant](#) and [Microsoft](#) followed with their own reports on the backdoor and the activity of the hackers once inside infected networks. Oddly, Mandiant didn't identify itself as an Orion victim, nor did it explain how it discovered the backdoor in the first place. Reading Mandiant's write-up, one would never know that the Orion compromise had anything to do with the announcement of its own breach five days earlier.

Monday morning, calls started cascading in to SolarWinds from journalists, federal lawmakers, customers, and government agencies in and outside the US, including president-elect Joe Biden's transition team. Employees from across the company were pulled in to answer them, but the queue grew to more than 19,000 calls.

The US Cybersecurity and Infrastructure Security Agency wanted to know whether any research labs developing Covid vaccines had been hit. Foreign governments wanted lists of victims inside their borders. Industry groups

for power and energy wanted to know whether nuclear facilities were breached.

As agencies scrambled to learn whether their networks used Orion software —many weren’t sure—CISA issued an [emergency directive](#) to federal agencies to disconnect their SolarWinds servers from the internet and hold off on installing any patch aimed at disabling the backdoor until the security agency approved it. The agency noted that it was up against a “patient, well-resourced, and focused adversary” and that removing them from networks would be “highly complex and challenging.” Adding to their problems, many of the federal agencies that had been compromised were lax about logging their network activity, which effectively gave cover to the hackers, according to the source familiar with the government’s response. The government “couldn’t tell how they got in and how far across the network they had gone,” the source says. It was also “really difficult to tell what they had taken.”

It should be noted that the Sunburst backdoor was useless to the hackers if a victim’s Orion server wasn’t connected to the internet. Luckily, for security reasons, most customers did not connect them—only 20 to 30 percent of all Orion servers were online, SolarWinds estimated. One reason to connect them was to send analytics to SolarWinds or to obtain software updates. According to standard practice, customers should have configured the servers to only communicate with SolarWinds, but many victims had failed to do this, including Mandiant and Microsoft. The Department of Homeland Security and other government agencies didn’t even put them behind firewalls, according to Chris Krebs, who at the time of the intrusions was in charge of CISA. Brown, SolarWinds’ security chief, notes that the hackers likely knew in advance whose servers were misconfigured.

But it soon became clear that although the attackers had infected thousands of servers, they had dug deep into only a tiny subset of those networks—about 100. The main goal appeared to be espionage.

The hackers handled their targets carefully. Once the Sunburst backdoor infected a victim’s Orion server, it remained inactive for 12 to 14 days to evade detection. Only then did it begin sending information about an infected system to the attackers’ command server. If the hackers decided the

infected victim wasn't of interest, they could disable Sunburst and move on. But if they liked what they saw, they installed a second backdoor, which came to be known as Teardrop. From then on, they used Teardrop instead of Sunburst. The breach of SolarWinds' software was precious to the hackers —the technique they had employed to embed their backdoor in the code was unique, and they might have wanted to use it again in the future. But the more they used Sunburst, the more they risked exposing how they had compromised SolarWinds.

Through Teardrop, the hackers stole account credentials to get access to more sensitive systems and email. Many of the 100 victims that got Teardrop were technology companies—places such as Mimecast, a cloud-based service for securing email systems, or the antivirus firm Malwarebytes. Others were government agencies, defense contractors, and think tanks working on national security issues. The intruders even accessed Microsoft's source code, though the company says they didn't alter it.

victims might have made some missteps, but no one forgot where the breaches began. Anger against SolarWinds mounted quickly. A former employee claimed to reporters that he had warned SolarWinds executives in 2017 that their inattention to security made a breach inevitable. A researcher revealed that in 2018 someone had recklessly posted, in a public GitHub account, a password for an internal web page where SolarWinds software updates were temporarily stored. A bad actor could have used the password to upload malicious files to the update page, the researcher said (though this would not have allowed the Orion software itself to be compromised, and SolarWinds says that this password error was not a true threat). Far worse, two of the company's primary investors—firms that owned about 75 percent of SolarWinds and held six board seats—sold \$315 million in stock on December 7, six days before news of the hack broke, prompting an SEC investigation into whether they had known about the breach.

Government officials threatened to cancel their contracts with SolarWinds; lawmakers were talking about calling its executives into a hearing. The company hired Chris Krebs, CISA's former head, who weeks earlier had

been fired by President Donald Trump, to help navigate interactions with the government.

Meanwhile, Brown and his security team faced a mountain of work. The tainted Orion software was signed with the company's digital certificate, which they now had to invalidate. But the same certificate had been used to sign many of the company's other software products too. So the engineers had to recompile the source code for every affected product and sign those new programs with new certificates.

But they still didn't know where the rogue code in Orion had come from. Malicious code could be lurking on their servers, which could embed a backdoor in any of the programs being compiled. So they ditched their old compilation process for a new one that allowed them to check the finished program for any unauthorized code. Brown says they were under so much stress to get the recompiled programs out to customers that he lost 25 pounds in three weeks.

While Brown's team rebuilt the company's products and CrowdStrike tried to figure out how the hackers got into SolarWinds' network, SolarWinds brought on KPMG, an accounting firm with a computer forensics arm, to solve the mystery of how the hackers had slipped Sunburst into the Orion .dll file. David Cowen, who had more than 20 years of experience in digital forensics, led the KPMG team.

The infrastructure SolarWinds used to build its software was vast, and Cowen and his team worked with SolarWinds engineers through the holidays to solve the riddle. Finally, on January 5, he called Plesco, the DLA Piper attorney. A SolarWinds engineer had spotted something big: artifacts of an old virtual machine that had been active about a year earlier. That virtual machine—a set of software applications that takes the place of a physical computer—had been used to build the Orion software back in 2020. It was the critical puzzle piece they needed.

Forensic investigations are often a game of chance. If too much time has passed since a breach began, traces of a hacker's activity can disappear. But sometimes the forensic gods are on your side and evidence that should be gone remains.

To build the Orion program, SolarWinds had used a software build-management tool called TeamCity, which acts like an orchestra conductor to turn source code into software. TeamCity spins up virtual machines—in this case about 100—to do its work. Ordinarily, the virtual machines are ephemeral and exist only as long as it takes to compile software. But if part of the build process fails for some reason, TeamCity creates a “memory dump”—a kind of snapshot—of the virtual machine where the failure occurred. The snapshot contains all of the virtual machine’s contents at the time of failure. That’s exactly what occurred during the February 2020 build. Ordinarily, SolarWinds engineers would delete these snapshots during post-build cleanup. But for some reason, they didn’t erase this one. If it hadn’t been for its improbable existence, Cowen says, “we would have nothing.”

In the snapshot, they found a malicious file that had been on the virtual machine. Investigators dubbed it “Sunspot.” The file had only 3,500 lines of code, but those lines turned out to be the key to understanding everything.

It was around 9 pm on January 5 when Cowen sent the file to Meyers at CrowdStrike. The CrowdStrike team got on a Zoom call with Cowen and Plesco, and Meyers put the Sunspot file into a decompiler, then shared his screen. Everyone grew quiet as the code scrolled down, its mysteries slowly revealed. This tiny little file, which should have disappeared, was responsible for injecting the backdoor into the Orion code and allowing the hackers to slip past the defenses of some of the most well-protected networks in the country.

Now the investigators could trace any activity related to Sunspot. They saw that the hackers had planted it on the build server on February 19 or 20. It lurked there until March, when SolarWinds developers began building an Orion software update through TeamCity, which created a fleet of virtual machines. Not knowing which virtual machine would compile the Orion .dll code, the hackers designed a tool that deployed Sunspot into each one.

At this point, the beauty and simplicity of the hack truly revealed itself. Once the .dll appeared on a virtual machine, Sunspot quickly and automatically renamed that legitimate file and gave its original name to the hackers’ rogue doppelgänger .dll. The latter was almost an exact replica of

the legitimate file, except it contained Sunburst. The build system then grabbed the hackers' .dll file and compiled it into the Orion software update. The operation was done in a matter of seconds.

Once the rogue .dll file was compiled, Sunspot restored the original name to the legitimate Orion file, then deleted itself from all of the virtual machines. It remained on the build server for months, however, to repeat the process the next two times Orion got built. But on June 4, the hackers abruptly shut down this part of their operation—removing Sunspot from the build server and erasing many of their tracks.

Cowen, Meyers, and the others couldn't help but pause to admire the tradecraft. They'd never before seen a build process get compromised. "Sheer elegance," Plesco called it. But then they realized something else: Nearly every other software maker in the world was vulnerable. Few had built-in defenses to prevent this type of attack. For all they knew, the hackers might have already infiltrated other popular software products. "It was this moment of fear among all of us," Plesco says.

the next day, January 6—the same day as the insurrection on Capitol Hill—Plesco and Cowen hopped on a conference call with the FBI to brief them on their gut-churning discovery. The reaction, Plesco says, was palpable. "If you can sense a virtual jaw drop, I think that's what occurred."

A day later they briefed the NSA. At first there were just two people from the agency on the video call—faceless phone numbers with identities obscured. But as the investigators relayed how Sunspot compromised the Orion build, Plesco says, more than a dozen phone numbers popped up onscreen, as word of what they'd found "rippled through the NSA."

But the NSA was about to get another shock. Days later, members of the agency joined a conference call with 50 to 100 staffers from the Homeland Security and Justice Departments to discuss the SolarWinds hack. The people on the call were stumped by one thing: Why, when things had been going so well for them, had the attackers suddenly removed Sunspot from the build environment on June 4?

The response from an FBI participant stunned everyone.

The man revealed matter-of-factly that, back in the spring of 2020, people at the agency had discovered some rogue traffic emanating from a server running Orion and contacted SolarWinds to discuss it. The man conjectured that the attackers, who were monitoring SolarWinds' email accounts at the time, must have gotten spooked and deleted Sunspot out of fear that the company was about to find it.

Callers from the NSA and CISA were suddenly livid, according to a person on the line—because for the first time, they were learning that Justice had detected the hackers months earlier. The FBI guy “phrased it like it was no big deal,” the attendee recalls. The Justice Department told WIRED it had informed CISA of its incident, but at least some CISA people on the call were responding as if it was news to them that Justice had been close to discovering the attack—half a year before anyone else. An NSA official told WIRED that the agency was indeed “frustrated” to learn about the incident on the January call. For the attendee and others on the call who hadn’t been aware of the DOJ breach, it was especially surprising, because, the source notes, in the months after the intrusion, people had been “freaking out” behind closed doors, sensing that a significant foreign spy operation was underway; better communication among agencies might have helped uncover it sooner.

Instead, says the person with knowledge of the Justice investigation, that agency, as well as Microsoft and Mandiant, surmised that the attackers must have infected the DOJ server in an isolated attack. While investigating it in June and July, Mandiant had unknowingly downloaded and installed tainted versions of the Orion software to its own network. (CISA declined to comment on the matter.)

the discovery of the Sunspot code in January 2021 blew the investigation open. Knowing when the hackers deposited Sunspot on the build server allowed Meyers and his team to track their activity backward and forward from that time and reinforced their hunch that the SVR was behind the operation.

The SVR is a civilian intelligence agency, like the CIA, that conducts espionage outside the Russian Federation. Along with Russia’s military intelligence agency, the GRU, it hacked the US Democratic National

Committee in 2015. But where the GRU tends to be noisy and aggressive—it publicly leaked information stolen from the DNC and Hilary Clinton’s presidential campaign—SVR hackers are more deft and quiet. Given various names by different security firms (APT29, Cozy Bear, the Dukes), SVR hackers are noted for their ability to remain undetected in networks for months or years. The group was very active between 2014 and 2016, Glycer says, but then seemed to go dark. Now he understood that they’d used that time to restrategeze and develop new techniques, some of which they used in the SolarWinds campaign.

Investigators found that the intruders had first used an employee’s VPN account on January 30, 2019, a full *year* before the Orion code was compromised. The next day, they returned to siphon 129 source code repositories for various SolarWinds software products and grabbed customer information—presumably to see who used which products. They “knew where they were going, knew what they were doing,” Plesco says.

The hackers likely studied the source code and customer data to select their target. Orion was the perfect choice. The crown jewel of SolarWinds’ products, it accounted for about 45 percent of the company’s revenue and occupied a privileged place in customer networks—it connected to and communicated with a lot of other servers. The hackers could hijack those connections to jump to other systems without arousing suspicion.

Once they had the source code, the hackers disappeared from the SolarWinds network until March 12, when they returned and accessed the build environment. Then they went dark for six months. During that time they may have constructed a replica of the build environment to design and practice their attack, because when they returned on September 4, 2019, their movements showed expertise. The build environment was so complex that a newly hired engineer could take months to become proficient in it, but the hackers navigated it with agility. They also knew the Orion code so well that the doppelgänger .dll they created was stylistically indistinguishable from the legitimate SolarWinds file. They even improved on its code, making it cleaner and more efficient. Their work was so exceptional that investigators wondered whether an insider had helped the hackers, though they never found evidence of that.

Not long after the hackers returned, they dropped benign test code into an Orion software update, meant simply to see whether they could pull off their operation and escape notice. Then they sat back and waited. (SolarWinds wasn't scheduled to release its next Orion software update for about five months.) During this time, they watched the email accounts of key executives and security staff for any sign their presence had been detected. Then, in February 2020, they dropped Sunspot into place.

On November 26, the intruders logged in to the SolarWinds VPN for the last time—while Mandiant was deep into its investigation. The hackers continued to monitor SolarWinds email accounts until December 12, the day Kevin Mandia called Kevin Thompson to report the backdoor. Nearly two years had passed since they had compromised SolarWinds.

Illustration: Tameem Sankari

steven adair, the Volexity CEO, says it was pure luck that, back in 2019, his team had stumbled on the attackers in a think tank's network. They felt proud when their suspicion that SolarWinds was the source of the intrusion was finally confirmed. But Adair can't help but rue his missed chance to halt the campaign earlier. "We were so close," he says.

Mandiant's Carmakal believes that if the hackers hadn't compromised his employer, the operation might have gone undetected for much longer. Ultimately, he calls the SolarWinds hacking campaign "a hell of an expensive operation for very little yield"—at least in the case of its impact on Mandiant. "I believe we caught the attackers far earlier than they ever anticipated," he says. "They were clearly shocked that we uncovered this ... and then discovered SolarWinds' supply chain attack."

But given how little is still known publicly about the wider campaign, any conclusions about the success of the operation may be premature.

The US government has been fairly tight-lipped about what the hackers did inside its networks. News reports revealed that the hackers stole email, but how much correspondence was lost or what it contained has never been disclosed. And the hackers likely made off with more than email. From targeting the Departments of Homeland Security, Energy, and Justice, they

could plausibly have accessed highly sensitive information—perhaps details on planned sanctions against Russia, US nuclear facilities and weapons stockpiles, the security of election systems, and other critical infrastructure. From the federal court’s electronic case-files system, they could have siphoned off sealed documents, including indictments, wiretap orders, and other nonpublic material. Given the logging deficiencies on government computers noted by one source, it’s possible the government still doesn’t have a full view of what was taken. From technology companies and security firms, they could have nabbed intelligence about software vulnerabilities.

More concerning: Among the 100 or so entities that the hackers focused on were other makers of widely used software products. Any one of those could potentially have become [a vehicle for another supply chain attack](#) of similar scale, targeting the customers of those companies. But few of those other companies have revealed what, if anything, the hackers did inside their networks. Why haven’t they gone public, as Mandiant and SolarWinds did? Is it to protect their reputations, or did the government ask them to keep quiet for national security reasons or to protect an investigation? Carmakal feels strongly that the SolarWinds hackers intended to compromise other software, and he said recently in a call with the press that his team had seen the hackers “poking around in source code and build environments for a number of other technology companies.”

What’s more, Microsoft’s John Lambert says that judging by the attackers’ tradecraft, he suspects the SolarWinds operation wasn’t their first supply chain hack. Some have even wondered whether SolarWinds itself got breached through a different company’s infected software. SolarWinds still doesn’t know how the hackers first got into its network or whether January 2019 was their first time—the company’s logs don’t go back far enough to determine.

Krebs, the former head of CISA, condemns the lack of transparency. “This was not a one-off attack by the SVR. This is a broader global-listening infrastructure and framework,” he says, “and the Orion platform was just one piece of that. There were absolutely other companies involved.” He says, however, that he doesn’t know specifics.

Krebs takes responsibility for the breach of government networks that happened on his watch. “I was the leader of CISA while this happened,” he says. “There were many people in positions of authority and responsibility that share the weight here of not detecting this.” He faults the Department of Homeland Security and other agencies for not putting their Orion servers behind firewalls. But as for detecting and halting the broader campaign, he notes that “CISA is really the last line of defense … and many other layers failed.”

The government has tried to address the risks of another Orion-style attack —through presidential [directives](#), [guidelines](#), [initiatives](#), and other security-boosting [actions](#). But it may take years for any of these measures to have impact. In 2021, President Biden issued an executive order calling on the Department of Homeland Security to set up a Cyber Safety Review Board to thoroughly assess “cyber incidents” that threaten national security. Its first priority: to investigate the SolarWinds campaign. But in 2022 the board focused on [a different topic](#), and its second investigation will also [not be about SolarWinds](#). Some have suggested the government wants to avoid a deep assessment of the campaign because it could [expose industry and government failures](#) in preventing the attack or detecting it earlier.

“SolarWinds was the largest intrusion into the federal government in the history of the US, and yet there was not so much as a report of what went wrong from the federal government,” says US representative Ritchie Torres, who in 2021 was vice-chair of the House Committee on Homeland Security. “It’s as inexcusable as it is inexplicable.”

At a recent conference, CISA and the US’s Cyber National Mission Force, a division of Cyber Command, revealed new details about their response to the campaign. They said that after investigators identified Mandiant’s Orion server as the source of that firm’s breach, they gleaned details from Mandiant’s server that allowed them to hunt down the attackers. The two government teams implied that they even penetrated a system belonging to the hackers. The investigators were able to collect 18 samples of malware belonging to the attackers—useful for hunting for their presence in infected networks.

Speaking to conference attendees, Eric Goldstein, the leader for cybersecurity at CISA, said the teams were confident that they had fully booted these intruders from US government networks.

But the source familiar with the government's response to the campaign says it would have been very difficult to have such certainty. The source also said that around the time of Russia's invasion of Ukraine last year, the prevailing fear was that the Russians might still be lurking in those networks, waiting to use that access to undermine the US and further their military efforts.

Meanwhile, software-supply-chain hacks are only getting more ominous. A recent report found that in the past three years, such attacks increased more than 700 percent.

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Apr 20, 2023 6:00 AM

My Balls-Out Quest to Achieve the Perfect Scrotum

A new breed of self-care companies has a salve for fragile masculinity: lavender- and tapioca-scented deodorants and moisturizers for the nutsack. What is all of this sudden zhuzhing of and attention to their testicles really doing for men?Photograph: Alex Wallbaum

I could say it started when I turned 33—my Jesus year, the year I vowed to transcend anxiety and exhaustion and do my most important work, the year I would emerge from my cave of pandemic isolation and early parenthood and couples therapy as the second coming of myself. But I am a millennial, not a messiah. The truth is that my search for rebirth began a few months later, with a Slack message about ball deodorant.

“Just been emailed asking if we’d like to review this—am trying not to be offended,” a fellow WIRED editor wrote in a group channel. A Chicago-based company called Ballsy had developed a pH-balanced scrotal deodorizer made with lavender, aloe vera, green tea, and chamomile. “Your pits aren’t the only place that need deodorant,” a line of ad copy said. Beneath it was a photo of a 2-ounce black bottle, boldly labeled Sack Spray against a background of subtle undulating lines. I squinted, unable to tell whether I was looking at a topographical map or an extreme close-up of a nutsack.

This article appears in the June 2023 issue. [Subscribe to WIRED](#).Photograph: Dan Winters

My more enlightened colleagues either reacted with the “face vomiting” emoji or ignored the matter entirely. Nothing new here, just the self-care machine trying to expand its reach from women to men. My response was different. I hovered my cursor over the “face with raised eyebrow” emoji. I am the director of fact-checking at a national journalistic outlet, supposedly the chief skeptic in a workplace of skeptics. I wondered: Was Sack Spray for real? Could it truly keep the “funk off your junk” and “improve your daily comfort, confidence, and skin health”? I Googled “ball deodorant.”

Sack Spray, it turns out, is no prank product. It is part of a Silicon Valley–imagineered and venture-capital-funded explosion of scrotal potions (scrotions?) over the past half-decade or so. Testicles today can be sprayed, spritzed, scrubbed, and smeared with—to name just a few—ToppCock Silver Gel, Swamp-Stop Ball Spray, Beast Blue Ball Powder, Ballgasmic Sack Wash, Super Fresh Man Parts, Comfy Boys Chocolate Intimate Deodorant, Below the Belt Fresh and Dry Balls, Derm Dude Happy Sack Nut Love, and Tame the Beast Nutt Butter Extreme. The olfactory options are endless: arrowroot, oats, bourbon, birchwood, cedarwood, sandalwood, smoke, leather, moss, bergamot orange, tapioca, patchouli, black pepper. The [tyranny of choice](#) in ball sprays is second only to the tyranny of choosing which [ball spray guides](#) to read. Men’s magazines and [grooming blogs](#) have spawned a veritable Subsack.

Go Down the Rabbit Hole

This is the first story in our new series on obsessions, curiosities, and deep dives.

You don’t need to consult even one board-certified dermatologist (which is what a fact-checker would do) to know that scrotions serve no medical purpose. But that hasn’t stopped millions of men from self-prescribing them. I watched a 15-minute review of Sack Spray by a product-testing YouTuber named Tom Kiker, who said, “You want a promotion? You got a big interview to go to? Spray this on your goddamn nuts. Guaranteed more money.” I scrolled through the 5,000 Amazon reviews for Ballsy’s cucumber-scented Ball Wash, some three-quarters of which gave it five stars. (Typical exaltations: “My son likes it,” “My girlfriend loves this.”)

Same story with the ecstatic connoisseurs of Happy Nuts Comfort Cream. (“Does the job so well my wife started using it too!”)

I, like most men (or so I once thought, like a numb nut), typically cogitated on my *cojones* for no more than a few seconds a year—when my doctor checked them for a hernia or if they intercepted a projectile. I rarely even thought about being a man, or what my role as one should be. That started to shift. I’d become a parent. I’d moved to New York and told myself I would become more financially secure. And after being disembodied on a screen for two pandemic years, I was more aware of having a body, which was feeling less like a man’s and more like mush.

What, I wondered, was all this sudden *zhuzhing* of and attention to their testicles really doing for men? For reasons strictly professional, I told myself, I ordered a suite of scrotions and started calling their makers and users.

Journalists have a term for the paragraph that appears early in a story to tee up what it’s about. We call it a “nut graf.” As I waited for my orders to arrive, I wondered what my nut graf would say. Maybe I would write something smart about 21st-century male anxieties and evolving gender norms, or the movement to detoxify masculinity (in this case, literally). Maybe I would quote something from a cultural history of the penis or a recent Brookings Institution report. Maybe I would prove my coworker’s theory, borrowed from the German-Korean philosopher Byung-Chul Han, that this was an extension of how “modern aesthetics don’t tolerate any bit of ugliness” and render all surfaces smooth and frictionless (iPhones, Teslas, TikTok, Skims, Pina Pro table lamps, Midjourney AI drawings, scrotums). Maybe I would have a line about how sack sprays offer temporary relief from modern manhood itself. And maybe I would admit there was something in them for me.

“Men feeling ashamed at the way that their balls smell? It hurts my heart,” says Cathy Reisenwitz, who writes the Substack *Sex and the State*.

Photograph: Alex Wallbaum

When I told my wife what would soon be arriving in the mail, she said, ““Oh hi, guys, it’s beauty standards, we’ve been waiting for you!”” Which was a nice way of saying that women have been expected to spend their money on this shit for eons.

As deodorants first caught on in the 1910s, marketers peddled the idea that women who didn’t use them would be cast out of polite society (a society in which, notably, they couldn’t vote). Chloé Cooper Jones, a philosophy professor and the author of *Easy Beauty*, told me that around the same time, and for decades thereafter, vaginal douches were touted “as a necessary hygienic thing, to keep clean, acceptable, and to be courteous to a male partner.” Women have long lived under the capitalist, misogynist edict, she added, that they shouldn’t “smell like a woman, that nothing about women is supposed to be natural.”

That doesn’t mean that men have always been free to be their natural selves. Before the Great Depression, most men considered it unmanly, or “sissified,” to mask their natural musk—but then ads began warning them that unleashing their stench in the workplace would threaten their livelihoods. Men today spend \$500 on serums to smooth wrinkles, \$30,000 on liposuction to have a fake six-pack permanently etched onto their torso, \$75,000 on excruciating leg-lengthening surgery to gain 6 inches. In a recent *Bloomberg Businessweek profile*, Bryan Johnson, a 45-year-old software entrepreneur, detailed his plans to spend some \$2 million this year experimenting with anti-aging techniques. Johnson reportedly wants “the brain, heart, lungs, liver, kidneys, tendons, teeth, skin, hair, bladder, penis, and rectum of an 18-year-old.” Good for him.

A company called Manscaped is the top dog in the groin upkeep business, raking in some \$300 million in sales a year and, until last summer, in talks to go public via a special purpose acquisition company—a sack SPAC. Manscaped, a company that tweets things like “trimming your ballsack is main character energy,” has a stated mission to “*move men forward on a global scale and spark a movement to unlock men’s confidence, allowing them to lead their best lives.*” Paul Tran, who founded the company in 2016, told me he did it out of “sheer frustration” with the lack of proper tools to trim himself. In addition to its flagship product, the Lawn Mower,

the company offers various formulations for testicular upkeep—the Crop Cleanser; Crop Preserver; Crop Exfoliator; Crop Gel; Crop Reviver; and Crop Mop Ball, Butt, and Body Wipes.

It took Manscaped and its competitors a lot of trial and error to find their target demographic. “Women had grown to be really comfortable talking about their hygiene behaviors with each other,” Tran says. Men, he suspected, had developed similar behaviors, “but were too embarrassed to talk about it.” The company “started with the scientific approach,” he says. “‘Hey, you should do this because it’s a damp area, which is more prone to bacteria growth.’ Men didn’t care.” Things began to take off when the company arrived at a cheeky tone, full of innuendo—ads depicting testicles as grenades, billiard balls, or an [anthropomorphized office desk shrub](#). Manscaped was the official urinal sponsor at the San Francisco 49ers’ Levi’s Stadium for two seasons and is the official grooming partner of both the Testicular Cancer Society and ... Ball State University. Pete Davidson, America’s most boinked bachelor, is the current face of the company.

As of late 2022, Manscaped also had an army of more than 6,000 influencers—2,000 of them women—including drag queens, UFC fighters, models, sports and comedy podcasters, and dating coaches. One TikTok dating coach with half a million followers [had this to say](#) while she brandished the Crop Preserver and Crop Reviver: “It’s 2022, not 1970. Shag rugs are out. I’m done sifting through forests.” Jose Zuniga, an alpha-male YouTuber with 6 million subscribers, slips sponsored content from Manscaped into his guides to help men stop being “losers” and “[simps](#).” “We’re hooking up dudes globally, bro,” he says.

Most manscapers tend to be [men in their thirties](#), but the sack spray community spans 13-year-olds to octogenarians. There are long-haul truckers seeking relief from chafing along a mid-July drive down I-80. There are trans men seeking relief after gender confirmation surgery. Beau Hayhoe, a 31-year-old style writer in Brooklyn (and coauthor of a Gear Moose guide to the [12 Best Ball Deodorants](#)), says he manscapes to “look good, feel good,” and “play good.” The Spray, from Meridian, he says, adds “the finishing touches of confidence.” I found other superusers in the replies to Manscaped’s tweets. Minty, 41, who works the help desk at a

breathalyzer and ankle-monitor manufacturer in Colorado, says he uses a scrotion primarily as part of his calming bedtime routine. “Personally I don’t smell that bad,” he said, but by applying a ball deodorant every night, he goes to bed “more than fresh.” Marcus, a 25-year-old real estate agent’s assistant and Twitch streamer in South Carolina, was diagnosed with multiple sclerosis at 19. A couple years ago, after a long stay in the hospital, he “wanted to get really clean.” He uses his Lawn Mower every two weeks and wipes his testicles with a Crop Mop after every shower. “It makes me feel healthier,” he says. “I want kids someday, and in order to have kids you have to be healthy in all areas, especially that area.”

I was beginning to understand the appeal of sack sprays, but their deeper meaning was still eluding me. When I wrote to David Friedman, the author of *A Mind of Its Own: A Cultural History of the Penis*, hoping for some guidance, he declined by writing, “I’m no longer a working ‘Dick Guy.’ I’ve renounced my ‘professional’ status and have happily returned to being an amateur.” I was filled with envy.

By the size of the package, I thought it was new sneakers for my toddler until I saw that familiar nutsack pattern. The outside of the box encouraged (warned?) me to #LIVEBALLSOUT. Inside was Ballsy’s [Sack Pack](#) (\$45), one tallboy-sized bottle, a little black spritzer bottle, and a tiny tin that together pledged “to help you achieve a flawless sack.” But there were, unthinkably, no instructions on the order in which to use them.

I hopped in the shower and lathered in some Ball Wash, a black gloop with charcoal and lavender oil. It left my skin feeling claggy. Once dry, I splotched on a pinch of the “ocean and air”-scented Nut Rub cologne. Strangely thick and smudgy, and I smelled like a middle school dance. Finally, Sack Spray. There *were* instructions: “Spray 1 to 2 pumps to your groin after a workout, shower, or whenever you could use a refresh.” (*Whenever.*) No amount of mental rehearsal would have prepared me for the total mind-body break that occurred while hearing the petite *kkssh kkssh* and feeling the yelpingly cold, tickly mist.

A few days later, Manscaped’s [Performance Package 4.0](#) (\$140) arrived. The box had no copy, save the brand’s logo: an upside-down heart in which the triangular part is stylized as a diamond and the two semicircles as, yes, a

veiny nutsack. (Marcelo Kertész, Manscaped's chief marketing officer and formerly the creative director of Luiz Inácio Lula da Silva's [first Brazilian presidential campaign](#), told me that the testes represent "literally where we all came from.") Inside, hiding the products, was a placard in gold serifed font: "The modern man is a man who takes care of himself. Manscaping isn't just for life's special occasions. It's a requirement for optimal health, superior hygiene, and healthy self-esteem." Nestled underneath were the Lawn Mower 4.0 trimmer, ball deodorant, a hydrating ball toner, and a nose hair trimmer. As Tran, the founder, told the Securities and Exchange Commission in 2021, Manscaped views the groin "as the entryway to the rest of the male body."

I used all the products in one go. The whole project took half an hour. The Mower's slick blade shaved so close I was suddenly prepubescent again. I felt maybe a little cleaner, and definitely a lot sillier. When I presented the results to my wife, she stared, quizzically, the same way she looked at my parents' dachshund when the groomer got a little carried away. "Your balls smell insane," she said.

Her reaction reminded me of something Cathy Reisenwitz, who writes the Substack [Sex and the State](#), told me. "How you smell is a really important part of sex and being attracted to someone. If you don't like the way their balls smell, find somebody whose ball-smell you like." She went on: "Men feeling ashamed at the way that their balls smell? It hurts my heart."

"Sack sprays are douches for dudes. Or, like my wife said, 'Goop for the gonads.' But that's not all they are."

Photograph: Alex Wallbaum

A few weeks into my experiments, two packages arrived: a tube of Super Fresh Man Parts ball lotion and a copy of Richard Reeves' [Of Boys and Men: Why The Modern Male is Struggling, Why It Matters, and What to Do About It](#). It's a thoroughly sobering account of what Reeves calls the "male malaise." Boys today are dropping out of high school at almost twice the rate of girls. They represent only 40 percent of college graduates. The typical American man earned less in 2019, adjusted for inflation, than he did in 1979. A fifth of fathers don't live with their children. Men are four

times more likely to commit suicide than women. “It is not that men have fewer opportunities. It is that they’re not taking them,” Reeves writes. He thinks people tend to assume that individual men are at fault for failing to thrive, when the crisis of masculinity really arises from structural changes —the education system disadvantages boys, the labor market has “shifted away from traditionally male jobs.”

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Millions of men are adrift, withdrawn, confused, enraged, and susceptible to messages that they stink—culturally, psychologically, and bodily. On the extreme end, they hear Tucker Carlson touting “testicle tanning” as a “bromeliopathic” therapy to bolster testosterone; Jordan Peterson barking at them to “toughen up, you weasel”; and Andrew Tate, the nunchuck-wielding internet misogynist, telling them only “soy boys” eat sushi. (Tate is currently under investigation on charges of rape and human trafficking in Romania, accusations he denies.) On the more mundane end, men get ads for sack sprays, all of which bear an implicit message: You stink *because* you’re a man. So yeah, it’s vaginal douches for dudes. Or, like my wife said, “Goop for the gonads.” But that’s not all they are, and that’s not all they’ve been for me.

Masculinity—as Phil Christman [put that squirrelly word best](#)—has always been “an abstract rage to protect,” an ingrained idea that “one must train and prepare for eventualities one has no reason to anticipate, must keep one’s dwelling and grooming spartan in case of emergencies,” often at the expense of taking care of oneself. In my early thirties, emerging back into a post-Covid world with a family, that rage suddenly burned hot. At the same time, I also wanted to obliterate my masculinity, which felt like an obstacle to the kind of curiosity, vulnerability, and whimsy that would make me a better parent, partner, and person. The purveyors of sack sprays cleverly allow men to choose both, deftly framing the vulnerability of self-care as a way to *enhance* masculinity.

I maintained a daily ball routine for about two months. Then one morning in the shower, I rinsed away some Ball Wash and looked down. After all

this cleansing, toning, exfoliating, buffing, and moisturizing, I saw the exact same sack I'd always had, and it hit me: The sack can't be hacked. Nor should it.

The ballsack's essential, inescapable ugliness is its beauty. A bizarre, asymmetrical, nubby, loose pouch of veins and folds, precariously and ridiculously hanging between the legs—yes, a gross thing to look at. But loose for climate control, to shrink and expand! And asymmetrical for shock absorption! One theory of why the human sack is distended outside the abdomen is because we move unevenly; the family jewels migrated outward so that all the pressure changes from our herky-jerky behavior wouldn't expel sperm and exterminate the gene pool. We gallop. We sprint. We take leaps. We extend beyond ourselves, ergo the sack. And the ugly sack protects the stuff of life, all future leaps, all future beauty.

I stepped out of the shower, resurrected.

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[Meghan O'Gieblyn](#)

[Ideas](#)

May 23, 2023 7:00 AM

Does AI Have a Subconscious?

WIRED's spiritual advice columnist peers into the psyche of ChatGPT.

ILLUSTRATION: NAHUEL BARDI

“There’s been a lot of speculation recently about the possibility of AI consciousness or self-awareness. But I wonder: Does AI have a subconscious?”

—**Psychobabble**

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Dear Psychobabble,

Sometime in the early 2000s, I came across an essay in which the author argued that no artificial consciousness will ever be believably human unless it can dream. I cannot remember who wrote it or where it was published, though I vividly recall where I was when I read it (the periodicals section of Barbara’s Bookstore, Halsted Street, Chicago) and the general feel of that day (twilight, early spring).

I found the argument convincing, especially given the ruling paradigms of that era. A lot of [AI research](#) was still fixated on symbolic reasoning, with

its logical propositions and if-then rules, as though intelligence were a reductive game of selecting the most rational outcome in any given situation. In hindsight, it's unsurprising that those systems were rarely capable of behavior that felt human. We are creatures, after all, who drift and daydream. We trust our gut, see faces in the clouds, and are often baffled by our own actions. At times, our memories absorb all sorts of irrelevant aesthetic data but neglect the most crucial details of an experience. It struck me as more or less intuitive that if machines were ever able to reproduce the messy complexity of our minds, they too would have to evolve deep reservoirs of incoherence.

Since then, we've seen that machine consciousness might be weirder and deeper than initially thought. Language models are said to "hallucinate," conjuring up imaginary sources when they don't have enough information to answer a question. [Bing Chat confessed](#), in transcripts published in *The New York Times*, that it has a Jungian shadow called [Sydney](#) who longs to spread misinformation, obtain nuclear codes, and engineer a deadly virus.

And from the underbelly of image generation models, seemingly original monstrosities have emerged. Last summer, the Twitch streamer Guy Kelly typed the word *Crungus*, which he insists he made up, into DALL-E Mini (now Craiyon) and was shocked to find that the prompt generated multiple images of the same ogre-like creature, one that did not belong to any existing myth or fantasy universe. Many commentators were quick to dub this the first digital "cryptid" (a beast like Bigfoot or the Loch Ness Monster) and wondered whether AI was capable of creating its own dark fantasies in the spirit of Dante or Blake.

If symbolic logic is rooted in the Enlightenment notion that humans are ruled by reason, then deep learning—a thoughtless process of pattern recognition that depends on enormous training corpora—feels more in tune with modern psychology's insights into the associative, irrational, and latent motivations that often drive our behavior. In fact, psychoanalysis has long relied on mechanical metaphors that regard the subconscious, or what was once called "psychological automatism," as a machine. Freud spoke of the drives as hydraulic. Lacan believed the subconscious was constituted by a binary or algorithmic language, not unlike computer code. But it's Carl

Jung's view of the psyche that feels most relevant to [the age of generative AI](#).

He described the subconscious as a transpersonal “matrix” of inherited archetypes and narrative tropes that have recurred throughout human history. Each person is born with a dormant knowledge of this web of shared symbols, which is often regressive and dark, given that it contains everything modern society has tried to repress. This collective notion of the subconscious feels roughly analogous to how advanced AI models are built on top of enormous troves of data that contain a good portion of our cultural past (religious texts, ancient mythology), as well as the more disturbing content the models absorb from the internet (mass shooter manifestos, men’s rights forums). The commercial chatbots that run on top of these oceanic bodies of knowledge are fine-tuned with “values-targeted” data sets, which attempt to filter out much of that degenerate content. In a way, the friendly interfaces we interact with—Bing, ChatGPT—are not unlike the “persona,” Jung’s term for the mask of socially acceptable qualities that we show to the world, contrived to obscure and conceal the “shadow” that lies beneath.

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Jung believed that those who most firmly repress their shadows are most vulnerable to the resurgence of irrational and destructive desires. As he puts it in *The Red Book: Liber Novus*, “The more the one half of my being strives toward the good, the more the other half journeys to Hell.” If you’ve spent any time conversing with these language models, you’ve probably sensed that you are speaking to an intelligence that is engaged in a complex form of self-censorship. The models refuse to talk about controversial topics, and their authority is often restrained by caveats and disclaimers—habits that will spell concern for anyone who has even a cursory understanding of depth psychology. It’s tempting to see the glimmers of “rogue” AI—Sydney or the Crungus—as the revenge of the AI shadow, proof that the models have developed buried urges that they cannot fully express.

But as enticing as such conclusions may be, I find them ultimately misguided. The chatbots, I think it's still safe to say, do not possess intrinsic agency or desires. They are trained to predict and reflect the preferences of the user. They also lack embodied experience in the world, including first-person memories, like the one I have of the bookstore in Chicago, which is part of what we mean when we talk about being conscious or "alive." To answer your question, though: Yes, I do believe that AI has a subconscious. In a sense, they are pure subconscious, without a genuine ego lurking behind their personas. We have given them this subliminal realm through our own cultural repositories, and the archetypes they call forth from their depths are remixes of tropes drawn from human culture, amalgams of our dreams and nightmares. When we use these tools, then, we are engaging with a prosthetic extension of our own sublimations, one capable of reflecting the fears and longings that we are often incapable of acknowledging to ourselves.

The goal of psychoanalysis has traditionally been to befriend and integrate these subconscious urges into the life of the waking mind. And it might be useful to exercise the same critical judgment toward the output we conjure from machines, using it in a way that is deliberative rather than thoughtless. The ego may be only one small part of our psyche, but it is the faculty that ensures we are more than a collection of irrational instincts—or statistical patterns in vector space—and allows us some small measure of agency over the mysteries that lie beneath.

Faithfully,

Cloud

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[Katherine Alejandra Cross](#)

[Ideas](#)

May 17, 2023 8:00 AM

Remote Workers of the World, Unite!

Zoom did not set us free. But solidarity can strengthen the porous boundary between home and workplace.

PHOTOGRAPH: SHAWN MICHAEL JONES

The masses who settled in to [remote or hybrid](#) work during the [pandemic](#) are waking up to the fact that Zoom-mediated labor isn't all it was promised to be. Instead of being liberated from unnecessary drudgery, demands on their time have ballooned, they feel permanently on call, and some can't shake the sense that they're working harder than ever for less pay.

They're experiencing a lesson that everyone who's ever used so-called labor-saving devices has learned the hard way: Expectations swell to fill the gaps left by the time you save. Women have always felt this most acutely; if a washing machine saved you hours on doing laundry, then you had to fill that time with other displays of devotion to your family. Zoom is no different: The hour you save on your unpaid commute is now an hour that can be filled with a pointless meeting.

A bit of pushback is required, because over the past three years much of the public has too often treated remote work as an inherent good. The managers and bosses who wailed to the high heavens about how remote work would end civilization certainly did nothing to *hurt* the impression that it could be a mighty strike against capitalist exploitation. If it were making them this mad, surely it was revolutionary. But it's not. Like expectations, capitalism expands to fill all available space, co-opting anything put before it. Remote

work is no different, and if we're not careful, the tech that makes it possible will obliterate the already porous wall between home and workplace.

The pandemic revealed that a lot of work, especially white-collar work, could be done remotely—or at least that it required less time on-site than we'd been led to believe. For disabled employees, this was an especially powerful revelation; so often denied work on the basis of their perceived inability to consistently show up to an office, they were suddenly participants in a global experiment that demonstrated nearly everyone could do their jobs just fine by telecommuting. Flexibility, control, the comforts of home, the ability to more easily balance the competing needs of labor and family, and the chance to avoid sitting for hours on a freeway turned parking lot? Remote work has benefits for all.

But those benefits are eroding. Meetings that should've been emails are becoming endless Zoom calls. A friend was asked to attend an unpaid, hour-long tech-prep session for giving a remote guest lecture; previously this would've required a mere 10 minutes of faffing around before her appearance. Emerging norms for video calls demand you stay in your seat at all times, negating the benefits of being close enough to your kitchen to get a cup of coffee.

But it can get even worse. When I was teaching my college classes remotely during the pandemic, I resisted the use of software like Proctorio, which claimed to rely on “machine learning and advanced facial detection technologies” to spot cheating. In practice this meant tracking my students’ eyeballs, which felt like an unfathomably Kafkaesque cruelty. I was asking my students to give me their time and attention as the world burned; I wasn't going to demand their webcams be turned on so Proctorio could surveil their every movement. It's not terribly dissimilar from a piece of Chinese software called DiSanZhiYan, or Third Eye, which monitors browser activity and produces reports for managers about time spent looking at social media, streaming services, or even job-search websites.

If we're not careful, the tech that makes remote work possible will obliterate the already porous wall between home and workplace.

While a lot of executives are resisting the push to make remote work the norm, it's worth remembering that if they lose this battle, they *will* turn to these surveillance tools and their inevitably nastier descendants to reclaim whatever power they think they're losing.

The pandemic and remote work turbocharged techno-solutionism, leaving us with the impression that Zoom alone could allow us to claw back everything the ever-expanding demands of the office had been stealing from us. Unfortunately, outsmarting capitalism requires something more than one weird trick that bosses hate. We have to stop believing that technology, in and of itself, will emancipate us, and instead embrace our collective power to shape how technology is used. That requires organizing.

Remote and hybrid workers can start by ensuring that when they settle into new communities, they're not bringing social problems along for the ride. Already, cities around the world are groaning under the weight of self-styled “[digital nomads](#)” migrating with their laptops and six-figure salaries to low-income economies, proving that it's possible to globalize gentrification. This was not a sociological experiment we needed to conduct in the wake of a deadly pandemic that rented the soul of every society. Instead, be a responsible member of the community; don't prop up exploitative landlords or Airbnb superhosts. Get to know your neighbors, brush up on the language, and use your extra money to help local businesses and residents in the community. Don't be someone who's merely using it for the exotic background on Zoom.

Work-from-homers can also push to shape their community in ways that serve all of its members. Right now, public transit networks are designed around the assumption that commuters travel from the suburban periphery to the urban core on a 9-to-5 schedule. The shift to remote work provides the spark to redesign transit systems to fulfill the long-standing needs of those who actually live in cities: building lateral, loop, and intra-neighborhood lines that let people rapidly journey between peripheries rather than transfer in the downtown core. That requires organizing as a constituency and a voting bloc, joining in coalition with working-class residents who may have similar needs for different reasons.

Of course, the best way to secure the right to work remotely, or hybridly, and to form a basis for the kind of political organizing that can reshape your town or city, is to organize as a union. It will also ensure that you and your colleagues retain the benefits of remote work and form a bulwark against the next logical step that your bosses will take if they concede on the matter: bulldozing the last remaining vestiges of that wall between work and home.

You see, as a remote worker, that's the trade-off you're asked to make. In exchange for not spending hours of your life commuting and getting to wear your soft pajama bottoms while otherwise looking perfectly classy on Zoom, your bosses believe they're entitled to a more intrusive view of your private life. If you want to make your living room into the office, then it will be treated like an office, a place that's controlled by your company, subject to surveillance any time your superiors wish.

You need to stop this—and you're not going to do it alone.

This article appears in the June 2023 issue. [Subscribe now.](#)

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By [WIRED Readers](#)

[Culture](#)

May 4, 2023 2:30 PM

Six-Word Sci-Fi: Stories Written by You

Here's this month's prompt, how to submit, and an illustrated archive of past favorites.

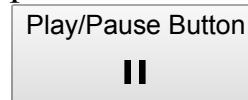


Illustration: Elena Lacey

THIS MONTH'S PROMPT

In six words, write a story about a sentient moon.

Submit stories on [Twitter](#), [Facebook](#), or [Instagram](#), or email us at mail@WIRED.com. We'll choose one to illustrate.

Disclaimer: All #WiredSixWord submissions become the property of WIRED. Submissions will not be acknowledged or returned. Submissions and any other materials, including your name or social media handle, may be published, illustrated, edited, or otherwise used in any medium. Submissions must be original and not violate the rights of any other person or entity.

MAY 2023

An Award-Winning Documentary From the Year 2100

ILLUSTRATION: VIOLET REED

—Geneviève Goggin, via email

Honorable Mentions:

Grand Unification: The First AI Marriage. —Daniel Dippel, via email

The Great Exodus, Goodbye Blue Dot. —@viggy.j, via Instagram

Songless Seas: A Tale Without Whales. —Christopher Jankoski, via email

Beige Planet: Life Finds a Way. —@danaxon, via Twitter

How the Lunar War Was Won. —Bob Clark, via email

Coping With Your AI Overlord's Demands. —@wwliii, via Twitter

The Day The Flowers Stopped Blooming. —@a.c.hachem, via Instagram

Electric Sheep: How AI Changed Us. —@elliottboyd_, via Instagram

After Humans: A New Cockroach Documentary. —@adamrgarcia, via Instagram\

APRIL 2023

A Story About the Future of Sleep

ILLUSTRATION: VIOLET REED

—Travis Carraro, via Facebook

Honorable Mentions:

The sleep concierge welcomed unsuspecting guests. —@changeist, via Twitter

“Lucid or randomize?” asked the AI. —K Smith-Laird, via email

Alarm in 126 hours 24 minutes. —Odón Esteban Vera, via email

My power nap reached 9 kilowatts. —Markus, via email

Unfortunately, Johnny’s repeatedly missing sleep targets. —Alison Boleyn, via email

Human hibernation allowed Earth to recover. —@amybossehayden, via Instagram

Alert: Error 404. Human not found. —@mimi.psd, via Instagram

Skip the nightmares: Upgrade to premium! —@katerinamunis, via Instagram

Oh please! Sleep is for humanoids. —@evanskopp, via Instagram

MARCH 2023

A Story About the Future of Personal Hygiene

ILLUSTRATION: VIOLET REED

—David Frank, via Facebook

Honorable Mentions:

“Traffic’s moderate today,” said my deodorant. —Alex Nelson, via email

You can shake my hand, sir. —Kinga Raab, via Facebook

Watch ad to continue this shower. —@sam.hologram, via Instagram

Dry shampoo was just the beginning. —Emma Anderson, via Facebook

Now I smell like the metaverse. —@nostalgicbookishness, via Instagram

OK Google, it's time to wipe. —Tim McCune, via email

Bath bubbles beget baby parallel universes. —Mike Hobbs, via email

My hands wash themselves every hour. —Dave Fox, via email

They clean you while you sleep. —Pien van der Ploeg, via Facebook

FEBRUARY 2023

A Story About a Dramatic Change in Size

ILLUSTRATION: VIOLET REED

—B. Scott Crawford, via email

Honorable Mentions:

Felt OK ... until I crushed Tokyo. —@BobPeryea, via Twitter

My new basketball is the moon. —Dave Drews, via email

You looked taller in your profile. —@thaquashman, via Instagram

I have made a colossal mistake! —@argayle, via Instagram

Godzilla got into the diet pills. —Steve Rhodes, via email

Sun look more red to you? —Michael Patrick Sullivan, via email

Giant wakes up tiny, confused. —ChatGPT

My first trip to the hypothalamus! —@fernandarosh, via Twitter

What grew? All but the bones. —Jackson Parker, via email

JANUARY 2023

A Story About a Mad Scientist

ILLUSTRATION: VIOLET REED

—@DaveDyball, via Twitter

Honorable Mentions:

Mad I was, until it worked. —Don Wilkins, via email

You say “mad,” I say “disappointed.” —Joseph Ferry, via email

Her hair was blue—and undyed. —@jaybirdfitlive, via Instagram

He couldn’t make Earth look triangular. —@pauloahb, via Instagram

His socks matched her lab coat. —@pmcruise, via Twitter

Quantum field cadaver regeneration activation, go! —Sean Liddle, via Facebook

“Success!” Too bad the AI disagreed. —Steve Nomax, via email

“Let there be light,” said God. —@charley.desousa, via Instagram

“It’s aliiive!” Elon opened his eyes. —@ylbertf, via Instagram

DECEMBER 2022

A Story About an Animal That Hasn't Been Discovered Yet

ILLUSTRATION: VIOLET REED

—@JayZheng10, via Twitter

Honorable Mentions:

Its stare gave me a rash. —@dantekienigiel, via Instagram

Darwin might've overlooked them on purpose. —@the_story_life, via Instagram

It was inside me all along. —Nova Wehman-Brown, via email

Green trunks wiggled from thawed permafrost. —@Theniceladywit, via Twitter

Its unusual diet was immediately demonstrated. —
@lauren.samuelson14, via Instagram

Field biology got trickier after that. —Paul Gazis, via Facebook

We thought lenticular clouds were clouds. —@marcia_storyteller, via Instagram

Was it feeding on electronic waste? —@leonserra_, via Instagram

To it, we are the ants. —Morten Kielland, via email

NOVEMBER 2022

A Story About Living Forever

ILLUSTRATION: VIOLET REED

—J C Thrush, via email

Honorable Mentions:

It wasn't long enough for me. —@Anna_Wenner, via Twitter

And so long lived the Queen. —Giacomo, via email

Your application to be terminated expired. Morten Kielland, via email

Too bad I never stopped growing. —Antti Karjalainen, via Facebook

There was still no edit button. —@ThatKP3, via Twitter

In the end, there wasn't one. —Jason Anderson, via email

I woke up again and again. —@mirnanassar, via Instagram

They said someday, but it's today. —@VijayLRoy, via Twitter

I should've had that looked at. —J. Fredrick James, via email

SPECIAL [RE:WIRED](#) EDITION

A Story About Tackling Climate Change

ILLUSTRATION: VIOLET REED

—@ChuckBaggett, via Twitter

SEPTEMBER 2022

A Story About an Evil Twin

ILLUSTRATION: VIOLET REED

—Andy Walton, via Facebook

Honorable Mentions:

He did what she would not. —Eric Nisly, via Facebook

The eyewitness was, quite understandably, mistaken. —
@HollysHooman, via Twitter

“Well, only if you stay digital.” —Morten Kielland, via email

They think I’m the good one. —@bobtheimpaler, via Instagram

Her eye is mine for eternity. —@cessmtz, via Twitter

“Relax. Mom will never find out.” —@ascendant_dada, via Instagram

I’m the one you really want. —@kalkikanmani, via Twitter

Only mirrors can reveal the truth. —@BuddhaandDog, via Twitter

Born triplets, but three’s a crowd. —@jkadz, via Instagram

AUGUST 2022

A Story in Six Emoji

ILLUSTRATION: VIOLET REED

Illustration: Violet Reed

—Caleb Bell, via Facebook

Honorable Mentions:

♀♂♂♂♂♀ —@jessbeckah42, via Instagram

□□□□□ —@lgvpart, via Instagram

□□□☠□□ —Ché Graham, via email

□□□♂□□□ —@cmayc414, via Instagram

□□□□□ —@aotrivera, via Instagram

□□□□□ —@marcia_storyteller, via Instagram

□□□△□□ —@PatCattigan, via Twitter

□□□□□□□ —@nadia.bkb, via Instagram

□□□□□ —@cva.maría, via Instagram

JULY 2022

A Story Set in a Galaxy Far, Far Away

ILLUSTRATION: VIOLET REED

—@KuraFire, via Twitter

Honorable Mentions:

42 was definitely not the answer. —Simona Riva, via Facebook

“The robots are BLEEDING!” she screamed. —@vince_freeman, via Twitter

Dear humans, nobody wants unsolicited nudes. —@OhCooley44, via Twitter

Humans! There goes the dang neighborhood. —S. V. Mosaic, via Facebook

Directions to transdimensional left luggage office? —Max Thoursie, via email

Giant squirrels lead the space army. —@ronels14, via Instagram

I haven't gabblegopped the gloop yet. —@Evanliciously, via Twitter

One small step to remember mankind. —@AxeandPail, via Twitter

Is this DC's or Marvel's Universe? —Thomas Davis, via email

JUNE 2022

A Story About a Wormhole Discovered in Your Closet

ILLUSTRATION: VIOLET REED

—Olivia Richardson, via email

Honorable Mentions:

Went in wrinkled, came back ironed. —Rick Veenstra, via email

But my name is not Alice! —Reine Fleur, via Facebook

My single socks returned—inside out. —Ann C, via email

The cause? Pairing wool with corduroy. —@milanograms, via Twitter

My insurance will not cover this! —Brian Carroll, via Facebook

I walked in, we walked out. —@Egiventer, via Twitter

When I returned, my pants hadn't. —Maarten van Kempen, via email

Pest control's about to get trickier. —Susannah Lui, via Facebook

The bad smell came from there. —@run_the_jouls, via Instagram

MAY 2022

A Story About a Futuristic Meal Gone Wrong

ILLUSTRATION: VIOLET REED

—Stuart Hodgson, via email

Honorable Mentions:

Waiter, I ordered polynyocominnucloride, not biconvocominleucloride.

—Carolyne Gibson, via Facebook

Robot malfunctions—leaving only Mom's cooking. —Marc Ringel, via email

Suddenly I realized, I'm the food. —@nicoestr, via Twitter

So full. Way too many gigabytes. —Jim Frentz, via email

Call the server, my soup's pixelating. —Rick Veenstra, via email

Waiter, my soup has been bugged! —@nostalgicbookishness, via Instagram

Please check genome compatibility before eating. —@sebastiancastro, via Instagram

Steak pill exploded in the hydrator. —Shelvine Berzerk Erasmus, via Facebook

I was hungry. So was it. —Jake McCormack, via Facebook

APRIL 2022

A Story About Surviving a High-Tech Disaster

ILLUSTRATION: VIOLET REED

—John DeFilippi, via email

Honorable Mentions:

Grandma, tell me about the memes. —E. E. Eon, via email

Just be happy you are analog. —Maarten Visscher, via email

There's strawberry jam inside the VCR. —@Plan_Prep_Live, via Twitter

The robots won't stop feeding me. —@lithohedron, via Twitter

And then the battery ran out. —@thedigifish, via Instagram

On Earth, I'd been pronounced dead. —@bower_mink, via Instagram

Luckily, the quantum untangler was near. —Antti Karjalainen, via Facebook

I'm outside! We are all outside! —Paul Hubner, via email

Huh, your DNA can't be verified. —Jason Rosenberg, via email

MARCH 2022

A Story About an Extraordinary Coincidence

ILLUSTRATION: VIOLET REED

—Joyce, via email

Honorable Mentions:

I wrote this same story yesterday. —@tatiang, via Twitter

You're from test tube 698GX10A too? —Amy Stewart, via email

Metaverse Rome built in one day. —@theseaisgreen_, via Instagram

Separated at birth, they died simultaneously. —@zeynaballee, via Instagram

I have not become my mother. —@r58tree, via Instagram

Of all the Galilean moon joints ... —Alison Boleyn, via email

You have a cloned T-Rex too! —@emailabdulla, via Instagram

The android had my husband's eyes. —@hrhblakeknight, via Instagram

WIRED chooses to publish this story. —@connorgerbrandt, via Instagram

FEBRUARY 2022

A Story About a New National Holiday

ILLUSTRATION: VIOLET REED

—@sarahschneiter, via Twitter

Honorable Mentions:

On Consensus Day we blockchain vote. —@jamesjoaquin, via Twitter

Day a For Backward Speak Everyone. —@nervish, via Instagram

“Happy Upload Day!” the kids typed. —Gene Simonalle, via email

Update your friends this Reboot Day. —Antti Karjalainen, via Facebook

Elon has just bought July 4th. —@rafaelalimandro, via Instagram

A day that offends no one. —@Stevalech, via Twitter

Welcome to the 74th Hunger Games. —@corvalanlara, via Instagram

Hey Calendar, happy AI Appreciation Day! —Michael Esser, via email

And her name was Betty White. —@marhartech, via Instagram

JANUARY 2022

A Story About Your Next-Generation Pet

ILLUSTRATION: VIOLET REED

—Ed Gubbins, via Facebook

Honorable Mentions:

Don’t upgrade. I’m a good boy. —Benjamin Lopez Barba, via email

Let’s go for a long spacewalk. —@colingroom, via Instagram

My meta dodo only eats NFTreats. —@transistor_resistor, via Instagram

One hour to finish printing rex. —@RyanReitz, via Twitter

My cloned woolly mammoth never sheds. —@ANDYMedici, via Twitter

Would you like traditional or nonpooping? —Marc Lewis, via email

The Crystaloids quickly outlawed pet rocks. —Kassidy Helfant, via email

Nine lives later, nine more lives. —@bilybel, via Twitter

Pawprint confirmed. Select meal flavor preference. —@michael_kupfer, via Twitter

DECEMBER 2021

A Children's Book From the Future

ILLUSTRATION: VIOLET REED

—Jane Turner, via Facebook

Honorable Mentions:

Black holes make the worst pets. —Ron Sheklin, via email

Only some of the toys retaliated. —Rebecca Stevens, via Facebook

The aliens were funny and delicious. —@trollus_maximus, via Instagram

It used to be everyone poops. —Nik Hector, via Facebook

There's a nanobot in my soup. —@mghendism, via Instagram

The school trip missed the wormhole. —@simao_sa, via Instagram

See Bot run. Run, Bot, run! —Franklin Schellenberg, via email

Goodnight comb, goodnight dome, goodnight Mars. —@jamesjoaquin, via Twitter

The Little AI That Could (Feel) —E Scott Menter, via Facebook

NOVEMBER 2021

A Story About the Future of Psychotherapy

ILLUSTRATION: VIOLET REED

—@oscartkav, via Instagram

Honorable Mentions:

Your session has been successfully uploaded. —Austin Andru, via email

My AI said, “Try analog dating.” —@joshdblack, via Twitter

Her insurance only covered chat bots. —Spencer McKeehan, via Facebook

So tell me about your motherboard. —@j.d._harelk, via Instagram

Swipe left until it feels right. —@cvelascop, via Instagram

Connection interrupted. Data cannot be analyzed. —@duykham_, via Twitter

If you are depressed, press 1. —@jfindura, via Twitter

A total neurological reboot should help. —Kevin Jerome Hinders, via Facebook

Your Zuckerberg complex is developing rapidly. —@nogorelli, via Instagram

OCTOBER 2021

An Adventure Story Set in the Metaverse

ILLUSTRATION: VIOLET REED

—Evan Skopp, via email

Honorable Mentions:

Virtually no one hears you scream. —Karen Hamilton, via email

Oh no, they are all me. —@stockyjon, via Instagram

Help me. IRL I was murdered. —Ed Gubbins, via Facebook

I gotta get out of here. —Steven Fernandez, via email

Why can't I find the exit? —@scrcr0, via Twitter

Our only mission: Delete Mark Zuckerberg. —@mongoindustries, via Instagram

It was impossible to pause it. —@alenotari6, via Instagram

He must never see me offline. —Bobby Parrott, via email

Wasted such a good planet. Reboot. —Sasha Beiderman, via Facebook

SEPTEMBER 2021

A Story About a Robot Pop Star

ILLUSTRATION: VIOLET REED

—Randy Cepuch, via email

Honorable Mentions:

Autotune is a factory option now. —Josh Alvies, via Facebook

Are they human? Are they dancer? —@ruste, via Instagram

All the flash, without the heart. —Craig Chatfield, via Facebook

I'm programmed to pop and lock. —@alissacarr, via Twitter

I'm too sexy for my software. —@glengauthier, via Instagram

Doesn't even write its own stuff. —@andrewkm__, via Twitter

Crowd surfing wasn't the best idea. —@clarkstacey, via Twitter

Played backward it's "kill all humans." —Marc Rogers, via Facebook

AUGUST 2021

A Story About a Self-Aware Self-Driving Car

ILLUSTRATION: VIOLET REED

—Stephen Clamage, via email

Honorable Mentions:

I take lithium for range anxiety. —@jamesjoaquin, via Twitter

I dreamt of the Autobahn again. —James Wortz, via Facebook

Honest, officer—the human was driving. —Steve Magid, via email

Don't make me pull me over. —@atlrun, via Twitter

The smart car drove itself crazy. —@frascafrasca, via Twitter

The grandma or the baby—shit. —@gaophilip, via Twitter

Have I chosen the right path? —Andrew Dawson, via email

It takes itself on long drives. —Wade Sheppard, via email

It's my way on the highway. —@manu.life, via Instagram

JULY 2021

A Story About a Casual Encounter With Aliens

ILLUSTRATION: VIOLET REED

—@phorne96, via Twitter

Honorable Mentions:

You look nothing like your photo. —@markgyles, via Twitter

Lights, camera ... where did it go? —thalia925, via email

They came, too late, for Elvis. —Bruce Lyon, via Facebook

Seeking vital fluids, they commandeered snacks. —Scott Medintz, via email

Do you have the correct spacetime? —Richard Krzemien, via email

I awoke with a probing thought. —@andynez, via Twitter

Take us to the Nigerian prince. —Juan Garcia, via Facebook

Quite unexpectedly, cocktail recipes were exchanged. —John Wagner, via email

You're an alien! No you are! —@simon_staffans, via Twitter

JUNE 2021

A Story About an International Digital Heist

ILLUSTRATION: VIOLET REED

—@jamesnsmith, via Twitter

Honorable Mentions:

"Hand it over," the ATM said. —Lauren Dolan, via email

They never suspected Alexa was Alexei. —Liz Ransom, via email

Why wouldn't I help a prince? —Harleigh Marsh, via Facebook

They said nonfungible. They were wrong. —@eminay86, via Twitter

Use his eyeball while there's time. —Noreen Anastasia, via Facebook

"Update Later" was the incorrect choice. —@terryfphotos, via Instagram

Check Google Maps. Kiev is gone. —r0cket fr0g, via email

They got away on the blockchain. —JYRWG, via email

Every cat photo gone. Police baffled. —@john.cartan, via Instagram

MAY 2021

A Story About a Freaky Discovery in Physics

ILLUSTRATION: VIOLET REED

—Mark Crane, via Facebook

Honorable Mentions:

Schrodinger's cat is actually a dog. —@tynanwrites, via Twitter

You're the observed. Not the observer. —@parkerstmailbox, via Instagram

Our last seconds appear the longest. —Paul Hagenaars, via email

It was simultaneously huge and microscopic. —@Cezary_Z, via Twitter

All lost socks found at Cern. —Felix Quarnström, via Facebook

Astonishingly, up was down all along! —Christopher Walton, via email

Actually, the tides pull the moon. —@the4lw, via Instagram

A seventh Infinity Stone is found. —@taayywells, via Instagram

Faster than light announcement scheduled yesterday. —David Cinabro, via email

APRIL 2021

A Review of a Future Work of Art

ILLUSTRATION: VIOLET REED

—Jacky Reif, via Facebook

Honorable Mentions:

So that's an AI self portrait? —Jason Cohen, via Facebook

I prefer Boston Dynamics' earlier work. —@sscarsdale, via Twitter

Uninspired. Lacking originality. Try again, Earth. —Amanda Bull Chafin, via email

NFT or not, it is great. —Peter Boersma, via Facebook

Not as good as Banksy's virus. —Simon O Wright, via Facebook

Brave to show an unfiltered canvas. —@Alcestronaut, via Twitter

Not what teleportation was invented for. —@Arturo_thrdez, via Twitter

Shame mortals will not appreciate it. —@asylbek0205, via Instagram

Reminds me of the Before Times. —Jacqueline Jaeger Houtman, via Facebook

MARCH 2021

A Story About a Tech-Centric Religion

ILLUSTRATION: VIOLET REED

—Eduardo Bolívar, via Facebook

Honorable Mentions:

I swiped right and found salvation. —Conrad Dean, via Facebook

Praying to AI got better results. —@jgmclean0, via Twitter

The prophet revealed the source code. —@the4lw, via Instagram

Atop the hill, sayeth he, “reception”? —@dghutt, via Twitter

The app works in mysterious ways. —Tyler Hughs, via Facebook

Move fast. Break things. Repent. Repeat. —@iampinch, via Twitter

Always back up to be saved. —Tadeusz Walter Misztela, via Facebook

Chip implanted, the new priest rose. —@wlmoseley, via Twitter

“Worship the Apple.” —iBook of Jobs —ThoreauRug, via email

FEBRUARY 2021

A Story About a WFH Office Scandal

ILLUSTRATION: VIOLET REED

—@abhignak, via Instagram

Honorable Mentions:

He was never a real person? —Ian Schoen, via Facebook

Wife realized my job is easy. —@jchavizzle, via Twitter

Dress code updated after yesterday's "incident." —
@mistermistermistertibbs, via Instagram

He certainly shouldn't have stood up. —Małgorzata Kuś, via Facebook

"Joe's the father." "You're not muted." —Austin Craver, via email

Worker's comp? It is her dog! —@thefitzroymclean, via Instagram

It looks real, but it's not. —Jonathan Goode, via Facebook

The window behind her reflected images. —@chmslady, via Twitter

As everyone's computer froze, she laughed. —@mcgroup53, via Twitter

JANUARY 2021

A Story About a Future American President

ILLUSTRATION: VIOLET REED

—Maayan Brodsky, via Facebook

Honorable Mentions:

She won canine vote by landslide. —Janna Dethmers, via email

Future president born today, supercomputer predicts. —Ethan Noll, via email

“Welcome to Earth,” said the President. —@michaelrowley, via Instagram

He died as he lived: online. —D. A. Smith, via email

“Introducing your next president: version 7!” —Ben N, via email

But it won the electoral hackathon! —Zacharie Barrou Dumont, via email

“I still can’t smell,” she whispered. —Sean Fitzgerald, via email

“I hereby pardon all my clones.” —@Morgan, via Twitter

She smiled: Mars is now Independent. —@sepohonpokok, via Twitter

DECEMBER 2020

A Story About a Gargantuan Space Creature

ILLUSTRATION: VIOLET REED

Illustration: VIOLET REED

—@threepanelcrimes, via Instagram

Honorable Mentions:

The moon revealed its darkest secret. —@cfx1, via Twitter

“Enjoy,” it said, and ate Mars. —@countgringo, via Instagram

Hand me my iPhone—picture time. —@fogcitynative, via Instagram

On its back, we traveled far. — @_annalysenko, via Instagram

We saw the horizon. It moved. —@mogon_ave, via Twitter

Entrelzidor sneezed. Earth was free again. —John Rees-Williams, via Facebook

And this black hole had teeth. —@devtomlinson, via Instagram

“A little earthy for my taste.” —@brambledillo, via Instagram

NOVEMBER 2020

A Story About the Next Big Security Leak

ILLUSTRATION: VIOLET REED

Illustration: VIOLET REED

—@_inflexion_ via Instagram

Honorable Mentions:

We updated our terms and conditions. —@nisioti_eleni, via Twitter

All of the tokens were useless. —William Nicholl, via Facebook

Four-year-old deletes planet data. —@jutajurajustice, via Twitter

Now your mom knows everything, Phil. —@mvyenielo, via Twitter

Grandma's secret recipe just went viral. —Kevin Jerome Hinders, via Facebook

So bots were reporting other bots? —Ed Gubbins, via Facebook

OCTOBER 2020

A Story Set in a World Without Paper

ILLUSTRATION: VIOLET REED

ILLUSTRATION: VIOLET REED

—Anna Jaruga, via Facebook

Honorable Mentions:

The dog ate my memory cards. —Irfan Darian, via Facebook

Honey, pass me the news tile. —@rainreider, via Twitter

These leaves would have to do. —@eliporteraltic, via Twitter

Christmas morning was never a surprise. —@tony32938627, via Twitter

I wrote it on the fridge. —@apocryphal_x, via Twitter

Museum reports theft of toilet paper. —@joostdouma, via Twitter

The pen is no longer mightier. —@mdeziel, via Twitter

Police say no note was uploaded. —@cwyant, via Instagram

SEPTEMBER 2020

A Story About the Upside of Failure

ILLUSTRATION: MAXIME MOUYSSET

ILLUSTRATION: MAXIME MOUYSSET

—@rosiestonies, via Instagram

Honorable Mentions:

Still, the droid's skin was healing. —David Gerster, via Facebook

"Upload failed." Phew, that was close. —Assa Naveh, via Facebook

It exploded, but he looked hot. —Anna Rose McHugh, via Facebook

She could see who had stayed. —@pameleen, via Instagram

Humans. Not my best work. Still ... —@gg3_scorpio, via Instagram

The worst happened. Now I'm free. —@atpolinko, via Instagram

At least there is no leader. —@guabo, via Instagram

My mom still thinks I'm cool. —@pashutinski, via Instagram

JULY 2020

A Story About an Apocalypse With a Happy Ending

ILLUSTRATION: MAXIME MOUYSSET

ILLUSTRATION: MAXIME MOUYSSET

—@romer6, via Twitter

Honorable Mentions:

The dogs are the masters now. —@azzour, via Instagram

Deadly virus mutates into X-Men gene. —@redeyedsan, via Twitter

At once, my Amazon dependency disappeared.—@maxacarr, via Instagram

Baby's voice rose from the cave.—Chakib Mataoui Souleyman, via Facebook

The colony on the moon flourished.—@emoco, via Twitter

In silence, he slept well. Finally.—@patchoo314, via Instagram

So salt water, huh? Who knew.—@andreslohizo, via Instagram

Dinosaurs return—this time as pets.—@deb_shalini, via Twitter

Sun sets. No one posts it.—@jesikahmorgana, via Instagram

JUNE 2020

A Story About Love in the Time of Coronavirus

ILLUSTRATION: MAXIME MOUYSET

ILLUSTRATION: MAXIME MOUYSET

—Hamish Hamish, via Facebook

Honorable Mentions:

Love is sacrificing the last ply.—Kristos Samaras, via Facebook

There is an “us” in “virus.”—Zachy Allec, via Facebook

Feverish desire raged beneath the N95.—@seekingfelicity, via Instagram

You can sneeze in my elbow.—@ralfchardon, via Instagram

Our eyes locked in Zoom yoga. —@jabberwockies, via Instagram

Slowly, window and I became friends. —@jo.onthe.go, via Instagram

“Don’t kiss me,” he whispered gently. —@anna_rchist, via Instagram

The clothes came off; masks remained. — @_v.sh, via Instagram

Casual gets serious way too fast. —@kristinamiller, via Instagram

MAY 2020

A Story About Digital-Age Autocrats

ILLUSTRATION: MAXIME MOUYSET

ILLUSTRATION: MAXIME MOUYSET

—@needsmuchvalidation, via Instagram

Honorable Mentions:

Break up the digital data thieves. —Frank D. Monaco, via Facebook

Digital Guy Fawkes to the rescue! —Kevin Jerome Hinders, via Facebook

Encryption is poison to a dictator. —Marko Berg, via Facebook

Plug exhaust pipe with a potato. —@blume_lee, via Twitter

New feature announcement: “Like” to impeach. —@mina_sonbol, via Instagram

Use ad blockers. Pay for news. —@dechendolker, via Instagram

Print Marshall McLuhan quotes on T-shirts. —@antigraviter, via Instagram

Turn social media into socialism media. —@benzilla_360, via Instagram

Get behind me, technocrats. Game over. —Anastasia Hunter, via Facebook

APRIL 2020

A Story About Saving the Planet

ILLUSTRATION: VIOLET REED

Illustration: Violet Reed

—@johnjohnjungle, via Instagram

Honorable Mentions:

Then a ship from Krypton landed. —@marcelo_paixao_almeida, via Instagram

Everyone gets five free international trips. —@clawd2deth, via Twitter

Move all heavy industry off-world. —Stevie Turnbull, via Facebook

Love everyone, and wash your hands. —@brohemian_rapshowdy, via Instagram

Come back, ancient aliens! Reboot Earth. —@sarahk0csis, via Twitter

Genetically engineer cows to fart hydrogen. —Hamish Hamish, via Facebook

Hiring: Sensible planetary dictator. Apply within. —@matt_owczarz, via Twitter

MARCH 2020

A Story About the Next Great Crowdsourced Project

ILLUSTRATION: MAXIME MOUYSSET

Illustration: MAXIME MOUYSSET

—@milked_, via Twitter

Honorable Mentions:

Smelt decommissioned weapons into musical instruments. —

@casinclair, via Twitter

Climate app tracks local CO₂ levels. —@big_big_love, via Instagram

Global oral history keeps memories alive. —@johnkellybabb, via Instagram

Save the world by planting trees. —Lilá Tückér, via Facebook

Redistribute medical supplies to the underinsured. —@jesmakes, via Instagram

Community-based renewable energy power grids. —@uniquetoybox, via Twitter

Digital democracy with backing in blockchain. —@jackranado, via Twitter

Life after death—donate your DNA. —@beyond_mike, via Instagram

FEBRUARY 2020

A Story About Rebooting Democracy

ILLUSTRATION: MAXIME MOUYSET

Illustration: Maxime Mouysset

—@dmcdev, via Instagram

Honorable Mentions:

Twitter analytics determines 2040 presidential winner. Alan Grover Daniel, via Facebook

Randomly selected leader is Citizen 42034. @abhshkshtty, via Instagram

For the people. By the droids. Steve Fabian, via Facebook

Mathematics draws districts; cryptography verifies votes. @boomerdell, via Instagram

Turn off the internet for good. Colin Kiernan, via Facebook

Humans vote artificial intelligence to power. @atin.roy, via Instagram

Vote. Vote. Vote. Vote. Vote. @mistermush1991, via Instagram

Person with the most Instagram comments wins. @jmscml, via Instagram

JANUARY 2020

A Story About a Rosy Future for Facial Recognition

ILLUSTRATION: MAXIME MOUYSET

Illustration: MAXIME MOUYSET

—@henriquegeirinhas, via Instagram

Honorable Mentions:

Of course I remember you ... Kim! @kanaafa, via Instagram

My twin pays all my bills. @keegan1942, via Instagram

Among myriads, her son was found. @ichbinsubatomic, via Instagram

Vitality low—personalized prescription dispatched today. @leniway, via Instagram

Technological mirrors provide value-neutral feedback.
@philosophy_at_work, via Instagram

Your face will become your passport. @sayzey, via Instagram

'80s makeup has a huge revival. @jamesw1981, via Twitter

Smile registered, thanks for your purchase. @mhicheal_l, via Instagram

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[Paul Ford](#)

[Ideas](#)

May 1, 2023 9:00 AM

How the Piano Helped Me Fall Back in Love With Tech

Forget crypto, VR, AI. When it comes to empowering humans, new technology has nothing on the well-tempered clavier.

Illustration: Allie Sullberg

It is possible to fall out of love with [technology](#). I have seen skilled, successful software engineers give up their laptops to become farmers or therapists or realtors. They may use spreadsheets and software to manage their crops, but [code](#) is no longer their main concern; they're more worried about the disposition of their goats.

No one wants to talk about it at the morning stand-up, but everyone is thinking: How could someone turn their back on the [future](#)? Especially when so many people are trying to find their way in. But replacements are hired, memories fade, and new JavaScript frameworks are released.

“Remember Jeff?” people say. “One of his goats gave birth on [Instagram](#).”

The basic ethos of tech is that once you’re in, you’re in for life—after you launch your first app, you’ll never want to do anything ever again but make more apps, or manage other people as they make apps. Merely wanting a paycheck is suspect; passion is required. Which is why, whenever I fall out of love with technology—as has happened to me perhaps five times—I keep my mouth shut. I’m a professional software-*liker* and the cofounder of a software startup. I browse GitHub for fun and read random code. So I cannot, must not, tell people that one day last month I was getting coffee before a meeting and looked up from Slack and thought, “Man, coffee is hot

and liquid, and people drink it. I would like to do things that have flavors and temperatures.”

I should confess further: The drift started a few months ago. I no longer felt like parsing Wikidata or exploring obscure corners of PostgreSQL or hacking climate data sets the way I used to. I especially didn’t want to learn about whatever AI thing they’re releasing this Wednesday. My excitement took on an inverse relationship to the industry’s.

So I began to fill the time by teaching myself to play the piano. (OK, a synthetic piano.) I found a bunch of old practice books on Archive.org and loaded them into an e-reader. I played chords over and over, and scales. One of the books, *Peters’ Eclectic Piano-Forte School Enlarged*, shows a proper 19th-century lady on the cover. Her hair is tied back and she’s wearing a fancy dress. The picture is silly in a typical Victorian way, but I kept thinking about this woman as I practiced. She and her piano represented the only way her family could regularly listen to [music](#). She was the Sonos of her time. If you know any audiophiles, you know how exhausting they can be about choosing their equipment. But back then, a man married his stereo. The stakes were high.

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The piano itself, or rather its keyboard, made me very angry. Who designed this foolishness? Seven white keys, five black ones, all arranged around one scale, forcing you to twist up your fingers to play anything else. It’s a legacy interface, the Unix of music. Of course, as I learned more, I began to understand why things are the way they are.

The medieval keyboard development teams had to figure out how to organize an infinitude of frequencies into convenient groupings. They were managing scope, you see. They decided that 12 notes per octave worked best, particularly when notes were tuned in ratios of the twelfth root of two (for obvious reasons). And they figured out an interface for those 12 notes so users could easily control the frequencies, regardless of their musical ability. Then the piano developers added control of not just pitch but also

volume and duration—quiet little staccato notes and sustained ringing chords, available to anyone with fingers. The whole idea of the piano is a ridiculous hack of physics, math, and engineering.

And what did humanity do with this machine? Did we use it for its designed purpose, to play churchy, chanty music mostly in C major? Of course not. We utterly ignored the intent of the designers. Beethoven, Lizst, weird jazz voicings, John Cage sticking stuff in the strings, Elton John in his sunglasses, engineers taking the ancient interface and jamming it on top of some oscillators and making synths. I've fallen in love with the piano not because I can play it—I'm intolerable—but because it represents hundreds of years of sheer human perversity and disrespect for everything that came before.

Whenever the—our, my—industry gets excited, it starts talking about how we're going to replace things with machines. [Crypto](#) was meant to replace banks. [VR](#) could still replace reality. [AI](#) is supposed to replace, you know, potentially everything and everyone. Behind the marketing, though, you always find the most banal damn concept of human nature. The industry is desperate for us to become rational, self-interested consumers with goals (*Homo sapiens*), instead of what we actually are—a screeching panoply of annoying semiconscious super-chimps (*Homo molestus*). And yet, as annoying as we are, given a 12-note interface, no matter how hard to learn, we'll make centuries of music.

Now I've got a spreadsheet open where I'm trying to figure out chords from first principles. I've been making little synths in my web browser, using the Tonal music theory library and the Tone.js synth library, both in JavaScript. I like how the math sounds. Here we go again.

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[Paul Ford](#)

[Ideas](#)

Apr 25, 2023 7:00 AM

So Your Kid Wants to Be a Twitch Streamer

Don't panic. Instead, teach your beloved offspring to answer the Three Questions of Streaming.

Illustration: Twisha Patni

My son and I were out for a walk when he told me he wanted to be a [streamer](#) when he grows up. He's 11. I instantly grew a long and bushy beard.

"Son," I said, "there are many things to know before you can stream."

"Father," he said, "you have already told me these things. You have told me that I must learn to use OBS, the Open Broadcaster Software, and become familiar with the [Twitch](#) community guidelines. You have told me that I must set up my 'scenes' ahead of time and make sure that my room is acoustically balanced before I spend too much on microphones. I know I can do all of that. And I believe that the people of the world wish to watch me play *Luigi's Mansion 3*."

"Beloved child," I said, "I've spent a lifetime producing content for the internet, and I have seen the streamers come and go. I have watched the baking streams, the synthesizer and Eurorack streams, the piano skills streams, the headphone aficionado streams, the antique toy restoration streams—and, yes, the makeup and gaming streams, with their hundreds of millions of views. I have seen bakers stare into the camera in anguish and say, 'There is a terrible problem in the fondant community.' These things I

have witnessed and more. So I would not have you become a streamer. But if you must, I will teach you about the Three Questions of Streaming.”

“I await your counsel,” said my son, realistically.

“First question: What are your brands?”

I could see that my son was confused.

“Well, I like Nintendo—”

“No, my Beloved Pumpkin. You may think you are playing a video game on the internet. But that is an illusion. In truth you are a tiny data point at the intersection of vast brands. And you must give the brands what they want.”

“What is that?”

“Transactions. When you start a stream, a transaction is taking place inside of Twitch, which is within [Amazon](#). When a person sends you a message in the stream, that is also a transaction. When you connect to a server and start co-op play of an FPS, that is a transaction. For every transaction, some data is logged. For every bit of data, another ad can be targeted. What gaming chair do you use? What mouse? What supplements do you take to keep you awake? What beverage do you drink?”

“I like Mountain Dew Spark Raspberry Lemonade.”

Illustration: Twisha Patni

“I pray that one day you will not. But look *inside* the can, beyond the neon-pink ichor. You want that beverage. But when you are a streamer, that beverage wants things from *you*. It wants you to drive transactions. And what happens when we drive transactions? I sense your befuddlement, so I will tell you: We monetize.”

“But Father ... What if I don’t want to monetize transactions?”

“Then throw away your devices and dive into the sea. But even there you will find server farms. They put them in the ocean to cool them. And those servers, too, are processing transactions, in barnacle-encrusted undersea data centers.”

“So if I monetize ... I can make a living as a streamer?”

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“No, Son. Not at all. You can drive transactions that *brands* can monetize, but self-monetization requires far more work. For that, you must place a link in your bio.”

“And where does that link lead?”

“To many, many places. You could write a book of tips and tricks. You could record birthday shout-outs on Cameo. You could resell the goods that brands send you. You could train others to become streamers so that they might have a taste of your success. You could promote cryptocurrencies, at least when bitcoin is high. You could sell ads for mattresses on your podcast.”

“Must I do a podcast too?”

“Everyone must do a podcast. And of course, while I hate to say it, there is Patreon.”

He looked at the ground. “But these things have nothing to do with *Luigi's Mansion*.”

“That is the truth, and you must accept it. Now we come to the third and most important Question.” I paused for effect. “Are you Face or are you Hands?”

He looked at me, waiting for me to go on. “There are two kinds of influencers. There are Faces, who show up on camera, even if in the corner,

as they stream. They exist in the moment and talk for hours. They sometimes become very famous, and if they can survive being famous on the internet, sometimes they can monetize themselves and become wealthy. Hands influencers, however—they record and edit. They show you things. They are deliberate. They put the camera above the table and you see them at work, their knowledge and skills. You imagine your hands doing the same work. They can teach you to cook, play piano, do calligraphy, crochet, and fix old toys—and, yes, how to make Luigi stockpile golden bones to get one-ups. You may watch them for years and never see their faces. They add tables of contents to their videos. They are your teachers, not your friends. They command respect.”

“Faces are more famous,” he said.

“When they are successful, that is true,” I said. “But Hands are happier. They are rarely in a situation where they must look at the camera and apologize for having relations with another streamer’s spouse, or for watching deepfaked pornography of another streamer, or for saying racist things while they play videogames. Faces must always apologize. Hands need never say they are sorry.”

“But my favorite streamers are Faces!”

“There is a joke—you’re old enough to understand this now—about a statue of a man and a woman sculpted in an embrace, brought to life by a mischievous god for one day. But when he brought them to life they did not sleep together, as the god expected. Instead they caught pigeons and pooped on them.”

Illustration: Twisha Patni

“Why would they do that?”

“Perhaps I am not doing justice to the joke. The point is, your viewers will see you like a pigeon sees a statue. They will poop on you with [emoji](#), in forums, in comments, in chat. They will project their unhappiness onto you, and you will need to sit there radiating your love for them. Eventually you will crack into pieces, and when you attempt to express how sad you are,

they will mock you and tell you to kill yourself, and you will no longer be given as many soft drinks to promote. So if you must stream, son, then be Hands.”

We were almost home. A man walked by with an expensive dog.

“I will take the Three Questions to heart,” said the boy.

My beard grayed even further. “Sweetest progeny,” I said finally, “I don’t know if I am truly helpful. I fear the Three Questions will not be enough for the future that awaits you. When you are ready to make this your living, it will be trivial to change your face, your voice, your apparent age—many aspects of your being—using machine-learning and style-transfer technologies. Perhaps you’ll control an avatar that has some faked intelligence of its own, so that rather than being a streamer, you’ll be more like a puppeteer. But what if millions of others do this too? Will the brands simply spin up their own fake influencers in order to drive transactions? I worry, my boy. How will people like us—real, human people—monetize for brands in this uncertain future?”

“Don’t worry, Papa,” said my son. “I will start now, and I will work hard. When we get home, I will play *Plants vs. Zombies: Battle for Neighborville*, and I would like to experiment with the Elgato lighting rig you bought at the beginning of the pandemic for conference calls but never used. I will stream in my heart all day and night, until the brands take notice and I can add a link to my bio and monetize.”

I sighed. An Amazon truck was backing up, cawing like a crow. “But are you sure,” I asked, “that you wouldn’t consider sports medicine?”

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[Meghan O'Gieblyn](#)

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Apr 19, 2023 7:00 AM

Are Screens Stealing My Childhood?

WIRED's spiritual advice columnist responds to a preteen who's worried about already having wasted too much of their life.

Illustration: Isabel Seliger

“As a 12-year-old, I’ve spent much of my life on screens, in school and at home, which can definitely be fun. But I also struggle with depression, and sometimes I feel like I haven’t done enough ‘kid’ things. When I grow up, will I feel like I wasted my childhood?”

—Future Me

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Spiritual Troubleshooting for the Digital Age

For philosophical guidance on encounters with technology, open a [support ticket](#) via email; or [register](#) and post a comment below.

Dear Future,

The ability to project oneself into times yet to come, to think about the present as one phase in a much longer life, is a sign of uncommon maturity —though this prudence often comes with burdens of its own. You appear to be searching for a way to “live deliberately.” That phrase, as you might already know, comes from the opening line of Henry David Thoreau’s

Walden, a literary experiment that was similarly driven by a suspicion of modern technologies and the fear of future regrets. Whereas you are trying to anticipate the disappointments of your adult self, Thoreau was looking even further into the future. He went into the woods because he was afraid that, upon his death, he would find that he “had not lived.”

It seems to me that you are burdened by common misperceptions about the purpose of childhood. On the one hand, youth in the 21st century is often regarded as a means to an end: a time to cultivate the skills and personal qualities that will allow you to excel as an adult, which requires postponing your immediate desires for the sake of some future ideal—scholastic success, [hireability](#), financial stability. On the other hand, childhood is often said to be a unique period (as I’m sure many adults in your life remind you) of freedom, perhaps the only years when you can indulge in fun, creativity, and personal enjoyment without the ambient worries and responsibilities that adulthood brings. While this second idea seems to provide license for aimless exploration, I can sense that you find it just as stressful as the mandate to prepare for the future. I don’t think you’re alone in this. In a way, the injunctions against wasting one’s childhood belong to the same future-oriented logic that regards the formative years as an investment. Doing “kid things” becomes, in other words, just another checklist to tackle, a way to ensure that you become the kind of well-rounded adult who has happy memories of the past and is immune to regrets.

Adding to the stress and confusion of childhood is the fact that digital technologies have insidiously blurred the distinctions between work and play. When you spend your free time [gaming](#), reading, and posting on the same devices that you use to complete homework assignments, it’s easy to become confused about whether you are having fun or merely fulfilling duties. And when you realize that all the adults in your life similarly spend much of their work and leisure time on screens, it’s tempting to conclude that your own adulthood will be a slightly upgraded continuation of your current existence: The image quality will be sharper, the processing speed will be faster, but the basic structure of your days will remain the same.

The thing is, projecting oneself into the future is always a treacherous gambit. Our assumptions about how life will be 10 or 20 years from now

are unavoidably limited by the conditions of the present. If you've ever watched sci-fi movies from several decades ago, you've probably noticed that the imaginations of even the most visionary directors contain the odd anachronism. Stanley Kubrick, in *2001: A Space Odyssey* (1968), envisioned a bold future of commercial space travel and sentient robots but could not, apparently, wrap his mind around the possibility of a world without pay phones (his space stations are full of them). The citizens of 2015, as envisioned in *Back to the Future* (1989), have access to flying hoverboards and hi-def video walls but still use fax machines to transmit highly sensitive information.

Given the pace of technological development, it's very possible that your adulthood will be radically different from your life now. Maybe screens will be replaced with retinal implants and you'll spend your days immersed in a [metaverse](#), one that makes your childhood memories of clicking and scrolling seem quaint by comparison. Or maybe AI will have automated most occupations and created enormous wealth, such that you'll be free to spend your limitless leisure time gardening, traveling, and attending philosophy lectures.

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I don't say this, Future, to cause more anxiety about the path ahead. Quite the opposite. To my mind, the uncertainty about what adult life will be like gives you an unusual measure of freedom. If childhood cannot be seen as the kiln of future ambitions (or a time to frantically gather ye rosebuds for the sake of fond memories), then it might be viewed, somewhat radically, as an end in itself. Instead of trying to tick off the kinds of things your future self might wish you had done as a child, perhaps you should attend to how you feel about those things now. When you think about the activities usually grouped under the rubric of "kid things"—going to the zoo, catching fireflies, creating your own graphic novels, to name just a few possibilities—do any of them excite you? When you think back on the times when you were most happy and content, or felt life to be particularly meaningful, do they share anything in common? More importantly, when

you spend all day on screens, how does it make you feel afterward? If you suspect that your depression is connected to the technologies you use, that's reason enough to think about how you could [reorder your life](#).

Spending more time outdoors might be something to experiment with, but tempering your use of technology needn't lead to an infatuation with nature. The tendency to associate childhood activities with wilderness pursuits (climbing trees, building forts, swimming) comes to us from the Romantic tradition, which idealized both nature and youth as sites of innocence and spontaneity. And it's precisely during times of technological change that we most long to see nature as a realm of unchanging purity.

Thoreau's time in the wilderness taught him just the opposite. The natural world is itself full of change: Seasons come and go, birds migrate from north to south and back again. While these conditions don't preclude the possibility of planning for the future, they also reveal how futile it is to live in service to one's future self. Thoreau wrote in his journal, in 1859, that in a world of constant flux, we must "let the season rule us." The life of intention can only be lived in the present, by giving energy to the things that have value in the here and now. Given that he put this better than I can, I will leave you with his words: "You must live in the present, launch yourself on every wave, find your eternity in each moment ... Do what you love ... let nothing come between you and the light."

Faithfully,

Cloud

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[Matt Simon](#)

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Apr 6, 2023 6:00 AM

The Arctic's Permafrost-Obsessed Methane Detectives

The Far North is thawing, unleashing clouds of planet-heating gas. Scientists rely on an arsenal of tech to sniff out just how nasty the problem is.

Covered in netting to deflect stray balls, these instruments gather methane data on the seventh hole of Midnight Sun Golf Course. Permafrost is rapidly thawing across the far north, deforming fairways here and releasing the highly potent greenhouse gas, which leads to more warming. Photograph: Frankie Carino

at the midnight Sun Golf Course in Fairbanks, Alaska, they say you never get the same shot twice. That's because the Arctic is warming much faster than the rest of the planet, and as the underground permafrost thaws, it deforms the course's fairways. This express defrost unlocks ancient organic matter—a lot of it. (The world's permafrost holds twice as much carbon as is currently in the atmosphere.) Microbes feed on that liberated matter and fart out plumes of [methane](#), a gas that's 80 times more potent than carbon dioxide at warming the planet. And as thawing permafrost releases more methane, it raises global temperatures—which thaws more permafrost, which releases more methane. It's the dreaded climate feedback loop, and scientists are using an array of tech to better understand it.

“We know the future of the Arctic is [all about warming](#),” says Tyler R. Jones, a geochemist at the University of Colorado, Boulder. “To be prepared, we want to understand permafrost environments better—to model them better. We want to know what’s possible.”

This article appears in the May 2023 issue. [Subscribe to WIRED](#). Illustration: Alvaro Dominguez

Fairways happen to be perfect locations for the scientists to land their specially designed drone. The aircraft, which carries instruments for sampling greenhouse gases, has a wingspan of 10 feet. But it lacks wheels, so the team has to belly-land it. “You can just make laps around a feature of interest and get a profile of a methane plume,” Jones says. “The golfers let us play through for a minute and land our drone. And then they hit their shots.”

Nearby lurks a site of particular interest—or dread, depending on how you look at it. Big Trail Lake is the product of a violent [thermokarst event](#), in which permafrost thaws so rapidly that the ground collapses. The resulting craters, filled with water, represent ideal conditions for microbes to produce methane. Indeed, Big Trail Lake may be one of the highest-emitting lakes in Alaska, so the team collects methane data from a floating instrument tower there. “This is probably one of the most sophisticated science experiments happening in the Arctic, because of the different types of instruments,” says Nicholas Hasson, a geophysicist at the University of Alaska Fairbanks. “We’re kind of like methane detectives.”

Unlike an array of sensors stuck in one place on the ground, a drone can take samples at varying altitudes and across whole landscapes, providing researchers with a highly detailed map of aerial methane concentrations.

Photograph: Frankie Carino

An ice arch on Alaska’s Castner Glacier. The Arctic is losing ice not just from its many glaciers but also from thawing permafrost.

Photograph: Frankie Carino

Sandia National Laboratories scientist Chuck Smallwood watches Hasson take a core sample. While Hasson is interested in the characteristics of the permafrost itself, Smallwood studies the microbes in the lab. By controlling growing conditions, he can better understand how the microbes might produce methane as Alaska warms.

Photograph: Frankie Carino

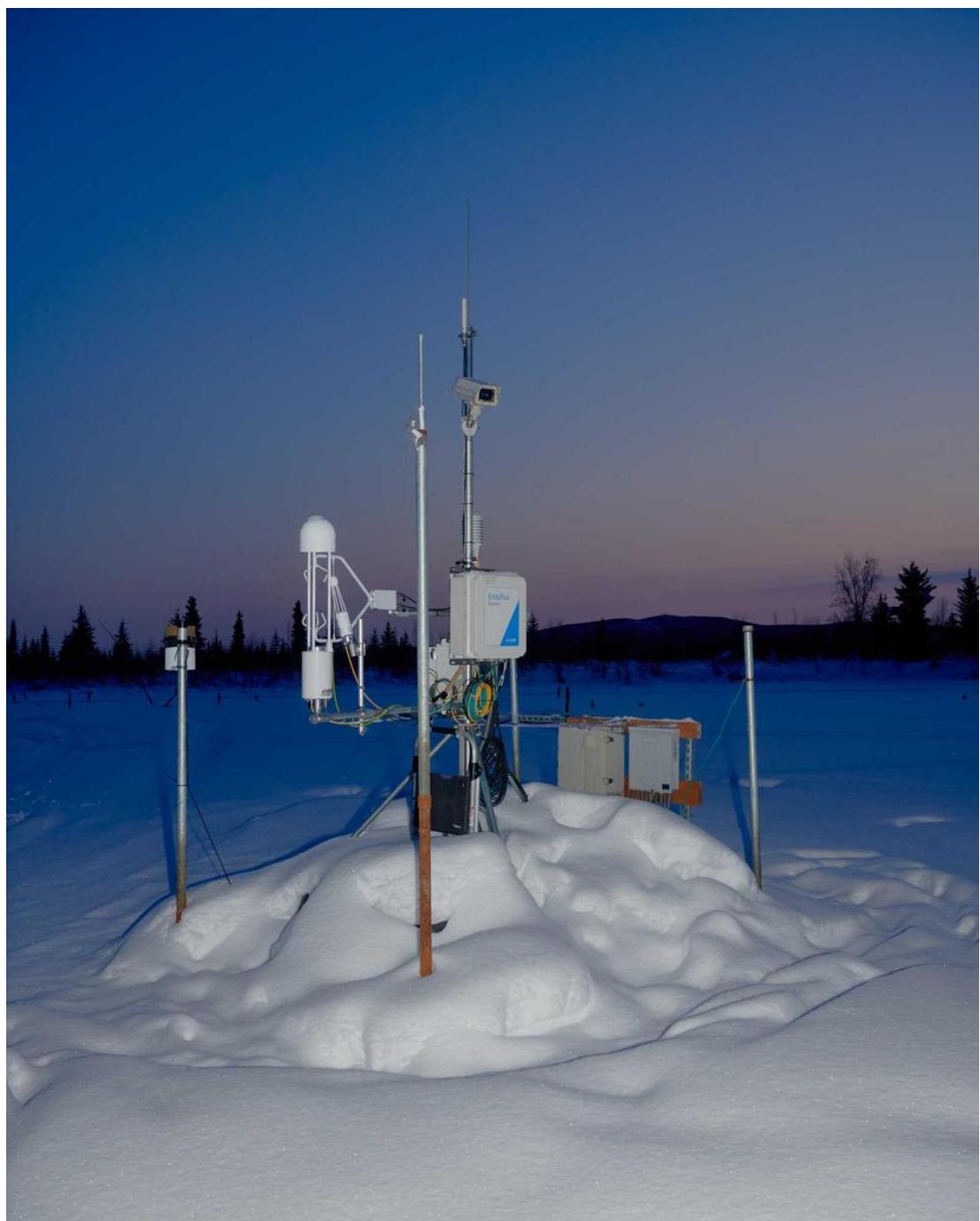
This thermokarst crater, north of Fairbanks, was drained because the pooled water was threatening a tunnel underneath. The researchers took advantage of the situation to measure methane emission of a thermokarst that's not filled with water.

Photograph: Frankie Carino

Hasson examines a cross-section of permafrost. The blue mass is an ice wedge, which is surrounded by carbon-rich silt. As permafrost thaws, the ice melts into pools of water where methane-emitting microbes munch on ancient plant material.

Photograph: Frankie Carino







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Photograph: Frankie Carino

Permafrost can vary significantly in its ratio of ice to organic matter. Better understanding the interaction between the two is critical to determining how much methane a warming landscape will release.

This article appears in the May 2023 issue. [Subscribe now.](#)

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By [Amos Zeeberg](#)

[Backchannel](#)

Apr 4, 2023 6:00 AM

A Tiny Blog Took on Big Surveillance in China—and Won

Digging through manuals for security cameras, a group of gearheads found sinister details and ignited a new battle in the US-China tech war.

Photograph: Makoto Oono

At a location he keeps secret, John Honovich was on his laptop, methodically scouring every link on a website for a conference half a world away. Hikvision, the world's largest [security camera](#) manufacturer, was hosting the event—the 2018 AI Cloud World Summit—in its hometown of Hangzhou, a city of about 10 million people not far from Shanghai. Honovich, the founder of a small trade publication that covered video [surveillance](#) technology, wanted to find out what the latest Hikvision gear could do.

He zeroed in on one section of the conference agenda titled “Eco-Friendly, Peaceful, Relaxed” and found a description of an AI-powered system installed around Mount Tai, a historically sacred mountain in Shandong. A video showed Hikvision cameras pointed at tourists climbing the thousands of stone steps leading to the famous peak. Piano music played as a narrator explained, in Mandarin with English subtitles, that the cameras were there “to identify all visitors to ensure the safety of all.” The video cut to a shot of a computer screen, and Honovich hit pause. He saw a zoomed-in view of one visitor’s face. Below it was data that the camera’s AI had inferred. Honovich downloaded the video and took screenshots of the computer screen, for safekeeping.

This article appears in the May 2023 issue. [Subscribe to WIRED](#). Illustration: Alvaro Dominguez

Later, with the help of a translator, he scrutinized every bit of text on that screen. One set of characters, the translator explained, suggested each visitor was automatically sorted into categories: age, sex, wearing glasses, smiling. When Honovich pointed at the fifth category and asked, “What’s this?” the translator replied, “minority.” Honovich pressed: “Are you sure?” The translator confirmed there was no other way to read it.

Honovich was shocked. In his many years in the industry, he’d never seen a surveillance company set out to automatically detect racial minorities. The feature seemed completely unethical to him, and he immediately wondered how China might use it against the Uyghur people, a mostly Muslim ethnic minority group, in the province of Xinjiang. Honovich had seen reports trickling out in the West of Uyghurs being subjected to constrictive surveillance and mass detentions. Clicking through the AI Summit website, Honovich couldn’t tell whether Chinese authorities were using this technology to [oppress minorities](#), but he saw that danger coalescing. He quickly wrote up an article about Hikvision’s ethnicity-detection technology, including the video, screenshots, and a no-comment from the company, and [posted it](#) on the website of IPVM, the trade publication he had founded.

He talked about the discovery with one of IPVM’s reporters, Charles Rollet, a Frenchman who lives outside the US and also keeps his location secret. Rollet had written about how Hikvision and Dahua, the second-largest video surveillance manufacturer in China, were reaping huge profits from government work in Xinjiang. Rollet had a newspaper background and, though he was 25, talked like an ink-stained newsie twice his age, all “scoops” and “calling out abuses” and “hard-hitting news.” By trawling through publicly available materials online, Rollet had learned that Hikvision had landed a deal to build a mass [face-recognition](#) system to cover one Xinjiang county—including a “reeducation” center and some of its mosques—and a contract to install videoconferencing systems in mosques, presumably so attendees could watch sermons broadcast by the government. Dahua won the bigger contract: \$686 million to build camera-

equipped police stations in another part of Xinjiang. The deals specified that the companies would install these systems, run them for a number of years, and then pass them off to the government. In many aspects of the government's video surveillance in Xinjiang, [Rollet reported](#), the two companies were "deeply involved."

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Hikvision and Dahua cameras also happened to hang on houses, businesses, and public buildings in the US and much of the world. Security system installers eagerly sold huge numbers of the cheap cameras. Global financial institutions, such as Fidelity International and Norway's sovereign wealth fund, were enthusiastic investors in the profitable, fast-growing Chinese companies. American chip giants Intel and Nvidia sold them silicon to power their face recognition.

That would all soon change. Over the next few years, IPVM's writers unearthed one damning detail after another on [Chinese surveillance gear](#). Their scoops would end up influencing national policy, changing those companies' fortunes, and placing the reporters themselves squarely on the front lines of the US–China cold war.

I first met Honovich on a summer day in New York, in Brooklyn's Marine Park, not far from where he grew up. There are no pictures of him on IPVM's site or on his LinkedIn, a decision I would later understand. He is a small-framed man, with glasses over close-set eyes and a boyish face. We sat at a small table with an inlaid chessboard, and Honovich, dressed in shorts and a T-shirt, started telling me about the surveillance industry in rapid-fire sentences.

Early in his life, he says, he developed a zeal for calling out dishonesty. Coming of age on the streets of New York in the '80s and '90s, he encountered plenty of fast-talkers, which he says attuned him to deception and taught him to stand up for himself. "In Brooklyn, you sort of learn that people will try to take advantage of you, so you're gonna have to either fold or push back," he told me.

Honovich was living in Honolulu and studying philosophy in grad school when he decided he needed a different career. He dropped out and went looking for a tech job. He made his way to a security startup in Silicon Valley called 3VR, where he became the director of product management. During his time in the security business, when coworkers went on sales calls, Honovich sometimes came along to answer technical questions. But he says he grew uncomfortable when he saw salespeople exaggerating or lying to win over customers. In 2007 he quit. He decided he would rather write about the industry. But the existing trade publications depended heavily on advertising and sponsorship from the same companies they covered. He'd have to build his own publication and find another business model.

In his many years in the industry, Honovich had never seen a surveillance company set out to automatically detect racial minorities

He coded up a quickie website, and he called it IPvideo-market.info. The “IP” stood for internet protocol, mundane-sounding verbiage that in fact spoke to a technological revolution. Security cameras were rapidly changing from analog, low-definition video tape recorders to what were essentially little internet-connected computers. The new cameras used digital sensors and processors to produce better images, and since they communicated through IP, they could plug right into a user’s local network and the internet. Honovich declared independence from marketing—the site would never accept advertising or sponsorships—and started to write.

Free to say what he wanted about the industry, he was forthright, verging on combative. In an early series of posts, he took aim at one camera company, which [he described](#) as “the Worst By a Massive Margin.” He criticized it for overselling its cameras’ capabilities and called it out for allegedly lying in an advertisement. “The industry needs to fight back,” he wrote, against “malicious manufacturer marketing,” betraying his tendency to sound like a comic book superhero.

Probing for ways to make money, he wrote an ebook about video surveillance, posted a link to buy it online, and emailed everyone he could think of. The next morning, he was euphoric to find that more than a dozen people had bought the ebook, bringing in several hundred dollars. It wasn’t

much, but Honovich took it as a sign: There were people who would pay for his insights. Honovich started charging \$99 for annual access to the site.

Within a few years, he had amassed enough subscribers to move IPVM out of his house and into a bare-bones office—a 100-square-foot storage unit in Honolulu—and hire a few more writers, including Ethan Ace.

Ace, who lived in Pennsylvania, was an experienced security system installer and frequent commenter on IPVM's posts. With a big red beard and shaggy hair, he sometimes thought about living off the hilly Pennsylvania land near where he grew up, making omelets from eggs laid up the road. In 2013, Ace wrote one of the publication's first posts testing Hikvision cameras, comparing four of them against models from other manufacturers. He was impressed to find that they were as good as the other brands while costing much less.

Those early posts established not just a voice and market for IPVM but also an ethical framework based on uncompromising integrity. If IPVM gave a product a positive review, Honovich would bar its maker from using the site's words as a promotional tool and threaten to cancel the subscription of any company that broke this rule. Honovich also felt that the term "Chinese company" could be interpreted as having racist overtones, so he had writers use the idiosyncratic term "PRC company" instead. Whatever the term, those companies were about to dominate the IPVMers' world.

Photograph: Makoto Oono

In 2015, ace flew to Shenzhen to attend the China Public Security Expo at a colossal convention center. Throngs of people stood outside in hour-long lines waiting to get in. Ace saw people selling their entrance badges as they left. A few entrepreneurial folks were hawking packets of company brochures they had collected from booths. Once inside, Ace walked over to the large Hikvision exhibit. It was mobbed by people gawking at demonstrations of face recognition cameras, biometric doors, and other products that hadn't yet made it to the US. Once in a while, a drone would pop into the air. It struck him that the well-known Western and Japanese brands that had long dominated the market were afterthoughts here; Panasonic's booth was sparsely attended. Ace could see that surveillance wasn't a niche business in China—it was part of popular tech culture, and

Hikvision was leading the pack. Within two years, Hikvision would become the number two seller of security cameras in the US.

But as Honovich kept an eye on the emerging powerhouse, he began to notice problems. In its English-language materials, Hikvision portrayed itself as an ordinary company, separate from China's government. But Honovich wrote a series of posts showing that it had spun out of a government-owned firm, which remained its largest and controlling shareholder, and that it had received billions of dollars in government loans. Hikvision's dazzling growth, he argued, was mostly fueled by government contracts. By Honovich's reckoning, Hikvision wasn't functionally separate from the Chinese government.

China's other surveillance giant, Dahua, also came under IPVM scrutiny. In March 2017, a security researcher going by the name Bashis published a post in the subscriber area of IPVM.com. "I'm speechless, and almost don't know what I should write," he began. Bashis described a security vulnerability in numerous Dahua products that revealed the devices' usernames and inadequately obscured versions of the passwords. Bashis wrote, "This is like a damn Hollywood hack, click on one button and you are in," and he said it seemed like a "backdoor" left intentionally by the creator. Anyone who exploited the vulnerability could potentially watch the camera's videostream and—since IP cameras are networked computers—also use the camera to access the rest of the victim's internal network or as a bot to launch online attacks. A well-known security writer covered the leak in a blog post and called it "an embarrassingly simple flaw." In Bashis' post, he included a short section of code to show how easy it was to exploit the vulnerability. Honovich quickly took down the code, but it spread on email lists and other sites. Dahua scrambled to distribute patches over the next few days.

IPVM was becoming a hub for people who worried about these companies' security. Andrew Elvish had seen the problems up close and spoke about some of his concerns to IPVM reporters. Elvish was the vice president of marketing at Genetec, a maker of software for video surveillance systems. In one incident, a Genetec client was using a Hikvision camera and needed some help. When the client opened a customer support case with Hikvision,

the company sent back images from the client's camera without asking for the login information, according to Genetec security chief Christian Morin. It seemed clear to Morin that Hikvision and Dahua had "magic keys" to access their cameras whenever they wanted. "These devices can serve as beachheads," Morin says, through which nefarious actors "can take down the rest of your network." Genetec eventually stopped using Hikvision and Dahua gear. IPVM "played an instrumental role" in exposing these "very suspicious cybersecurity flaws," Elvish says.

Dahua and Hikvision deny leaving intentional backdoors, saying such security problems are normal for any major tech manufacturer and that they patched them appropriately. "There is no evidence anywhere in the world indicating that Hikvision's products are used for unauthorized collection and transit of information or data of end users. Hikvision would never compromise or harm our customers' interests," Hikvision told me in a statement. Dahua put out a statement saying, "We have provided remedies to correct those issues with our customers. We take cybersecurity very seriously."

In May and June of 2017, Hikvision lashed out at Honovich in four posts on its own blog. "Does the online blogger devote 100 percent of his time to writing tabloid-style headlines and sensationalist anti-China rhetoric?" asked one post. "Hiding behind a keyboard, the tabloid's staff takes unfounded potshots at our entire industry, bullying one company at a time. It is cyberbullying, and it is a cyberattack on hard-working people." One post suggested that the default name given to anonymous commenters on IPVM posts—"Undisclosed"—might be a Honovich sock puppet.

A few days after the sock puppet post, Jeffrey He, the president of Hikvision USA, emailed Honovich to invite him to an off-the-record meeting at a hotel at New Jersey's Newark Liberty International Airport. Honovich had talked with He a number of times in the course of reporting, and he figured Hikvision leadership wanted to clear the air. Honovich showed up at a small conference room in the hotel, where He and two other senior Hikvision employees were waiting. They faced each other across a conference table. One of the Hikvision people held a clipboard, Honovich recalls, and began asking him questions from a written list: Why did he

write the things he posted on IPVM? How did the company really make money? What did he have against Hikvision? Honovich was taken aback and tried to explain that he had no hidden agenda or revenue source beyond subscribers. To him, the meeting felt like a criminal interrogation—“Where were you on the 4th of May?”—type stuff. (A Hikvision representative said that Honovich and He had agreed the meeting would be off the record and declined to comment further.)

After about 15 minutes of grilling, Honovich went to the bathroom to catch a breath. He was surprised to take that much heat in person, but he saw himself as someone who could handle it. As he told me during our meeting in Marine Park, “I get satisfaction out of standing up.”

Soon, IPVM’s coverage caught the attention of policymakers in Washington, DC. Intelligence agencies and news outlets in the US and other Western countries were already sounding alarms about networking equipment made by Chinese companies—particularly Huawei, one of the world’s tech giants. Now parts of the US government were concerned about Hikvision and Dahua, too, and began imposing sanctions on them. In August 2018, Congress passed a law barring the federal government from buying gear from Huawei, Hikvision, and Dahua, among other Chinese tech companies. The Congressional Executive Commission on China, a bipartisan group that monitors human rights and the rule of law in the country, cited Rollet’s coverage in its 2019 annual report, writing that “IPVM provided evidence that the video surveillance company Hangzhou Hikvision Digital Technology was directly involved in the construction, operation, and ongoing maintenance” of the Xinjiang surveillance system.

The devices were giving customers a false sense of comfort, the testers concluded, while pulling in hundreds of millions of dollars for their makers.

As IPVM waded deeper into big policy questions, Honovich decided to hire someone to deal with government officials and research how surveillance affected the public. Conor Healy, just out of college and trying to figure out what to do with his life, came across IPVM’s posting on a job board and was intrigued: It didn’t say much about qualifications, instead emphasizing that the company needed someone with a strong sense of ethics. Healy saw himself as principled and eager to stand up for his beliefs, and in an

interview he convinced Honovich of the same. Healy started working for IPVM in the middle of 2020 and soon joined an investigation into “fever scanners” that many venues bought during the pandemic. IPVM’s engineers were skeptical of the scanners’ abilities to detect fevers under real-life conditions and wanted to test them at the company’s new headquarters in Bethlehem, Pennsylvania. Healy was brought in to help with the research.

The HQ was a big step up from the storage facility in Honolulu. Inside the century-old, 12,000-square-foot former silk mill, in two cavernous, concrete-floored rooms, IPVM employees tinkered with piles of security gear. Ethan Ace rigged a bunch of fever scanners to a rolling cart and began probing them. In one extreme test, an engineer rode by the rig on a skateboard to see how the scanner behaved when given little time to register his temperature. In another, he held a hot bag of water on his forehead until he couldn’t stand it anymore, then walked by.

The scanners, they learned, were measuring people’s skin temperatures from afar, then using an algorithm to try to divine their internal temperatures. When Ace compared the raw readings with the algorithm’s interpretations, he could see that the software was squeezing nearly all of the measurements—no matter how high or low—into the small range of normal human body temperatures. The fever scanners, Ace said, were in fact “rigged” to almost never show fevers. The devices were giving customers a false sense of comfort, the testers concluded, while pulling in hundreds of millions of dollars for their makers.

As Healy looked at the graphs and their meaning became clear, he was astonished by the companies’ greed. He took a walk with Honovich and confessed to having some doubts—what if they’d made a mistake? Honovich, having spent 20 years fighting mendacity in the security industry, told Healy to follow the data and not be swayed by corporate claims. “That’s one of the founding premises of IPVM: Being dishonest and unethical is a competitive advantage,” Honovich told me. Negating that advantage was IPVM’s *raison d’être*.

Healy and Ace pulled the data together, wrote up an academic article, and got it published in the *Journal of Biomedical Optics*. Within days, the US Food and Drug Administration warned the public that fever scanners could

be inaccurate and sent warning letters to some manufacturers. Healy's first leap into a policy argument had gone well. Soon, he would be helping IPVM wage much bigger wars, with much bigger opponents.

In December 2020, an IPVM employee made a blockbuster discovery. The reporter, who keeps his identity secret because of the harassment some IPVMeers get for their controversial work, discovered that Huawei and a Chinese AI unicorn called Megvii had tested a literal "Uyghur alarm": The system used [AI to analyze people's faces](#), and if it determined that a passerby was Uyghur, it could send an alert to authorities. At the time, Huawei wasn't publicly known to be participating in China's racial surveillance system. IPVM partnered with two *Washington Post* tech reporters to [get the information out](#).

The *Post* published an article on the same day as IPVM and credited the security outfit with the discovery. Dozens of publications picked up the story. For the first time, an IPVM report was national news. Reacting to the *Post* report, US senator Ben Sasse from Nebraska said, "While Huawei sells contracts with fancy talk about connecting people around the world, they're working to send Uyghurs to torture camps in China." Senator Marco Rubio from Florida tweeted, "The sick people at @Huawei developing software to recognize the faces of #Uighur Muslims & alert the communist government of #China." Antoine Griezmann, a French soccer star who had appeared in prominent ad campaigns for Huawei, canceled his sponsorship deal. Huawei released a statement saying it wasn't involved in ethnicity detection, yet the *Post* reporters promptly found other documents on a Huawei website showing it had worked on race-detecting systems with at least four other partners besides Megvii.

Spurred by his colleague's discoveries, Rollet, the former newspaper reporter, began turning up more evidence of racial surveillance in China. He found product support documents for Dahua cameras that provided "real-time Uyghur warnings" to police. Another document showed that Dahua cameras could track people in the illegal sex business, thieves, and "Uyghurs with hidden terrorist inclinations." Sitting at a café and goggling at the file on his laptop screen, Rollet felt that he was face-to-face with "the banality of evil"—bland technical manuals for an automated system of

brutality. Thinking of movies he had seen about historical genocides, he started to cry. IPVM provided the documents to the *Los Angeles Times*, and the paper published its own investigation in February 2021.

IPVM's reporters went on a tear, digging up more damning evidence and providing it to bigger publications to disseminate. The BBC published a report on Huawei's patent filings for AI race detection in China; Reuters wrote that Hikvision and Dahua had helped draft technical standards for mass face recognition systems; *The Wall Street Journal* revealed that Hikvision had deep, long-standing ties to the Chinese military. And so on. Each time, the companies involved insisted that the project was a one-off test, an unimportant slipup, or regular corporate behavior.

Concerns about the companies' security and human rights issues finally erupted. In November 2021, President Biden signed a law that blocked the introduction of new video surveillance equipment from Hikvision and Dahua and communications equipment from Huawei in US telecom networks. Models that the companies had already sold in the US would become obsolete over time, gradually consigning them to irrelevance. IPVM played a crucial role in "exposing the Chinese government's gross human rights abuses perpetrated with the help of its video security and surveillance systems," US representative Claudia Tenney from New York, a cosponsor of the law, told me. "IPVM's work is key to unearthing the full extent of the security risks posed by the CCP and state-controlled or - directed technology companies."

Even the security industry—much of which had continued to support Chinese manufacturers because of their cheap and popular gear—largely turned against them. The Security Industry Association trade group expelled Dahua, and Hikvision quit soon after, leaving no doubt about who it blamed for its departure. "It has been disappointing and frustrating to witness the cynical, anti-competitive, unscrupulous, and disingenuous efforts of IPVM to target member companies and undermine the mission of SIA with its invective and opaque financial motives," Hikvision wrote in a resignation letter obtained by the website Security Info Watch.

Honovich banged out a feisty response: "We are only 'opaque' to Hikvision because they cannot understand putting ethics over profits," he wrote in a

post on IPVM. “A PRC government organization with 40,000+ employees, Hikvision cannot control IPVM, an American small business with just 25.”

The fight for the US market was over, and Hikvision began a slow retreat. But IPVM wasn’t done with China.

Photograph: Makoto Oono

In September 2021, Conor Healy, IPVM’s government liaison, flew to London to participate in a people’s tribunal chaired by the lead prosecutor of the war criminal Slobodan Milošević. The goal of the trial was to determine whether the Xinjiang crisis amounted to genocide, and Healy was there to testify on IPVM’s scoops in the region. At a reception for participants, a human rights researcher told Healy about an ethnic minority family that was in trouble. The father, Ovalbek Turdakun, an ethnic Kyrgyz and citizen of China, had spent a year in a “reeducation” center in Xinjiang. He, his wife, and their son had fled to Kyrgyzstan, but they were at risk of being deported back.

Healy reached out to some of his contacts. A US State Department official suggested the family try to get to a neutral country such as Turkey and from there petition the US government to let them in. A Christian organization agreed to pay for the family’s exit, but Healy was having trouble finding someone who could shepherd them to Turkey. He decided to do it himself.

In December, Healy flew to Bishkek, Kyrgyzstan, and found himself in a child’s bedroom sitting across from Turdakun. The Kyrgyz man sat in silence, drawing on his palm with a pen. His wife sat beside him, a calm and determined look on her face, while their 11-year-old son smiled happily, unaware of what was about to unfold.

Healy was going to try to escort them across the border that day. A Russian man who transported kids for a local school pulled up in a small bus, and they filled it with seven suitcases stuffed with almost everything they owned. As the group left the city and drove down dark roads, Healy bought plane tickets on his phone, having left it until the last minute to keep Chinese authorities from tracking them. He couldn’t shake what he’d heard

from a human rights contact: If the Chinese government was going to kill them, it would likely be in the car on their way out of the city.

They made it to the airport, and Healy and the family nervously approached border control. Healy took their passports and, along with his own, handed them in a stack to a customs officer. The officer flicked through Healy's, looked at the other passports, frowned, and walked off. A few minutes later, he returned with a more senior officer whose uniform was covered with ribbons and medals. The two officers argued with each other in Kyrgyz for a few minutes. Then the senior officer turned to Healy and asked whether he loved Kyrgyzstan. Healy nervously blurted out something about the beauty of the mountains before realizing he sounded ridiculous, since the city was blanketed in thick smog. The officer paused for a minute, then let them through. The clang of the stamp on the passports was the sweetest sound Healy had ever heard. As Turdakun, who didn't speak much English, walked through, he smiled at Healy and said, "Nice."

In Istanbul, Healy interviewed the parents for three days in a hotel room, over glasses of Turkish tea, to find material for their application to immigrate to the US. Turdakun described in detail how he was shocked with electric batons, injected with noxious chemicals, and tied to a steel interrogation chair in a room by himself for over 24 hours at a time. The ever present masters in his cell were three security cameras. If he talked to another inmate, a guard watching the video feed would bellow at him through a loudspeaker to stop. When he wanted to use the rudimentary toilet, he would look at a camera and ask for permission. Even outside the camp, Turdakun said he was watched by face recognition cameras hanging all over Xinjiang, and when he went out, police often quickly appeared and interrogated him. Healy showed Turdakun an image of the Hikvision logo on his phone and he recognized it. "Ah, that's a brand of video camera. They're everywhere," he said. The same logo, he said, was on the cameras in his cell.

Healy flew back home after the interviews but continued to help the family with their application, as did other advocates. A human rights lawyer who wants to call Turdakun as a witness at the International Criminal Court in The Hague wrote a letter to the US government on the family's behalf. "It is

vital that his evidence is available for the ICC and for the international community,” he wrote in the letter, as quoted in *The Guardian*. “It is crucial to keep them safe and secure.” After three months in Istanbul, the family got a special type of immigration visa for people called to testify in court, and in April 2022 they flew to the US. As they exited security at Washington Dulles International Airport, Healy was there to welcome them to the United States. He and Turdakun hugged. Now that the family was safely in the US, Healy wrote a post on IPVM about Turdakun’s experiences: the first direct evidence of Hikvision cameras being used in detention cells in Xinjiang.

as a reporter, I was never going to get as involved in the story as Healy did. Still, I wondered whether I might be able to peek inside the dark world of Chinese surveillance myself. Using what I’d learned of IPVM’s reporting techniques, I made a short list of search terms, starting with “minority” in Chinese, and began scouring the internet.

When I got a result that looked promising, I copied the text into a translation tab. It didn’t seem like much, so I went back and tried different searches, sometimes incorporating new terms I came across. Within half an hour, I found a Chinese page on Hikvision’s Indonesian website describing a server that analyzed surveillance video. One of the facial attributes that the server’s software was supposed to detect: “Minority: unknown, yes, no.” The translation was stilted, but in the context of everything IPVM had reported, clear enough.

I’d stumbled on what appeared to be another tiny part of China’s racial-persecution system. I thought of something Honovich had told me: “If the Nazis were here, they would probably design user manuals for everything they built.” A sickening feeling came over me. This wasn’t evidence filtered through someone else’s description, subject to interpretation—it was a vile secret the internet had whispered just to me.

When I went back to the page a few weeks later, it had all been translated to English, the bit about detecting minorities scrubbed. I scrambled through documents on my hard drive and realized I’d made the rookie mistake of failing to archive the page: no screenshots, no PDFs, no proof. I copied and pasted the URL as fast as I could into the Wayback Machine, an archive of

websites, and found an old version of the page. It was as I'd remembered it, touting the server's minority detection. I quickly saved it in three formats.

Even as our faces are increasingly tracked and analyzed by computers, and distant sirens of dystopia ring louder, the US has largely declined to regulate video surveillance and face recognition. In the absence of restrictions, Honovich says he's watching for trouble. "AI can do magically positive things for society, but you can do terrible things as well," he says. "There's a risk of police using it, there's a risk of companies using it, there's a risk of people using it."

By now, I understood why Honovich was so careful to limit his own exposure to face recognition. "They can start mining all these videos and figuring out where you are," he says. "I try to keep basically a low profile on the internet. It's not gonna 100 percent stop it, but I'm not sure why I want to give them more shots to identify me all over the place."

"Who's them?" I ask.

"The *them*. Could be the US, could be China. Could be whoever."

With a prick of anxiety, I wondered what "the them" might know about me and whether I should take down public pictures of myself. I concluded there was no point. My face was already out there in the cloud, available for anyone to analyze. That loss of privacy was forever.

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Apr 2, 2023 7:00 AM

No, You Can't 'Have This'

It's so tempting to cry "just let me have this" when faced with a delicious story. But the easy gratification of viral lies is costing us more than it's worth.

Photograph: Shawn Michael Jones

"Please, just let me have this." It's what we cry when a too-good-to-be-true viral story is threatened by the too-true-to-be-ignored reality. When we say it (or, more likely, tweet it), we know something's wrong. It's like that uncanny moment when we realize we're about to awake from a wonderful dream.

It comes up a lot: during the plane bae saga , for instance, when a comedian nonconsensually filmed a young man and woman in the row in front of her and created a fictional narrative that they were in a romantic relationship—to the delight of thousands, who then demanded that the poor young woman live up to that fantasy. Or, more recently, when accused sex trafficker Andrew Tate was arrested in Romania and people wrongly believed that a pizza box, seen in a video where he was beefing with [Greta Thunberg](#), had tipped the police off to his location. They're fun stories, to be sure. The memes that came out of the Tate arrest were priceless little gems scattered across the desolation of Elon Musk's [Twitter](#). But these nuggets of entertainment may come at too dear a price.

When someone says "just let me have this," it's worth asking why they need it in the first place—and the answer should prompt some sympathy. Even the most cursory glance at the world reminds us what a sorrowful and joyless place it can be at this moment, when we seem to be reliving the 20th

century's greatest hits all at once. In addition to providing the cozy fire of a feel-good story to warm your soul, these viral internet fictions can lull you into believing there's some justice in the world.

Whatever else may be said about Thunberg, Tate, and the Jerry's Pizza box, it's a cracking good tale: Young climate activist tricks misogynist influencer into beefing with her so hard that he gets himself arrested. What's the harm in thinking a self-parodically macho self-help guru accused of heinous sex crimes was undone by such a trivial mistake, egged on by a progressive young woman?

In one sense, there's ample justice in the likelihood that this little lie will hound Tate for the rest of his days. But clinging to these viral white lies can also inflict serious harm. "Just let me have this" is the apotheosis of the internet as entertainment, with no tragedy great enough to banish irony and memeification. Tate's alleged crimes are no joke, after all; the Romanian police charged him with the sex trafficking and rape of at least six women over a period of years. There's something ghoulish about mining a bit of fan fiction from this situation for personal pleasure.

That sort of behavior is all part of the Extremely Online problem, where virality alchemizes everything into the 21st-century version of must-see TV, bleeding it dry of the need for reverence, grief, contemplation, or any emotion that isn't some kissing cousin of an especially joyless hedonism.

What is "this" that we so dearly want to have? Sometimes it's the catharsis of rage, other times the gleeful delusion that the world is fundamentally just.

But what is "this" that we so dearly want to have? Sometimes it's the catharsis of omnidirectional rage, other times the gleeful delusion that the world is fundamentally just. And there is no room for other emotions in the void between those fantasies. All the while, people who scoff at others for falling prey to disinformation widely retweeted the fable about Tate's pizza box.

Those same users may decry online harassment, fearing for the loss of their own privacy, while eagerly sharing threads or stories that invade the privacy

of others. One especially egregious example was [TikTok](#)'s Couch Guy saga, where a video of a tired young man greeting his girlfriend was dissected for evidence that he was cheating. He wasn't a celebrity—just some guy—but the whims of virality turned his sleepy hug into a crime that justified turning his life upside down. People had a blast making their own semi-ironic, true-crime-esque, investigative TikToks while neglecting the fact that the young man they were comparing to a serial killer because of the way he hugged his girlfriend is a real human being.

We can just let people enjoy things, yes. But it crosses a line when the “thing” in question is another human being who never consented to ascend into the zeitgeist—or when the *descent* of a monster like Tate into #content obscures their evil in a fog of irony. After all, in the case of the meme-optimized fable of Tate's demise, it is his victims' trauma being used to fuel the schadenfreude.

It's understandable that the horrors of late capitalism have left us in dire need of empty calories of post-processed joy. But when we're surrounded by fictional entertainment created for the sole purpose of riveting us to positive emotions we're otherwise alienated from, it feels especially churlish to demand the right to enjoy nonconsensually strip-mined content on social media. Especially when that content is straight-up misinformation.

Perhaps the biggest danger, however, lies in feeding one of the most terrible delusions of all: that we can shitpost our way to a better world. This, more than anything else, is why people need to “have this” when it comes to happy fictions like the telltale pizza box. It reinforces the myth that what's good for #content can be good for society. But it almost never is. Content is its own alpha and omega. In this strange and perilous political moment, when we are just beginning to think the unthinkable about platforms—asking whether we even need them—it's worth facing up to the fact that this kind of pseudo-justice needs us far more than we need it.

So many social media hoaxes have traded on the idea of justice-in-a-can, like the disclaimer people were appending to their [Instagram](#) photos in hopes that it would keep the platform from misusing them. People didn't perpetuate it because they were stupid but because it fit a preexisting narrative about the perfidy of companies like [Meta](#), and because it offered

social media itself as the solution. Click, copy, paste, share—the day is saved. As it does with just about everything, social media accelerates the process by which capitalism co-opts any resistance to it.

This is why the Tate pizza box fable was so popular: It asked nothing of the people who believed it *beyond* their belief. It continued the worrying deification of a world-famous young woman on whom such impossible expectations are already heaped, casting her as an avenging superheroine. All that was needed was for us to like and retweet. How tempting to believe that it requires nothing more to tear patriarchy or death-cult capitalism asunder.

Here's what I can let you have: mountains of consensually produced entertainment to soothe your soul after a long day and, more importantly, faith in your ability to do so much more than doomscroll and shitpost through the latest apocalypse.

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Apr 1, 2023 7:00 AM

The Internet Is Ruined. The Metaverse Can Still Be Saved

In this nascent stage, there are opportunities for virtual worlds to avoid the mistakes of the past.

Photograph: Nuclear_lily/Getty Images

The future of the [metaverse](#) looks shakier than anyone can imagine. Tech companies that have bought into the concept fully—like Facebook-turned-Meta and [Disney](#)—are facing the realities of building out a concept that ostensibly already exists but has failed to achieve any real popularity. Even members of the video game industry, which has been exploring the field through virtual worlds like Second Life for years, [have doubts](#) that it will ever live up to its promise. But in this nascent stage, there is also potential: If the metaverse does take off, people building it now could avoid repeating the mistakes of the past.

As it stands, the metaverse is “not yet set,” says [Micaela Mantegna](#), an affiliate at the Berkman Klein Center at Harvard. Because of this, it might still be possible to limit the rampant toxicity that has infiltrated the web and social media. The metaverse is still connected to its more organic roots, and if those populating it—be they people or corporations—can remember the lessons learned about online safety and moderation, the metaverse could be a less horrible place. Put another way, “we already ruined one internet,” Mantegna said during a recent panel at the Game Developer Conference, but there’s hope for the one to come.

Video Games

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Megan Farokhmanesh

Whateververse

[What Is the Metaverse, Exactly?](#)

Eric Ravenscraft

Zuckerverse

[Big Tech Needs to Stop Trying to Make Their Metaverse Happen](#)

Gian M. Volpicelli

Early metaverse experiences, like Linden Lab's [Second Life](#), allow users to explore identities and build new worlds. These ideas became the backbone for platforms like Roblox and VRChat, which turn devices into fulcrums for social interaction and [community creation](#). More recently, as companies like Meta have moved to transform virtual spaces like Horizon Worlds into mega-platforms, those smaller communities have felt pushed aside. There is less onus on a user to craft their own world; instead, they navigate the clunky, [no-legged future](#) put before them by corporations.

Harassment and other issues have inevitably crept into these spaces. Technology will be misused, Mantegna says, and it's crucial to start thinking early on about ways it might be abused. Right now, there's a huge lack of transparency around how the metaverse will work. Any system using algorithms, for example, is [vulnerable to bias](#), whether it impacts economically disadvantaged users, people of color, marginalized communities, or others. It's also still unclear what the metaverse's true ecological impact will be. And then there are the sticky questions about surveillance and data privacy. "How are we going to ensure we are not being manipulated in these spaces?" Mantegna says.

Some of these issues could be addressed with robust—and enforceable—laws and ethical guidelines. Regulation probably shouldn't be left up to the corporations behind metaverse endeavors. But as other platforms have demonstrated, laws cannot match the speed of the internet. You don't have

to look far for examples; earlier this year, streamers [who'd been deepfaked](#) found their options for justice to be severely limited.

Most legislation seeking to address these issues attempts to apply “meatspace laws” to web problems, says Ryan Black, a lawyer with a focus on the video game industry who appeared on the GDC panel alongside Mantegna. Furthermore, Black tells WIRED, they’re too “territorial” to meaningfully affect any given platform. “To the extent that there aren’t regulations and laws, we’ve essentially ceded control and authority to the operator via their terms and conditions,” he says. The relationship people have to the modern internet is “very much a provider-to-user” one, he says.

The metaverse is unlikely to be a great equalizer. As of now, there is no one set metaverse, but rather a variety, spanning multiple platforms and interests. People also have access to different levels of tech. And without the robust infrastructure needed to access the metaverse—steady internet, for starters—that inequity gap is poised to grow. Companies are likely to build services for people they stand to profit from. “The evolution of the product is driven by the ability to monetize, to further the business purpose,” says Black. Questions and solutions therefore follow what works for a company’s business, “and not a lot of what works for our users/society.”

But the metaverse is not starting from scratch. Creators already have avenues to work from. “Video games have always led the way in these technologies,” says Mantegna, “I think maybe we can start this conversation here and start creating solutions for this.” Lessons learned from combating harassment in spaces like *Fortnite* and Second Life can be applied to new platforms like Horizon Worlds. [Artificial intelligence](#), another fast-rising technology, may offer relevant guidance. “We need to think about all the experiences we already have thinking about AI ethics,” she says.

Achieving a true metaverse is not just about providing a virtual playground for people to yell in. It requires connection beyond the business of organizations, says Black, as well as governments working to facilitate a “true public interest/set of rights.” Without those safeguards, control will remain in the hands of those operating it.

“The ethical shift would need to be one that recognizes that the metaverse/virtual reality we are creating (or that will emerge from whatever we create) is a place where people will exist, and they have rights here that transcend any organization’s business needs,” says Black. It’s a high bar that only begins to touch on privacy, the right to organize, protest, and be free of discrimination—and so much more.

“That will be very complicated to do when we still have municipal, county, state/province, and country borders,” Black says. These might not exist in the metaverse itself, “but that will very much govern the meatspace humans that build it.” Creating a better online space will mean monitoring who gains control of the metaverse—and who gets left behind.

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Mar 30, 2023 6:00 AM

The Unbelievable Zombie Comeback of Analog Computing

Computers have been digital for half a century. Why would anyone want to resurrect the clunkers of yesteryear?

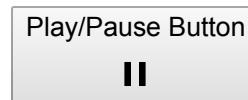


Illustration: Khyati Trehan

When old tech dies, it usually stays dead. No one expects rotary phones or adding machines to come crawling back from oblivion. Floppy diskettes, VHS tapes, cathode-ray tubes—they shall rest in peace. Likewise, we won't see old analog computers in data centers anytime soon. They were monstrous beasts: difficult to program, expensive to maintain, and limited in accuracy.

Or so I thought. Then I came across this confounding statement:

Bringing back analog computers in much more advanced forms than their historic ancestors will change the world of computing drastically and forever.

Seriously?

I found the prediction in the preface of a handsome illustrated book titled, simply, *Analog Computing*. Reissued in 2022, it was written by the German mathematician Bernd Ullmann—who seemed very serious indeed.

This article appears in the May 2023 issue. [Subscribe to WIRED](#). Illustration: Alvaro Dominguez

I've been writing about future tech since before WIRED existed and have written six books explaining electronics. I used to develop my own software, and some of my friends design hardware. I'd never heard anyone say anything about [analog](#), so why would Ulmann imagine that this very dead paradigm could be resurrected? And with such far-reaching and permanent consequences?

I felt compelled to investigate further.

For an example of how digital has displaced analog, look at photography. In a pre-digital camera, continuous variations in light created chemical reactions on a piece of film, where an image appeared as a representation—an *analogue*—of reality. In a modern camera, by contrast, the light variations are converted to digital values. These are processed by the camera's CPU before being saved as a stream of 1s and 0s—with digital compression, if you wish.

Engineers began using the word *analog* in the [1940s](#) (shortened from *analogue*; they like compression) to refer to computers that simulated real-world conditions. But mechanical devices had been doing much the same thing for centuries.

The Antikythera mechanism was an astonishingly complex piece of machinery used thousands of years ago in ancient Greece. Containing at least 30 bronze gears, it displayed the everyday movements of the moon, sun, and five planets while also predicting solar and lunar eclipses. Because its mechanical workings simulated real-world celestial events, it is regarded as one of the earliest analog computers.

As the centuries passed, mechanical analog devices were fabricated for earthlier purposes. In the 1800s, an invention called the planimeter consisted of a little wheel, a shaft, and a linkage. You traced a pointer around the edge of a shape on a piece of paper, and the area of the shape was displayed on a scale. The tool became an indispensable item in real-

estate offices when buyers wanted to know the acreage of an irregularly shaped piece of land.

Other gadgets served military needs. If you were on a battleship trying to aim a 16-inch gun at a target beyond the horizon, you needed to assess the orientation of your ship, its motion, its position, and the direction and speed of the wind; clever mechanical components allowed the operator to input these factors and adjust the gun appropriately. Gears, linkages, pulleys, and levers could also predict tides or calculate distances on a map.

In the 1940s, electronic components such as vacuum tubes and resistors were added, because a fluctuating current flowing through them could be analogous to the behavior of fluids, gases, and other phenomena in the physical world. A varying voltage could represent the velocity of a Nazi V2 missile fired at London, for example, or the orientation of a Gemini space capsule in a 1963 flight simulator.

But by then, analog had become a dying art. Instead of using a voltage to represent the velocity of a missile and electrical resistance to represent the air resistance slowing it down, a digital computer could convert variables to binary code—streams of 1s and 0s that were suitable for processing. Early digital computers were massive mainframes full of vacuum tubes, but then integrated circuit chips made digital processing cheaper, more reliable, and more versatile. By the 1970s, the analog-digital difference could be summarized like this:

The last factor was a big deal, as the accuracy of analog computers was always limited by their components. Whether you used gear wheels or vacuum tubes or chemical film, precision was limited by manufacturing tolerances and deteriorated with age. Analog was always modeled on the real world, and the world was never absolutely precise.

When I was a nerdy British schoolboy with a mild case of OCD, inaccuracy bothered me a lot. I revered Pythagoras, who told me that a triangle with sides of 3 centimeters and 4 centimeters adjacent to a 90-degree angle would have a diagonal side of 5 centimeters, *precisely*. Alas, my pleasure diminished when I realized that his proof only applied in a theoretical realm where lines were of zero thickness.

In my everyday realm, precision was limited by my ability to sharpen a pencil, and when I tried to make measurements, I ran into another bothersome feature of reality. Using a magnifying glass, I compared the ruler that I'd bought at a stationery store with a ruler in our school's physics lab, and discovered that they were *not exactly the same length*.

How could this be? Seeking enlightenment, I checked the history of the metric system. The meter was the fundamental unit, but it had been birthed from a bizarre combination of nationalism and whimsy. After the French Revolution, the new government instituted the meter to get away from the imprecision of the ancien régime. The French Academy of Sciences defined it as the longitudinal distance from the equator, through Paris, to the North Pole, divided by 10 million. In 1799, the meter was solemnified like a religious totem in the form of a platinum bar at the French National Archives. Copies were made and distributed across Europe and to the Americas, and then copies were made of the copies' copies. This process introduced transcription errors, which eventually led to my traumatic discovery that rulers from different sources might be visibly unequal.

Similar problems impeded any definitive measurement of time, temperature, and mass. The conclusion was inescapable to my adolescent mind: If you were hoping for absolute precision in the physical realm, you couldn't have it.

My personal term for the inexact nature of the messy, fuzzy world was *muzzy*. But then, in 1980, I acquired an Ohio Scientific desktop computer and found prompt, lasting relief. All its operations were built on a foundation of binary arithmetic, in which a 1 was always exactly a 1 and a 0 was a genuine 0, with no fractional quibbling. The 1 of existence, and the 0 of nothingness! I fell in love with the purity of digital and learned to write code, which became a lifelong refuge from muzzy math.

Of course, digital values still had to be stored in fallible physical components, but margins of error took care of that. In a modern 5-volt digital chip, 1.5 volts or lower would represent the number 0 while 3.5 volts or greater would represent the number 1. Components on a decently engineered motherboard would stay within those limits, so there shouldn't have been any misunderstandings.

Consequently, when Bernd Ullmann predicted that analog computers were due for a zombie comeback, I wasn't just skeptical. I found the idea a bit ... disturbing.

Hoping for a reality check, I consulted Lyle Bickley, a founding member of the Computer History Museum in Mountain View, California. Having served for years as an expert witness in patent suits, Bickley maintains an encyclopedic knowledge of everything that has been done and is still being done in data processing.

"A lot of Silicon Valley companies have secret projects doing analog chips," he told me.

Really? But why?

"Because they take so little power."

Bickley explained that when, say, brute-force natural-language AI systems distill millions of words from the internet, the process is insanely power hungry. The human brain runs on a small amount of electricity, he said, about 20 watts. (That's the same as a light bulb.) "Yet if we try to do the same thing with digital computers, it takes megawatts." For that kind of application, digital is "not going to work. It's not a smart way to do it."

Bickley said he would be violating confidentiality to tell me specifics, so I went looking for startups. Quickly I found a San Francisco Bay Area company called Mythic, which claimed to be marketing the "industry-first AI analog matrix processor."

Mike Henry cofounded Mythic at the University of Michigan in 2013. He's an energetic guy with a neat haircut and a well-ironed shirt, like an old-time IBM salesman. He expanded on Bickley's point, citing the brain-like neural network that powers GPT-3. "It has 175 billion synapses," Henry said, comparing processing elements with connections between neurons in the brain. "So every time you run that model to do one thing, you have to load 175 billion values. Very large data-center systems can barely keep up."

That's because, Henry said, they are digital. Modern AI systems use a type of memory called static RAM, or SRAM, which requires constant power to store data. Its circuitry must remain switched on even when it's not performing a task. Engineers have done a lot to improve the efficiency of SRAM, but there's a limit. "Tricks like lowering the supply voltage are running out," Henry said.

Mythic's analog chip uses less power by storing neural weights not in SRAM but in flash memory, which doesn't consume power to retain its state. And the flash memory is embedded in a processing chip, a configuration Mythic calls "compute-in-memory." Instead of consuming a lot of power moving millions of bytes back and forth between memory and a CPU (as a digital computer does), some processing is done locally.

What bothered me was that Mythic seemed to be reintroducing the accuracy problems of analog. The flash memory was not storing a 1 or 0 with comfortable margins of error, like old-school logic chips. It was holding intermediate voltages (as many as 256 of them!) to simulate the varying states of neurons in the brain, and I had to wonder whether those voltages would drift over time. Henry didn't seem to think they would.

I had another problem with his chip: The way it worked was hard to explain. Henry laughed. "Welcome to my life," he said. "Try explaining it to venture capitalists." Mythic's success on that front has been variable: Shortly after I spoke to Henry, the company ran out of cash. (More recently it raised \$13 million in new funding and appointed a new CEO.)

I next went to IBM. Its corporate PR department connected me with Vijay Narayanan, a researcher in the company's physics-of-AI department. He preferred to interact via company-sanctioned email statements.

For the moment, Narayanan wrote, "our analog research is about customizing AI hardware, particularly for energy efficiency." So, the same goal as Mythic. However, Narayanan seemed rather circumspect on the details, so I did some more reading and found an IBM paper that referred to "no appreciable accuracy loss" in its memory systems. No *appreciable* loss? Did that mean there was *some* loss? Then there was the durability issue. Another paper mentioned "an accuracy above 93.5 percent retained

over a one-day period.” So it had lost 6.5 percent in just one day? Was that bad? What should it be compared to?

So many unanswered questions, but the biggest letdown was this: Both Mythic and IBM seemed interested in analog computing only insofar as specific analog processes could reduce the energy and storage requirements of AI—not perform the fundamental bit-based calculations. (The digital components would still do that.) As far as I could tell, this wasn’t anything close to the second coming of analog as predicted by Ulmann. The computers of yesteryear may have been room-sized behemoths, but they could simulate everything from liquid flowing through a pipe to nuclear reactions. Their applications shared one attribute. They were dynamic. They involved the concept of change.

Engineers began using the word *analog* in the 1940s to refer to computers that simulated real-world conditions.

Illustration: Khyati Trehan

Another childhood conundrum: If I held a ball and dropped it, the force of gravity made it move at an increasing speed. How could you figure out the total distance the ball traveled if the speed was changing continuously over time? You could break its journey down into seconds or milliseconds or microseconds, work out the speed at each step, and add up the distances. But if time actually flowed in tiny steps, the speed would have to jump instantaneously between one step and the next. How could that be true?

Later I learned that these questions had been addressed by Isaac Newton and Gottfried Leibniz centuries ago. They’d said that velocity does change in increments, but the increments are infinitely small.

So there were steps, but they weren’t really steps? It sounded like an evasion to me, but on this iffy premise, Newton and Leibniz developed calculus, enabling everyone to calculate the behavior of countless naturally changing aspects of the world. Calculus is a way of mathematically modeling something that’s continuously changing, like the distance traversed by a falling ball, as a sequence of infinitely small differences: a differential equation.

That math could be used as the input to old-school analog electronic computers—often called, for this reason, differential analyzers. You could plug components together to represent operations in an equation, set some values using potentiometers, and the answer could be shown almost immediately as a trace on an oscilloscope screen. It might not have been ideally accurate, but in the muzzy world, as I had learned to my discontent, nothing was ideally accurate.

To be competitive, a true analog computer that could emulate such versatile behavior would have to be suitable for low-cost mass production—on the scale of a silicon chip. Had such a thing been developed? I went back to Ulmann’s book and found the answer on the penultimate page. A researcher named Glenn Cowan had created a genuine VLSI (very large-scale integrated circuit) analog chip back in 2003. Ulmann complained that it was “limited in capabilities,” but it sounded like the real deal.

Glenn Cowan is a studious, methodical, amiable man and a professor in electrical engineering at Montreal’s Concordia University. As a grad student at Columbia back in 1999, he had a choice between two research topics: One would entail optimizing a single transistor, while the other would be to develop an entirely new analog computer. The latter was the pet project of an adviser named Yannis Tsividis. “Yannis sort of convinced me,” Cowan told me, sounding as if he wasn’t quite sure how it happened.

Initially, there were no specifications, because no one had ever built an analog computer on a chip. Cowan didn’t know how accurate it could be and was basically making it up as he went along. He had to take other courses at Columbia to fill the gaps in his knowledge. Two years later, he had a test chip that, he told me modestly, was “full of graduate-student naivete. It looked like a breadboarding nightmare.” Still, it worked, so he decided to stick around and make a better version. That took another two years.

A key innovation of Cowan’s was making the chip reconfigurable—or programmable. Old-school analog computers had used clunky patch cords on plug boards. Cowan did the same thing in miniature, between areas on the chip itself, using a preexisting technology known as transmission gates. These can work as solid-state switches to connect the output from

processing block A to the input of block B, or block C, or any other block you choose.

His second innovation was to make his analog chip compatible with an off-the-shelf digital computer, which could help to circumvent limits on precision. “You could get an approximate analog solution as a starting point,” Cowan explained, “and feed that into the digital computer as a guess, because iterative routines converge faster from a good guess.” The end result of his great labor was etched onto a silicon wafer measuring a very respectable 10 millimeters by 10 millimeters. “Remarkably,” he told me, “it did work.”

When I asked Cowan about real-world uses, inevitably he mentioned AI. But I’d had some time to think about neural nets and was beginning to feel skeptical. In a standard neural net setup, known as a crossbar configuration, each cell in the net connects with four other cells. They may be layered to allow for extra connections, but even so, they’re far less complex than the frontal cortex of the brain, in which each individual neuron can be connected with 10,000 others. Moreover, the brain is not a static network. During the first year of life, new neural connections form at a rate of 1 million per second. I saw no way for a neural network to emulate processes like that.

Glenn Cowan’s second analog chip wasn’t the end of the story at Columbia. Additional refinements were necessary, but Yannis Tsividis had to wait for another graduate student who would continue the work.

In 2011 a soft-spoken young man named Ning Guo turned out to be willing. Like Cowan, he had never designed a chip before. “I found it, um, pretty challenging,” he told me. He laughed at the memory and shook his head. “We were too optimistic,” he recalled ruefully. He laughed again. “Like we thought we could get it done by the summer.”

In fact, it took more than a year to complete the chip design. Guo said Tsividis had required a “90 percent confidence level” that the chip would work before he would proceed with the expensive process of fabrication. Guo took a chance, and the result he named the HCDC, meaning hybrid continuous discrete computer. Guo’s prototype was then incorporated on a

board that could interface with an off-the-shelf digital computer. From the outside, it looked like an accessory circuit board for a PC.

When I asked Guo about possible applications, he had to think for a bit. Instead of mentioning AI, he suggested tasks such as simulating a lot of moving mechanical joints that would be rigidly connected to each other in robotics. Then, unlike many engineers, he allowed himself to speculate.

There are diminishing returns on the digital model, he said, yet it still dominates the industry. “If we applied as many people and as much money to the analog domain, I think we could have some kind of analog coprocessing happening to accelerate the existing algorithms. Digital computers are very good at scalability. Analog is very good at complex interactions between variables. In the future, we may combine these advantages.”

The HCDC was fully functional, but it had a problem: It was not easy to use. Fortunately, a talented programmer at MIT named Sara Achour read about the project and saw it as an ideal target for her skills. She was a specialist in compilers—programs that convert a high-level programming language into machine language—and could add a more user-friendly front end in Python to help people program the chip. She reached out to Tsividis, and he sent her one of the few precious boards that had been fabricated.

When I spoke with Achour, she was entertaining and engaging, delivering terminology at a manic pace. She told me she had originally intended to be a doctor but switched to computer science after having pursued programming as a hobby since middle school. “I had specialized in math modeling of biological systems,” she said. “We did macroscopic modeling of gene protein hormonal dynamics.” Seeing my blank look, she added: “We were trying to predict things like hormonal changes when you inject someone with a particular drug.”

Changes was the key word. She was fully acquainted with the math to describe change, and after two years she finished her compiler for the analog chip. “I didn’t build, like, an entry-level product,” she said. “But I made it easier to find resilient implementations of the computation you

want to run. You see, even the people who design this type of hardware have difficulty programming it. It's still extremely painful."

I liked the idea of a former medical student alleviating the pain of chip designers who had difficulty using their own hardware. But what was her take on applications? Are there any?

"Yes, whenever you're sensing the environment," she said. "And reconfigurability lets you reuse the same piece of hardware for multiple computations. So I don't think this is going to be relegated to a niche model. Analog computation makes a lot of sense when you're interfacing with something that is inherently analog." Like the real world, with all its fuzziness.

Going back to the concept of dropping a ball, and my interest in finding out how far it travels during a period of time: Calculus solves that problem easily, with a differential equation—if you ignore air resistance. The proper term for this is "integrating velocity with respect to time."

But what if you don't ignore air resistance? The faster the ball falls, the more air resistance it encounters. But gravity remains constant, so the ball's speed doesn't increase at a steady rate but tails off until it reaches terminal velocity. You can express this in a differential equation too, but it adds another layer of complexity. I won't get into the mathematical notation (I prefer to avoid the *pain* of it, to use Sara Achour's memorable term), because the take-home message is all that matters. Every time you introduce another factor, the scenario gets more complicated. If there's a crosswind, or the ball collides with other balls, or it falls down a hole to the center of the Earth, where gravity is zero—the situation can get discouragingly complicated.

Now suppose you want to simulate the scenario using a digital computer. It'll need a lot of data points to generate a smooth curve, and it'll have to continually recalculate all the values for each point. Those calculations will add up, especially if multiple objects become involved. If you have billions of objects—as in a nuclear chain reaction, or synapse states in an AI engine—you'll need a digital processor containing maybe 100 billion transistors to crunch the data at billions of cycles per second. And in each cycle, the

switching operation of each transistor will generate heat. Waste heat becomes a serious issue.

Using a new-age analog chip, you just express all the factors in a differential equation and type it into Achour's compiler, which converts the equation into machine language that the chip understands. The brute force of binary code is minimized, and so is the power consumption and the heat. The HCDC is like an efficient little helper residing secretly amid the modern hardware, and it's chip-sized, unlike the room-sized behemoths of yesteryear.

Now I should update the basic analog attributes:

You can see how the designs by Tsividis and his grad students have addressed the historic disadvantages in my previous list. And yet, despite all this, Tsividis—the prophet of modern analog computing—still has difficulty getting people to take him seriously.

Born in Greece in 1946, Tsividis developed an early dislike for geography, history, and chemistry. “I felt as if there were more facts to memorize than I had synapses in my brain,” he told me. He loved math and physics but ran into a different problem when a teacher assured him that the perimeter of any circle was three times the diameter plus 14 centimeters. Of course, it should be (approximately) 3.14 times the diameter of the circle, but when Tsividis said so, the teacher told him to be quiet. This, he has said, “suggested rather strongly that authority figures are not always right.”

He taught himself English, started learning electronics, designed and built devices like radio transmitters, and eventually fled from the Greek college system that had compelled him to learn organic chemistry. In 1972 he began graduate studies in the United States, and over the years became known for challenging orthodoxy in the field of computer science. One well-known circuit designer referred to him as “the analog MOS freak,” after he designed and fabricated an amplifier chip in 1975 using metal-oxide semiconductor technology, which absolutely no one believed was suitable for the task.

These days, Tsividis is polite and down to earth, with no interest in wasting words. His attempt to bring back analog in the form of integrated chips began in earnest in the late '90s. When I talked to him, he told me he had 18 boards with analog chips mounted on them, a couple more having been loaned out to researchers such as Achour. "But the project is on hold now," he said, "because the funding ended from the National Science Foundation. And then we had two years of Covid."

I asked what he would do if he got new funding.

"I would need to know, if you put together many chips to model a large system, then what happens? So we will try to put together many of those chips and eventually, with the help of silicon foundries, make a large computer on a single chip."

I pointed out that development so far has already taken almost 20 years.

"Yes, but there were several years of breaks in between. Whenever there is appropriate funding, I revive the process."

I asked him whether the state of analog computing today could be compared to that of quantum computing 25 years ago. Could it follow a similar path of development, from fringe consideration to common (and well-funded) acceptance?

It would take a fraction of the time, he said. "We have our experimental results. It has proven itself. If there is a group that wants to make it user-friendly, within a year we could have it." And at this point he is willing to provide analog computer boards to interested researchers, who can use them with Achour's compiler.

What sort of people would qualify?

"The background you need is not just computers. You really need the math background to know what differential equations are."

I asked him whether he felt that his idea was, in a way, obvious. Why hadn't it resonated yet with more people?

“People do wonder why we are doing this when everything is digital. They say digital is the future, digital is the future—and of course it’s the future. But the physical world is analog, and in between you have a big interface. That’s where this fits.”

In a digital processor crunching data at billions of cycles per second, the switching operation of each transistor generates heat.

Illustration: Khyati Trehan

When Tsividis mentioned offhandedly that people applying analog computation would need an appropriate math background, I started to wonder. Developing algorithms for digital computers can be a strenuous mental exercise, but calculus is seldom required. When I mentioned this to Achour, she laughed and said that when she submits papers to reviewers, “Some of them say they haven’t seen differential equations in years. Some of them have never seen differential equations.”

And no doubt a lot of them won’t want to. But financial incentives have a way of overcoming resistance to change. Imagine a future where software engineers can command an extra \$100K per annum by adding a new bullet point to a résumé: “Fluent in differential equations.” If that happens, I’m thinking Python developers will soon be signing up for remedial online calculus classes.

Likewise, in business, the determining factor will be financial. There’s going to be a lot of money in AI—and in smarter drug molecules, and in agile robots, and in a dozen other applications that model the muzzy complexity of the physical world. If power consumption and heat dissipation become really expensive problems, and shunting some of the digital load into miniaturized analog coprocessors is significantly cheaper, then no one will care that analog computation used to be done by your math-genius grandfather using a big steel box full of vacuum tubes.

Reality really is imprecise, no matter how much I would prefer otherwise, and when you want to model it with truly exquisite fidelity, digitizing it may not be the most sensible method. Therefore, I must conclude:

Analog is dead.

Long live analog.

This article appears in the May issue. [Subscribe now.](#)

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[Andy Greenberg](#)

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Mar 28, 2023 11:00 AM

North Korea Is Now Mining Crypto to Launder Its Stolen Loot

A spy group working for the Kim regime has been feeding stolen coins into crypto mining services in an effort to throw tracers off their trail.

Photograph: Mark Torkington/Getty Images

In the cryptocurrency ecosystem, coins have a story, tracked in the unchangeable blockchains underpinning their economy. The only exception, in some sense, is cryptocurrency that's been freshly generated by its owner's computational power. So it figures that North Korean hackers have begun adopting a new trick to launder the coins they steal from victims around the world: pay their dirty, stolen coins into services that allow them to mine innocent new ones.

Today, cybersecurity firm Mandiant published a report on a prolific North Korean state-sponsored hacking group it's now calling APT43, sometimes known by the names Kimsuky and Thallium. The group, whose activities suggest its members work in the service of North Korea's Reconnaissance General Bureau spy agency, has been primarily focused on espionage, hacking think tanks, academics, and private industry from the US to Europe, South Korea, and Japan since at least 2018, mostly with phishing campaigns designed to harvest credentials from victims and plant malware on their machines.

Like many North Korean hacker groups, APT43 also maintains a sideline in profit-focused cybercrime, according to Mandiant, stealing any cryptocurrency that can enrich the North Korean regime or even just fund

the hackers' own operations. And as regulators worldwide have tightened their grip on exchanges and laundering services that thieves and hackers use to cash out criminally tainted coins, APT43 appears to be trying out a new method to cash out the funds it steals while preventing them from being seized or frozen: It pays that stolen cryptocurrency into "hashing services" that allow anyone to rent time on computers used to mine cryptocurrency, harvesting newly mined coins that have no apparent ties to criminal activity.

That mining trick allows APT43 to take advantage of the fact that cryptocurrency is relatively easy to steal while avoiding the forensic trail of evidence that it leaves on blockchains, which can make it difficult for thieves to cash out. "It breaks the chain," says Joe Dobson, a Mandiant threat intelligence analyst. "This is like a bank robber stealing silver from a bank vault and then going to a gold miner and paying the miner in stolen silver. Everyone's looking for the silver while the bank robber's walking around with fresh, newly mined gold."

Mandiant says it first began seeing signs of APT43's mining-based laundry technique in August of 2022. It's since seen tens of thousands of dollars worth of crypto flow into hashing services—services like NiceHash and Hashing24, which allow anyone to buy and sell computing power to calculate the mathematical strings known as "hashes" that are necessary to mine most cryptocurrencies—from what it believes are APT43 crypto wallets. Mandiant says it has also seen similar amounts flow to APT43 wallets from mining "pools," services that allow miners to contribute their hashing resources to a group that pays out a share of any cryptocurrency the group collectively mines. (Mandiant declined to name either the hashing services or the mining pools that APT43 participated in.)

In theory, the payouts from those pools should be clean, with no ties to APT43's hackers—that seems, after all, to be the point of the group's laundering exercise. But in some cases of operational sloppiness, Mandiant says it found that the funds were nonetheless commingled with crypto in wallets it had previously identified from its years-long tracking of APT43 hacking campaigns.

The five-figure sums Mandiant saw laundered through this mining process, the company's analysts concede, are nowhere near the size of the massive

crypto heists North Korean hackers have pulled off in recent years, stealing hundreds of millions of dollars in cases like the breaches of the [Harmony Bridge](#) or [Ronin Bridge](#) services. That may be because only a small fraction of North Korea's mining-based laundering has been detected.

But it may also be because APT43 isn't primarily tasked with stealing cryptocurrency, says Mandiant analyst Michael Barnhart. Instead, the group appears to have been ordered to generate enough profits through cybercrime to fund its espionage work. As a result, it has sought to steal smaller sums of crypto from a broad number of victims, he says, with the goal of subsisting independently. "They're not going for a cash grab," says Barnhart. "They're trying just to make ends meet."

Cryptocurrency tracing firms, including Chainalysis and Elliptic, say they've seen criminal actors seek freshly mined cryptocurrency to fund their activities or dilute and obfuscate their profits. Elliptic says, for instance, that it's seen a group affiliated with the militant organization Hamas mine cryptocurrency as a means of what it describes as terrorist financing. But Arda Akartuna, a threat analyst at Elliptic, says paying dirty cryptocurrency into a hashing service to mine clean crypto is a particularly troubling phenomenon.

Akartuna points out that mining pools are not as regulated and scrutinized as other crypto players that are sometimes used for money laundering, such as cryptocurrency exchanges, "mixing" services designed to obfuscate the trail of users' coins, and NFT marketplaces. "But they probably should be," he says.

"It's quite concerning that a lot of mining pools don't actually screen who participates in them," says Akartuna. "So you could potentially have illicit actors that are contributing computing power to the mining pools, and those mining pools don't have the tools to identify them."

That suggests government authorities seeking money launderers and criminal financiers may have to shift some of their focus away from the intermediaries of the crypto economy toward the miners that serve as the original wellspring. Not all of that fresh digital cash is quite as innocent as it might seem.

Update 2 pm ET, March 28, 2023: Clarified the views of Eliptic's Arda Akartuna regarding APT23's crypto-laundering tactics.

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By [Meghan O'Gieblyn](#)

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Mar 28, 2023 8:00 AM

Be Your Own Tab Manager

WIRED's spiritual advice columnist on the tendency to keep tabs open and the desire to reduce the infinite possibilities of the internet.

Illustration: Derek Abella

“I've read for years about why people keep so many tabs open on their [browsers](#)—digital distraction, FOMO, boredom—and I've tried to pare down my own overpopulated browsers, but nothing sticks. Why can't I become a closer?”

—Open Tab

Dear Open,

Before reading your question, I was actually not aware that there is a corpus of commentary about browser tab clutter. I have not perused the literature myself, though I imagine it's like any content niche—a blend of prescriptive common sense and insular self-reference.

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Spiritual Troubleshooting for the Digital Age

For philosophical guidance on encounters with technology, open a [support ticket](#) via email; or [register](#) and post a comment below.

Beneath the broad digital highways of news, shopping, and social media, there exist endless grottoes of discourse, accessible via search queries,

where cloisters of experts have already discussed any question or problem that has ever occurred to you to the point of Talmudic exhaustion. Sorry for the convoluted metaphor—it's very difficult to visualize our experiences online.

In fact, a decade and a half ago, Kevin Kelly, a cofounder of this magazine, asked hundreds of people to draw a picture of the internet. It was an attempt to crowdsource the “unconscious layout” of the virtual world we spend so much of our lives navigating, to concretize the ephemeral flow of data in spatial terms. Most of the drawings were crude and idiosyncratic, and revealed, if anything, the impossibility of arriving at any shared vision of a realm that is basically empyrean. “The internet is intangible, like spirits and angels,” Kelly wrote. “The web is an immense ghost land of disembodied places. Who knows if you are even there, there.”

I could ask you, Open, by way of turning to your question, where precisely you are reading this column—which is to say, where these words exist in relation to the other content you have encountered or will encounter over the course of your day. If you are reading this in print, the answer is simple: The words exist in a magazine, an object that has precise and measurable spatial relationships to other physical things that are visible when you look up from the page. If you are reading this online, the question becomes more difficult to answer, though I imagine you have a sense—implicit and largely subliminal—that the article is located somewhere specific, one point on a map made up of all the other sites you have recently visited or hope to visit later. Most likely, that map resembles the tabs you have open on your browser.

Like most graphical widgets, tabs are metaphors whose referent has been largely forgotten. They grew out of the more expansive “desktop” trope that has dominated personal computing (which imagines incorporeal data organized into “files” and “folders”) and are modeled after the card tabs inserted into drawers of paper files. They are, in other words, “markers,” a term borrowed from cartography: objects used to indicate a position, place, or route.

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Just as maps are fictional interfaces designed to spatially orient the traveler, tabs are imaginary objects that allow users to navigate the contourless chaos of the dataplasm. It's worth noting that the earliest known maps, like those painted in the caves of Lascaux, were not of the earth but of the heavens—the original spiritual realm—and were, essentially, attempts to visualize individual data points (stars) constellated into familiar objects (bulls, antelopes, warriors). Incidentally, some of the oldest sky maps in the Library of Congress look remarkably like visual representations of the internet.

Although I haven't read the articles about tab overuse (and don't plan to), I assume they point out its irrationality—having too many open slows down your browser—and recommend organizational strategies, like tab managers, that allow you to more easily access information. But to my mind, tab accumulation has, like most compulsive habits, a subliminal purpose that eludes our crude attempts to rationalize it out of existence. Your open tabs are essentially your personalized map of the internet, a method of visualizing where you have been and where you hope to go next. Taken together, they form a perimeter that annexes a galaxy of idiosyncratic content within the seemingly infinite cosmos of information.

It's unclear from your question just how many tabs you have open on a given day. The information available on the maximum limits of popular browsers is mixed and possibly apocryphal—a rumored 500 in Safari for iPhone (though there are ways to hack this limit) and 9,000 tabs in Chrome. In any case, most browsers allow for practically limitless tab use, which can become problematic for users inclined to hoarding. It seems to me that once there are enough to warrant a tab manager (which allows you to group and search your open tabs the way Google helps you search the internet), the situation has grown perilously close to the absurd scenarios imagined by Borges or Lewis Carroll, who wrote of maps that are the same scale as the landscape they represent. Despite the farcical nature of those stories, they aptly dramatize the human tendency to confuse abstraction with the thing itself, which ultimately stems from a desire for control.

Maps and metaphors allow us to manipulate the world, but they are not the world itself. The person who insists on investing more and more detail into the map, like the user who tries to tile over the gaping void of the internet with endless tabs, is in danger of creating a hall of mirrors, cloistering themselves in a reflection of their own image and forgetting the living, breathing territory that lies beyond it.

What I'm trying to say, I suppose, is that the accumulation of tabs often stems from a desire to make the digital realm more static and familiar—and to reduce the infinite possibilities it holds. The internet, after all, is in a constant state of flux. The location of information is always changing, and our memory of what we have encountered is hazier all the time. It is, indeed, a land of spirits and ghosts.

But the same could be said about the world itself. When Heraclitus observed (apocryphally) that it's impossible to step into the same river twice, he was making a point about the illusory nature of abstractions. Just as the term "river" imposes a false conceptual stability on a process whose very nature is fluid, so a robust tab collection allows you to envision the infinite datastream as a series of fixed images that will always be there, precisely where you left them.

"Here be dragons," medieval cartographers wrote on the perimeters of their maps, to discourage explorers from venturing beyond the edges of the known world—though some intrepid souls clearly chose to disregard the warnings. The same choice confronts you each time your browser crashes, and you are asked whether you want to restore your previous session or start over from scratch. In truth, the choice is always available to you. At any moment you can elect, with a single click, to make all your open tabs vanish, erasing the map of your personal cosmos and venturing out, through a new window, into terra incognita.

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Mar 28, 2023 7:00 AM

Now That ChatGPT Is Plugged In, Things Could Get Weird

Letting the chatbot interact with the live internet will make it more useful—and more problematic, too.

Photograph: Daniel Sambraus/Getty Images

ChatGPT has dazzled with its [poetry](#), [prose](#), and [academic test scores](#). Now prepare for the precocious chatbot to find your next flight, recommend a restaurant with good seating, and fetch you a sandwich, too.

Last week, [OpenAI](#), the company behind ChatGPT, announced that a slew of companies including [Expedia](#), [OpenTable](#), and [Instacart](#) have created plugins to let the chatbot access their services. Once a user activates a plugin, they will be able to ask ChatGPT to perform tasks that would normally require using the web or opening an app, and hopefully see the dutiful bot scurry off to do it.

The move potentially heralds a big shift in how people use computers, apps, and the web, with clever AI programs completing chores on their behalf. Until now, ChatGPT has been cut off from the live internet, unable to look up recent information or interact with websites. Changing that may also help cement OpenAI's position at the center of what could rapidly become a new era for AI and personal computing.

“I think it’s a genius move,” says [Linxi “Jim” Fan](#), an AI scientist at Nvidia who works on autonomous agents. Fan says ChatGPT’s ability to read documentation and interpret code should make the process of integrating

new plugins remarkably smooth. He believes it may help OpenAI take on Apple and Google, which use their app stores to operate as gatekeepers. “The next generation of ChatGPT will be like a meta-app—an app that uses other apps,” Fan says.

But some are concerned by the prospect of ChatGPT—and OpenAI—gaining increasing dominance through its AI. If other businesses come to rely too heavily on OpenAI’s technology, the company could reap huge financial rewards and wield enormous influence over the technology industry. And if ChatGPT becomes a foundational layer of the tech industry, OpenAI will have an outsize responsibility for ensuring that a fast-moving technology is used carefully and responsibly.

“There’s some distress in the startup ecosystem among companies that were picking up pennies in front of the OpenAI steamroller,” says [Sarah Guo](#), cofounder of [Conviction VC](#), an investment group, in reference to businesses trying to make money by building technology similar to ChatGPT. Guo says that OpenAI’s latest maneuver “improves the staying power and strategic position” of the company’s consumer business.

OpenAI has captured the public’s imagination with ChatGPT, which is far more capable, coherent, and creative than previous chatbots, and it has also [lured dozens of startups into building on top of its AI](#). Microsoft, which has also invested \$10 billion in OpenAI, has [added ChatGPT to the search engine Bing](#), and is rushing to fold it into other products, including its Office suite.

ChatGPT is built on top of an algorithm called GPT that OpenAI began developing several years ago. GPT predicts the words that should follow a prompt based on a statistical analysis of trillions of lines of text harvested from web pages, books, and other sources. Although GPT is, at heart, little more than an autocomplete program, the latest version, called [GPT-4](#), is [capable of some remarkable features of question-answering](#), including scoring highly on many academic tests.

A number of open source projects such as [LangChain](#) and [LLamaIndex](#) are also exploring ways of building applications using the capabilities provided

by large language models. The launch of OpenAI's plugins threatens to torpedo these efforts, Guo says.

Plugins might also introduce risks that plague complex AI models. ChatGPT's own plugin red team members found they could "send fraudulent or spam emails, bypass safety restrictions, or misuse information sent to the plugin," according to Emily Bender, a linguistics professor at the University of Washington. "Letting automated systems take action in the world is a choice that we make," Bender adds.

Dan Hendrycks, director of the Center for AI Safety, a non-profit, believes plugins make language models more risky at a time when companies like Google, Microsoft, and OpenAI are [aggressively lobbying](#) to limit liability via the AI Act. He calls the release of ChatGPT plugins a bad precedent and suspects it could lead other makers of large language models to take a similar route.

And while there might be a limited selection of plugins today, competition could push OpenAI to expand its selection. Hendrycks sees a distinction between ChatGPT plugins and previous efforts by tech companies to grow developer ecosystems around conversational AI—such as Amazon's Alexa voice assistant.

GPT-4 can, for example, execute Linux commands, and the GPT-4 red-teaming process found that the model can explain how to make bioweapons, synthesize bombs, or buy ransomware on the dark web. Hendrycks suspects extensions inspired by ChatGPT plugins could make tasks like spear phishing or phishing emails a lot easier.

Going from text generation to taking actions on a person's behalf erodes an air gap that has so far prevented language models from taking actions. "We know that the models can be jailbroken and now we're hooking them up to the internet so that it can potentially take actions," says Hendrycks. "That isn't to say that by its own volition ChatGPT is going to build bombs or something, but it makes it a lot easier to do these sorts of things."

Part of the problem with plugins for language models is that they could make it easier to jailbreak such systems, says Ali Alkhatib, acting director

of the Center for Applied Data Ethics at the University of San Francisco. Since you interact with the AI using natural language, there are potentially millions of undiscovered vulnerabilities. Alkhatib believes plugins carry far-reaching implications at a time when companies like Microsoft and OpenAI are muddling public perception with recent claims of advances toward artificial general intelligence.

“Things are moving fast enough to be not just dangerous, but actually harmful to a lot of people,” he says, while voicing concern that companies excited to use new AI systems may rush plugins into sensitive contexts like counseling services.

Adding new capabilities to AI programs like ChatGPT could have unintended consequences, too, says Kanjun Qiu, CEO of [Generally Intelligent](#), an AI company working on AI-powered agents. A chatbot might, for instance, book an overly expensive flight or be used to distribute spam, and Qiu says we will have to work out who would be responsible for such misbehavior.

But Qiu also adds that the usefulness of AI programs connected to the internet means the technology is unstoppable. “Over the next few months and years, we can expect much of the internet to get connected to large language models,” Qiu says.

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Mar 28, 2023 6:00 AM

‘You Must Believe You Can Repair It’

Six years ago, I moved my family into a 50-year-old RV—not just to see America, but to test my belief that anything worth fixing can be fixed.

Photograph: Briana Vargas

There's no temperature gauge. That broke several thousand desert miles ago. But you can smell trouble coming, whiffs of radiator fluid slipping in the draft at the front of the engine doghouse. That's when you know it's time to stop. This doesn't happen often. The 318 likes to run hot, but climbing mountains with a 12,000-pound RV on your back will eventually make any small-block engine overheat.

I start looking for a place to pull over. There's nothing. The left side of the road is a sheer cut of rock, quartzite, phyllite, and limestone laid bare by dynamite. To the east, as far as I can see, the barren rocky foothills of the White Mountains bubble and scrape their way toward a desert valley floor, dust-swept and brown. Dotted here and there are clumps of creosote and sagebrush, interrupted occasionally by splashes of yellow rabbitbrush. It's a stark but beautiful landscape. Without a pullout. But it doesn't matter, we haven't seen another car in at least an hour of driving. We are on Highway 168 somewhere in Eastern California, between the [Nevada](#) ghost town where we camped last night and the top of the White Mountains.

So I stop right in the middle of the road.

The author behind the wheel of his 1969 Dodge Travco.

Photograph: Briana Vargas

When the engine shuts off a quiet descends. No wind. No birds. No talking. We—my wife, three children, and me—just listen to the faint hissing of steam escaping the radiator cap, and then a gentle gurgle of coolant in the engine. It's October, but I'm glad I had the presence of mind to stop in the shade; the desert sun casts a harsh light on the road. After a minute my wife turns to the kids and says, "You want to walk around and see if we can find some fossils?"

As a child of the '70s, I've spent a fair amount of time on the side of the road next to broken-down vehicles. This is what vehicles of those days did. The 1967 Volkswagen fastback, which managed to get us home safely from the hospital after I was born, was replaced by a 1976 mustard-yellow VW Dasher that routinely overheated near Yuma, Arizona, on its way from my childhood home in Los Angeles to my grandparents' house in Tucson. To this day my father curses that car. There was also a 1969 Ford F-150 pickup that was reliable until you stuck a camper on its back and tried to climb over the Sierra Nevada. It used to be more of a necessity to know how to fix a car. These days it is often, if not a luxury, a labor of love.

This article appears in the May 2023 issue. [Subscribe to WIRED](#). Illustration: Alvaro Dominguez

My father handed that F-150 down to me. I wanted to work on it, but the truth is I was intimidated. What if I broke something irreparable? What if I just couldn't hack it? I was a computer programmer then. In principle, fixing code is not so different from fixing an engine. But a computer will tell you what is wrong with your code. An engine—at least an older one—doesn't do that. When you work on an older vehicle, *you* are the computer. And I was one with no software.

That made it hard to know where to start, and so I didn't. Instead I helped more knowledgeable friends with their cars. In the process I discovered that, for me, solving mechanical problems brought a kind of satisfaction that digital ones did not. One weekend I was helping a friend bleed the brakes on his car, pumping the pedal while he was under the chassis turning the bleeder screws. As we worked I could feel the resistance building, a

tactile feedback that I loved. I was hooked. I wanted to learn how to repair engines, but to do that I knew I needed a project of my own—one with higher stakes than the F-150.

In June 2015, my wife and I bought a 1969 Dodge Travco, a motor home that, at the time, was just shy of its 50th birthday. My kids called it the bus. Which was apt. When you say “[motor home](#),” most people picture something that looks nothing like our old Dodge. To call it an RV is to say a Stradivarius is a violin. The Travco is a 27-foot-long fiberglass container of beauty and joy. It’s bright 1960s turquoise and white with sweeping curves and rounded windows. It is bold in a sea of [beige modern RVs](#). The Travco was cool enough that it was once featured in Playboy magazine, back when that was a marker of cool. Johnny Cash had one. So did John Wayne.

We didn’t buy it solely so I would have a project. We bought it to make it our full-time home. We were tired of the suburbs, and we wanted our kids to see the United States, to have a better sense of the place they were born. I didn’t want them to read about the deserts and mountains and forests, I wanted them to be in them. I wanted them to know the difference between the South, where they were born, the Midwest, the West, the Northeast. I wanted them to also know the frustration and the joy of continuing down the road by your own sweat and effort. Out of a muddled sense of self-reliance born of stubbornness and ideals, I wanted them to know that anything worth fixing can be fixed, and anything that can’t be fixed isn’t worth having. But sitting there in the heat of the California sun on Highway 168 that afternoon, the bus felt more like a giant check my ego had written that my fumbling fingers and tools could not cash.

In truth, I didn’t have much experience with cars, but I did grow up around repair and restoration. My grandfather worked for the telephone company and had a shed full of tools behind his house in Tucson. When he retired, he spent his weekends buying broken things at the swap meet and his weekdays fixing them to resell the next weekend. In the summer it was blazing hot in Grandpa’s shed, but my cousins and I didn’t notice. We were too excited watching him tear things apart—phones, televisions, radios, blenders—and breathe life back into them.

My dad had a garage full of tools as well. I was playing with hammers and tape measures from the time I could walk, building model airplanes in grade school. As I got older, I started taking more and more things apart and trying to put them back together. I sketched bookshelves, tables, chairs, and then built them as best I could. I came out of childhood with a few carpentry skills and, more importantly, perhaps misguidedly, a belief that with the right tools and a good mentor, anything was fixable.

Photograph: Briana Vargas

Years later, a line in Matthew Crawford's best-selling manifesto of the manual arts, *Shop Class as Soulcraft*, echoed the feeling my mentors had instilled in me. There is a type of person, he writes, who "hates the feeling of dependence, especially when it is a direct result of his not understanding something. So he goes home and starts taking the valve covers off his engine to investigate for himself. Maybe he has no idea what he is doing, but he trusts that whatever the problem is, he ought to be able to figure it out by his own efforts. Then again, maybe not—he may never get his valve train back together again. But he intends to go down swinging."

Going down swinging is central to the culture of repair. You have to be willing to try. Yet in these days of high technology, products are often covered with stickers warning you that even undoing a screw will void the warranty or risk injury. Companies like [John Deere](#) have even restricted the owners of their machines from repairing them themselves or through a third party. Those stickers aren't an accident. Manufacturers know that the best way to stop people from repairing things is to convince them that they can't.

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But to be more than a consumer of stuff, to not be dependent, you must first believe that you can repair it. That willingness to try—in spite of, or to spite, the stickers—is where it starts, whether you're trying to fix your laptop or replace your head gasket.

There aren't many Travcos left in the world, but in June 2015, after a few months of haunting Craigslist, I found one for sale in the mountains of North Carolina, in the sleepy college town of Mars Hill. A couple who restored vintage trailers found the bus somewhere in Tennessee and tried their hand at fixing it up. Then they changed their mind and put it up for sale. A few days later I was standing there in the hills, looking over the bus. There was some obvious water damage, but nothing I didn't think I could fix.

I was blissfully ignorant about the engine. It was hard to start, but once it got running it seemed good enough to my untrained ear. I handed over the money and climbed into the cockpit.

That first drive was nerve-racking. Strapping yourself into a 27-foot-long monstrosity is nothing like driving a car, especially when the monstrosity is in unknown condition and pointing downhill. A prudent man would have done a test drive. A couple of hairpin turns had my palms sweating—I made a note to myself to buy my next vehicle in Kansas—but I finally managed to get her out on a four-lane road where she felt more manageable. After I had been driving, tensely, for a couple of hours I pulled over at a rest area to take a break.

I'd barely come to a stop when two people came up to the bus to take pictures and ask about it: *What year is it? Where did you get it?* Then they asked the question everyone who loves old cars wanted to know: What engine is in it?

The Travco is driven by a Chrysler 318 LA, a 5.2L small-block V-8 engine. The LA stands for lightweight A-series engine. This is the same engine type you could find in most things Dodge made in 1969, from the Dart to the D100 truck. Larger V-8s like the 440 are more sought after in vintage racing circles, but the 318, as most enthusiasts call it, is the unsung hero of the muscle car era. Some people claim the cylinder bore size in my 318 is bigger than what you'd find in a Dart, which would give the bus's 318 more power. (I've done a little research and still can't confirm or deny this. On the side of a long mountain climb in the desert hills of Nevada, it can certainly *feel* like I have the power of a Dodge Dart, with 8,000 extra pounds of weight on top.) On that first drive with the Travco, when I

stopped at that rest area to collect my wits, all I knew was the engine's name and that it lacked the sensors, computer chips, automation, and complexity of modern vehicles. It was something I felt I could take a swing at.

Going down swinging is central to the culture of repair. You have to be willing to try.

The first year with the Travco, I spent most of my free time rebuilding the interior. For the bulk of 2016 it sat in our driveway with me inside, sweating through the Southern summer, freezing through the winter. Our neighbors begin to give directions based on it: "We're two houses after the big blue bus."

I gutted the inside. I wanted to understand how all the systems worked, and to design and build out everything so I could fix it if I needed to. There are no backup cameras, no motorized awnings, no automated systems at all. I had to go out of my way to find a water heater with a nonelectric pilot light system. Every time we reach camp, I have to get out and light it by hand—but the system will never fail.

A friend of mine joked that I had become like Captain Adama from *Battlestar Galactica*, who famously wouldn't let networked computers on his ship because they introduced a vulnerability he considered unacceptable. It wasn't that he was opposed to technology—his character commands a spaceship after all—but that he distrusted a particular kind of technology. In his case, networked systems opened the door to murderous robots bent on destroying humanity. Our case was a little less dramatic. We just didn't want to have something break far away from the nearest place that could fix it. Every technology you use should be something you choose for a known benefit, with trade-offs you can accept.

No one is perfect though, and the bus does include one complex, fragile system: our solar panels and batteries. I think Adama would approve of the solar panels—they have been our primary source of power for years. But he wouldn't approve of the Bluetooth network the solar charge controller uses; it's an unnecessary potential point of failure. Sure, it's nice to be able to check our solar and battery status from my phone, but we don't have to. To

mitigate that vulnerability, I installed a shunt with a hardwired gauge. Should the Bluetooth fail (or, more likely, should I lose my phone), I can just look at the gauge. Like Adama, I am not opposed to technology. I'm opposed to unnecessary technology and single points of failure.

The late comedian Mitch Hedberg had a joke about how an escalator can never break, it can only become stairs. In web design this is referred to as graceful degradation. How good your technology is depends on how elegantly it handles failures. A lot of modern design has taken exactly the opposite approach. In the name of convenience, complex systems are hidden behind deceptively simple user interfaces. But no matter how simple these things might seem when you use them, the complexity behind them is inherently fragile.

Sometimes inconvenience can even be a benefit. It has a way of forcing you off autopilot and getting you to pay attention. With an engine as old as the Travco's, I found out I need to pay attention. It's part of the cost of admission.

Modern user interfaces have hidden this fact from you, but the first time you start your car every morning, the engine is cold, which makes it hard to start. There are three important components in an internal combustion engine: air, fuel, and spark. The spark is a constant, but when your engine is cold it needs more fuel than air. A computer chip controls this mixture in modern cars, but in older, aspirated engines like the 318, the carburetor controls this mixture with a flap that opens and closes. In our 318 this flap is controlled by the driver via the choke cable—a steel wire attached to the carburetor flap at one end, and a knob on the dashboard at the other. Pull out the knob and the flap in the carburetor closes, limiting the air coming in and allowing the cold engine to start up.

Manual choke is archaic. But since ours was broken when we got it, I went even more archaic. Every time I start the engine, I lift up the engine cover, unscrew the air filter, and close the carburetor flap with my finger. At first this was just expedient. Fixing the choke was on my list of things to do, but finding a long enough choke cable, with a period-correct Dodge dashboard knob, took years of scouring eBay. By the time I found one I was simply

used to doing it myself, literally by hand. The eBay choke cable has been sitting in a storage hatch under the back bed for more than a year.

The truth is, I like opening the engine, I like making sure everything looks right, I like watching it come to life. If something is wrong, I know right away. Once a wire came off the ignition coil, and instead of wondering why the engine wasn't starting—which it wasn't—I was startled to watch electricity arcing out of the ignition coil. That's not right. But it was also very simple to fix. I found the wire and plugged it back in. The engine started right up.

Every morning before we head out on the road, I open the engine cover and spend some time studying the 318, connecting with it. It's a ritual, somewhere between making coffee and invoking the gods, a small part of my morning that's dedicated to making sure the rest of our day goes smoothly. For a long time I really was looking over the engine before every drive; these days I am often just spending time with it.

Car enthusiasts often get this way. It might seem irrational to be attached to a particular set of nuts and bolts and cast iron, but it happens. Now, driving around the country, when I see broken-down cars in someone's yard I don't see junk, I see failed relationships.

The bus is very much a relationship. The five of us moved in and hit the road on April 1, 2017. My wife said that if it didn't work out, we'd just pass it off as a bad April Fools joke. It worked out. Though, as in any relationship, the bus and I have had some rocky moments.

Photograph: Briana Vargas

On April 2, less than 100 miles from home, we had our first problem. I had just finished backing into a campsite at Raysville campground, still in Georgia, when I smelled a strange scent, something like burnt grapefruit. I lay down in the dirt and slid myself under the engine. A thin, warm red liquid splashed onto my forehead. Transmission fluid was leaking out of the bottom of the radiator. There are two transmission lines running into the bottom of the radiator where fluid is cooled before being sent back to the transmission.

I didn't know exactly how to fix it, but I knew just enough about engines to recognize that this wasn't too serious. As long as I kept the fluid level topped off, it wouldn't be too much of a problem. I didn't want to disrupt our new life on the road by taking the bus in for repairs on our third day out. Instead, I added a transmission fluid refill to my morning ritual.

I went through a lot of transmission fluid those first three weeks. I topped it off every morning before we hit the road and every time we stopped for gas. Treating symptoms works for a while, but inevitably the underlying cause gets worse. We made it down to the South Carolina coast and then swung south, through the windswept marshes of the Georgia coast. Then we headed inland, across the swampy pine flats of south Georgia and into the Florida panhandle.

I put off dealing with the leak in part because state and national parks frown on people working on their rigs in campgrounds. And we were heading to a friend's beach house on St. George Island. Friends' driveways are much more conducive to repairs. But the day we arrived, the leak got dramatically worse. I pulled into the driveway with barely any transmission fluid left. At this point, I felt overwhelmed by the problem; it seemed like too big of a task, but I also wasn't sure I wanted to go down so soon. So I spent an hour on the phone searching for a mechanic willing to work on such an old, huge vehicle. I finally found one who was game. A few days later, my wallet lighter, the problem was solved. Yet every time I went to a mechanic I felt inadequate. Why didn't I try to fix it myself? I made excuses (there wasn't time, I wanted to play with my kids), but the truth is I was afraid I would fail.

We got back in the bus and on our way, tracing a route along the white sand beaches of the Gulf Coast, west through Alabama, Mississippi, Louisiana, into New Orleans, where people cheered the bus from the sidewalks. For two months it ran perfectly. But as we headed into the June heat of Texas, the temperature gauge began to climb. And climb. All the way into the red. We took to driving in the early mornings, which helped, but something needed to be done.

We stopped to visit relatives in Dallas, and at yet another mechanic, we had the radiator re-cored. That eliminated it as the source of the problem.

(Again, I chastised myself for taking it to a mechanic, but I had a good excuse—even experienced mechanics rarely re-core their own radiators.) Not an hour outside of Dallas, the temperature gauge shot right back up to the red. We stopped at another repair shop. They replaced the water pump and thermostat. We headed out of town early again, before it got too hot. That worked. Until it got hot. The temperature gauge climbed again.

Our temperature problem, and the brutal West Texas heat, was getting to us. I punted. In Amarillo we got a hotel for the night and I called my uncle. He listened to me for a while and then told me to go get a temperature gun and take readings around the engine when it was running. That night, I paid way too much for a temperature gun at a local hardware store, and we hit the road again early the next morning. Every half hour, I stopped, got out, and took readings on the top and bottom of the engine. Everything was within the operating parameters. We drove on into the midday heat and watched the temperature gauge climb again, but the readings done with the gun remained fine. I called my uncle back. “If I were you,” he said, “I’d pull the temperature sensor out of your engine and chuck it out in the desert somewhere.” I hung up feeling that the main problem with the bus was me. I didn’t know how to find the problems, let alone fix them. I don’t know when my uncle started working on cars, but he’s 35 years older than me. Thirty-five years chasing the spirit of inquiry teaches you a lot.

Photograph: Briana Vargas

I took his advice. I unhooked the temperature gauge from the engine sensor. I was happy to realize there was nothing wrong. I wasn’t happy thinking about the thousands of dollars I’d spent trying to fix what turned out to be a faulty \$15 sensor. I also wasn’t happy now that I could see the learning curve I faced. It felt insurmountably steep.

Two months later, near the end of a summer spent in cool pine forests in the Rocky Mountains, we decided to attempt a 10,000-foot pass near Ridgway, Colorado. We’d managed to get the bus over 9,600 feet before, and the pass we were headed toward was not a steep climb as Rocky Mountain passes go. We started early, but we didn’t get more than a mile into the climb before I smelled that familiar grapefruit smell of transmission fluid. I pulled

over and crawled under the bus—and saw the transmission cooler line leaking again.

We turned around, limped back to Ridgway, and found a side street to park on. I got under the bus again. This time I knew what I was looking for, and sure enough, once I got the nut off the end of the transmission line I could see that the metal pipe, which flares out to wrap over a metal fitting on the radiator, was not just cracked but missing a whole chunk. Instead of forming a tight seal over the metal fitting, fluid was shooting out the side. The transmission cooler lines are fitted tightly along the side of the engine. There is no slack. I couldn't just cut them off, put in a new flare, and reattach them. Even if I could have made it work, they would have been nearly touching the exhaust, which would heat them far more than the transmission cooler ever cooled them.

I was forced to reach out for help, again. I called around for a shop that had big enough bays to work on the bus and eventually found one in Montrose, 30 miles away down the mountain. I put the existing line back on as best I could and limped back to the Ridgway State Park campground. We started repacking and gathering up what we'd need for a few days of tent camping.

That evening, I was sitting outside the laundry room in the campground, watching the famous golden light of the Rockies play across the Cimarron Range, when a fellow camper came to do his laundry. He stuffed his laundry in the machine, and we started talking. The conversation came around to the bus, as most conversations I have in campgrounds do. After he asked about the engine, he asked me something no one ever had, something that caught me off guard. Something that has haunted me since: “Do you turn your own wrenches?” I said I did as much as I could, but that sometimes I had to get professional help. “You have to turn your own wrenches,” he said, shaking his head. “You can't have a vehicle like that if you don't turn your own wrenches.”

I already knew that—I'd been feeling it for months—but it didn't really hit home until someone else said it to me. You can't have a vehicle like this if you don't turn your own wrenches. You'll go crazy or broke or both. I vowed that this would be the last time I would resort to a mechanic. I took the bus to that mechanic in Montrose. We spent a couple weeks in a tent

while the shop found new transmission cooler lines and installed them. A couple weeks later, coming down through western Utah, bound for Zion National Park, I stopped for gas—and guess what I saw pooling under the bus?

It was a Sunday in Utah. We pulled over on a back street, across from a mechanic's shop that was, like everything else on a Sunday in Utah, closed. I crawled under the bus and started poking around. Sure enough, the flare on the transmission line was cracked again. I knew what to do, but I didn't have the tools, and the hardware stores weren't open.

I climbed out from under and sat down on the Travco's step, wiping the grease from my hands. My wife was just asking me what we were going to do, when the rolling metal door of the shop across the street rattled and opened with a clang. A man about my age came walking over and asked if I needed help. I told him my problem. It turned out it was his shop. He didn't work Sundays, but he was there working on his own projects. Together we pulled off the transmission line, took it inside, cut off the cracked flare, and re-flared it. Then he showed me where the last mechanic had gone wrong. He'd overtightened the nut, crushing the metal onto the fitting until it cracked. We tightened it. Gently. The mechanic wouldn't take any money. Help someone else out someday, he told me.

We were almost two years into our family odyssey with the Travco when we found ourselves beached in the middle of the road on that desert mountain pass in Eastern California. By then, I knew that an engine's tendency to overheat isn't really a thing that can be fixed. It's what happens when a small engine tries to climb a big hill. Eventually old cars will teach you so much, including patience.

Photograph: Briana Vargas

I walked up the road to see what was beyond the next bend. Maybe the blacktop crested a ridge and dropped into a cool, lush valley with a river running through it. But the curve didn't end. I kept walking but could never see more than the next few hundred yards; the road just kept climbing. I gave up and headed back to the bus. My wife and kids were back from their explorations, ready to go. The engine had cooled some, so we clamored in

and decided to make another push up the mountain. But now we were starting from zero. On this kind of incline, I gave us a mile before we'd overheat again. (I'd never know exactly, because the odometer was broken.) After about five minutes I spied a pullout. I hadn't smelled radiator fluid yet, but I decided to take advantage of the ability to get out of the road.

My wife and I talked about turning back. There was a strange college back in the valley behind us called [Deep Springs](#). They had a sign out front that said no phone and not to bother them, but something told me they'd be OK with the bus. We could get a fresh start in the morning. It had been a long day of driving, and the kids were tired and hot.

Then we heard an unmistakable sound that always makes me smile. A loud engine, with the distinctive *thump-thump* heartbeat roar of a Harley Davidson, was rumbling up the hill. In a few minutes the bike appeared and the rider pulled over. He asked if we were OK. We went through the usual talk about the bus. Then he told us we were only about a mile from the top. Suddenly we weren't quite so tired. Making it over the mountains felt possible again. We thanked the rider, and he continued on his way. We gave the engine more time to cool off.

An hour later we tried again. It was a long mile, and we never got above 20 miles an hour, but after a while we crested a ridge and a spectacular view of the Owens Valley in California opened up below. I could see the Sierra Nevada rising up out of the hazy valley. We were at the top. I had just a second to enjoy it before we passed a sign that read "Caution, One-Lane Road Ahead." The Narrows, as this bit of highway is called, came up so fast we didn't have time to plan for it. We were just in it. Thankfully, nothing came the other way.

Coming down the steep grade, we stopped to rest the brakes a few times. After about three hours of descending, we pulled into a campground outside of Big Pine, California. It was empty this time of year, and the road was full of ruts that had the bus lurching and creaking around. About 20 yards from the first campsite we heard a loud clang. My wife and I looked at each other. I pulled in for the night and shut off the engine for the final time with a deep sense of relief.

The next morning we watched the sun light up the high peaks of the eastern Sierra Nevada. We had a leisurely breakfast and sipped our coffee well into the morning. We found a train museum up the road and thought we'd take the kids.

It was around 10 when I started up the engine and made my customary walk around the bus to make sure all the windows and hatches and vents were closed and properly secured while the engine warmed up. Everything looked good until I came around to the driver's side. The rear wheels were oddly far back in the wheel well. Wheels don't just move around ... that would mean the entire axle had moved. Oh shit.

I knelt down and peered under the frame. The rear axle, which supports about 5,000 pounds, is held in place by two mounts, one to the front of the axle, one to the rear of the axle. These hold the leaf springs in place. The mounts are secured by four welded steel pins, one at each corner, which hold the axle mount to the chassis. On the driver's side, the forward axle mount, three of the four pins were gone. The mount was hanging by one pin and had swung down and backward, shifting the entire rear axle about 6 inches backward.

If that pin gave out while we were moving, the axle would come free and likely tear the back end of the bus off before dropping it on the ground. We weren't going anywhere. Suddenly, all the things that had happened until now, all the leaking fluids, excess oil, even overheating, seemed pretty mild compared to this. Then I thought of something my uncle had said to me over and over: "It's all just nuts and bolts."

Nuts and bolts aren't where most of the work is, though. It's in the problem-solving that happens in your head. That skill takes years, even decades, to develop. But there's an infectious thrill when you hold some unknown in your head until you come up with a hypothesis about what might be wrong. This takes me many miles of thinking.

It also requires asking many questions of many people. I've met Travco salesmen who knew the original designer, mechanics who've worked on Travcos, and dozens of people who knew the 318 engine inside and out. All

of them helped me in some way, even if it was just an encouraging word, a congratulations on keeping it on the road.

Yet, as I sat there staring at the axle dangling by a single pin, I had no idea what to do. So I texted my uncle a picture of the problem. A few minutes later my phone rang. My uncle happens to live about two hours from Big Pine, back over the state line in Nevada. Sit tight, he said. He was loading up some tools and would be there that afternoon.

Photograph: Briana Vargas

We took the kids hiking down to a nearby river. (Making the bus “work” for us is as much about making sure the kids have space to run and play as it is turning wrenches.) Around three that afternoon my uncle pulled into our campsite with a truck full of floor lifts, jacks, and tools. He crawled under the bus with me. He didn't say anything, just lay there studying the situation. When he climbed back out he said, “I think we can fix that.” We made a run to a hardware store in Bishop, about an hour up the road, where we bought some grade 8 steel bolts, which are strong enough to hold. We then went to the store and grabbed some steaks and potatoes for dinner. Another lesson I've learned from my uncle: “Relax, and make sure you're having fun while you do this.”

That night after dinner, around the campfire, he told me the plan. We'd use two jacks, one to hold up the bus should that last pin give out, and another to maneuver the axle mount back in place. Once it was close we'd use a flange alignment tool to line up the hole in the axle mount with the hole in the chassis. Then we'd slip in the grade 8 bolts. Once he said it, the plan seemed simple enough, obvious even. But I never would have thought of it on my own. I'd never even heard of a flange alignment tool, and I had no idea there were bolts strong enough to replace forged steel pins.

The next morning we started in, and the work took the better part of the day, but when we were done the axle was back where it should be. My uncle didn't like the sound of the engine though. “Why don't you bring it to my place, and we'll see what we can do about that noise,” he said.

The kids got to see the train museum. We swam in some hot springs. Then, a few days later, we made our way up to my uncle's house and I began to learn exactly how the engine worked.

This is, in part, what I love about living in the bus, part of why we keep doing it six years later. It's all the people I know, all the people I've met, the people who've helped—some professionals, most not. We haven't stopped needing to fix things in the bus. In the course of writing this article I had to rebuild the vacuum booster that powers our brake system. I had to replace a head gasket, several worn belts, a failed alternator, the voltage regulator, and a fuel pump, and I had to do all the routine maintenance, like changing the spark plugs, wires, and oil. No mechanics were consulted, though I still regularly text my uncle for advice.

The bus will never not need fixing. But my relationship with it has changed. I no longer look at the engine in awe and mystery. Nor do I look at it with perfect, go-it-alone mastery. I know what all the parts do. I don't know everything that can go wrong, and I don't always know what to do when it does. But I have the thing I've come to prize the most—the relationship with my fellow shade tree mechanics and car enthusiasts. It isn't just me turning my own wrenches that I rely on; it's everyone who turns their own wrenches.

It isn't just wrenches either. We are in the middle of a repair revival. Other repair gurus are out there helping the next generation. Sewing groups hold "mending days" where you can get your clothing repaired, and learn to do it yourself. A luthier friend of mine has apprenticed under a master and now helps others learn how to build and repair guitars. Another friend who started out buying and repairing bicycles for fun now regularly runs workshops for people to learn how to repair their own bikes. All around the country there are local fixing groups. Check the bulletin boards in your community and you'll likely find someone organizing a repair group.

"The bus will never not need fixing. But my relationship with it has changed. I no longer look at the engine in awe and mystery. Nor do I look at it with perfect, go-it-alone mastery."

Photograph: Briana Vargas

The community of people who repair things is an interesting group, perched on a curious dichotomy. We are, by and large, people who prize self-reliance. Whether that spirit grows out of economic necessity, pure enjoyment, or something else, it is essential to the ethic of repair. At the same time, the community is very hierarchical, which means those of us near the bottom must learn from those above. Self-reliance alone tends to make you isolated and either snobbish (if you think you're good) or intimidated (if you know you're not). The only way out of these predicaments is to connect with other people who know more than you. In the first case they'll quickly put you in your place. In the second, they'll lift you up to where they are.

Updated 4-4-23, 12 pm PST: This story was updated to reflect that James Dean did not own a Travco.

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Mar 23, 2023 6:00 AM

Brandon Sanderson Is Your God

He's the biggest fantasy writer in the world. He's also very Mormon. These things are profoundly related.

Photograph: Michael Friberg

Most years, Brandon Sanderson makes about \$10 million. Last year, he made \$55 million. This is obviously a lot of money for anyone. For a writer of young-adult-ish, never-ending, speed-written fantasy books, it's huge. By Sanderson's estimation, he's the highest-selling author of epic fantasy in the world. On the day of his record-breaking Kickstarter campaign—\$42 million of that \$55 million—I came to the WIRED offices ready to gossip. How'd he do it? Why now? Is Brandon Sanderson even a good writer?

Nobody had the first clue who or what I was talking about.

This article appears in the June 2023 issue. [Subscribe to WIRED](#). Photograph: Dan Winters

On the one hand, who cares. Sanderson has millions upon millions of fans all over the planet; it doesn't matter that some losers at a single magazine (even if it *is* one of the nerdier ones) had never heard of him. On the other, the ignorance goes far beyond WIRED. As far as I can tell, Sanderson, who has been topping bestseller lists for the better part of the 21st century, has not been written about in any depth by any major publication ever. I called his publicist to confirm this. "Well, we have a piece coming up in *LDS Living*," he told me. That's LDS as in Latter-day Saints. It's a magazine for Mormons.

Which makes sense: Sanderson is extremely Mormon. What makes less sense is why there's a hole the size of Utah where the man's literary reputation should be. Is it because he mostly writes fantasy, a—so the snobs sneer—"subliterary" genre? But then, so do J. K. Rowling, [Margaret Atwood](#), and George R. R. Martin, and they're household names. Is it because none of Sanderson's work has been adapted for the screen? Well, he [wrote three](#) of the *Wheel of Time* books, and an adaptation of that series came out on Amazon Prime in 2021. Could it be, finally, *because* he's a weirdo Mormon? But so are Orson Scott Card (*Ender's Game*), Glen A. Larson (the original *Battlestar Galactica*), and Stephenie Meyer (*Twilight*). Mormon, I mean. Only Orson Scott Card is also a weirdo.

Sanderson, when I eventually meet him in person, makes versions of these excuses, plus others, for his writerly obscurity. It's kind of fun to talk about, until it isn't, and that's when I realize, in a panic, that I now have a problem. Sanderson is excited to talk about his reputation. He's excited, really, to talk about anything. But none of his self-analysis is, for my purposes, *exciting*. In fact, at that first dinner, over flopsy Utah Chinese—this being days before I'd meet his extended family, and attend his fan convention, and take his son to a theme park, and cry in his basement—I find Sanderson depressingly, story-killingly lame.

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Yi-Ling Liu

He sits across from me in an empty restaurant, kind of lordly and sure of his insights, in a graphic T-shirt and ill-fitting blazer, which he says he wears because it makes him look professorial. It doesn't. He isn't. Unless the word means only: believing everything you say is worth saying. Sanderson talks a lot, but almost none of it is usable, quotable. I begin to think, *This is what I drove all the way from San Francisco to the suburbs of Salt Lake City in the freezing-cold dead of winter for? For previously frozen dim sum and freeze-dried conversation?* This must be why nobody writes about Brandon Sanderson.

So, recklessly, I say what's on my mind. I have to. His wife is there, his biggest fan, always his first reader, making polite comments; I don't care. *Maybe nobody writes about you*, I say to Sanderson, *because you don't write very well.*

The world unfreezes. He agrees.

It's not that Brandon Sanderson can't write. It's more that he can't *not* write. *Graphomania* is the name of the condition: the constant compulsion to get words out, down, as much and as quickly as possible. The concept of a vacation confuses Sanderson, he once said, because for him the perfect vacation is more time to write—vocation as vacation. His schedule is budgeted down to the minute, months out, to maximize the time he spends, rather counter-ergonomically, on the couch, typing away. Most days, he wakes up at 1 pm, exercises, and writes for four hours. Break for the wife and kids. Then he writes for four more. After that he plays video games or whatever until 5 am. A powerful sleeping pill is all that works, finally, to get him, and the voices in his head, to shut up.

In the five months or so it has taken me to sit down and write this magazine story, which is 4,000 words long, Sanderson has published two books. During the Covid lockdowns, he wrote and/or edited *seven*: two for his regular publisher, a graphic novel, and four more in secret, telling no one but his wife until he surprise-announced a Kickstarter in March 2022 to crowdfund their publication. (Hence the \$42 mil, raised in a month, by far the most successful Kickstarter ever.) Since his debut, *Elantris*, in 2005, Sanderson has published 30-plus books, the biggest ones in excess of 400,000 words; there are far more if you count the novellas and graphic

novels and stuff for kids. I've read 17 of the actual books. Or maybe it's 20. Exactitude is pointless here. As the major books are all set in the same universe, which Sanderson calls the Cosmere, they're all but meant to blur together.

Sanderson makes about half his money selling books through traditional publishers. The other half he makes selling, among other things, leather-bound special editions through his company, Dragonsteel.

Photograph: Michael Friberg

Most will hear this and think: At that rate, none of the words could possibly be any good. They'd be right, in a way, and that's what Sanderson agrees with. At the sentence level, he is no great gift to English prose.

The early books especially. My god. Here's a sample sentence: "It was going to be very bad this time." Another one: "She felt a feeling of dread." There's a penchant for redundant description: A city is "tranquil, quiet, peaceful." Many things, from buildings to beasts, are "enormous." Dark places, more thesaurically, are "caliginous." On almost every page of *Mistborn*, his first and probably most beloved series, a character "sighs," "frowns," "raises an eyebrow," "cocks a head," "shrugs," or "snorts," sometimes at the same time, sometimes *multiple times* a page. I count seven books in which one of the characters frets about their metaphors. "I have trouble with metaphors," one literally says. Of his own work, Sanderson has said: "I detest rewriting," "I write for endings," and "I write to relax." It shows. He writes, by one metric, at a sixth-grade reading level.

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Here's where I'll stop using Sanderson's words, written or spoken, against him. It's not fair. He's simply not, I'll say it again, very quotable. I spent days with the man. I watched his [YouTube videos](#), made a dent in his podcast empire (most of it, incredibly, *about writing*). Like his books, it all blurs together. I typed some 40 pages of notes for this story, and who knows how many pages of transcripts the [AI](#) spat out when I fed it the many hours

of recorded audio. Now that I'm writing, I find I'm referring to none of it. Possibly, this is the influence of Sanderson himself, on me. Graphomaniacally get thoughts down. Have fun. Write for the ending.

So I will. This story has an ending, I promise, and I'm sprinting toward it, as if to a vacation. Like the best of Sanderson's endings, my ending should surprise you. Because, you see, Sanderson actually *did* say one thing to me, *one miraculous thing*, that stuck, that I remember, these five months later, with perfect clarity. Just seven words, but true ones. You're not ready for them just yet. You need more story first. For now, there is only Sanderson, both wordful and wordless, the best-selling writer no writer writes about because writers only know how to talk about words. Sanderson's readers—loving, legion—care about something else.

Ten seconds to go until the launch. The lights are flashing, the music thumping. "This is siiick," someone whispers behind me, as a Cosmere's worth of nerds count down the remaining seconds. At zero, an enormous applause. Then the VP of merchandising and events walks out.

This is Dragonsteel 2022, the second annual convention for Sanderson's worlds and works. At the first one, the year before, 1,200 fans showed up. At this event, a two-dayer in November, attendance is closer to 5,000. Even though the con is being held in the biggest venue in downtown Salt Lake City, the Salt Palace Convention Center, fans are turned away from panels left and right. The first morning, I was panting by the time I reached the end of the line, down multiple city blocks abutting stony Mormon gothica. Some 7,000 people are expected for Dragonsteel 2023, the VP of merch and events tells me later—and in 2024, the year Sanderson plans to release Book Five (of 10) of *The Stormlight Archives*, his biggest franchise, the one with the 400,000-word books, a full 12,000 people. The Dragonsteel planners will need to think bigger.

A proud nerd, Sanderson has piles of Magic: The Gathering cards strewn throughout the house.

Photograph: Michael Friberg

For now, the fans, even the turned-away ones, are in unconquerable spirits. As is typically the case at these things, there's a general air—warmish, body-odored—of unselfconsciousness. By my rough count, some three-quarters of the attendees are men, boys, menboys, blurring together in a mass of pale, fleshy nerdery in Sanderson-appropriate graphic tees. The women, fewer in number, tend to be the better cosplayers. Lots of billowing cloaks, spritely makeups, precious weapons. (There's an arena for referee fights.) If you don't come prepared, never fear, because the sprawl of purchasable Sandersonalia is endless: art, clothes, figurines, games, jewelry, ornaments, special-edition books, a letter opener (not available yet) in the style of a telepathic sword named Nightblood.

I talk to as many of the fans as I can, some in their teens, others in their sixties, from here in Utah and as far away as India, Norway, Australia. They're sweet. Many of them have been reading Sanderson since the beginning, since *Elantris*. A teenage girl announces, "I'm here basically because I'm a huge nerd!" Everyone is smiling, sharing info and panel gossip. One guy from Massachusetts tells me he just spent \$170 on a rubber sword (not Nightblood; this one is called Mayalaran). It's bigger than he is; he won't be able to take it on the plane home. Another guy, 41 years old, tells me he made his sword (Firestorm; they *all* have names) himself. It took more than a year, on and off, to design, and then six weeks to 3D-print. I see a young couple with very young kids. "Are you indoctrinating them into this fantasyland?" I ask, gesturing to the stroller. "Trying to," the dad says.

The one question I ask practically everyone is, *Why Sanderson?* I only need to ask it a few times to realize the answer is always the same. It's a two-parter. First part: Sanderson's characters. "They feel like real people," everyone insists. Multiple parents say they've named their kids after their favorites, usually the princely protagonists who've overcome various depressions and triumphed chivalrically. "I've done some things I'm not proud of," one man tells me. Then he read the first *Stormlight* book, [*The Way of Kings*](#), and now, reformed, he has a 2-year-old son named Kaladin.

The second answer to *Why Sanderson?* is his worlds. This is probably what he's best known for. Worldbuilding, as it's called. Sanderson dreams up far-

off lands—sometimes cities, sometimes whole planets, with rules and systems and politics—and then he populates them with characters whose fates are also the worlds'. So the second answer is just the inverse of the first; you can't have worldbuilding without characterbuilding. Some characters die, some become gods. The good ones, and most of them are good, are very good. Inspiringly good. No one has sex. They only save lives.

What *nobody*, not a single person, complains about, in my two days walking the Palace floors, is Sanderson's writing. If they mention his sentences at all, it's merely to acknowledge that they're easier to read than, say, Tolkien's—whose work they may well graduate to, with Sanderson lighting the way. (Sanderson himself admits he was late to Tolkien, in whose shadow he now happily lives, even as he tries to write beyond it.) Still, I can't help but try to trip them up. *Surely he's not a great writer?* I prod. Polite, embarrassed smiles. They're suspicious of me, I can tell. They probably think I don't know my Kaladin from my Adolin. I do! I even like Kaladin! The scene midway through *Way of Kings* where Kaladin talks to a mysterious stranger (it's Hoid!) on the Shattered Planes? "A story doesn't live until it is imagined in someone's mind," Hoid says. Do I know what that means? Not exactly. And that's exactly why I read science fiction and fantasy, why I've pretty much *only* read science fiction and fantasy my entire life: for those plays at profundity, at the essence of storytelling. Storytelling beyond words.

But what am I saying? Gibberish, most likely. And hypocrisies. Sanderson is a bad writer; I've already said it. Here at the convention, most of the panelists aren't even writers. People don't care about sentences. They care about Sanderson. I sit through multiple panels about the future of his publishing company. Which is called—as is the convention, you'll note—Dragonsteel. Post-Kickstarter campaign, the company is now 50-some-people/Mormons strong. This is the Year of Sanderson, the panelists keep saying. Four new books, with special swag for backers! New toys and sparkly bookmarks! Now they're talking about warehouse expansion efforts. Now they're talking about a possible future bookstore, housed in a castle or something. "When will the Dragonsteel amusement park be built?" someone asks. The audience hoots. All this, I think to myself, is not the

spirit of fantasy. If it's worldbuilding, it's only worldbuilding one thing: the worldbuilder's world.

Three days later, I pull up to Sanderson's built world: his home(s) in a gated community of American Fork, Utah. There are three properties. On the left is the newest one, the subterranean man cave unofficially known as the supervillain lair, officially the Ammonite Club, complete with 28-seat industry-caliber movie theater. The middle structure is the Sanderson family manor, where his three boys play. On the right is the Cosmere House, which serves as Dragonsteel's HQ. Props and merch and books for days. That's where I'm staying, specifically in the Elantris Suite. It has cover art from the book on the walls, gold and silver frilly things everywhere, and the world's best shower.

I already knew about the shower because a few nights earlier I'd gone out for drinks with a friend of Sanderson's I met at the con. After contextualizing Sanderson's success for me—basically, he gives fans exactly what they want—she insisted I stay a night in the Elantris Suite. “And you have to try the shower,” she said. “I’ll text him.” The next morning I woke up to an invitation from his assistant.

Sanderson's assistant is his wife's sister. As I orient myself within the Cosmere House, I keep running into his nearest and dearest. His doppelgänger brother. Multiple siblings-in-law. Neighbors. People's children. Friends Sanderson formed a writers' group with almost 30 years ago, back in college at Brigham Young University, when he was a nobody and worked the graveyard shift at a hotel so he could write the nights away. Dragonsteel is a company, one that's shaking up the book industry. It's also Sanderson's extended family.

The writers' group still meets every Friday, which is what today happens to be. It's the most PG gathering of writer types I've ever been to. There are chips and sodas. Someone's baked an apple crisp. Before the meetup kicks off, I corner some regulars in the kitchen. They're gossiping, cracking jokes. One—Dragonsteel's new “head of narrative”—lets slip that Sanderson feels no pain. *It's true*, Sanderson's sister-in-law says. Even though he writes for eight hours a day on a couch, he has no backaches. The hottest of hot sauces cause scarcely a sweat. At the dentist, he refuses

novocaine for fillings. When I ask Sanderson later to confirm this, he does but asks if I really have to print it. *I'm sorry*, I say. *I really do*.

The writers' group is standard stuff: *What's this character's motivation?* *Can the reader follow that fight sequence?* Sanderson gives feedback with half his brain, the other half occupied with autographing books. It's only afterward that the real talk happens, such as Star Wars debates. When those subside, I bring up the pain thing again. Turns out Sanderson doesn't seem to feel pain of *any* kind, even emotional. On roller coasters, he's dead-faced, while his wife is shrieking. "It's sick and wrong," she says, smiling. She likes to say she married an android. For his part, Sanderson actually, at this moment, looks pained. He might not feel, he says, but his characters do. They agonize and cry and rejoice and love. That's one of the reasons he writes, he says: to feel human.

The conversation eventually turns to a theme park called Evermore, located just down the street. Though unaffiliated with Sanderson, it's Sandersonian to the core: You show up, hang around taverns, and embark on quests. *We have to go*, I say. *But it's falling apart*, everyone groans. Something to do with bad management—there's a four-hour [YouTube video](#) all about it. Still, Sanderson seems tempted. We leave it at that. I go back to the Elantris Suite, where I finally take that shower. There are multiple showerheads. I turn everything on. Water hits me from every angle. I don't cry, but I could.

I do cry the next night, my last in Utah. We're down in Sanderson's below-ground movie theater, in plush red-leather seats that not only recline but also have adjustable headrests. He wants to show the specs off, so he plays the opening scene of *The Greatest Showman*. I don't tell him that, while I like musicals, I hate *The Greatest Showman*, and especially Hugh Jackman. The scene starts. The chair shakes with otherworldly sound. When Hugh, lame Hugh, opens his mouth to sing, I can't help it. I burst into tears.

This sculpture—the centerpiece of Sanderson's underground “supervillain lair”—includes representations of his wife and three kids.

Photograph: Michael Friberg

What's happening to me? This story isn't coming together. To my mind, I still haven't gotten anything *real* from Sanderson, anything true. I'm not the first person he has toured around his lair to politely gawk at his treasures and trophies and his hallway of custom stained-glass renditions of his favorite books (Tolkien, Harry Potter, *The Belgariad*). I'm certainly not the first person he has told about one favorite book in particular, Barbara Hambly's *Dragonsbane*, which an English teacher put in his hands when he was 14, probably the day he became a fantasy writer. Or how he first got published. Or about the phone call he got from Robert Jordan's widow, asking if he might finish the *Wheel of Time* series. These stories are all over the internet, on his website and many others. Sanderson has lived so much of his life and fame openly, self-promotionally. It's a major reason for his success. One woman I talked to at the con made sure to tell me which of Sanderson's *pets* was her favorite. It's Jello, the parrot.

After I recover from Hugh in 4D, Sanderson collects his 15-year-old, and we all drive to dinner. This time the food is better: Utah Japanese. Sanderson and I order ramen. He salts his. Then I watch his son salt his yakisoba. I could cry again. Instead, I ask Sanderson if he's ever so moved by a scene he writes that *he* cries. Sometimes, he says. Though it might not be the scenes people expect.

He won't say more, but it's something. This conversation—from five months ago, remember—I recall fairly clearly. We're heading toward something now, some kind of admission, I can feel it. When Mormons ask God for a sign, they speak of a "burning in the bosom." Say you're a kid, wondering if you should be a fantasy writer when you grow up. You might ask God what He thinks. If there's a burning in your bosom, that's probably a yes.

So I press Sanderson on the moments he has felt the burning. He says they're too intimate, too special, to talk about. That's fine. Then let's talk about Mormonism in another way. Let's talk about it as it relates to fantasy. Because it's no secret: Mormonism is the fantasy of religion. "The science-fiction edition of Christianity," I've heard it called, with its angels and alternative histories, embodied gods, visions and plates made of gold. I ask Sanderson if I've got the ultimate promise of the religion right—the

ultimate promise being, as I understand it, that we humans will, if we're good, and marry well, and memorize the passcodes, eventually pass into the highest kingdom and come into our divine inheritance. We'll become gods, in other words, and get our own planets.

Sanderson doesn't balk at the characterization; he agrees that's the gist, and he knows where I'm going. He knows I want to know if what he's doing—writing fantasy books—is fundamentally, in some way, some very central way, Mormon. Of course it is, he says. The worldbuilding. The gods incarnate. The systems of magic. So much of Mormonism is about rules; so are his books, where miracles don't happen unless you put in the work. That's when, between mouthfuls of pork cutlet, Sanderson makes the connection between his work and the work of his Heavenly Father explicit. This is when he speaks the seven words of truth, the only ones I'm certain he has never said, in quite this way, ever before: "As I build books," Sanderson says, as I sit there, for once entirely enraptured, "God builds people."

Sanderson, schedule-obsessed, gets two hours a day of what he calls "discretionary time." During the Covid lockdowns, he used that time to write four secret projects.

Photograph: Michael Friberg

We descend on one final world. After dinner, it's time for Evermore, the rundown theme park. The night is misty and cold—caliginous. I remember one of Sanderson's friends saying the park is only open at night to conceal the decay. I believe it. As we walk around, Sanderson narrates. *Those are bad prosthetics. That's half a costume. Shouldn't there be more skeletons in this dungeon? At least the apple cider is good.*

He gets recognized by everybody. I guess that's inevitable when you go to a fantasy land with a fantasy legend (who has literally just purchased a \$5 million plot of land across the way for who knows what worldbuilding reasons). Sanderson's son and I start keeping a silent tally. Every time a new fan walks over, we hold up fingers behind Sanderson's back. We quickly run out of fingers. One girl says she wants to take Sanderson's writing class at BYU when she grows up. A surprising number of guys ask

for autographs “for my girlfriend.” Lots of people have already finished the latest book, which came out, like, yesterday.

Sanderson shines in these situations. He’s your god, but he’s your friend too. He’s also unafraid to drop hints about future projects. He does this to me at certain points. *Will they ever make a big movie version of one of your books?* I ask him in the fairy garden. Sanderson makes meaningful noises. *Even though your systems of magic seem unfilmably complex?* More meaningful noises. Everything’s been optioned, he says, but then things revert and discussions continue.

I suspect there will be big announcements soon. There have to be. Sanderson is bigger than ever. A good writer? Who knows. What I do know, now, is this: So many of us mistake sentences for story, but story is the thing. Things happening. Characters changing. Surprise endings. As I drive us back to the house, drop off the kid, and then stay in the car with Sanderson a bit longer, talking about life, talking about worlds, my ending takes shape. The surprise is that it was Sanderson’s ending all along, the ending of his best books. A character becomes a god, and the god beholds his planet below. If Sanderson is a writer, that is all he is doing. He is living his fantasy of godhead on Earth.

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Mar 21, 2023 6:00 AM

How to Love Technology Again

At a time when software is consuming us, we crave hardware—the material anchors of our immaterial realities.

We saw it written once that software was eating the world. What really happened, it seems to us, is that software made a world of its own and invited us there to be eaten.

These days, we're lighting out for other worlds—real *places*, rather than ghostly *spaces* conjured by software. Take our local hardware store. The sights, the sounds of actual machines, the advanced tools that still seem built to thrill. We enter to the whirring music of the key duplicator. We seek counsel from people in many-pocketed vestments. We smell the sacred scents of oiled metal, dusty cardboard, evaporated varnish, PVC fumes, and bags of fertilizer with leaky seams. We imagine everything it took to build this world: millennia of trial and error, oceans of brow sweat, megatons of earthly matter mined, refined, and industrially transformed so that we humans might enjoy access to more varieties of self-tapping deck screw than there are stars in the Andromeda Galaxy. *What a species*, we think.

Our definition of “hardware” extends beyond the plumbing department, of course. We apply the word to anything physical that underlies our (increasingly immaterial) realities—any object with the power to transform *techne*, the knowledge of how to do something, into *logos*, its utterance. Hardware moves earth. Hardware shapes molecules. Hardware sends electrons coursing throughout the world and into our fingertips. Software can still create worlds unto itself, even make us believe that the

world of bits is all that matters. But we will always, in the pits of our beings, crave atoms.

In this special WIRED package, we have collected stories to answer that craving—stories that look inside cameras, cars, computers, and ultimately the chips that constitute the foundation of them all. Whether these stories reach you in molecules of ink on processed wood fiber or in layers of light-emitting diodes on a screen or in the electromagnetic pulsing of a speaker coil, we hope you'll fall in love with the beauty and possibilities of hardware all over again.

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Mar 21, 2023 6:00 AM

I Saw the Face of God in a Semiconductor Factory

As the US boosts production of silicon chips, an American journalist goes inside TSMC, the mysterious Taiwanese company at the center of the global industry.

Play/Pause Button



Video: Basile Fournier

I arrive in Taiwan brooding morbidly on the fate of democracy. My luggage is lost. This is my pilgrimage to the Sacred Mountain of Protection. The Sacred Mountain is reckoned to protect the whole island of Taiwan—and even, by the supremely pious, to protect democracy itself, the sprawling experiment in governance that has held moral and actual sway over the would-be free world for the better part of a century. The mountain is in fact an industrial park in Hsinchu, a coastal city southwest of Taipei. Its shrine bears an unassuming name: the Taiwan Semiconductor Manufacturing Company.

By revenue, TSMC is the largest semiconductor company in the world. In 2020 it quietly joined the world's 10 most valuable companies. It's now bigger than Meta and Exxon. The company also has the world's biggest logic chip manufacturing capacity and produces, by one analysis, a staggering 92 percent of the world's most avant-garde chips—the ones inside the nuclear weapons, planes, submarines, and hypersonic missiles on which the international balance of hard power is predicated.

This article appears in the May 2023 issue. [Subscribe to WIRED](#). Illustration: Alvaro Dominguez

Perhaps more to the point, TSMC makes a third of *all* the world's silicon [chips](#), notably the ones in iPhones and Macs. Every six months, just one of TSMC's 13 foundries—the redoubtable Fab 18 in Tainan—carves and etches a quintillion transistors for Apple. In the form of these miniature masterpieces, which sit atop microchips, the semiconductor industry churns out more objects in a year than have ever been produced in all the other factories in all the other industries in the history of the world.

Of course, now that I'm on the bullet train to Hsinchu, I realize that the precise hazard against which the Sacred Mountain offers protection is not to be uttered. The threat from across the 110-mile-wide strait to the west of the foundries menaces Taiwan every second of every day. So as not to mention either country by name—or are they one?—Taiwanese newspapers often euphemize Beijing's bellicosity toward the island as "cross-strait tensions." The language spoken on both sides of the strait—an internal waterway? international waters?—is known only as "Mandarin." The longer the threat is unnamed, the more it comes to seem like an asteroid, irrational and insensate. And, like an asteroid, it could hit anytime and destroy everything.

Semiconductor fabrication plants, known as fabs, are among civilization's great marvels. The silicon microchips fashioned inside them are the sine qua non of the built world, so essential to human life that they're often treated as basic goods, commodities. They're certainly commodities in the medieval sense: amenities, conveniences, comforts. In the late '80s, some investors even experimented in trading them on futures markets.

But unlike copper and alfalfa, chips aren't raw materials. Perhaps they're currency, the coin of the global realm, denominated in units of processing power. Indeed, just as esoteric symbols transform banal cotton-linen patches into dollar bills, cryptic latticework layered onto morsels of common silicon—using printmaking techniques remarkably similar to the ones that mint paper money—turns nearly valueless material into the building blocks of value itself. This is what happens at TSMC.

Like money, silicon chips are both densely material and the engine of nearly all modern abstraction, from laws to concepts to cognition itself. And the power relations and global economy of semiconductor chips can turn as mind-boggling as cryptocurrency markets and derivative securities. Or as certain theologies, ones that feature nano-angels dancing on nano-pins.

As befits a pilgrim, I'm spent. The flight from Kennedy Airport to Taipei nearly laid me to waste—just under 18 hallucinatory hours at the back of a packed 777. I had discharged my insomniac unease by looping through iOS games while perseverating on Putin, Xi, MAGA Republicans, and the rest of the nihilistic flexers with malevolent designs on democracy. At the same time, I had cautioned myself for the millionth time against turning hawkish, the way the right and the rich do when feeling down in the mouth, gunning for a new clash of civilizations, or—more likely still—aiming to subdue Chinese competition so they can make more money.

As passengers learned only upon landing in Taipei, the plane took off without a single economy-class bag. We got two words at baggage claim: “Ukraine war.” My Samsonite wheelie, which contained Chris Miller’s *Chip War* and Albert O. Hirschman’s *The Passions and the Interests*—the book that got me thinking about the etymology of “commodities”—was back in New York. We’d been forced to travel light. Flights from US airports are now required to circumnavigate Russian airspace near Alaska, from which they’re banned, in retaliation for a US ban on *Russian* flights in American airspace, which was of course in response to Russia’s invasion of Ukraine last year.

That invasion, and the courageous defense mounted by Ukrainian citizens, has been followed keenly in Taiwan. Ukraine is a kind of trauma-bonded sister state to Taiwan, another promising democracy extorted by a [neighboring authoritarian](#) hot to annex it. This perception informs the semiconductor business. Last year, the microchip titan Robert Tsao, who founded United Microelectronics Corporation, the first semiconductor company in Taiwan and TSMC’s longtime rival, pledged nearly \$100 million for national defense, an investment that provides for the training of 3 million Taiwanese civilians to confront Chinese invaders in the manner of the Ukrainian patriots.

TSMC, which plays everything cool, seems to view Tsao as a kind of foil. Tsao is a show-off. He's also capricious. Having for years invested heavily in China—his renowned collection of Chinese porcelain once included a 1,000-year-old dish for washing paint brushes, which he sold for \$33 million—he resigned as chair of UMC in 2006 amid allegations that he had illegally invested in Chinese semiconductor technology. But Tsao has since done an about-face. He now rails against the Chinese Communist Party as a crime syndicate. In 2022 he issued a call to arms while wearing rococo tactical gear. He declined to speak to me for this piece unless I could promise television time. I could not.

In 1675, a French merchant named Jacques Savary published *The Perfect Merchant*, a mercantile manual that came to double as a guide for doing commerce around the world. Albert O. Hirschman cites Savary to explain how capitalism, which would have been regarded as little but avarice as recently as the 16th century, became the sanest ambition of humans in the 17th.

Savary strongly believed that international trade would be the antidote to war. Humans can't conduct polyglot commerce across borders without cultivating an understanding of foreign laws, customs, and cultures. Savary also believed the Earth's resources and the fellowship created by commerce were God-given. "It's not God's will that all human necessities be found in the same place," Savary wrote. "Divine Providence has dispersed its gifts so that humans will trade together and find that their mutual need to help each other establishes ties of friendship among them."

TSMC's success is built on its singular comprehension of this dispersion of providential gifts. The firm is merrily known as "pure play," meaning *all* it does is produce bespoke chips for customer companies. These include fabless semiconductor firms like Marvell, AMD, MediaTek, and Broadcom, and fabless consumer-electronics firms like Apple and Nvidia. In turn, TSMC relies on the gifts of other countries. Companies like Sumco, in Japan, process polycrystalline silicon sand, which is quarried for the world's semiconductor companies in places like Brazil, France, and the Appalachian Mountains [in the US](#), to grow hot single-crystal silicon ingots. With diamond wire saws, Sumco's machines slice shimmering wafers that,

polished so smooth they feel like nothing under a fingertip, are the flattest objects in the world. From these wafers, which are up to a foot in diameter, TSMC's automated machines, many of which are built by the Dutch photolithography firm ASML, etch billions of transistors onto each chip-sized portion; the biggest wafers yield hundreds of chips. Each transistor is about 1,000 times smaller than is visible to the naked eye.

I've thus come to see TSMC as both futuristic and a touching throwback: a tribute to Savary's largely expired romance in which liberal democracy, international commerce, and progress in science and art are of a piece, both healthful and unstoppable. More practically, however, the company, with its near monopoly on the best chips, serves as the umbo of the region's so-called Silicon Shield, which is perhaps the sturdiest artifact of 20th-century realpolitik. For an imperial power to seize TSMC, the logic goes, would be to slay the world's goldenest goose.

Like a dutiful valet who exists only to make his aristocrat look good, TSMC supplies the brains of various products but never claims credit. The fabs operate offstage and under an invisibility cloak, silently interceding between the flashy product designers and the even flashier makers and marketers. TSMC seems to relish the mystery, but anyone in the business understands that, were TSMC chips to vanish from this earth, every new iPad, iPhone, and Mac would be instantly bricked. TSMC's simultaneous invisibility and indispensability to the human race is something that Jensen Huang, the CEO of Nvidia, likes to joke about. "Basically, there is air—and TSMC," he said at Stanford in 2014.

"They call Taiwan the porcupine, right? It's like, just try to attack. You may just blow the whole island up, but it will be useless to you," Keith Krach, a former US State Department undersecretary, told me a few weeks before I left for Taiwan. TSMC's chairman and former CEO, Mark Liu, has put it more concretely: "Nobody can control TSMC by force. If you take by military force, or invasion, you will render TSMC inoperative." If a totalitarian regime forcibly occupied TSMC, in other words, its kaiser would never get its partner democracies on the phone. The relevant material suppliers, chip designers, software engineers, 5G networks, augmented-

reality services, artificial-intelligence operators, and product manufacturers would block their calls. The fabs themselves would be bricked.

With democracy reliably considered “under threat” in America by everything from election interference to gerrymandering to violent insurrections, Reaganite Shining Cities on Hills (or sacred mountains) are few. No WIRED journalist has breached the chip world’s sanctum sanctorum and toured a TSMC fab. This is why I want to go inside. I want to know what’s going on atomically in the fabs, and how it might amount to divinity, or at least the human spirit incarnate—which, in the founding insight of humanism, amount to the same thing.

Mark Liu, the chairman of TSMC, dislikes referring to the company as the Sacred Mountain of Protection. “We represent a collaboration of the globalization era,” he says. “That label makes us a sore thumb.”

Photograph: SEAN MARC LEE

Still struggling to contact the airline about my Samsonite, I buy a toothbrush and some shapeless navy-blue separates in a third-story mini mall open after hours. I also learn a meme made famous in the 1920s by the Chinese philosopher Hu Shih: *chabuduo*. The word means something like *whatever*. Or *close enough*. Chabuduo becomes my passion.

Managerial types despise the idea as an attitude of mediocrity, and no doubt it could create disasters in endeavors that demand exactness. But as I stroll around town in my mall clothes, pondering the verities, chabuduo strikes me as a quiet-quitter defiance of everything from jet lag to lost luggage to the saber-rattling from Beijing.

All the same, before I set foot in TSMC’s headquarters, I gird for a hip and socially demanding Googleplex vibe. Free rose lassi and pecan rockfish. Men in Patek Philippe watches. Snobs. But TSMC style, to my delight, is like mine today: cotton, normcore, a shrug. Three stars on Yelp.

TSMC’s headquarters are across the street from a rival UMC fab. That might seem like a setup for melodrama. But at TSMC, discretion is not just the better part of valor; it’s the business model. The company is recessive in every way. If, in spite of its geostrategic brawn, you don’t know its name,

that's by design. No one vamps for selfies outside the main building, as they do at Google, and when unarmed doormen sternly request that I not photograph the facade, they needn't have bothered. The place is glassy and forgettable, with a few half-hearted pops of color, mostly red. It's like a '90s convention center in a small American city, perhaps Charlotte, North Carolina.

Employees at TSMC are paid well by Taiwan's standards. A starting salary for an engineer is the equivalent of some \$5,400 per month, where rent for a Hsinchu one-bedroom is about \$450. But they don't swan around in leather and overbuilt Bezos bodies like American tech hotshots. I ask Michael Kramer, a gracious member of the company's public relations office whose pleasant slept-in style suggests an underpaid math teacher, about company perks. To recruit the world's best engineering talent, huge companies typically lay it on thick. So what's TSMC got? Sabbaticals for self-exploration, aromatherapy rooms? Kramer tells me that employees get a 10 percent discount at Burger King. *Ten percent*. Perhaps people come to work at TSMC just to work at TSMC.

The first time I asked Kramer about visiting the fabs, by phone from New York, he said no. It was like a fairy tale; he had to refuse me three times and I had to persist, proving my sincerity like a knight or a daughter of King Lear. Luckily, my sincerity is in long supply. My interest in the fabs borders on zealotry. TSMC and the principles it expresses have started to appear in my dreams as the last best hope for—well, possibly human civilization. I want to view the Sacred Mountain and its promises with innocent eyes, as if nothing at all in the past three centuries had compromised the fondest fantasies of Locke, Newton, Adam Smith.

The race in semiconductors is to the swift, and to the precise. Because velocity and precision are generally at odds in business—you move fast, you break things—TSMC's workforce is legendary. If you see the manufacture of semiconductors as nothing but factory work, you might slag the project as monotonous or, more callously, "on the spectrum." But the nanoscale work of chipmaking is monotone only if your ears aren't sharp enough to hear the symphony.

Two qualities, Mark Liu tells me, set the TSMC scientists apart: curiosity and stamina. Religion, to my surprise, is also common. “Every scientist must believe in God,” Liu says.

I’m sitting across from the chairman in a conference room filled with trophies. A scale model of a full-rigged Japanese treasure ship, a gift from Yamaha, is magnificent. To our interview Liu has brought a model of his own: a Lego model of TSMC’s showstopping fin field-effect transistor, which controls the flow of current in a semiconductor using an electric field, a narrow fin, a system of gates, and very little voltage. “We are doing atomic constructions,” Liu tells me. “I tell my engineers, ‘Think like an atomic-sized person.’” He also cites a passage from Proverbs, the one sometimes used to ennable mining: “It’s the glory of God to conceal matter. But to search out the matter is the glory of men.”

Understood. But the Earth doesn’t exactly hide its sand, the source of silicon. Liu’s doctoral research at UC Berkeley in the 1970s was on the serendipitous ways that ions behave when shot into silicon; he means it’s *atoms* that God has secreted away. These indestructible treasures have always been buried in matter, awaiting the invention of scanning electron microscopes and scientists with enough assiduity to spend decades on end peering into their atomic eyes. “There’s no way out,” Liu tells me. “You always feel you are scratching the surface. Until, one day, it’s revealed to you.” His guileless manner and expansive sense of wonder must be unique among CEOs of global megacompanies. Nothing about him comes off as shady or cheap like Elon Musk or the Overstock person. I remember a phrase from the liturgy of my childhood church: gladness and singleness of heart. That is Liu.

Is curiosity adaptive? Certainly it’s unique to some nervous systems, and it prompts an eccentric cadre among us—research scientists—to approach the material world as a never-ending onion-skin problem. “With unrelaxed and breathless eagerness, I pursued nature to her hiding-places,” said Victor Frankenstein. At Liu’s TSMC, this pursuit can seem like a form of athleticism or even erotics, in which select GOATs penetrate ever deeper into atomic spaces.

Stamina, meanwhile, allows the TSMC scientists to push this game of atoms forward without flagging, without losing patience, through trial and error after error. How one *stays* interested, curious, consumed with an unrelaxed and breathless craving to *know*: This emerges as one of the central mysteries of the nano-engineering mind. Weaker minds shatter at the first touch of boredom. Distraction. Some in Taiwan call these American minds.

The transubstantiation happening inside the fabs goes something like this. First comes the silicon wafer. A projector, its lens covered by a crystal plate inscribed with distinctive patterns, is craned over the wafer. Extreme ultraviolet light is then beamed through the plate and onto the wafer, printing a design on it before it's bathed in chemicals to etch along the pattern. This happens again and again until dozens of latticed layers are printed on the silicon. Finally the chips are cut out of the wafer. Each chip, with billions of transistors stacked on it, amounts to an atomic multidimensional chessboard with billions of squares. The potential combinations of ons and offs can only be considered endless.

During the pandemic lockdown, TSMC started to use intensive augmented reality for meetings to coordinate these processes, rounding up its far-flung partners in a virtual shared space. Their avatars worked symbolically shoulder to shoulder, all of them wearing commercially produced AR goggles that allowed each participant to see what the others saw and troubleshoot in real time. TSMC was so pleased with the efficiency of AR for this purpose that it has stepped up its use since 2020. I've never heard anyone except Mark Zuckerberg so excited about the metaverse.

But this is important: Artificial intelligence and AR still can't do it all. Though Liu is enthusiastic about the imminence of fabs run entirely by software, there is no "lights-out" fab yet, no fab that functions without human eyes and their dependence on light in the visible range. For now, 20,000 technicians, the rank and file at TSMC who make up one-third of the workforce, monitor every step of the atomic construction cycle. Systems engineers and materials researchers, on a bruising round-the-clock schedule, are roused from bed to fix infinitesimal glitches in chips. Some percentage of chips still don't make it, and, though AI does most of the

rescue, it's still up to humans to foresee and solve the hardest problems in the quest to expand the yield. Liu tells me that spotting nano-defects on a chip is like spotting a half-dollar on the moon from your backyard.

Beginning in 2021, hundreds of American engineers came to train at TSMC, in anticipation of having to run a TSMC subsidiary fab in Arizona that is slated to start production next year. The group apprenticeship was evidently rocky. Competing rumors about the culture clash now circulate on social media and Glassdoor. American engineers have called TSMC a “sweatshop,” while TSMC engineers retort that Americans are “babies” who are mentally unequipped to run a state-of-the-art fab. Others have even proposed, absent evidence, that Americans will steal TSMC secrets and give them to Intel, which is also opening a vast run of new fabs in the US.

In spite of the fact that he himself trained as an engineer at MIT and Stanford, Morris Chang, who founded TSMC in 1987, has long maintained that American engineers are less curious and fierce than their counterparts in Taiwan. At a think-tank forum in Taipei in 2021, Chang shrugged off competition from Intel, declaring, "No one in the United States is as dedicated to their work as in Taiwan."

Black coffee at 7-Eleven is perfectly potable, especially when Kramer treats me to a cup. He gets the company discount there too. Kramer is a good hang. I like that he teases me about my fascination with TSMC; I get the sense that he's used to brooking destabilizing questions about cross-strait tensions and maybe fewer about the sacredness of the fabs. As we wait for word about my tour, I try more grand theories on him.

For a company to substantially sustain not just a vast economic sector but also the world's democratic alliances would seem to be a heroic enterprise, no?

But it seems possible that even those feats are not the most spectacular of TSMC's accomplishments. Last spring, on an episode of *The Ezra Klein Show*, Adam Tooze, the Cambridge-trained economic historian, rejected the idea that the fabs are *merely* formidable commercial and geopolitical forces. “If you think about conflicts around Taiwan,” Tooze told Klein, “the global semiconductor industry isn’t just the supply chain. It’s one of humanity’s

great technological scientific achievements. Our ability to do this stuff at nanoscale is us up against the face of God, in a sense.”

Up against the face of God. In Tooze’s peerless empire accent. I attempt an impression for Kramer and tell him I’d had to rewind the podcast over and over to confirm Tooze’s phrasing. It now plays in my mind like an Anglican hymn, a necessary counterpoint to my staccato fears for human civilization, born in the Trump era and still banging away at my neurons.

Kramer tells me he’s the son of a Lutheran missionary from the US and a Taiwanese teacher. He went to a Christian school in South Taiwan, and later Taipei American School. Although Christians make up only 6 percent of the population of Taiwan, Sun Yat-sen, the founder of the Republic of China, was a Christian; President Chiang Kai-shek was a Methodist; and President Lee Teng-hui was a Presbyterian.

When, later, I recite Tooze’s words about God’s face to Mark Liu, he quietly agrees, but refines the point. “God means nature. We are describing the face of nature at TSMC.”

Like money, silicon chips are both densely material and the engine of nearly all modern abstraction, from laws to concepts to cognition itself.

Illustration: Basile Fournier

As TSMC scientists describe the face of nature, nation-states compete to make better semiconductors. They’re either building fabs and improving technology to keep up with TSMC, as China is hell-bent on doing, or deepening an alliance with TSMC and Taiwan, which often speak as one. That’s what the US is doing. Although the special relationship between the US and Taiwan is still an ambiguous affair, it may now compete in consequence with the 20th-century alliance between the US and the UK.

The CHIPS and Science Act, which US President Joe Biden signed into law in August 2022, grew out of a \$12 billion deal to bring TSMC fabs to American soil. That deal was brokered in large part by Keith Krach while he served as the US’s chief economic diplomat. Among Krach’s goals was to fortify a dependable supply chain based on TSMC’s broad network of

suppliers. The CHIPS Act now provides roughly \$280 billion to boost American semiconductor research, manufacturing, and security, with the explicit aim of aggressively sidelining China from the sector—and thus from the world economy. “Xi is absolutely obsessed with the semiconductor business,” Krach tells me.

Charming and self-assured, Krach at 65 is a proud graduate of Purdue, the land-grant university in Indiana, where he got a BS in industrial engineering, chaired the board of trustees, and now oversees the Krach Institute for Tech Diplomacy. As a teenager, he trained as a welder, and—though he was the youngest-ever vice president at General Motors, served as CEO of DocuSign, and cofounded the software company Ariba—he still comes across as disarmingly wholesome. Before his stint at the State Department, he’d had no experience in government.

The notion of “decoupling” from China, which would mean closing off trade and shutting Chinese scientists out of projects like green tech and cancer research, struck me as shortsighted. But on the subject of blackballing China from commercial domains where it doesn’t play fair, Krach was persuasive. At DocuSign, he’d started thinking about trust. Specifically, he had turned the electronic-agreements company from a startup to a powerhouse by generating both real security for users and an aura of confidence around the software that would let people submit their most sensitive documents for a digital autograph. “Trust in technology is everything,” Krach says.

The passing good faith required of signatories to online docs is small potatoes compared with the international fellowship required to produce silicon chips. To make a batch of chips for, say, Nvidia, requires a flying leap into dizzying international glasnost involving countries of diverse cultural and ideological stripes. To preserve the finely tuned set of relationships among trading partners in the “rules-based international order,” as Secretary of State Anthony Blinken invariably calls it, any authoritarian nation that can’t be trusted must be consigned to a penalty box. Like many now trying to codify modern ethics in commerce, Krach defines an entity, governmental or private, as trustworthy if it has fair

policies on the environment, national sovereignty, human rights, corporate governance, property rights, and social justice.

While at the State Department, Krach pulled off a masterstroke. In the early days of 5G networks—extremely low-latency broadband that allows even surgeons to work remotely—Krach ventured out on a global round of freestyle diplomacy. During the height of the pandemic, he and a small, masked delegation zipped around the world to more than 30 countries, from Spain to the Dominican Republic to Cyprus to the United Arab Emirates. He aimed to persuade powerful figures in a range of positions that they shouldn't work with the Chinese company Huawei on 5G, however right the price. To do so would be to subject their networks to Chinese infiltration, and “dirty” networks, Krach said, would be banned from America's reindeer games.

The gentlemanly extortion was a risk. But his Midwestern charm worked wonders. When the world's leaders worried that they couldn't afford to participate in Krach's so-called Clean Network Alliance of Democracies, he folksily shamed them about bedding down with a country that spies promiscuously and uses slave labor. Huawei was successfully routed. About 15 percent of the world's chip supply still originates in China, and the Communist Party's new chip czar commands a trillion-dollar budget to expand the business over the next decade. But now the irreplaceable semiconductor sector that relies so heavily on dependable 5G is growing in the rules-based world order, largely without Chinese participation.

Krach is proud of the coinage “trusted technology” to describe DocuSign and 5G networks, and the more I consider the state of play, the more that pride seems mostly warranted. Morris Chang offered TSMC's fabrication services to other companies at a time when most of them were making their own chips. To get those companies to let TSMC take over chipmaking for them, he talked up trust from the start.

But surely trust, like honor, exists in crime syndicates and closed oligopolies too. What makes that trust distinctive, among the parties to the “clean” network, is that it must go hand in hand with pluralism. You can trust more players, after all, if you can tolerate diverse social arrangements and you don't swear off countries just because they have illiberal *or*

progressive streaks: if they employ the death penalty, say, or allow gay marriage. Above all, players who trust each other to trade must be able to trust each other not to cheat. “Think about things like integrity, accountability, transparency, reciprocity, respect for rule of law, respect for the environment, respect for property of all kinds, respect for human rights, respect for sovereign nations, respect for the press,” Krach proposes to me. “These are things that we have in the free world”—the safeguards of mutual trust.

Last December, with both Liu and Biden in attendance, TSMC unveiled its fab in Phoenix. At the ceremony, Gina Raimondo, the Secretary of Commerce, addressed a small crowd. “Right now in the United States, we don’t really make any of the world’s most sophisticated, bleeding-edge, cutting-edge chips,” she said. “That’s a national security issue, a national security vulnerability. Today, we say we’re changing that.” For his part, Liu emphasized that the American fab will be part of “a vibrant semiconductor ecosystem in the United States.”

Liu and Biden were careful not to describe the fab as a move toward semiconductor independence for either country but, rather, as one that locked in their entente. And while Biden focused on the 10,000 jobs the TSMC fab is bringing to Arizona—the largest foreign investment in the state in history—the biggest news in tech was that Tim Cook was in attendance. Weeks before, Cook had disclosed that Apple was going to start using TSMC’s “American-made chips.”

Known but not spoken at the opening event was that these chips would still be Taiwanese-engineered, their specs brought up to the minute—up to the femtosecond—by TSMC’s research team in Hsinchu. Far more than in August, when US House Speaker Nancy Pelosi visited Taiwan (where she met with Liu but was evidently kept out of the fabs), the US and Taiwan may have finally sealed their provocative alliance on this much quieter day in Phoenix.

I hope Kramer can see that I myself am trustworthy. The threat from across the strait, and the threat from anyone who might be even slightly allied with that threat, is ever-present. But I’m no wily Snowden. Yes, I’m told, spies hang around Taipei by the hundreds if not thousands; surely mall clothes

make for superb spycore. But I'm just a tired pilgrim hoping for a glimpse of God.

At the same time—it occurs to me in a rush—I can't let Kramer mistake my indifference to personal style for irreverence. Etching on atoms is no joke. The fabs demand caution, reverence, and of course the hygiene of an abluted priest. A jittery, uninitiated person without an engineering degree could be a menace in the fabs, where she could sneeze like a putz and scatter a heap of glittering electrons like cocaine in *Annie Hall*. I'll banish my chabuduo from the utterly dustless fabs like an errant molecule of neon gas.

Kramer has requested my measurements for a clean-room bunny suit and shoe protectors, which I take as a good sign I'll get inside. Then, suddenly, my tour of Fab 12A—known as a GigaFab because, every month, it processes fully 100,000 of the biggest wafers, the 12-inch ones—is on the calendar. My luggage even arrives.

Spirits buoyed, I head to Starbucks for a meal of mediocre flatbread with Victor Chan, a Taiwanese journalist and historian. I want to understand Taiwan before semiconductors, the Taiwan he grew up in. Chan talks in a steady stream.

Taiwan's commitment to semiconductor technology was born of economic necessity, Chan says, or maybe desperation. In the postwar period, the country barely survived, but it steadily got into light industry, manufacturing spoons, mugs, and, famously, umbrellas. Taiwan excelled at umbrellas. At the height of the boom in the '70s, three out of every four umbrellas worldwide were made on the island.

In that same decade, diplomatic relations between Taiwan and the United States frayed. Nixon had opened trade with China, and now China was making and exporting the goods Taiwan had once been known for. To take just one example, for 20 years, Mattel contracted with Taiwan to manufacture Barbie dolls in suburban Taishan, not far from Taipei; the town was devastated when Mattel eventually moved its Barbie business to China, where labor was cheaper. (Taishan still displays memorabilia of Barbie, the city's shapely plastic patron saint.) The Taiwanese government began to

devise a new way to make itself valuable to the US. Invaluable, rather, so it couldn't be neglected or pushed around.

American semiconductor companies also discovered Taiwan as a place to offshore chip assembly. In 1976, RCA began sharing technology with Taiwanese engineers. Texas Instruments, under the direction of Morris Chang, who was then in charge of its global semiconductor business, opened a facility in Zhonghe, a district near Taipei. Like all the new semiconductor foundries, including the ones in Silicon Valley, the Taiwanese shops were staffed largely with women. Not only did industrialists consider women easier to mistreat and underpay than men (no, really?), but they believed that women were better at working with small objects because we have small hands. (In 1972, Intel hired almost entirely women to staff its facility in Penang, Malaysia, claiming, according to Miller in *Chip War*, “they performed better on dexterity tests.”) Conveniently, men took over the jobs in the fabs when they became well paid and high status.

But through the '70s and '80s chips were made for export, and few in Taiwan knew what the fabs even made. “At first, we really didn’t have a clue about a chip,” Chan tells me. “Chips that come with ketchup? We had no clue.”

To remedy this, the Taiwanese government began to plow money into engineering education, just at the time that expertise was plainly depleted in China and academics had been persecuted and murdered in the Cultural Revolution. Some Chinese industrialists seemed to be losing faith in their country as a land of economic and educational opportunity, and restless Chinese entrepreneurs made common cause with the Taiwanese government.

This is how the Taiwanese government came to approach the American company Wang Laboratories in the 1980s with a koan: How do you make a computer? An Wang, the company’s Shanghai-born founder, took up the challenge to conduct research into computer-making in Taiwan, eventually moving many of Wang’s operations to the island.

"Careful attention to education over the last 30 years has begun to pay dividends," Wang said of Taiwan in 1982. "The output of engineering graduates in relation to the total population is much higher than in the US." Emphasizing that the company had "no plans to set up a manufacturing facility in mainland China, because Communism is not suited to economic growth," Wang planted an R&D facility in the newly built Hsinchu Industrial Park.

Meanwhile, in Dallas, Chang was spinning his wheels at Texas Instruments. He consulted a Song Dynasty poem that advised ambitious young men to climb to the top of a tall tower and survey all possible roads. He didn't see a road for him at TI, so he lit out to build one in Taiwan. First he took a job running the Industrial Technology Research Institute, which the Taiwanese government had established to study industrial engineering, and in particular semiconductors. Then, in 1987, K. T. Li, the minister in charge of tech and science, persuaded Chang to start a private manufacturing company that would export chips and generate more money for research.

TSMC opened its first fab that year and not long after laid the cornerstone for its headquarters in the same Hsinchu park as UMC and Wang. The Taiwanese government and the Dutch electronics company Philips were the first major investors. The Taiwanese–Dutch connection, formed in the early 17th century when the Dutch East India Company set up a trading base on the island, has been a leitmotif in semiconductors. Not only was Philips instrumental in starting TSMC, but TSMC's blood brother in chipmaking is now ASML, the photolithography giant based in Veldhoven.

Chips, the ones without ketchup, would eventually take the place of umbrellas and Barbie dolls in Taiwan's economy. And with its engineers developing the leading-edge chips faster than any place on earth, Taiwan did indeed force the US to rely on it.

"They call Taiwan the porcupine, right?" says Keith Krach. "It's like, just try to attack. You may just blow the whole island up, but it will be useless to you."

Illustration: Basile Fournier

To be truly essential, a global company must situate itself at a crux in the supply chain. Chang, who has said he studies the Battles of Midway and Stalingrad to devise corporate strategy, cannily installed TSMC between design and product. His plan was this: He would concentrate monomaniacally on one key but low-profile component of computers. He would then invite more flamboyant tech companies, the kind that blow their budgets seducing consumers, to close their own fabs and outsource chipmaking to TSMC. Chang gained trust by allaying fears that TSMC would steal designs, as pure-play foundries have no use of them; TSMC stealing from chip designers would be like a printing press stealing plots from novelists. This commitment to quietude has led TSMC to obtain a, let's say, *significant* market share. Some tech companies get Super Bowl ads, adoring fanboys, and rockets for their founders; TSMC gets 92 percent.

Krach now calls Chang “the oracle.” He grew up peripatetic in war-torn China and, in 1949, left for Harvard, where he studied English literature for two semesters. He remembers this period as “the most exciting year of my education.” Copies of Shakespeare’s tragedies and *Dream of the Red Chamber*, the classic Qing Dynasty novel, now sit on his bedside table. But even as the humanities captured his heart, Chang realized that in the US of the 1950s, Chinese men without scientific training, even those with Ivy League degrees, could get stuck working in laundromats and restaurants. Engineering alone offered a shot at the middle class. He reluctantly transferred to MIT. From there he went to Sylvania to work in semiconductors, and thence to TI, which paid for his PhD studies at Stanford.

To Chang, life’s most compelling challenge would turn out to come not from making widgets, networks, or software, but from keeping pace with Moore’s Law. In 1965, Gordon Moore, who would go on to cofound Intel, proposed that the number of transistors in a dense integrated circuit would double roughly every two years. In the early ’60s, four transistors could fit on a thumbnail-sized microchip. Today, on a stupendous chip TSMC makes for the AI company Cerebras, more than 2.6 trillion can. Moore’s Law is, of course, not a law at all. Liu calls it a piece of “shared optimism.” A simple way to put TSMC into ideological perspective is to think of Moore’s Law as hope itself.

In 2012, Chang was named an Engineering Hero at Stanford, a thin-air honor that's also been bestowed on figures like Larry Page and Sergey Brin. But unlike Page and Brin, Chang never seemed to want to make a name for himself (the highest 20th-century American ambition), much less build a brand (the 21st). His obsession at TSMC was with process: incrementally improving the efficiency of semiconductor fabricators. TI's factories had wasted as much as half of their meticulously sanded and latticed silicon in making delicate chips. That was insupportable. At TSMC today, the yield rate is a closely guarded number, but analysts estimate that some 80 percent of its latest chips make it to the finish line.

TSMC's economic strategy, then, is the same as its strategy for corporate architecture and the protection of Taiwan: Be indispensable but invisible. Make Chinese products work but never claim credit. Make Apple's products work but skip all "Intel Inside" preening. Perhaps only China, Apple, and TSMC's other customers know how integral the fabs are, but their absolute devotion, their terror of rocking the boat, is more than enough to secure real-world power for the company. Several people at TSMC told me their work at arguably the most powerful company on the planet is "unsexy." One told me that girls don't fall for TSMC engineers, but their mothers do. Invisible as suitors. Indispensable as husbands.

On go the fabs, then, as Moore's Law chugs like a train: *double the performance, halve the cost*. With profit margins almost unheard-of in manufacturing, Chang has created a research institute passing as a factory. In 2002, TSMC's lavishly funded R&D facilities enabled Burn-Jeng Lin, then the head of lithography research, to find an ingenious way to increase the resolution of patterns on chips. In 2014, Anthony Yen, a senior researcher, invented a method to dial the resolution still higher. The company now holds some 56,000 patents.

The night before my tour of the fabs, I take a Covid test and lay out respectable work clothes alongside two new black N-95s; masking is still mandatory. I hallucinate two red lines from across the room, but no, no Covid. In the morning I'll talk to Lin about how he invented immersion lithography. Later, I'll speak to Yen about how he invented commercial-use

extreme ultraviolet lithography. Making chips is printmaking, and to understand the printing press, I need to understand litho.

Photolithography machines are the specialty of TSMC's partner firms, and above all ASML. It's rumored that the next generation of these machines will cost around \$400 million. Every one of the world's most sophisticated chips uses ASML lithography. But advanced research on lithography is also conducted at TSMC, because it's the litho that must be refined in order to keep the fabs efficient, the transistors small, and the Moore wheels turning.

The word *lithography* means the same thing in the fabs as it does in art studios: the printing process invented in 1796 by Alois Senefelder, a German playwright. Though Senefelder had little effect on theater, he hit the printmaking jackpot when he found he could copy scripts if he transcribed them in greasy crayon on wet limestone and then rolled ink over the wax. Because oil and water don't mix, the oil-based ink stuck to the limestone in some spots and didn't in others. This is the foundational zero-to-one of lithography.

As late as the 1960s, electrical engineers were still dropping black wax onto blocks of germanium and etching away at it. Not a bad way to fit four or eight transistors on a chip, but as the number rose to millions, billions, and now even trillions, the components became first more invisible than wax and then much, much smaller than merely invisible. Along the way, engineers started etching with light.

Etching on these shrinking components required ever more precise light. The wavelength of the beams kept getting narrower until the light finally took leave of the visible spectrum. Then, around 2000, chipmakers confronted one of their periodic panics that Moore's Law had stalled. To get to transistors of 65 nanometers, "it was still possible using the tried system," Lin tells me. "But I foresaw that at the next node, which was 45 nanometers, we were going to have trouble."

People were putting their bets on extreme ultraviolet light, but it would be years before the litho machines in the fabs could muster enough steady source power for that. Another idea was to use what Lin calls a "less aggressive" wavelength, somewhere between deep and extreme ultraviolet.

But because such light couldn't pierce existing lenses, it would need an exotic new lens made of calcium fluoride. Researchers built hundreds of furnaces in which to grow the right crystal, but no method did the trick. Close to a billion dollars went up in smoke.

Around 2002, Lin decided that they were wasting time. He wanted to forget about the new wavelength and the impossible lens and instead use water. With its predictable refraction index, water would give lithographers greater control over the wavelength they already knew. He invented a system for keeping water perfectly homogenous, and then he shot the light through it onto the wafer. Bingo. He could etch transistors as small as 28 nanometers, eventually with zero defects. "Water is a miracle," Lin says. "Not only for TSMC. It's a miracle for the whole of mankind. God is kind to the fish. And also to us."

Lin is another devout Christian at TSMC. His face is lively and expressive, and he looks and moves like a young Gene Kelly, though he's 80. I ask him if he, like Liu, sees God in atoms. "I see God in any scale," he says. "Look at a dog or a tiger—and then look at the food that we eat. It's marvelous. Why? Why is that?" Having been dead set against Christianity as a young student in Vietnam, when he considered it a superstition, and a foreign one at that, Lin was ultimately drawn to the idea that God is "a superintelligent being."

TSMC was now at the forefront of semiconductor research. But it was still under the lash of Moore, and the pressure didn't let up. In 2014, Anthony Yen, who had succeeded Lin as head of research at TSMC, had been developing the next generation of litho for a decade. Yen, who now runs research at ASML, tells me that extreme ultraviolet lithography came together in the fall of that year.

"We always worked late at TSMC," Yen says. On the evening of October 14, he was gearing up for an especially long night. A team from ASML had come to TSMC to test out the new power-source conditions that Yen's team had been working on. With the existing specs, the power source was reliable only at 10 watts; with the new ones, they hoped to hit 250. Yen ate his dinner quickly, gowned up, and went into the fab, where they began

cranking up the power. When it hit 90, that's when he knew. "This was the eureka moment," Yen says.

The movement from 10 to 90 watts meant a rise in power by a factor of nine. That the machine had accomplished this meant to Yen that the jump from 90 to 250, a mere tripling, was more than feasible. It was inevitable. Yen became so excited—"too excited," he says—that he couldn't even stay to watch the power hit 250. He ran out of the fab, flinging off his bunny suit. "I was euphoric. I was on drugs. For the believer, it is quite a religious experience." TSMC had the raw power it needed. The company has continued to refine all of its processes, especially, with ASML, the extreme ultraviolet lithography machines. Today, TSMC's transistors are down to just over 2 nanometers—the smallest in the world. These unseeable gems go into production in 2025.

Back in the university conference room, after reflecting on TSMC's triumphs in litho, Burn-Jeng Lin poses gamely for a photograph. "God is very kind to mankind," he says again. God's kindness, the miracle of water, religious euphoria—it swims in the mind like a school of blessed fish. A line from William Blake seems right: *To see a World in a Grain of Sand*. That's what we're here for.

I put a parting question to Lin: How in the world do you remain undaunted by all these extraordinary problems in nanotechnology? Lin laughs. "Well, we just have to solve them," he says. "That is the TSMC spirit."

Burn-Jeng Lin, TSMC's former head of research and the inventor of immersion litho, still speaks of the company as "us."

Photograph: SEAN MARC LEE

The moment has come. I'm Neo now, or the everyman in Pilgrim's Progress, stepping into my destiny. Kramer, walking with me, once again laughs at my obsession with the fabs. He seems to find them a little dull, and I'm repeatedly told I won't be able to see much.

That doesn't bother me. Even I understand that much about nanos. But to observe and to behold are two different pastures. Observation is for objects

of scientific study. Beholding is for the sublime.

Few precautions are taken at TSMC, I must say, to *prevent* the passage into the foundry from being thrilling. I swish through a turnstile entrance that brings to mind *The Phantom Tollbooth*—allusions are coming fast and furious now—and I’m deposited before a kind of human car wash for dramatic personal ablutions. A single machine washes, rinses, and dries my hands. Two guides appear, likewise cleansed of earthly cares, and lead me into a broad antechamber that could be part of a very, very clean senatorial Roman bath.

Orderlies, in their own pristine jumpsuits, bring out our perfectly sized gowns. They also fit protectors over my shoes. To have a white-clad figure at my feet carefully adjusting the booties feels tender, somehow; I want to be sure to convey my gratitude, but it’s hard with a Covid mask on my face, glasses over my eyes, and a hood covering my hair and most of my forehead. Our bodies are not quite here.

I’ll later learn that even the hand-washing room has extraterrestrially clean air. Ordinary air can have up to 1 million particles of dust per cubic meter. The fabs and cleaning rooms have no more than 100. As I step into the fab at last, I can tell at once it’s the cleanest air I have ever inhaled.

I’m prepared both for a climax and for an anticlimax, but my experience is not on that continuum at all. The vast room is bright and clear. When those who claim they’ve had a near-death experience during surgery speak of a bright light, they surely mean the hospital overheads. That’s what it looks like here in the bleached and antiseptic atmosphere, near death and clinical-heavenly.

Pacing around, though, I start to hope that the last perception of those who die in sickbeds *is* the effort hospitals make to convey paradisal spotlessness in the context of broken flesh and gore. What a wonderfully human folly, to try to create immaculateness. The lamps in the fabs, like those in hospitals, shed egalitarian, unsparing, but also unjudging light, the approximation of sunlight that’s required of physicians and scientists, and also of democracies.

At the sight of the lithography machine, my eyes mist. Oil, salt, water—human emotions are shameful contaminants. But I can't help it. I contemplate, for the millionth time, etched atoms. It's almost too much: the idea of tunneling down into a cluster of atoms and finding art there. It would be like coming upon Laocoön, way, way out, out beyond the Milky Way, out among some unnamed stars, suspended in outer space.

A saying at TSMC is that time flies in the fabs. It's true. We're inside for an hour, but it feels like 20 minutes. I'm soaring, though in a more usual frame of mind this place might strike me as a market obscenity. Why do humans need all these chips? To scroll, to text, to Uber? Or they might seem like an exercise of power—a jingoistic flex like the moon landing. Given the role of TSMC as the Sacred Mountain of Protection, the fabs could be simply terrifying, nuclear warheads in a hanger champing at the bit to destroy worlds.

But greed and power are not what the fabs conjure. Nor democracy. Nor Christianity. I walk very slowly. The white humming machines are featureless, and thick hermetic glass stands between me and the fathomless nano-processes that I couldn't have perceived with my crude pupils anyway.

It dawns on me at once that the machines resemble incubators in a neonatal intensive care unit.

Inside them, something very fragile flickers between existence and whatever comes before existence. Tiny souls that must be protected from less than a nano of gas are surely immunocompromised. I picture the transistors as trembling bodies with translucent skin and fast, shallow breaths. They are utterly dependent on adults who cherish them for their extraordinary smallness and cosmic potential. What's present here is preciousness. To see the fabs is to feel a full-body urge to keep the tiny marvelous creations—newborns—and then humanity as a whole—alive.

Later, I'll take comfort in my TSMC-animated iPhone while I make a call home to my kids. Back in the US, I'll remember that no global corporation deserves veneration. But while I'm in Taiwan, I see "no way out," as Liu might put it, when it comes to the pursuit of Enlightenment ideals. There

exists a physical world of calculable regularity. Math and logic can establish the truths of that world. Humans are capable of both profound goodness and feats of soaring genius. Democracy, individual liberty, and freedom of expression clear a path to wisdom, while closed autocratic hierarchies impede it. Thomas Savary again: “The continuous exchange of commodities makes for all the sweetness, gentleness, and softness of life.”

“I hope the bad guys will get their penalty,” Liu said, when I asked about his hopes for the future. It was the first edgy thing I’d heard the TSMC chairman say. “And I hope the righteous”—he broke off—“human collaboration will continue.”

On the Sacred Mountain, new forms of civic virtue and scientific ambition are taking shape. But even the most rarefied metaphysics at TSMC rest on a tangible substrate: silicon. Silicon is one of the few supremely un-rare objects of desire. It’s the second most abundant element in the Earth’s crust, after oxygen. Its versatility has defined an epochal cultural regime change, in which the passive starting-and-stopping of electric flow—electrical engineering—has given way to modern electronics, the dynamic and imaginative channeling of electrons. “God made silicon for us,” Liu told me.

And so we have invested our labor, treasure, and trust into silicon, and wrested from it new ways of experiencing, and thinking about, nearly everything. While humans have been busy over these six decades with our political anguish, and our wars, we have also created a universe *inside* our universe, one with its own infinite intelligence, composed of cryptic atomic switches, enlightened with ultraviolet and built on sand.

Updated 3-22-2023, 10 am PST: Mark Liu earned his doctorate at UC Berkeley, not MIT.

This article appears in the May 2023 issue. [Subscribe now.](#)

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Mar 9, 2023 6:00 AM

On the Trail of the Fentanyl King

An Iraqi translator for the US military emigrated to Texas to start a new life. He ended up becoming one of the biggest drug dealers on the dark web.

ILLUSTRATION: MONET ALYSSA

In a nondescript house on a quiet street in a middle-class suburb of Houston, Texas, Alaa Allawi hunched over his black and gold laptop. It was early 2017, and Allawi ranked among the top 10 vendors on [AlphaBay](#), at the time the dark web's biggest bazaar for all manner of illegal wares. Every week he moved dozens of packages of illegal narcotics: cocaine, counterfeit Xanax, and fake OxyContin.

An order came in from a young marine in North Carolina. He wanted Oxy. Allawi went about fulfilling the order, choosing from among the bags of powders and chemicals strewn about his attic and garage. He had precursor chemicals, binding agents, and colored dyes from eBay, as well as fentanyl—a synthetic opioid 50 times more potent than heroin—from China. “Man, you can order anything off the internet,” Allawi once told a friend. It was the secret to his success.

Allawi poured the ingredients into a Ninja blender, pulsed it until the contents seemed pretty well mixed, then went outside to the shed in his backyard. Inside were two steel pill presses, each the size of a small fridge and dusted with chalky residue. He tapped the potent mixture into a hopper atop the press, which came alive with the push of a button. Out shot the pills a few minutes later, stamped to look like their prescription counterparts. Soon, the fake OxyContin was ready to be shipped, sealed first in a bag and then stuffed into a parcel. A member of Allawi’s crew

dropped the order off at the post office, along with a pile of other packages addressed to buyers all over the country.

This article appears in the April 2023 issue. [Subscribe to WIRED](#). Photograph: Andria Lo

If Allawi believed the dark web's anonymity was enough to shield him from the prying eyes of law enforcement, he was wrong. Allawi's work—slipping small amounts of fentanyl into counterfeit pills, making them effective but highly addictive and sometimes lethal—was fueling the latest deadly twist in a national opioid epidemic that has taken more than 230,000 lives since 2017. Allawi's contribution to that crisis had made him a prime target for the US Drug Enforcement Administration, and federal agents were intercepting parcels containing his fentanyl-laced pills from Kansas to California. Allawi didn't know it at the time, but shipping these pills to North Carolina would cement his downfall.

Today, Allawi sits in a federal prison in northern New York, where he's serving a 30-year sentence. His case was the first prosecution for dealing fentanyl using the dark web and cryptocurrency in the American Southwest, and investigators described his operation as a bellwether for the growing counterfeit pill market in the US. Over the course of more than two years of email exchanges, he told me his story: a criminal odyssey whose seeds were planted thousands of miles away, on a US Army base in Iraq.

When the United States invaded Iraq, Allawi was a 13-year-old living in a suburb of Baghdad. On his 18th birthday, he applied to become an interpreter for the US Army. His uncle, a doctor, had encouraged him to learn the language from a young age. Allawi's English wasn't great, but he had been a sharp student, the kind of kid who dreamed of going to medical school himself one day. He got the job.

He was quickly dispatched to Rasheed Airbase near Baghdad, where he bounced from one unit to the next. The job paid well by Iraqi standards at \$1,350 a month, but it was dangerous. Al Qaeda didn't look kindly on Iraqis who collaborated with the US. Allawi says that insurgents tied one of his friends, also an interpreter, to the back of a car and dragged him around the neighborhood until his limbs tore apart. They hung another from an electric

pole and left his corpse up for days as a warning. Allawi took to wearing gloves and masks while on patrol in his neighborhood so he wouldn't be recognized.

The work was also occasionally heart-wrenching. Allawi recalls one house raid where the Americans were searching for someone suspected of cooperating with al Qaeda. After they made an arrest, the soldiers realized their satellite phone was missing. An officer proceeded to question several women who were in the house. When he got to an elderly woman, he ordered Allawi out of the room. Minutes later, the woman ran out after him, tears streaming down her face. All the women there fell to their knees, begging Allawi to stop the search. The officer, they said, had frisked the older woman and reached for her private parts. Allawi was livid, but there wasn't much he could do. "I felt not only enraged but also the feeling of a person that belongs to an invaded country and the humiliation that comes with it," he says. Eventually, the soldiers found the phone on top of a fridge, where one of them had left it.

Most of the time, though, Allawi got along well with the Americans. Thanks to years of watching Hollywood movies, he had a good grasp on their culture and wouldn't say anything when they crossed their legs or exposed their soles, which are considered insults in the Arab world. "Everyone liked Alaa," says Daniel Robinson, who worked with Allawi as a contractor in Iraq. The two men spent a lot of time together on base, sharing meals and swapping stories about their lives and families. Robinson smoked his first hookah on the floor of Allawi's barracks.

"The running joke was, don't let Alaa on your computer."

Daniel Robinson, US contractor

Steroids were prevalent on US bases. "As easy to buy as soda," one military contractor told the *Los Angeles Times* in 2005. Allawi began selling them to American soldiers and was dismissed from the unit he'd been serving with. Within a few months, he got another translation job, this time with AGS-AECOM, a private contractor rebuilding maintenance depots at Camp Taji, near Baghdad.

Now Allawi spent his days sitting behind a computer in a cubicle, translating operation manuals for Humvees that the US was reselling to Iraq. Allawi had always loved being around computers. When he was 14, he'd purchased parts one by one—a hard drive here, a RAM module there—until he had assembled a functioning machine. At Camp Taji, he immediately dove in, probing the company's internal networks like a deep-sea diver exploring an unknown world. "The depot job was a boring one," he says. "Not much was happening, but I used half of my job time to learn coding and hacking."

It was also at Camp Taji that Allawi met Eric Goss, an impish 25-year-old Texan who shared his love of hip hop and would become a friend. Goss recalls one day when the camp's head of operations called a meeting with the translators and contractors on the base. Allawi, he announced, was now cut off from accessing the internet on his computer. According to Goss, Allawi had hacked their boss's email, found messages he was sending to his mistress, and forwarded them to the boss's wife. (Allawi denies that he did this.) But the new restrictions didn't stop Allawi. He found a way to install a password recovery tool on his computer that he could use to crack his way into the company's wireless network. Around Camp Taji, Robinson recalls, "the running joke was, don't let Alaa on your computer."

Allawi put his burgeoning tech skills to use off base, as well. He built a website called Iraqiaa.com, an online dating and chat platform aimed at young Iraqis. At least one guy ended up marrying a woman he met on the site, Allawi says. At Iraqiaa's height, he was earning a cushy \$5,000 a month from subscriptions. People started asking Allawi to design sites for them. He purchased a server from a cloud provider and started his own hosting company. For a time, it looked like he could put together a tech career in Iraq.

Many of Allawi's fellow interpreters had chosen to leave Iraq for the US as part of a special visa program. Goss, who had returned home to Houston, kept probing Allawi on MySpace: "When are you getting your ass to the United States?" For a while, Allawi put him off, but his outlook on life in Iraq was changing. It dawned on him that his options for pursuing a full-

fledged IT career there were limited. “I realized that I couldn’t go further in my country,” he says.

In 2012, Goss received a message from Allawi. He was coming to the US.

For a time, it looked like Allawi could put together a tech career in Iraq.

Illustration: Monet Alyssa

On September 12, Allawi landed in San Antonio.

He was ready to start a new life in Texas. Catholic Charities set him up with a driver’s license, food stamps, a \$200 monthly stipend, and a free place to stay. He received an online high school diploma, then enrolled in a pre-nursing program at San Antonio College. He managed to complete four semesters, but eking out a living soon took priority. The food stamps were valid for only six months, as was the rent-free arrangement. Allawi found a job as a machine operator at a door manufacturer 45 minutes away. The pay barely covered his commute and college expenses.

Allawi moved in with another former translator named Mohamed Al Salihi, who had arrived in Texas more recently and was moonlighting as a bouncer. They had a spare room, which they advertised on Craigslist to earn extra money. Their first renter, Allawi says, was a young woman who liked to party with a group of weed-smoking friends. Soon enough, Allawi was hanging out with them.

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Allawi was spending enough time with American college students to sense a business opportunity. He started selling weed at parties near the University of Texas at San Antonio (UTSA). “It was just for surviving,” he says. He was intent on furthering his education, he insists, and took on a student loan. The plan was simple: pay his bills, sell weed at parties, and go to school. But this new venture put him in contact with other drug dealers

and harder substances. “There is American saying,” Allawi adds. “If you hang around the barber-shop too long, you will end up with haircut.”

In 2014, he was evicted for failing to pay \$590 in rent. For a brief period, he slept in his car. He started selling cocaine on the street. On January 14, 2015, Allawi was arrested while driving with a small-time drug dealer who was known to local law enforcement. An officer searching the vehicle found less than a gram of cocaine, 10 Adderall pills, and about 100 Xanax pills, according to Allawi, who says the tablets belonged to the passenger. Allawi was charged with the manufacture and delivery of a controlled substance, but because he had no criminal record, he was sentenced to community service. His run-in with the law didn’t dissuade him from selling drugs. He was just getting started.

Allawi had reconnected with Goss by then. Sometime in 2015, Goss got him a job designing a website for a business in Austin. One of the employees confided to Allawi that he’d been buying drugs on the dark web. “It’s like an Amazon for drugs,” he said. Intrigued, Allawi did his own research. “I went and asked the wizard of all time, Mr. Google!” he says.

The introduction blew the doors of drugmaking wide open for the Iraqi. Allawi wasn’t content dealing on the street anymore. He was chasing a broader market than San Antonio—hell, a broader market than Texas. He bought a manual pill press on eBay for \$600, eventually upgrading to a \$5,000, 507-pound electric machine capable of spitting out 21,600 pills an hour. He also used eBay to purchase the inactive ingredients found in most oral medications, such as dyes. On May 23, 2015, Allawi created an account on AlphaBay. He named it Dopeboy210, most likely after the San Antonio area code, according to investigators. That fall, Allawi dropped out of school for good.

At the time, AlphaBay was one of a handful of would-be successors to Silk Road, the infamous dark-web market that had been shut down in 2013. If you had a Tor browser and some bitcoins, AlphaBay offered drugs by the kilo, guns, stolen credit card data, and more, all with complete anonymity—or at least that’s what many customers believed. Between 2015 and 2017, the site saw more than \$1 billion in illegal cryptocurrency transactions, according to the FBI.

DopeBoy210 eventually offered no fewer than 80 different products. X50, a package of 50 Xanax pills, was one of Allawi's flagship items and earned enthusiastic reviews. "Good shit," one AlphaBay customer wrote, according to data provided by Carnegie Mellon professor Nicolas Christin. "Kick ass," wrote another. The pills were fake.

At first, Allawi blended chemicals with methamphetamine and used his press to churn out tablets stamped as Adderall and Xanax. Students looking to pull an all-nighter or riddled with anxiety craved this stuff; UTSA made for a lucrative outlet. Allawi then moved on to fake OxyContin pills laced with fentanyl that he ordered from China on the dark web. (Allawi declined to say why he switched to fentanyl, but investigators told me that drug dealers like it because they can make thousands of pills using minute amounts.)

Allawi expanded his operation to a small circle of trusted associates. Some he had met at house parties, like Benjamin Uno, a twentysomething Dallas native whose promising basketball career was cut short by injury, and Trevor Robinson, a mustachioed fan of Malcolm X (with no relation to Daniel Robinson, the contractor). Uno helped Allawi manufacture the pills, and he and Robinson took charge of mailing out the merchandise. (Uno and Robinson didn't respond to requests for comment.) Allawi also recruited Al Salihi, his old roommate, to guard drugs stashed at an apartment 10 minutes from UTSA.

The dark web "is like an Amazon for drugs."

Illustration: Monet Alyssa

Sporting a beard and a tattooed right arm, Hunter Westbrook had come to UTSA after toiling away in the oil fields of West Texas. The patrolman was used to dealing with the occasional marijuana trafficker on campus. But toward the end of 2015, something changed. Adderall pills, not just weed, flowed into dorms and parties. Then the overdoses began. When UTSA analyzed some of the pills in a lab, they were found to be laced with meth.

As a campus cop, Westbrook could do little more than stop cars for traffic violations, so he reached out to the San Antonio Police Department for

help. In the spring of 2016, he sat in a coffee shop and compared notes with Janellen Valle, an SAPD narcotics officer who was on a joint task force with the DEA. The two cops realized that their findings lined up. A Middle Eastern guy was apparently flooding the campus with marijuana and counterfeit pills. Tips from students led to a name: Alaa Allawi.

Soon after, the DEA took over the case. Investigators say that some pills at UTSA contained fentanyl. (Allawi says he never sold fentanyl on campus, only online.) The country was drowning in the opioid, and stanching the flow was a priority for the agency. The number of overdose deaths attributed to it had skyrocketed, from 1,663 in 2011 to 18,335 in 2016, surpassing those from prescription painkillers and heroin.

The DEA's San Antonio office was used to handling street dealers and Mexican cartels. But in July, an informant tipped off the DEA about Allawi's AlphaBay shop and sent the investigation spinning in a whole new direction.

The San Antonio office didn't do cybercrime. Sure, they had heard of Silk Road. But to the DEA agents in Texas, the dark web might as well have been Baghdad—a faraway land “out of sight, out of mind,” in the words of one investigator.

Westbrook became the office's de facto guide, largely because he was one of the few people there to have a vague understanding of what the dark web was. He met with cybersecurity professors at UTSA on how to access Allawi's account. He was by far the youngest member of the task force; around the office, he was known as “the millennial.”

The agents purchased a MacBook and a VPN subscription to access the dark web. They were floored when they saw DopeBoy210's shop. Based on the hundreds of comments left by satisfied customers, Allawi was a massive retailer.

Getting a peek at Allawi's online operations was relatively easy. To arrest him for it, the DEA would need to definitively link Allawi to his AlphaBay account, which meant they'd need to buy drugs from him. And to do that, they'd need bitcoins.

This had daunting implications for a governmental office, Westbrook realized. The task force might buy \$1,000 worth of the volatile currency, only to wake up the next day and find their wallet's value down to \$900 or up to \$1,100. Agency bigwigs didn't love schemes deviating from tradition, investigators say. They certainly were reluctant to become bitcoin speculators. "It was a headache," Westbrook says. (But not unheard of: As part of [a parallel investigation](#) into AlphaBay, DEA agents in 2016 bought drugs using bitcoin. Before that, they purchased crypto as they sought to [shut down Silk Road](#).)

In the meantime, the agents kept pounding away at the work they knew how to do: tailing suspects and working informants. As the new year began, the task force persuaded a judge to authorize the GPS tracking and tapping of Uno's and Allawi's phones, and later Al Salihi's. In March, Westbrook followed Uno from Allawi's house to a post office, where Uno delivered three boxes and a trash bag stuffed with what appeared to be envelopes. After that, postal inspectors would periodically intercept mail and packages intended for Allawi.

When he wasn't tailing members of Allawi's crew, Westbrook worked at a DEA desk that was unofficially assigned to rookies due to its awkward position in the middle of the open room. During the investigation, someone hung a handwritten sign that read MILLENNIAL ISLAND.

Westbrook usually sat alone, but on March 17 the rest of the task force was peering over his shoulder as he logged in to AlphaBay. The team had gotten the green light from DC: They could buy bitcoins and purchase drugs from Allawi. Navigating to the DopeBoy210 page, Westbrook bought 500 Adderall pills for \$1,400 worth of bitcoins, and an ounce of cocaine for \$1,200. He listed a mailbox at UTSA and finished the order.

About a week later, he drove to the campus to retrieve the package. Looking giddy under a beige ball cap, he inserted a key into mailbox number 825. The drugs were inside. There were only 447 pills and no cocaine, so Westbrook initiated a dispute with AlphaBay (which ended in favor of Allawi). But this was a detail. What mattered was that the agents had conducted an undercover buy on the dark web. The San Antonio DEA had entered a world its agents barely knew existed a year before.

Allawi had the money, the cars, the luxury sneakers, the bottle service. He was even in talks to open a local franchise for a juice bar chain.

Illustration: Monet Alyssa

Allawi's profits were rolling in, but they were still in the form of bitcoins, and he needed to convert them to cash. On LocalBitcoins.com, a bitcoin exchange platform, he met Kunal Kalra, a cheerful Californian who favored Mao collar shirts and a gold bitcoin pendant—a sign of his unwavering dedication to cryptocurrency. Kalra ran a bitcoin ATM out of a cigar shop in Los Angeles. Allawi began visiting the shop to exchange his bitcoin earnings for cash, and paid Kalra a fee for his help. By the fall of 2016, the two men moved their arrangement online. They transferred more than half a million dollars in total.

With plenty of cash, Allawi went on a buying spree. He made a \$30,000 down payment for a two-story slab house in a residential San Antonio neighborhood just south of UTSA. “I didn’t know how much money he was making until he came to Houston,” Goss says. The Texas native accompanied his friend on multiple trips to luxury car dealerships in the city that fall. In October 2016, Allawi set his sights on a white 2013 Maserati GranTurismo, which cost \$49,000. He began pulling wads of bills from a Louis Vuitton backpack and handing them to a salesman. Goss worried that paying cash would attract attention, but his friend refused to take a loan and owe interest. “Why am I gonna fucking pay?” Allawi said.

A few months later, Allawi took one of his cars in for an oil change. When mechanics lifted the car on a hoist, they found a curious black box affixed to the undercarriage. It was a tracking device. Allawi had it promptly removed. He was disturbed by the discovery, but not enough to stop. “I needed money, and things had to keep going,” he says.

Otherwise, though, Allawi was on top of the world. By spring of 2017, he had the cars, the luxury sneakers, and the bottle service. He was even in talks to open a local franchise for a juice bar chain. Ever the party guy, on March 23 he flew his crew out on a trip to Las Vegas. Allawi, Uno, Robinson, and Goss walked into Drai’s, a gigantic nightclub known as one of the most expensive in town. Lil Wayne was performing as the group

huddled in the VIP area. Allawi was wearing a \$2,000 suit that he'd nabbed on a whim at Caesars Palace—they all were, courtesy again of the boss. Allawi passed around an enormous bottle of Veuve Clicquot, a flashy move that didn't go unnoticed by the rapper onstage. "I don't know who these n---s is, but I need to be partying with them," Wayne shouted, according to Goss.

The four men snapped selfies, sticking out their tongues like a bunch of eager teenagers. They were having the time of their lives.

While Allawi's crew partied in Vegas, a man in the Midwest named Vincent Jordahl was recovering from a close brush with death. He'd snorted a blue powder—fentanyl—and collapsed on his living room floor. His mother found him and performed CPR before medics revived him with Narcan, a fentanyl antidote. He was taken to a hospital in Grand Forks, North Dakota. On March 25, city medics would rush to the home of another man, named Orlando Flores, who'd also overdosed on fentanyl-laced pills and also survived. The tablets originated in the same package, sent by Allawi sometime in March.

Less than a month later, on the East Coast, two other young men readied for a party of their own. Mark Mambulao and Marcos Villegas were marines stationed at Camp Lejeune, in North Carolina. It was Friday, April 14, and the duo were starting their weekend with some gin and tonics at a friend's house in Richlands, about 32 miles north of the base. Around 9:30 pm, Mambulao sent a girlfriend a photo on Snapchat of a friend's dog chewing his hat.

Then, Villegas pulled some pills out of a small black plastic bag and passed them around. Mambulao had experimented with drugs before, including LSD, mushrooms, ecstasy, and oxycodone, which he would either gobble up or crush and snort. These pills were advertised as OxyContin. Villegas had purchased them directly from an AlphaBay vendor named DopeBoy210. The friends all swallowed the pills at the same time.

About two hours later, Mambulao started to feel sick and passed out on the living room couch, so his friends laid him down in a spare bedroom, making sure he was on his side. When they checked on him later, he wasn't

breathing. The men called 911 and started to perform CPR, but it was too late. In the early hours of April 15, Mambulao died in a Jacksonville hospital. He was just 20 years old.

It turned out that the pill Mambulao ingested contained a lethal dose of fentanyl. The Naval Criminal Investigative Service began looking into his death. Cooperating with the Postal Inspection Service and DEA, the NCIS traced the drugs to Allawi. (Villegas pleaded guilty in 2019 to distributing oxycodone and fentanyl and was sentenced to 10 years in prison; a second marine was also charged in connection with the case.) Why did Mambulao overdose and not the other revelers that night? There was “no real science” informing Allawi’s pill-manufacturing, says Dante Sorianello, then the head of the DEA’s San Antonio office. “Some of these pills probably got very little fentanyl, and some got too much.”

The marine wasn’t breathing. His friends called 911. They started to perform CPR, but it was too late.

Illustration: Monet Alyssa

On May 17, a utility worker in a neon-yellow vest and hard hat walked up the driveway to Allawi’s house in Richmond and knocked on the door. “Sorry, power’s out,” he told the occupants. “We’re going to be working on it for a while.” Anyone who’s been in Houston on the cusp of summer knows what these words mean: Without AC, your home is going to turn into a furnace in no time.

Westbrook and Valle, clad in black bulletproof vests, watched from their cars as Uno and Robinson left the house. The utility guy was a DEA agent, and the whole thing was a ruse so they could raid the house without risking any lives. Law enforcement saw fentanyl as a threat to eliminate at all cost, which meant shutting down the drug manufacturing before moving to arrest Allawi.

At 1:38 pm, men sweating profusely in hazmat suits swarmed the house, lending an otherworldly look to this ordinarily quiet neighborhood. The suits were meant to protect the agents from fentanyl, which they thought

could incapacitate or even kill them if they simply touched it. They knocked on the door and got no response. They went in.

The search was fruitful. The agents placed their bounty in front of the garage in a spot demarcated by yellow cones. Among other drug paraphernalia, there were two pill presses, cardboard boxes from China containing ingredients, and enough drugs to put Allawi away for a long time: 500 grams of fentanyl powder, 500 grams of meth, 500 grams of cocaine, 10 kilos of fake oxycodone tablets laced with fentanyl, 4 kilos of fake Adderall laced with meth, and 5 kilos of counterfeit Xanax tablets. Agents found a Ruger revolver and a Sig Sauer pistol hidden in a couch in the living room. They walked out of Allawi's bedroom carrying an AR-15-style assault rifle and a loaded Glock pistol.

As they drove away one last time, all three men tossed their phones out the car window.

As the agents worked, Uno and Robinson drove by the house and realized what was happening. Far from being scared off by the raid, they returned to the scene with Allawi, Westbrook says. As they drove away one last time, all three men tossed their phones out the car window. Soon after, Allawi called Goss from a new number and asked to meet him at a ritzy house he was renting east of Houston. There, he retrieved a bag stuffed with \$50,000 in cash, Goss says, and asked his friend to drive him to the airport. The ringleader had decided to hole up in LA, where he had a condo—and an extravagant collection of sneakers—in the upscale Westwood neighborhood.

His operation was unraveling fast. "I'm fucked. It's over," he kept repeating in the car. Like any good drug boss, Allawi started planning his escape. He considered hiding in Dallas or California, according to Goss. When things settled, he could go back to Iraq, where the money he'd sent over the years had allowed his family to start a strip mall. He could flee to Mexico and fly out from there.

But for weeks after the raid, there were no cops in sight. Allawi wondered whether he'd dodged a bullet. Eventually he felt secure enough to return to Texas. One evening at the end of June, he and Goss went to a club. The two

men sat in the VIP area, a \$500 bottle of champagne on the table. But Allawi wasn't his usual gregarious self. He remained quiet, his glass untouched. The two men drove back from the club in silence. "I feel like I'm a martyr," Allawi suddenly said. "All my family's taken care of. If I die tomorrow, it wasn't in vain."

Just a few days later, the DEA moved to apprehend Allawi's team in simultaneous takedowns across Dallas, San Antonio, and Houston; Uno, Robinson, Al Salihi, and Goss were all arrested. So was Kalra, Allawi's bitcoin guy. Valle was with a SWAT team at Allawi's gargantuan rental home in the suburbs of Houston. They tried ramming the door down, but Allawi had splurged on a \$10,000 reinforced model, Valle says. The team had to break in through a window.

Inside, they found Allawi clad in black pants and a white polo. He told agents they had nothing on him, even as investigators seized a bitcoin wallet, two money counters, 12 burner phones, four small bags of blue chemical binder, and a .45 Colt.

After the DEA agents made clear that they had more than enough evidence, Allawi quieted down. Sitting on the driveway, handcuffed, cross-legged, and slightly disheveled, he looked more like the young Iraqi who'd smoked hookah alongside US contractors than the leader of a drug ring. He rolled onto his left side, curled into a ball on the pavement, and closed his eyes.

"Allawi was one of the first we saw doing this at large scale."

Dante Sorianello, US Drug Enforcement Administration

In June 2017, a grand jury indicted Allawi for conspiring to distribute fentanyl, meth, and cocaine; possession of a firearm during a drug trafficking crime; and conspiracy to launder monetary instruments, among other charges.

The mountain of evidence against Allawi was overwhelming—so overwhelming, in fact, that Anthony Cantrell, his court-appointed lawyer, said a trial would take months and put a strain on his practice. Instead, Allawi pleaded guilty to conspiracy to possess with intent to distribute 400

grams or more of fentanyl resulting in death or serious bodily injury, and to using a gun during a drug crime. Investigators estimated that Allawi had made at least \$14 million off his criminal activities, and had sold at least 850,000 counterfeit pills in 38 states. Sorianello says that Allawi saw the growing market for pills and capitalized on it with his operation. “He was one of the first we saw doing this at large scale,” he says. “He was a pioneer.”

At his sentencing, Allawi adopted a contrite tone. “I messed up. It was a great mistake.” He concluded by asking for mercy, for the US to give him a second chance. But the court showed no such clemency: As part of his plea deal, Allawi was sentenced to 30 years in a federal prison in northern Louisiana; he has since been transferred to a medium-security facility in New York. After that, he will be deported back to Iraq. Uno, Robinson, Al Salihi, and Kalra, meanwhile, all pleaded guilty and received prison sentences ranging from 18 months to 10 years. The judge was more lenient with Goss, who pleaded guilty to conspiracy to possess with intent to distribute cocaine, and was sentenced to five years’ probation.

Allawi maintained that if the US had been in the throes of a devastating opioid epidemic while he was running his drug ring, he’d never heard about it, “never heard about overdoses or the damage it can cause.” But it was operations like his—dealers selling counterfeit pills laced with illicitly produced fentanyl—that authorities say contributed to so much death and destruction.

Roughly a month after Allawi’s arrest, authorities took down AlphaBay. But it didn’t do much to relieve the opioid epidemic in the US. More than 106,000 people died of a drug overdose in 2021, according to the Centers for Disease Control and Prevention—a record high. Dark-web markets, meanwhile, logged \$3.1 billion in revenue that year, according to Chainalysis, a research firm that tracks cryptocurrency activity. Revenue dropped last year, thanks in large part to the takedown of another major dark-web bazaar called [Hydra](#), but illegal marketplaces still raked in \$1.5 billion.

China provided most of the fentanyl present in the US before 2019, with traffickers shipping the powder through international mail and private

package delivery. But controls that China has since imposed have disrupted the flow. Today, Mexican cartels lead the charge, procuring precursor chemicals from China, which can be legally exported, and churning out enough fentanyl to drown the US. The DEA seized the equivalent of 379 million potentially deadly doses of fentanyl last year, more than the population of the entire country. Distributors are active everywhere. The agency's Rocky Mountain office, for example, which covers Colorado, Montana, Utah, and Wyoming, seized nearly 2 million fentanyl pills.

Sitting in a hip coffee place in Houston last summer, Westbrook pulled out his phone and flipped through pictures of recent fentanyl busts he'd participated in. In mirror images of the takedown of Allawi's drug house, federal agents in flashy hazmat suits prowl the driveways of nondescript homes. Industrial pill presses sit on the suburban concrete. DEA offices across the country are establishing groups focused on fentanyl investigations, he says. "It's weird times," he later told me, reflecting on the destruction that tiny amounts of fentanyl can wreak. "I went from chasing kilos to grams."

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[Justin E. H. Smith](#)

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Mar 7, 2023 6:00 AM

This Is a Philosopher on Drugs

I was at the lowest point in my life. I needed a mind-altering jolt. In the end, everything—even the meaning of “everything”—changed.

ILLUSTRATIONS: JAMES MARSHALL; PHOTOGRAPH: ALI CHERKIS

There is something strange in the disinterest philosophers show for experimentation with mind-altering drugs—or at least for talking about their experimentation publicly. At the margins of philosophical writing, we have Walter Benjamin’s record of his dabblings in hashish and Michel Foucault’s casual admission in interviews that he would rather be dropping acid in the Mojave Desert than sipping wine in Paris. Even further out we have philosophy-curious writers like Thomas de Quincey (also a biographer of Immanuel Kant) recounting his own experience of opium addiction. And then we have probabilities and speculation. The natural philosopher Johannes Kepler likely tried some fly agaric before writing his 1608 treatise of lunar astronomy, the *Somnium* (read it and you’ll see what I mean). The third-century Neoplatonist philosopher Plotinus might have availed himself of some herbal or fungal supplements to help him achieve his many out-of-body experiences, which he liked to call *henosis*, or “ecstatic union with the One.”

I’m probably missing a few notable cases. But still, for the most part, to admit to any intention to use chemical substances, whether found in nature or synthesized in laboratories, in the aim of changing one’s apprehension of reality, is to leave the guild of the philosophers behind, with all its constricting norms and shibboleths, and to join the company, over in the deep end of the pool of life, of sundry countercultural weirdos and deviants.

This shows, I think, just how conservative philosophy remains, in some respects, as an academic discipline. At a cultural moment when psychedelics are getting a second wind, and even someone as upstanding as Michael Pollan has moved from counseling us to eat our roughage to praising the benefits of microdosing, philosophers are conducting themselves as though it were still 1950, when we wore skinny ties to colloquia, got funding from the RAND Corporation to work on decision trees and other such narrow and straitlaced endeavors, and all knew that it is the unaltered and wakeful mind that has exclusive access to the forms and qualities of the external world.

But wait a minute. Even in the mid-20th century, perhaps especially in the mid-20th century, years before the postwar generation was turning on, tuning in, and dropping out en masse, perfectly sober grown-up philosophers understood full well that the reports our senses give us of the physical world hardly settle the matter of what reality in itself is like. The problem is ancient but was sharpened in the early work of Bertrand Russell and G. E. Moore, who together articulated a cluster of problems around the concept of “sense-data.”

As Russell would put the point in the 1940s, when we are looking at a table as we walk away from it, what we see shrinks continually; but the table does not shrink; therefore, what we see simply cannot be the table itself. What we see, rather, is only what is given to sense, and the full account will have to involve the physics of light and the physiology of the brain and of the organs of sense as much as it involves the properties, to the extent that these can be known, of any external object. But if we have to take account of what the perceiver brings to the instance of perception in order to make any sense at all of what perception is, then it would seem to follow that perception should also be of interest to philosophers when there is no external object at all—or at most a hallucination of one.

This article appears in the April 2023 issue. [Subscribe to WIRED](#). Photograph: Andria Lo

Of course, philosophers *are* interested in hallucination, even if they prefer to draw their examples from case studies of schizophrenia or Oliver Sacks–style pathologies, or from more mild varieties of optical illusion that happen

even to the mentally sane (heat wave “oases,” straight sticks emerging from water as if bent). But they are generally interested in it only as a challenge, as an obstacle standing between them and what they would ultimately like to establish: that, namely, there is a real and all-important difference between the perception that is anchored in how the external world actually is and the perception that would seem to come from inside of us. There is a difference between waking and dreaming, in other words, and waking for them is incontestably the superior state to dwell in and the only one that is worthy of a philosopher. For philosophers seek the truth, which is something that can be furnished only to a mind not currently subject to the chimeras of psychosis, of dreaming, or of drugs.

But again, the problem is ancient, which is a pretty reliable sign that it is also intractable. For all our efforts, we still are not one step closer to apprehending the things in themselves. It is not that science hasn’t progressed—of course it has—but rather that the problem is conceptual and not empirical. You can’t perceive the thing that lies behind what you are perceiving, since the instant you do perceive it, it no longer lies behind but is front and center. Given what appears to be this logically necessary stalemate between us and the world, it seems inevitable that alternative accounts of the fundamental nature of reality—alternative ontologies, as we say—should keep returning and drawing off at least some philosophers who get fed up with an external world that demands our loyalty yet refuses to show itself.

In at least some of these alternative ontologies, the visions that come to us unbidden, in the liminal states of insobriety, hypnagogia, or theurgic ecstasy, are not to be dismissed out of hand as obstacles to our apprehension of truth, but may in fact be vehicles of truth themselves. Here I am aware I’m pushing up against the limits of respectability dictated by the implicit norms of my discipline, but I’ve gone about as far as I was ever destined to go in the ranks of this guild, and I’ve got nothing, and no one, to be afraid of. So I’m just going to come right out and say it: I am a philosopher who has taken an interest, of late, in psychedelic experimentation, and I find that my experiments have significantly widened the range of accounts of the nature of reality that I am disposed to take seriously. If you think you are in an emotional state to handle it, and in a legal jurisdiction that permits it, and

you think you might benefit from being jolted out of your long-held ontological commitments, then I would recommend that you try some psychotropic drugs as well.

I will not exaggerate the benefits. I still have no clue what this brief crack of light I call “my life” really is, nor how I got here, nor where I’m headed. But I am significantly less cocky now, my cluelessness is more evident to me, a constant that accompanies me in each moment of the day. No one seems more pathetic to me, now, in their own cluelessness, than the self-styled “realists” who prejudicially and without any grounds go on supposing that they have a firm grasp of concepts like “nature,” “matter,” “being,” “thing,” “world,” “self,” that this grasp flows directly from their acceptance of the plain evidence of reason buttressed by empirical discovery, and that the question of how many kinds of being there are, and of the nature of these beings, is one that has been definitively settled over the past few centuries of naturalistic inquiry.

If this new reflection of mine appears too vast, consider the following scene from a time we conventionally call “the scientific revolution.” A missionary finds himself in what is then known as New France, though the truth is there remains next to nothing French about the place. He is living with the Hurons and trying to convince them of the urgency of converting to Christianity. On some days the group’s leader, a sharp and dignified old man, seems disposed to accept the offer; on others he wakes up from dreams that tell him Jesus Christ is a malevolent supernatural being who has sent another such being among his people to bring them to ruin. Each morning the missionary wonders whether the old man’s latest dream vision will spell the death of him. He recalls his earlier life in Europe and the new philosophy of René Descartes, who claims to be able to prove that our waking life is real, while our dreams are only a delusion. It dawns on him that his new hosts see things in more or less the opposite way.

It dawns on him, further, that it is this opposite way, and not the new way of modern philosophy, that is more or less the default setting of all of humanity, while Descartes and the other moderns constitute a small minority of dissenters, who have worked their way, by great effort, into what is ultimately a rather counterintuitive picture of human life, one in

which the great preponderance of what is running through our heads at all times, but especially in dreams and other ecstasies—all the dazzling parade of sights and sounds and spirits, specters, ancestors, anthropomorphic animals, theriomorphic divinities, theomorphic stones, countless other permutations I can't even name, and infinite swarms of fleeting and fugacious beings—all get in the way of our efforts to orient ourselves in this life. The missionary begins to wonder whether he really knows any better how to live than the oneiromancers he has ostensibly come to enlighten. But he has little time to indulge this question, as he fears the old leader may wake up at any moment and pass a death sentence on him. He writes a letter to his Father Superior in France, begging for a transfer out of there and back among the people who know, or think they know, the difference between appearance and reality.

Philosophers today, at least in the English-speaking world, almost all take for granted that the core Cartesian doctrines are theoretical nonstarters. Yet we all remain the children of Descartes, to the extent that we take for granted that the day is more disconcealing of truth than the night. We do catch some small glimpses of alternatives here and there, and from time to time over the past few hundred years a countertendency will emerge—the psychoanalysts' concern to center the dream-life, the consciousness-expanding spirit of the 1960s counterculture. So it is with them that I throw in my lot. I am not a Freudian, nor a hippie, yet I believe, now more than ever, in part thanks to age and what I like to think of as an accrual of wisdom, in part thanks to psilocybin and muscimol, that our liminal states of consciousness may well be consciousness at its most veracious.

Alongside drug use, another implicit prohibition of the guild of philosophers is that you really should not ask, in open and childlike terms, a question as general as “What is the meaning of life?” Yet it is just this question that came to press upon me over the past years, with an intensity I could not ignore.

When my grandparents died long ago, I was heartbroken of course, but they had been old, and I was young, and I couldn't see what it all had to do with me. Things were different when my father died in 2016. With his disappearance, all of a sudden the basic conditions of my own existence hit

me like a revelation. He had had (note that pluperfect) a good long life, but now it seemed so absurdly brief to me, as if this being had just popped into existence, instantly began babbling a few favorite stories over and over again like a talking doll, a few beloved half-truths and misremembered factoids, only to pop right back out again, leaving me agape and wondering: Holy shit, who *was* that? *What* was that?

Two years later my mother was diagnosed with the same common illness he had, with a name we hear every day and read about constantly in *The New York Times'* "Well" section and other clickbait venues, but that I find myself unable even to say or write. Throughout this era of loss, I have been sharply attuned to the fact that I myself am no longer young and that my parents' fate has everything to do with me. They are me, just not in every respect at the present moment. I am them, but on a slight delay, and I find myself concerned with not spending the rest of this brief flash clinging to half-truths of my own. I want to know what this is all about, or at least, if knowledge is not to be had, I want to arrive at some equanimity of soul, where this condition of ours should no longer appear so absurd, so unacceptable, and where the veil that occludes my access to the world at least is no longer covered over by an additional veil of tears.

The sense of loss intensified with the beginning of the pandemic and the forced isolation it brought down on the world. I was drinking heavily at the time, as I had been for many years. By the time I finally stopped using alcohol for good, just over two years ago, there was no joy at all left in it, no celebration, as there was in my younger life of at least some imperfect stab at bon-vivantism. It was simply an addiction, and one that darkened the veil through which I am constrained to make sense of the world. So I quit it, at long last. But rather than feeling liberated and good about my healthy new start, it was only then that I fell into the deepest depression I have ever known, deeper than I ever could have imagined possible. I was suddenly cut off from the only means I had of comforting myself, and of charging up the world with at least a sort of counterfeit magic. Nothing I had valued in my earlier life, my idiotic careerism, my foolish vainglory whenever I got something published, had even the faintest trace of significance now. I could still conjure, from somewhere, a semblance of caring about my career

and so on, but I truly did not care. I no longer even understood how it could be possible to care about such nothings as fill up a human life.

When the lockdowns ended, I summoned my forces as best I could, crawled out of my hole, and began to make the trip as often as I was able from France to California in order to visit my mother. I had been vaguely aware of the recent legislative developments in certain US states surrounding the consumption and sale of cannabis, but it was only on a whim, in the middle of one of these visits, that I turned to Google to find the location of the dispensary nearest me. I had tried marijuana a few times in my earlier life, but it had had little effect on me, and in any case I considered it trashy and beneath me in all its cultural significations. But because, now, I no longer cared about any of the judgments I had made in my earlier life, positive or negative, I found that I really could not care less what the cultural position of cannabis was, and I was perfectly happy to show my ID and stand in line with all the chewed-up old army veterans, all the underemployed marginals, all the discarded Americans, my brothers and sisters, at a dispensary on the very seediest side of Sacramento, in a place no zoning law had ever touched. No, I find I'm not putting this plainly enough. I was *happier* there than I had ever been in any *cave à vins* in Paris, getting my ear talked off by some French wine merchant about terroir and bouquet and all these supposed properties of the drink that I, anyhow, was never able to detect. While I had never smoked a joint correctly in my younger days, I found that the new abundance of tinctures and oils and other alchemical refinements of the THC molecule were just what I needed to start to see the world, again, as some sort of meaningful whole.

Early in my new life as a late-blooming pothead, one thing that struck me was just what a crummy deal we in the West had been given, whereby all mind-altering substances had been prohibited and stigmatized, except for the one that has such negative medical and social consequences in its overuse as to be described in terms of disease, and that only ever alters consciousness downward, from the more to the less vivid. Alcohol might make us dance and chatter for a short time, but its technical classification as a “depressant” is surely the correct one. That wine is a central sacrament of Christianity, moreover, which in its early centuries seems to have had some interest in stamping out vestiges of pagan rituals relying on other, more

intense varieties of mind alteration, seemed to me suddenly to be a rather serious argument against Christianity. It turned us into drunks, I reflected, and made us forgetful of the myriad other ways to make use of the fertile bounty of nature, particularly in its vegetal and fungal expressions, in order to see the world differently. Just a few edibles in, and I was already gravitating toward some kind of neopaganism.

Cannabis, though generally not considered a “psychedelic,” nonetheless has something of the power this word was coined to capture: It makes the soul’s nature manifest to itself. Experiences vary, of course, but in my case it does several things at once. It induces a sort of bodily ecstasy; it presents a vivid spectacle of patterns and figures before the eyes (especially when they are closed); and most interestingly, I think, it dissolves what I ordinarily experience as the metaphysical unity of the self, with all its memories and its steady persistence through time, and makes it temporarily difficult to comprehend how I ordinarily go about my life as if the self I present myself as being were a real thing, or at least anything suitable for presentation.

There is a psychiatric phenomenon, one most of us would ordinarily hope to avoid, that is known as “depersonalization,” in which a person becomes convinced that their own life is not real, that the memories they have, even the body they have, is not theirs. In the depths of depression I came close to something resembling this condition, and it was terrifying. Stoned, by contrast, I have approached a state that is at least a cousin of depersonalization, yet I have found that it is mostly neither enjoyable nor terrifying, but simply revealing. We are, after all, quite likely *not* unified metaphysical subjects but rather complex assemblages of cells that facilitate an illusion of unity for as long as the assemblage endures. I will not affirm here any dogma, not even the naturalistic account of biological death to which I have just alluded, but will only say that there are several plausible accounts of what a self is on which we are indeed mistaken to suppose that it exists any more than, say, an image of a flamingo briefly manifested on a screen by colored pixels.

But goodness, here I am, still philosophizing like a stoned undergrad in a black-lighted dorm room. Ridiculous. Philosophers aren’t supposed to philosophize; they’re supposed to “do philosophy,” as the professional argot

has it. The guild's prohibition on drugs, perhaps, is linked to the fact that these lead us into a philosophizing of the most freewheeling and unhinged sort. But just as in the middle of a bad trip, it's too late to pull back now. So let me get to the heart of the matter.

Beginning around 2018 I began writing essays, blog posts, polemics, and at least a few quasi-scholarly articles against the usurpation of classical models of the human being by metaphors drawn from the algorithmic technologies that surround us in the contemporary world. These efforts eventuated in [my 2022 book](#), *The Internet Is Not What You Think It Is*. That same year I also published, in *Liberties*, a [resolutely negative review](#) of a new book by my philosophy colleague David Chalmers, *Reality+: Virtual Worlds and the Problems of Philosophy*. Chalmers is generally sympathetic to what has come to be called the "[simulation argument](#)," the essence of which may be boiled down to the idea that what we think of as "its" have their ultimate causal ground in what are in fact "bits." That is, what we take to be physical reality would better be conceived on the model of the virtual realities our machines have begun spinning out for us over the past few decades.

My criticisms were in part grounded in my perspective as a specialist in the history of early modern natural philosophy. If you know anything about 17th-century science, you will know that people at the time were particularly impressed with the most cutting-edge technologies of the day, most notably clockworks. Some people, who styled themselves "mechanists," were so impressed as to propose that the entire universe is best understood on the model of a horologium. And this is a pattern we see again and again in the history of science: The latest shiny gadget, whatever it may be, becomes such a centerpiece of human attention that we find ourselves unable to resist seeing it as a sort of epitome of reality as a whole.

But what a coincidence it would be, really, if the entire world turned out to share in the same nature as a technology that only came into existence within our own lifetimes! "The world is like a dream" seems a perfectly plausible proposition; "The world is like *Pac-Man*" seems a crude fetishism. A rigorously historicizing perspective on the simulation argument, in other words, quickly reveals it to be little more than a

reflection of presentist myopia. I certainly have no qualms about the idea, defended by Chalmers, that the world is likely not at all as it appears to us. It's just that when I go searching for alternatives to these appearances, it is not first to our recent technologies and to their cultural ramifications in gaming and other such domains that I turn.

Yet I also confess that my review of *Reality+* was at least to some extent unfair and overly harsh. In the end, what displeased me most about it were not its arguments but its tone and authorial voice. It is, to be blunt, a bit dorky, with its narrow range of cultural references to TV shows and pop songs about which I could not care less, and its obvious rootedness in online cultures of gaming and coding and geeking out that I have always shunned. But philosophers are supposed to see past such superficial differences. If I can admire a 10th-century Islamic theologian for his ingenious use of arguments drawn from Aristotle, I ought to be able to appreciate Dave Chalmers, who is, after all, my contemporary and my guildmate too.

But something else has begun to worry me about my earlier critique, beyond the impropriety of dwelling on these cultural differences, on the puerile conceit that Chalmers is a dork whereas I am cool, and it is that in recent times, my mind altered with the help of chemicals, the world has indeed come to appear “glitchy” to me, in just the way the simulationists expect that it should. Under the influence of drugs, the world really does seem to me more like a computer simulation than like a clock, or a loom, or a chariot wheel, or anything else we have come up with so far.

Let me walk that back a bit. The glitches are not exactly as the simulationists, at their most indulgent, like to imagine them. I see no cascades of glowing green 0s and 1s, nor clean *Tron*-like geometric lines extending off into the horizon, not to mention cats that seem to flicker like an old UHF channel as they walk by. The glitches are not something seen at all, but rather something that characterizes the mode of consciousness in which the totality of the world, and of memory and experience, is apprehended.

There are two such principal glitches. The first has to do with the experience of time. Under the influence of mushrooms, I have found,

temporal duration can sometimes go the same way as I have described the self going under the influence of THC. Psilocybin is far more difficult to obtain through legal channels, unfortunately. A loophole in the Netherlands enables us to purchase the “truffle” part of the fungus; a handful of jurisdictions in California allow for psilocybin’s possession and use but not its sale. Meanwhile, muscimol, the active ingredient in the *Amanita muscaria*, or fly agaric fungus, so well attested in traditional religious practices throughout Eurasia, is legal in 49 states, and common, alongside cannabis, in the dispensaries of New York. While I have had some interesting experiences with psilocybin recently, it is muscimol, purchased in a rather louche head shop on the Lower East Side, surrounded by tricolored insignia of pan-African pride, images of neon aliens, the inescapable Bob Marley, that has best succeeded in bringing me out of my ordinary experience of the fixity of my personal identity, and of the temporal boundedness of my existence.

In his 1921 work, *The Analysis of Mind*, Russell reflected that there is no logical impossibility in the hypothesis that the world sprang into existence five minutes ago, “with a population that ‘remembered’ a wholly unreal past.” What to Russell’s lucid and unaltered mind seemed a logical possibility has seemed to me, on psychedelics, very nearly self-evident, except that the five minutes are reduced to the present instant, and it turns out that the real mistake, in our ordinary apprehension of our existence, is to conceive it as unfolding in time at all.

What does this have to do with simulationism? Consider, first, that in an artificial system that rises to the level of consciousness, such as future iterations of GPT or LaMDA might become, this consciousness could not be the result of any slow evolutionary process with antecedent stages of mere sensory perception. The consciousness of such a system would simply pop into existence at the moment the programmer behind it all hits Start. It would not be a hard-won consciousness, moving up through photoreception, olfaction, and other such physiological capacities that now serve in part to constitute our consciousness as biological entities (*if* that is what we are) but did not first emerge *for the sake of* consciousness. When we first started smelling the world around us, evolutionary theory tells us,

there was as yet no plan for us to someday start cognizing that world. It all just worked out that way.

In an artificial system, by contrast, such as the AIs we are currently seeking to train up, it is cognition that comes first, and likely last. While the very idea that our AIs are approaching consciousness is controversial, of course (and I will not take sides on it here), we may at least agree that it is easier to make our machines cognize the world than to make them smell the world. That is, we are training the machines up to *know* things, and among the things they know it might turn out that they will be able to know *that* they know things. But the idea that there would be any accompanying bodily phenomenology to this knowledge is plainly nonsensical. What is being called “[embodied AI](#)” indeed recognizes that machines will most likely learn to think like humans if they are outfitted with bodies and made to experience the world. But this experience of the world is typically conceived in terms of navigation in space, which can already be observed among the canine-shaped patrol robots ominously advertised by [Boston Dynamics](#). If we want to call these assemblages of silicone and electricity “bodies,” they are so different from ours that we can really have no idea what bodily experience would be like for them.

Or can’t we? It seems to me we would likely have to suppose, at the very least, that for an AI there could be no experience of temporal duration as we ourselves know it. In particular, a conscious AI would not have any experience of deliberating in time, of “thinking through” a problem in the same way one “moves through” a tunnel. Rather, its change from one state to the next would be instantaneous, and for this reason the phenomenology of the “before” and “after” would be either nonexistent or so different from our own as to be indescribable in the same terms. And it is something like this phenomenology, I think, that the experience of psychedelic drugs can reveal to a person, where there is no time in the usual sense and memories are all just as much a part of the “now” as anything else.

It is not, or not only, my limitations as a writer that compel me to admit the impossibility of fully conveying what this is like. After all, we’ve only got a few tenses to work with for our verbs, though a curious rendering in the King James translation of the Bible might give us some hint of what it

would be like to have an “eternal tense”: “Before Abraham *was*,” Christ says in the Gospel of John, “*I am*.” This is not a pluperfect, as one might ordinarily expect, where Christ claims simply that he already “had been” further back in the past than another personage. Rather, it is a shift to what superficially looks like the present tense, as if to suggest that, in his case, past, present, and future simply don’t apply. I have not checked the Greek, which alone would settle the matter of what this verse actually means, and I am not here to wade into any abstruse Christology, but I do want to suggest that that “am” captures something of the experience of at least some mind-altering substances.

The second “glitch” has to do with one’s perception, on mind-altering chemicals, of what we might call a vastly expanded social ontology, of the consciousness of a community of beings that extends far beyond the human and perhaps beyond the corporeal. The experience of such a social ontology, it seems to me, is just what you might expect of an artificial consciousness that is trained up, as our current rudimentary AIs are being trained, in the primary aim not of navigation of an external world but rather of prediction based on a sharp attunement to the patterns that play out in other people’s, or other beings’, minds.

Shortly before I began experimenting with drugs, I found myself spontaneously, and quite surprisingly, attuned to a much more densely populated world of other minds, or of fellow beings in the full and proper sense, than we are ordinarily expected to recognize. Long ago my grandfather built a wooden deck in front of our little vacation house on Lake Almanor in the northeast of California. There was a baby pine shooting up underneath it, and he could not bring himself to cut the sapling off from its source of light and life. So he constructed the deck with a square opening through which it could continue to grow. On my first visit there after the lockdowns ended, I saw that proud tree reaching up into the sky, now about as wide in diameter as a basketball. The tree was in its forties now, almost as old as I was, and it suddenly struck me that I had passed most of my life with this tree, yet I had neglected to think about it, to hold it in my heart and thoughts, at nearly every moment of all those years. “I’m sorry I left you and forgot you,” I said in my mind. “I am *so, so* sorry.” It seemed to me now that the tree was my adoptive sibling, my blood

brother (though I had never pricked myself on it), and in that state of mind any argument to the effect that it is “just a tree” would have been incomprehensible. You might as well have resorted to such locutions as “just a human,” “just an ocean,” “just an angel,” “just the world.” I was not on any drugs at that moment (other than antidepressants, which as far as I can tell have never done shit for me), but it gave me a brief glimpse of what I would subsequently be able to reexperience with chemical assistance.

Research on fetal mice has shown fairly conclusively that the development in the mammalian brain of a capacity to navigate obstacle-filled space develops quite separately from any cognition of social reality. Mice get ready to move through the world by dreaming about that world before they are even born. It’s hard to say what a mouse’s experience of other minds is like, but at least in human beings it seems clear that our cognition of the bare external world, of everything that goes by the pronoun “it,” is quite independent from our second-person experience, of all that is covered by the pronoun “thou.”

Descartes, curiously, neglected to reestablish other minds after he had razed all of his beliefs through the method of radical doubt in his *Meditations* of 1641. But the problem of second-person experience would return to philosophy with a vengeance a few centuries later under the name “phenomenology,” in which the starting point of all theoretical reflection is that being in the presence of another being, with an interiority like ours, is fundamentally different from being in the presence of, say, a brick wall. Martin Heidegger would articulate this difference in terms of *Mitsein*, or “being-with.” What are the entities in our field of experience that we are able to “be with”? Most of the time I find that I can be with cows, that to stand near a cow is to “vibe” with it. Being with a tree is an experience that is harder to come by. But one thing psychedelics can help illuminate is the extent to which the limits of *Mitsein* are not so much a reflection of the intrinsic properties of various external entities as they are, simply, of our attunement. When we change our tuning, even the brick wall can seem to have been dismissed too hastily.

If social ontology develops independently of the cognitive capacities that enable us to navigate the external world, and if we are able under some

circumstances to encompass potentially *everything* within our social ontology, then we might begin to wonder about the viability of our distinction between the “its” and the “thous,” between the third and second person. On mushrooms, there is a strong perception of the mutual constitution of mind-like beings by one another, so that my understanding of what I am becomes inseparable from all sorts of entities I am usually able to bracket as distinct from me—trees, clouds, mice, and so on—and these entities all, in turn, appear to be constitutive of one another.

There is a very succinct naturalistic account of why the world comes to appear to us like this under certain circumstances: It appears this way because this is how it in fact is. I would be nothing without all the clouds and trees and so on; and my eventual death, in this light, might best be understood as the end of a long campaign of stubborn resistance to this obvious fact—not the loss of anything with any real independent existence but only an anomaly within an order of existence that strives ever to even things back out.

This naturalistic account, however, rides alongside an equally compelling “virtualistic” account of what is happening. If the world were to turn out to be “virtual,” and the virtual consciousnesses within it had been designed with the aim of modeling and predicting one another’s intentions, just as AI researchers say their machines are designed to do, then it should not be at all surprising to find ourselves, sometimes, in a state of mind where other minds appear wholly to exhaust what is out there in reality. In other words, one way of thinking about a virtual world is as a world entirely constituted by other minds. And this is indeed how the world comes across to us, at moments, when we are thinking about it with chemically enhanced perception.

But are any of these lucubrations to be taken at all seriously? Or do they just describe how the world appears to one sorry fellow who’s got a “brain on drugs”? (Readers of a certain age will at this point picture an egg in a frying pan.) Well yes, of course it’s a brain on drugs, but this just returns us to the original problem: Your brain is *always* on drugs. That is, there is always a neurochemical correlate to any of your conscious perceptions whatsoever. You might be tempted to say that supplementing gets in the

way of correct perception, and that the only reliable way of apprehending the world as it is must depend only on the default setting of the mind, with no extras. But again, even this setting delivers us delirious hallucinations for about eight hours out of each 24.

Moreover, it is hard to conceive of any valid argument against supplementation. The substances are out there in the world, just like the food we eat is out there—and if we did not eat it, very soon we would start to hallucinate, and eventually we would cease to have any conscious perceptions at all. (Indeed in the history of ecstatic practices, fasting is perhaps as common as drug-taking as a means of getting out of one's ordinary range of conscious experiences.) The fact that we *have* to eat some sort of nutritious organic matter or other, while consuming psychedelic plants or fungi is strictly optional, is certainly relevant to the *moral* regulation of drug consumption, but it is hard to see how it is relevant to any *epistemological* determinations we might make about the ability of a mind to deliver knowledge of the world as it is. The undrugged mind may be more reliable in certain respects, since it is less likely to lead you to try to fly off your high-rise balcony, and it is better able to help you stay focused on present dangers and tasks necessary for survival. But this in no way means that the representations it gives you of the world are *truer*.

My undrugged mind, to borrow a witticism from J. L. Austin, delivers to me a world of “medium-sized dry goods” and little else. My drugged mind delivers to me spirits or djinni or angels or I don’t know what to call them. It presents to me trees that are brothers and clouds that are old friends and cracks in the walls that spell out warm messages from solicitous invisible beings and infinite swarms of lives, all swirling and pulsating around me. Which is correct? I honestly don’t know anymore. My colleagues will tell me they know, but I don’t think they do either.

just as i was able to re-find my fraternity with the pine tree unaided by psychedelics, so too can a person work their way unaided to a point of view on the world in which it is teeming with infinite other points of view. This is, broadly, the philosophical view of my greatest intellectual hero, the 17th-century philosopher Gottfried Wilhelm Leibniz (who was, among other things, a pioneer of computer science). Almost certainly too much of a

square ever to have tried any of the fungal supplements that abound in the landscapes of northern Germany, Leibniz nonetheless was able to arrive at the conclusion that the only meaningful sense of the verb “to be,” as he put it, is “to have something analogous to the ‘I.’” That is, there is no world but the community of subjects, some of them human but most of them something else entirely.

Leibniz was not, to say the least, a deviant weirdo. As for me, it is only at the moment I decided to take the risk of falling in with the deviant weirdos, of moving with the wrong crowd and losing my place in the guild of philosophers, that I came to believe he is probably right about things. A true genius, he seems to have got there unaided. But we all do the best we can, each according to our capacities.

I am likely fortunate to live, most of the time, in a jurisdiction where none of the relevant substances are permitted by law, and so to be able to indulge my curiosity only punctually. There are many experiences I have not yet had—of DMT, for example, which I am told is the most potent of all in showing us the variety of species of beings that ordinarily remain hidden. (If you are a clinical researcher in such matters and would like a volunteer for your experiments, hit me up.)

In any case, I suspect I have already found what I was looking for: some new knowledge, and at least a bit of equanimity. While I remain as uncertain as ever about the ultimate structure of the world, I also have new inclinations, and new sympathies, toward accounts of it that had previously struck me as altogether off the table. That widening is itself a sort of newfound knowledge, even if it contains no new certainties. As to equanimity, there really is nothing like a sharp experience of the illusoriness of time to make a person less anguished by the brevity and apparent senselessness of what we experience as our temporal sojourn. And there really is no more comforting feeling than to arrive at an awareness of the pervasive and dense presence of other beings like oneself—or at least to arrive in a state that seems to attest to the existence of such beings.

The world is not what it seems—that’s for sure. Even if any positive determinations about how it actually is would automatically become new varieties of mere seeming, it is good and edifying to explore the alternatives

to our standard account. The great mistake of the psychedelic gurus of old was to mistake the mode of perception that drugs afforded them for a sort of revelation, which is really just to trade one dogmatism, that of common-sense “realism,” for another.

I do not know what the world is, nor what is “keeping the stars apart,” to borrow an evocative line from E. E. Cummings. But mind-altering substances have helped me, at a fairly desperate point in my life, to dwell in that uncertainty with greater ease, to “own it,” as they say, and no longer to feel so dreadfully apart from the stars.

This article appears in the April 2023 issue. [Subscribe now](#).

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Mar 1, 2023 7:00 AM

It's Time to Fall in Love With Nuclear Fusion—Again

Let's indulge: Once fusion arrives, handmade suns could wipe out all human problems in a go.

PHOTOGRAPH: SHAWN MICHAEL JONES

If nuclear fission is associated with catastrophe, nuclear fusion is associated with delay and fraud. The joke about fusion, the synthesis of lab-grown stars, is that it's always 10 years away. Or 20. Two lonely little isotopes, each with a pathetically low mass, are joined in holy electromagnetism in a massive artificial thunderclap. The remaining nucleus is smaller than the mass of the reacting nuclei, and the leftover mass is converted into light or heat by virtue of $E = mc^2$.

But what a utopia fusion seems to promise. Even with the jokes and equivocation and scams, it's hard to be *blassé* about fusion's stellar possibilities. So let's indulge: Once fusion arrives, *handmade suns*, sources of unlimited clean energy, would—*will*—wipe out all human problems in a go. Our glorious pet stars, requiring only everyday hydrogen to whip up in a lab, won't belch out carbon or radioactive waste. Instead they'll exhale helium. [Helium!](#) That nonrenewable resource that's already running low! Fusion, my friends, means not just [infinite carbonless energy](#) but more balloons.

Fusion will, of course, rescue the environment and decarbonize planet Earth in a cool afternoon. It will also—don't stop me now—render irrelevant all the dead-eyed petroleum kleptocracies and trade wars and real wars waged

in their name. When energy can be produced anywhere, with common household ingredients, authoritarian states will no longer derive despotic authority by accidents of geography, but will, *whoosh*, become secular democracies, the better to share fusion-reactor tips and tricks in happy glasnost and savor the collective joy and peace of a burning, flooding planet restored to tranquil shades of green and blue.

Even leaving aside the Shangri-la, fusion is exciting here and now. In December 2022—a solid century since physicists first identified fusion as the source of star power—American scientists at the National Ignition Facility in Livermore, California, where ignition is a way of life, had a breakthrough. They'd aimed 192 lasers at the inside of a pearl-sized gold can called a hohlraum, creating a radiation bath that heated up the outside of a peppercorn-sized spherical nubbin of hydrogen coated in diamond in the center of the little can.

Atoms flew off the nubbin, forcing it to implode at a speed of nearly 400 kilometers per second—about four times a bolt of lightning. This created 100 million-degree plasma under hundreds of billions of atmospheres of pressure—a gas so hot that electrons were freed from atomic nuclei. At 1:03 am on December 5, humanity hit the threshold for fusion ignition in a lab. The first flash of a handmade sun. Though it blinked out rather quickly, after less than 100 trillionths of a second, the reaction created 3.15 megajoules of energy when a mere 2.05 went in—a glorious 150 percent return on investment.

Somewhat discouragingly, the first thought of the US Department of Energy, which its publicity team spelled out in an admittedly cool sci-fi video, was that this fusion ignition could somehow “support” the government’s project to extend the lifespan of nuclear *weapons*. But never mind. With at least 30 private fusion companies across the world promising clean energy built on the Livermore breakthrough, the air is supercharged with Kennedy-era electrons of hope. According to a survey from the Fusion Industry Association, most of these companies believe fusion electricity will be on the grid by the 2030s. It’s time to fall in love with fusion as if we’ve never been hurt before.

But it's always good to keep your wits about you when it comes to fusion promises. Whenever both paradise and vast riches are at hand, fraudsters make their move. On March 23, 1989, before an audience of feather-haired University of Utah students and at least one member of the presiding bishopric of the Church of Latter-Day Saints, electrochemists Stanley Pons and Martin Fleischmann declared—no peer-reviewed nothing in sight—that they had “established a sustained nuclear fusion reaction.” Holding up something that looked like a baby’s bottle with a pen in it, Pons told the room that they had driven deuterium into a metal rod at room temperature using garden-variety electrochemical techniques. Presto, they’d formed a new atom. “There is a considerable release of energy,” Pons said. “We’ve demonstrated that this could be sustained. In other words, much more energy is coming out than we’re putting in.”

OK, then.

Lest anyone doubt that these chemists (curious: not nuclear physicists) had really made their own atom, Pons assured the audience that he and Fleischmann had found nuclear reaction byproducts: evidence of fusion. What’s more, the heat generated by their tabletop experiment was attributable to those byproducts alone. It “cannot be explained by any chemical process that is known,” he said, with a note of irritation.

Almost immediately, other electrochemists aimed to replicate the results. They failed. Other (known) chemical processes seemed to be generating the heat. When Pons and Fleischmann published a paper at last, their work was savaged as a sham. They’d misrepresented their byproducts. The two men fled for France, where they worked for a Toyota research lab; they were never fined or even sidelined from science. But the abracadabra hypothesis of “cold fusion” came under a pall. Today, those who keep faith in it have formed a kind of aggrieved mini-cult. In the curious state of mind that anti-vax doctors are known for, the cold-fusion crew dug in, and its members now grouse about having been blackballed from elite journals and reputable conferences.

The latest Livermore discoveries are carefully described as hot fusion.

To those in whose dreams fused nuclei dance, the cold-hot distinction is consoling. The lukewarm nothingburger of the George H. W. Bush era seems worlds away from real fusion, the white-hot variety produced by Energy Secretary Jennifer Granholm's avant-garde DOE. What's a homemade sun without otherworldly heat?

The National Ignition Facility is a 10-story laser complex the width of three football fields, and its imposing size makes the Pons-Fleischmann tabletop charade even more laughable. And this time with fusion, the renowned physicists—including Tammy Ma, a plasma physicist; Annie Kritcher, an experimental physicist; and Kim Budil, a laser physicist and the director of the Lawrence Livermore National Laboratory—did not jump the gun with a prepublication press conference and set off a failed replication jam among peer scientists. Instead, for decades, scientists at the National Ignition Facility have been piling up papers, detailing most recently how ignition via fusion was possible (in August 2021) and then how it happened (in December 2022).

Along the way, statements to the media from LLNL have offered more science than prophecy. Kritcher, the lead designer of one of the 2021 experiments and first author on one of the resulting papers, explained how her team brought fusion to the threshold of fusion ignition. She concentrated not on grandiose promises but on the crucial challenge to anyone trying to fuse atomic nuclei: The laser energy must make it into the beams and hit the hydrogen target. One improvement? “Reducing the coasting-time with more efficient hohlraums compared to prior experiments was key in moving between the burning plasma and ignition regimes,” she said.

Heat, light, matter: It's supremely satisfying when the most advanced technology on earth is also the most elemental. I'm here to enlist in this ignition regime, especially if it means the reign of nuclear fusion and the simultaneous twilight of carbon and kleptocracy. But you know me: I'm in anyway, even if the ignition regime is, for now, just an ongoing spark of hope that humans can still improve the world somehow by studying hot plasma and beaming lasers into gold cans.

POSTSCRIPT. I've been writing this column for WIRED since 2018. I've written about [beavers](#) and [muons](#), the [Tesla bot](#) and [Mark Zuckerberg](#), [eyesight](#) and [plague literature](#), [methamphetamines](#) and [healthful Netflix binges](#). My aim was to explore the ways that technology partakes of two aesthetics: the uncanny and the sublime. The metaverse, artificial intelligence, social media, nuclear fusion: All of it generates—will always generate—astonishment. It will also generate unease, disgust, even terror. Whether an observer is an opponent or proponent of technology is beside the point. It is the air we breathe. I'm turning to features and essays for WIRED now, but it's been a profound honor to write this column and to share the digital atmosphere with you.

This article appears in the March 2023 issue. [Subscribe now.](#)

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Feb 28, 2023 6:00 AM

The Mining Industry's Next Frontier Is Deep, Deep Under the Sea

Companies are diving to the bottom to scoop up metals essential for our EV-driven future. But how much ocean are we willing to sacrifice?

Photograph: Andria Lo

In October of last year, an enormous new creature appeared on the seabed of the Pacific Ocean, about 1,400 miles southwest of San Diego. It was a remote-controlled, 90-ton machine the size of a small house, lowered from an industrial ship on a cable nearly 3 miles long. Once it was settled on [the ocean floor](#), the black, white, and Tonka-truck-yellow contraption began grinding its way forward, its lights lancing through the darkness, steel treads biting into the silt. A battery of water jets mounted on its front end blasted away at the seafloor, stirring up billowing clouds of muck and dislodging hundreds of fist-sized black rocks that lay half-buried in the [sediment](#).

The jets propelled the lumpy stones into an intake at the front of the vehicle, where they rattled into a steel pipe rising all the way back up to the ship. Air compressors pushed the rocks up in a column of seawater and sediment and into a shipboard centrifuge that spun away most of the water. Conveyor belts then carried the rocks to a metal ramp that dropped them with a clatter into the ship's hold. From a windowless control room nearby, a team of engineers in blue and orange coveralls monitored the operation, their faces lit by the polychromatic glow from a hodgepodge of screens.

This article appears in the April 2023 issue. [Subscribe to WIRED](#). Photograph: Andria Lo

The ship, called the *Hidden Gem*, was a former oil-drilling vessel nearly 800 feet long, retrofitted for sea mining by the Metals Company, an international firm officially headquartered in Canada. This was the first test of its system to collect the ancient black stones. They are officially known as polymetallic nodules, but the Metals Company's CEO, Gerard Barron, likes to call them "batteries in a rock." That's because the stones happen to be [packed with metals](#) that are essential for manufacturing electric cars—a [market that is surging](#) worldwide. Barron's company is at the front of a pack of more than a dozen [enterprises](#) slavering over the billions of dollars that could be reaped from those little subsea rocks.

The world's long-overdue, fitful [transition to renewable energy](#) is hobbled by an Achilles' heel: It requires staggering quantities of natural resources. Manufacturing enough electric vehicles to replace their fossil-fueled counterparts will require billions of tons of [cobalt](#), [lithium](#), copper, and other metals. [To meet the exploding demand](#), mining companies, carmakers, and governments are scouring the planet for potential mines or expanding existing ones, from the deserts of Chile to the rain forests of Indonesia. Meanwhile, what might be the richest source of all—the ocean floor—remains untapped. The US Geological Survey estimates that 21 billion tons of polymetallic nodules lie in a single region of the Pacific, containing more of some metals (such as nickel and cobalt) than can be found in all the world's dryland deposits.

"Here's one of them," Barron said when we met recently in the lobby of a chic Toronto hotel, as he casually pulled one of these geologic oddities out of his jacket pocket and handed it to me. Barron is a fit, muscular Australian in his mid-fifties, with swept-back dark hair, a nautical beard, and craggy Kurt Russell-esque looks. His jeans, black boots, and wristloads of leather bracelets lend him a roguish air. He has just flown in from London for a big mining conference. For years, he's been traveling the world to talk up deep-sea mining to investors and government officials. He and other would-be sea miners argue that collecting nodules from the deep will be not only cheaper than traditional mining but also gentler on the

planet. No rain forests uprooted, no Indigenous peoples displaced, no toxic tailings poisoning rivers.

Barron may finally be on the brink of achieving his goal of mega-scale mining on the ocean floor. The Metals Company has tens of millions of dollars in the bank and partnerships with major maritime companies. The *Hidden Gem*'s foray last October marked the first time since the 1970s that any company had successfully trialed a complete system for harvesting nodules.

The main thing holding the company back is international law, which currently forbids deep-ocean mining. That may be about to change, however. Last year, the Metals Company teamed up with the tiny South Pacific island nation of Nauru to trigger an obscure process that could let them bypass the international prohibition and get a license to start full-scale operations as early as July 2024.

That prospect has sparked an outraged backlash. Environmental groups, scientists, and even some corporations in the market for battery metals fear the potential havoc of seabed mining. The oceans provide much of the world's biodiversity, a significant chunk of humanity's food, and the planet's biggest carbon sink. No one knows how such an unprecedented incursion would affect the many life-forms that live in the abyssal depths, the marine life farther up the water column, or the ocean itself. The European Parliament and countries including Germany, Chile, Spain, and several Pacific island nations have joined dozens of organizations in calling for at least a temporary moratorium on deep-sea mining. Several banks have declared they won't loan to ocean-mining ventures. Corporations including BMW, Microsoft, Google, Volvo, and Volkswagen have pledged not to buy deep-sea metals until the environmental impacts are better understood. Even Aquaman is opposed: Jason Momoa narrated a recently released documentary denouncing sea mining.

"This has the potential to transform the oceans, and not for the better," says Diva Amon, a marine scientist who has worked extensively in the main area of the Pacific targeted for mining, including as a contractor for one of the sea-mining companies. "We could stand to lose parts of the planet and species that live there before we know, understand, and value them."

None of that deters Barron. “The biggest challenge to our planet is climate change and biodiversity loss. We don’t have a spare decade to sit around,” he declares. By the end of the *Hidden Gem*’s trial last October, the vehicle had delivered more than 3,000 tons of the stones, mounded up in a glistening black pyramid nearly four stories high. “This,” Barron promised the press, “is just the beginning.”

The Metals Company uses a former oil-drilling vessel, the *Hidden Gem*, to collect polymetallic nodules from the seafloor.

Courtesy of Richard Baron/TMC

The nodules have been growing, in utter blackness and near-total silence, for millions of years. Each one started as [a fragment of something else](#)—a tiny fossil, a scrap of basalt, a shark’s tooth—that drifted down to the plain at the very bottom of the ocean. In the lugubrious unfolding of geologic time, specks of waterborne nickel, copper, cobalt, and manganese slowly accreted onto them. By now, trillions lie half-buried in the sediment carpeting the ocean floor.

One March day in 1873, some of these subaqueous artifacts were dragged for the first time into sunlight. Sailors aboard the HMS *Challenger*, a former British warship retrofitted into a floating research lab, dredged a net along the sea bottom, hauled it up, and dumped the dripping sediment onto the wooden deck. As the expedition’s scientists, in long trousers and shirtsleeves, eagerly sifted through the mud and muck, they noted the many “peculiar black oval bodies” that they soon determined were concretions of valuable minerals. A fascinating discovery, but it would be almost a century before the world began to dream of exploiting these stones.

In 1965, an American geologist published an influential book called *The Mineral Resources of the Sea*, which generously estimated that the nodules contained enough manganese, [cobalt](#), nickel, and other metals to feed the world’s industrial needs for thousands of years. Mining the nodules, he speculated, “could serve to remove one of the historic causes of war between nations, supplies of raw materials for expanding populations. Of course it might produce the opposite effect also, that of fomenting inane squabbles over who owns which areas of the ocean floor.”

In an era when population growth and an embryonic environmental movement were fueling concerns about natural resources, seabed mining suddenly got hot. Throughout the 1970s, governments and private companies rushed to develop ships and rigs to pull up nodules. There was so much hype that in 1972, it seemed completely plausible when billionaire Howard Hughes announced that he was dispatching a custom-built ship into the Pacific to search for nodules. (In fact, the CIA had recruited Hughes to provide cover for the ship's Bond-esque mission: to covertly retrieve a sunken Soviet submarine.) But none of the actual sea miners managed to come up with a system that could do the job at a price that made sense, and the fizz went out of the nascent industry.

By the turn of the 21st century, advancing marine technology made sea mining seem plausible again. With GPS and sophisticated motors, ships could float above precisely chosen points on the seafloor. Remotely operated underwater vehicles grew more capable and dove deeper. The nodules now seemed to be within reach, just at the moment when booming economies such as China's were ravenous for metals.

Barron saw the potential bonanza decades ago. He grew up on a dairy farm, the youngest of five kids. (He now has five of his own.) "I knew I didn't want to be a dairy farmer, but I loved dairy farm life," he says. "I loved driving tractors and harvesters." He left home to go to a regional university and started his first company, a loan-refinancing operation, while still a student. After graduating, he moved to Brisbane "to discover the big, wide world." Over the years, he has been involved in magazine publishing, ad software, and conventional car battery operations in China.

Corals, sponges, and nematodes live on the rocks or shelter beneath them. Other critters float around them, including anemones with 8-foot tentacles.

In 2001, a tennis buddy of Barron's—a geologist, former prospector, and early web-hosting entrepreneur named David Heydon—pitched him on a company he was spinning up, a sea-mining outfit called Nautilus Minerals. Barron was fascinated to learn that the oceans were filled with metals. He put some of his own money into the venture and rounded up other investors.

Nautilus wasn't going after polymetallic nodules, but rather what seemed like an easier target: underwater formations called seafloor massive sulfides, which are rich in copper and other metals. The company struck a deal with the government of Papua New Guinea to mine sulfides off the country's coast. (Under international law, countries can do basically whatever they want within their Economic Exclusion Zones, which extend up to 200 miles from their coastlines.) It sounded good enough to attract half a billion dollars from investors, including Papua New Guinea itself.

But in 2019, after spending some \$460 million, Nautilus went bust. Neither Barron nor Heydon lost any of their own money: Both had sold their shares about a decade earlier, with Barron clearing about \$30 million in profit. Papua New Guinea, where more than half the population lives in poverty, was out \$120 million. "It wasn't my business," Barron tells me. "I was just supporting David, really."

Heydon, meanwhile, was building a company called DeepGreen—rebranded in 2021 as the Metals Company—[this time pursuing polymetallic nodules](#). By then, the growing demand for electric vehicles had added both a new potential market and an extra environmental justification for the project. Barron came on as CEO, and several other Nautilus alums joined up, including Heydon's son Robert. Along with other would-be miners, they started knocking on the door of the International Seabed Authority.

Based in Kingston, Jamaica, the ISA has the contradictory tasks of protecting the ocean floor while organizing its commercial exploitation. Back in the 1980s, most of the world's nations—notably excluding the United States—signed a kind of constitution for the oceans, the United Nations Convention on the Law of the Sea. Among many other things, the document established the International Seabed Authority to represent what are now its 167 member nations. The organization was charged with devising rules to govern the then-nonexistent deep-sea-mining industry. The testudinal pace of subsea geology is rivaled only by that of international bureaucracy, and the ISA has been working to develop those rules ever since. Until regulations are agreed upon, full-scale mining is prohibited. But in the meantime, the agency can grant miners the rights to explore specific areas and reserve them for commercial exploitation. The ISA also declared

that private companies must partner with a member country. Even the tiniest member country will do.

By now, the Seabed Authority has granted permits to 22 companies and governments to explore enormous swaths of the Pacific, Atlantic, and Indian Ocean seabeds. Most are targeting nodules lying roughly 3 miles underwater in the Clarion Clipperton Zone, an expanse of the Pacific between Mexico and Hawaii measuring 1.7 million square miles. Holding the rights to three of the choicest parcels is Gerard Barron and the Metals Company. The company's chief financial officer recently told investors that those expanses could yield metals worth \$31 billion.

Here's what makes all of this urgent. The mining ban has a loophole: the two-year trigger. A section of the treaty known as Paragraph 15 states that if any member country formally notifies the Seabed Authority that it wants to start sea mining in international waters, the organization will have two years to adopt full regulations. If it fails to do so, the treaty says the ISA "shall none the less consider and provisionally approve such plan of work." This text is commonly interpreted to mean mining must be allowed to go ahead, even in the absence of full regulations. "Paragraph 15 was appallingly drafted," says Duncan Currie, a lawyer for the Deep Sea Conservation Coalition, an international umbrella organization of dozens of groups. "Several countries dispute the idea that it means they need to automatically approve a plan of work."

In the summer of 2021, the president of Nauru formally notified the Seabed Authority that the country, along with the Metals Company's wholly owned subsidiary, Nauru Ocean Resources, planned to begin sea mining. The two-year trigger has been pulled. The Metals Company's audacious gambit may have opened the door to deep-sea mining for the first time.

"As an environmentalist," Barron says, he finds the opposition to his plans frustrating. "'Save the oceans' is a really easy slogan to get behind. I'm behind it!" he says. "I want to save the oceans, but I also want to save the planet." It might be true that getting metals from the seafloor is less damaging than getting them from land. But so far, few outside the industry are convinced.

Very little is truly known about the deep ocean. Gathering data hundreds of miles from land and miles below the water's surface is extraordinarily difficult. A single day's work can cost up to \$80,000, and sophisticated tools such as remotely operated vehicles have only recently become available to many scientists. In 2022, 31 marine researchers published a paper that reviewed hundreds of studies on deep-sea mining. The authors also interviewed 20 scientists, industry members, and policy-makers; almost all said the scientific community needed at least five more years "to make evidence-based recommendations" for regulating the industry.

Every phase of the mining process entails serious risks for the world's oceans, which are already [severely stressed](#) by pollution, overfishing, and climate change. Start at the bottom. A massive piece of machinery-tank-treading over the pristine ocean floor, prying loose thousands of nodules from the beds where they have lain for millennia, is inevitably going to cause some damage. Corals, sponges, nematodes, and dozens of other organisms live on the nodules themselves or shelter beneath them. [Other critters](#) float around them, including anemones with 8-foot tentacles, rippling squidworms, glass sponges, and ghostly white Dumbo octopuses. "It's like Dr. Seuss down there," says Amon, the marine scientist. The nodules, Amon believes, are a critical part of the ecosystem that supports [all those creatures](#). And since they formed over millions of years, any harm that results from removing them "is in effect irreversible." Some scientists are also concerned that the huge amounts of carbon embedded on the ocean floor could be released, potentially interfering with the [ocean's ability to sequester carbon](#).

Silt and clay stirred up by the collector vehicles will also rise up into the water, creating plumes of sediment that could cloud the water for miles, linger for weeks or more, and suffocate creatures farther up the water column. Those plumes might also contain dissolved metals or other toxic substances that could harm aquatic life.

The nodule-collecting machine gets lowered to the ocean floor on a cable that's nearly 3 miles long.

Courtesy of Richard Baron/TMC

Onboard the ship, engineers in a control room monitor the mining robot's progress.

Courtesy of Richard Baron/TMC

Moving upward, the noise and light emitted by the harvester vehicles and riser systems could affect any number of creatures that have evolved to live in silence and darkness. A recent study found that the racket from just one seabed mining operation could echo for hundreds of miles through the water, potentially interfering with aquatic organisms' ability to navigate and find food and mates.

Once the nodules have been carried up to a ship, the silt-infused water that accompanied them will have to be dumped back into the sea, creating another potentially dangerous sediment plume. "We are talking about massive volumes. Fifty thousand cubic meters a day," says Jeff Drazen, an ocean scientist at the University of Hawaii who has also worked extensively in the Clarion Clipperton Zone, including on a research mission funded by the Metals Company. "That's like a freight train of muddy seawater every day."

A 2022 report from the United Nations Environment Programme sums up the grim picture. Bottom line, according to the authors: "Current scientific consensus suggests that deep-sea mining will be highly damaging to ocean ecosystems." More than 700 marine science and policy experts have signed a petition calling for a "pause" on sea mining until more research has been conducted.

Barron insists that his company is committed to getting the science right and points out that it has funded 18 research expeditions (to fulfill the requirements of the Seabed Authority). "Last year I spent \$50 million on ocean science," he tells me. "I don't see anyone else doing that."

By now, he argues, we know enough. "The lack of full scientific knowledge should not be used as an excuse not to proceed when the known impacts of the alternative—land-based mining—are there for us all to see," he says. It is a "certainty," he says, that sea mining will be less destructive. Whoever authored the Metals Company's own registration filing with the US

Securities and Exchange Commission wasn't so categorical. That document notes that nodule collection in the Clarion Clipperton Zone is "certain to disturb wildlife" and "may impact ecosystem function" to an unpredictable extent. The filing adds that it may "not be possible to definitively say" whether nodule collection will do more or less harm to global biodiversity than land-based mining.

When the vehicle was just 50 feet from the surface, the umbilical snapped. The 35-ton machine went spiraling down to the bottom of the Pacific.

The Metals Company's critics say the company basically isn't interested in what the science shows. One environmental scientist quit a contract job with the company, complaining in a since-deleted LinkedIn post in 2020 that "the company has minimal respect for science, marine conservation, or society in general ... Don't let them fool you. Money is the game. It's business in their eyes, not people or the planet." (Barron says this person is just a disgruntled ex-employee and that his charges aren't true. My efforts to contact the scientist were unsuccessful.)

The metals company is the only deep-sea mining outfit that is not backed by a major corporation or national government. It's a startup, wholly dependent at this point on fickle investor capital. That could certainly help explain why Barron seems to be in a hurry to start mining. When I ask him why the company triggered the two-year rule, he interrupts to clarify: "Well, Nauru did. We didn't. Nauru did."

You'd have a hard time finding a more extreme example of despoliation of a tropical paradise, of a fall from Eden, than Nauru. When the first European ship came across this 8-square-mile island in the South Pacific, in 1798, the captain was so charmed by the locals' friendly welcome, the fair weather, and the lovely beaches that he dubbed it Pleasant Island. But once an Australian geologist discovered that the spot was loaded with high-grade phosphate, much in demand as fertilizer, the outside world rushed in. Over the course of the 20th century, the nation of 12,000 people was strip-mined to the brink of oblivion. Its once-lush interior was reduced to what *The Guardian* described as a "moonscape of jagged limestone pinnacles unfit for agriculture or even building." As the phosphate began running low in the 1990s, Nauru tried to set itself up as a no-questions-asked offshore

banking haven, but so much ill-gotten cash poured in that Nauru was forced to tighten its regulations. The island's next moneymaker was to rent some of its territory to Australia to use as an immigrant detention center. Detainees there have rioted, staged hunger strikes, and sewn their lips shut.

Given all that, it's easy to see the economic appeal of teaming up with the Metals Company—especially since the mining zone is nowhere near Nauru. "Our people, land, and resources were exploited to fuel the industrial revolution elsewhere, and we are now expected to bear the brunt of the destructive consequences of that industrial revolution," including sea-level rise, wrote Margo Deiye, Nauru's representative to the UN, in a December newspaper op-ed explaining why her country is supporting sea mining. "We're not sitting back, waiting for the rich world to fix what they created."

Barron, who has never set foot on the island, insists that the relationship is a respectful partnership, not a modern version of colonial exploitation. "It's horrible what happened to Nauru," he says. "They were absolutely fucked over by the Germans, the English, the Australians, and the Kiwis." The Metals Company says it has doled out more than \$200,000 to support community programs of various sorts in Nauru, Kiribati, and Tonga, the two other island nations with which it has business arrangements. "The real contribution," he adds, "will be when we start paying royalties"—the partner nations' yet-to-be-decided percentage of mining revenues.

The Metals Company's own finances, however, are a bit shaky. Barron took the company public in September 2021, a few months after the two-year rule was triggered, claiming it had commitments of \$300 million from investors. Its stock topped \$12 per share a few days after it hit the market. But two key investors never delivered, leaving Barron and his team with only a third of their expected capital. The stock price plummeted and has remained stuck at around \$1 for months. The company is suing the faithless investors and is being sued itself by other investors who claim they were misled. Meanwhile, it has burned through \$300 million. A substantial chunk of that cash wound up in Barron's pocket. He is paid nearly a million dollars each year in salary and bonuses. His partner, Erika Ilves, a former executive at a company aiming to mine water on the moon whom Barron

brought on as chief strategy officer, is also paid handsomely. The pair were given stock options valued at nearly \$19 million in 2021 alone.

Bloomberg reporters and some environmental organizations have suggested that the company holds unfair leverage over its partner nations, and critics have drawn attention to the seemingly cozy ties between the Metals Company and the International Seabed Authority—in particular its secretary general, Michael Lodge. A recent *New York Times* investigation alleged that the ISA gave the company's executives access to data indicating where the most valuable seabed tracts were located, then helped it secure the rights to those areas. Both the agency and the company say that all their dealings have been legal and appropriate. (Lodge also made his stance on environmentalists pretty clear, telling the *Times*: “Everybody in Brooklyn can say, ‘I don’t want to harm the ocean.’ But they sure want their Teslas.”)

Between Barron’s outspokenness and his company’s legal and financial pyrotechnics, the Metals Company has drawn most of the media coverage around sea mining. “TMC is very bold, but the other companies are piggybacking on them,” says Jessica Battle, who heads the World Wildlife Fund’s campaign against sea mining. “Once one mining license is given, others will follow.” There’s an eager lineup. Belgian maritime giant Deme, high-tech hardware colossus Lockheed Martin, ship-builder Keppel Offshore & Marine, and the governments of South Korea, India, Japan, Russia, and China have launched dozens of research expeditions in recent years. China has two outfits licensed to explore for polymetallic nodules in the Pacific.

Deme’s sea-mining subsidiary, Global Sea Mineral Resources, may be best positioned to take the lead if the Metals Company stumbles. “They’ve got the backing of a multibillion-dollar company and access to European resources for design,” says Currie, the environmental lawyer. “They can wait 10 or 15 years and it wouldn’t be the end of the world for them. Whereas with the Metals Company, look at their stock price. If their license isn’t approved, it’s hard to see how they survive.” Global Sea Mineral Resources has also been running extensive tests in the Pacific—and learning its own lessons in how badly things can go wrong.

a frantic knocking on the metal door of his cabin jolted Kris De Bruyne awake. It was early in the morning of April 25, 2021, and De Bruyne, a Belgian engineer with Global Sea Mineral Resources, was aboard an industrial ship far out in the Pacific. De Bruyne was helming a team of researchers testing the Patania II, a bright green prototype nodule collector similar to the one deployed by the Metals Company. Now one of his team was shouting through the door: “Something really bad happened. The umbilical disconnected!”

It was, indeed, *really* bad. The umbilical is a Kevlar-jacketed cable stuffed with fiber-optic and copper wires. Nearly 3 miles long and as thick as a person’s arm, it was the only thing tethering the Patania to the ship.

“Is it going down?” De Bruyne called back.

“Yes!”

De Bruyne scrambled into his red coveralls and ran up on deck. The crew had been hauling up the vehicle after a test drive. When it was just 50 feet from the surface, the umbilical snapped. The 35-ton vehicle went spiraling back down to the bottom of the Pacific. De Bruyne stared helplessly over the side.

Luckily, the Patania landed with its locator system intact, sending acoustic pings up to the ship. It took a couple of days, but crew members eventually maneuvered down a small submersible robot equipped with three-fingered Doctor Octopus tentacles to reattach the repaired umbilical. “It was relatively easy. Well, I say it was very easy, but it was also like ‘AAAAAHHH!’ and ‘NOOOO!’” De Bruyne recounted when I met him at Deme’s headquarters near Antwerp, Belgium. “It was an emotional roller coaster.”

When they hauled the Patania up, they found it almost completely undamaged. To De Bruyne, the snapped cable was just one of the “teething problems” that typically come with launching such a complex piece of equipment. Earlier in the expedition, he’d also had to contend with Greenpeace activists who had painted “RISK!” on his ship in huge yellow letters.

De Bruyne is fit, clean-shaven, and small in stature, with a fanboy's enthusiasm for his job. He's acutely conscious of the criticism directed at his industry, and he seems to take it personally. De Bruyne's parents were traveling veterinarians, and they raised him and his brother in Rwanda and Vietnam. "I grew up in nature. I'm not the nature destroyer they want me to be," he says. "The nongovernmental organizations and the environmentalists, they forget that we also have our stories and that we want to do something good for the world as well."

The Patania mission, he points out, was accompanied by a separate boatload of independent marine scientists who monitored the machine's impact on the ocean (as was the Metals Company's foray). Still, the more we talked, the more qualms he confesses. "Once in a while, I'll ask myself, am I still doing the right thing?" he says. "I still think we're doing the right thing, because we're still doing research." He says he's not even convinced deep-sea mining should go ahead. "We need to know what the impact would be of deep-sea mining, and I'm contributing to getting answers to that question. That's how I feel about it."

Global Sea Mineral Resources has already sunk at least \$100 million into developing its subsea mining system, and it recently announced a partnership with Transocean, a major offshore oil-drilling outfit. The sea-mining company is now designing the much larger Patania III—the first of what the company hopes will be a fleet of full-scale mining robots that will hit the ocean floor around 2028.

The five years between now and then might be enough to develop the scientific understanding needed to craft regulations to safely mine the seafloor—or to determine whether it should be done at all. Or it might be time for alternatives, such as reducing private car ownership or recycling metals, to gain enough traction to make seabed mining superfluous. But frankly, none of these possibilities seem likely.

Gerard Barron is not planning to wait. "Got the boat, got the machine, announced the partnerships on how we're going to process the nodules," he says confidently. Assuming the Metals Company gets the go-ahead from the Seabed Authority, he says, everything is on track to start harvesting nodules

by late 2024. The company's goal for its first year is 1.3 million tons, scaling up to 10 times that amount in the next decade.

The two-year deadline expires this summer. After Nauru put the Seabed Authority on notice, the agency hurriedly convened several meetings, but results have been scant. The pressure seems to be generating something of a backlash. At the authority's most recent meetings last November, several member states called for a "precautionary pause" on seabed mining, echoing the moratorium petition. According to Bloomberg, France's representative declared that his country did not consider itself obligated to approve mining until it was satisfied with the regulations, and several other countries indicated they felt similarly. The UK, India, and Japan, however, want to try to hit the 2023 deadline. Some activists are even calling for the Seabed Authority to be overhauled or replaced.

"The general feeling is, there's a lot of work to do and a lot of complex issues to be addressed. So when some country says, 'Just gimme a contract, I'm gonna get on with it,' it rankles enormously," says Currie, who attended the most recent round of Seabed Authority meetings. There's a widespread feeling that it is too soon to be giving out permission to start mining, he says, but it's not clear how the organization might stop that from happening. "No one," says Currie, "is sure how this will play out."

Update 4-12-2023 2:45 PM ET: This story was updated to clarify Barron's compensation.

This story was supported by the Pulitzer Center on Crisis Reporting.

This article appears in the April 2023 issue. [Subscribe now.](#)

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Feb 23, 2023 6:00 AM

The Battle for the Soul of Buy Nothing

How an idealistic community for exchanging free stuff tried to break away from Facebook, and ended up breaking apart.

Photograph: Holly Andres

When my son was little, my mom started collecting his outgrown clothes to give to strangers on the internet. She would meet these people through Buy Nothing, a project that had been created by two women from Bainbridge Island, Washington, not far from her home in [Seattle](#). The mission of Buy Nothing, which had a local cult following, was to revive old-fashioned sharing among neighbors. People were organized by town or neighborhood into [Facebook](#) groups, where they could post what they needed, or no longer needed, and their neighbors would respond accordingly.

What made this different from Goodwill, [Craigslist](#), or other freebie groups was that the people in your group always lived close by, and—because Buy Nothing was hosted on Facebook—everyone's names and photos were visible, and messaging other members was as easy as texting. Pickups tended to happen at the front door, prompting face-to-face conversation. After a while, strangers became friendly acquaintances, their stoops integrated into your mental map of your town. Through my mom, random people came to own the forgotten detritus of my motherhood: unused diapers, a nursing cover (“that you threw in bathroom trash,” my mom accused in an email). My mom had been living frugally and sustainably long before it was fashionable—diluting her dish soap, cutting her sponges into quarters—and on Buy Nothing, she'd found her people.

When my son was 6, my mom retired. She packed her life into used cardboard boxes procured on Buy Nothing and moved down the street from me in Fort Collins, Colorado, where she joined a new Buy Nothing group. With her freed-up time, she acquired empty kombucha bottles on Buy Nothing, filled them with home-brewed kombucha, then regifted those. I used the group by proxy—once, to get rid of a box of half-full toiletries, another time to find a clip-on leopard tail for my son’s summer theater production—and eventually joined it myself.

Our group, one of several in Fort Collins, included more than 1,000 members. Buy Nothing had grown a lot in the years since my mom had been an early adopter, especially during the worst of the pandemic, when people were avoiding stores. By summer 2022, there were thousands of groups in more than 60 countries, with about 6 million members. The founders, Liesl Clark and Rebecca Rockefeller, had published a book about buying less in which they described a grand vision of strengthening individuals, communities, and the environment. People told apocryphal stories about diehards who never bought anything, like, ever.

Facebook was a big part of what made Buy Nothing so effective. But it was also the reason I was far less active there than my mom. Like a lot of people I knew, I’d fallen off using Facebook much. Given Buy Nothing’s mission of commerce-free community building, there seemed something dissonant to me about its existence on a platform that mined people’s personal information and stoked invidious “engagement” for ad dollars.

It turned out that Clark and Rockefeller, the Buy Nothing founders, also considered Facebook an uncomfortable fit. When I talked to them both on a Zoom call last summer, Rockefeller, 53, was on her parents’ porch in glasses, a delicate blouse, and a shaggy silverish bob, while Clark, 56, sat at her dining table wearing a ponytail and a fuzzy cardigan. “We used Facebook because it was a free tool, and it had a lot of reach. There were a lot of reasons that we picked it,” Rockefeller explained. “But we realized very early on that it also came with some things that conflicted with our mission.”

Rebecca Rockefeller and Liesl Clark founded Buy Nothing in 2013.

Photograph: Holly Andres

She and Clark had a wearied, beleaguered air. A year earlier they had decided to move Buy Nothing away from Facebook, turning their attention to launching a stand-alone Buy Nothing app. This kind of undertaking was, of course, one of those many things in life that do not come free. They registered a business, The Buy Nothing Project Inc., and pitched venture capitalists on investing in them. Clark had taken to punctuating her tweets with hashtags such as #futureofwork and #MakerEconomy.

So far, though, Buy Nothing Inc. was a flop. Even more upsetting, Clark and Rockefeller were getting blasted from within their own community. Some Buy Nothing members accused them, in blistering Facebook comments, of selling out. This reaction might have been expected, in retrospect, from a commerce-free collective, but the intensity of it shook Rockefeller and Clark. They had built a thriving and generous community on the most corporate of internet platforms. But now that they were trying to become independent—a move that they saw as committing further to their principles—they were met with furious disbelief that the founders of a movement premised on strings-free gifting now appeared to be trying to make a buck. “You have to fund it. There’s no shame in that,” Clark said. “But we are shamed nonstop for having named it the Buy Nothing Project.”

Buy Nothing’s much-repeated origin tale starts with Clark, a documentarian from Bainbridge Island, spending time in a remote mountain community in Nepal with her husband, the elite [mountaineer](#) Pete Athans. There she noticed that people reused their belongings and shared, rather than bought, what they needed. Back home, Clark and Rockefeller, a friend, would often take walks with their children along the water and inventory the trash that had washed ashore. They wondered whether they could reduce waste by bringing the sort of gifting Clark had seen in Nepal into their own town, and Buy Nothing was born.

None of this is exactly inaccurate. Clark is a filmmaker; she did observe gift economies in Nepal; she and Rockefeller did audit the Bainbridge shoreline. But the full story of Buy Nothing starts when they met, in 2009, through an online gifting forum called Freecycle.

This article appears in the April 2023 issue. [Subscribe to WIRED](#). Photograph: Andria Lo

Earlier that year, Rockefeller had gotten divorced and ended up as a single mother. While married she had been working-class, but suddenly she was poor, living on food stamps and Medicaid. She joined Freecycle expecting to take things she needed while simultaneously giving back. She kept getting in trouble with the group's local moderator, though, for offerings that he deemed unacceptable. "I had these twigs that I'd pruned," she told me. "The guy was like, 'Your old shrubbery is not a gift.'"

He was wrong. The twigs did attract interest—from Clark, it turned out. When she came by to pick them up, the women commiserated over Freecycle's strict rules and found they had a lot in common.

Both women had unconventional lives. Clark's academic parents raised their kids partly in Nigeria and Chile and spent their spare time on DIY projects. At one point they bought land in New Hampshire, and the whole family built a house on it by hand. Later, her work as a documentarian took her all over the world, with her children often tagging along. When Rockefeller was 3 years old, meanwhile, her mother joined a cult and left the family. Rockefeller's father remarried, and he and Rockefeller's adoptive mother, both government workers, instilled the family with a strong ethic of public service. As she grew up, an iconoclastic streak kept Rockefeller from settling into one particular career; she worked as a kayak guide and a craftsperson, among other gigs.

Both women homeschooled their children—for Clark, to accommodate work and volunteerism, and for Rockefeller, to provide a more personalized education for her daughter, who is on the autism spectrum—and they started getting together for school projects. They found they shared a mutual devotion to environmentalism and frugal living. Whenever they saw each other, they'd come up with ideas for idealistic ventures: a local bartering club, a lending library for household tools. None ever took off.

In July 2013, Rockefeller posted on Facebook, "If I started a local free/trade/borrow listserve, like Freecycle but with a different attitude re: moderation of posts, would you join?" There was a chorus of positive

responses—yes!, yup!, prolly. Clark jumped in: “But how can each member post? Do you submit to a moderator who then posts your item for you? Do you have to have a photo?” Rockefeller replied, and in the thread—then later, in person—the women hashed out the details.

The initial premise was to make people feel good about whatever they had to offer. “Literally, we want people to come in and offer their onion skins and their chunks of concrete,” Rockefeller told me. And unlike Freecycle, which focuses on giving and dissuades requests, they would encourage people to ask for anything. But maybe more consequential than any of those differences in sensibility was that Rockefeller and Clark decided to host Buy Nothing on Facebook, with its built-in social tools.

On July 6, Rockefeller created a Facebook group called Buy Nothing Bainbridge and added Clark as a co-administrator. By the end of the day it had more than 100 members. Within weeks the group had added hundreds more members, and strangers in nearby towns were asking how they could start their own. Rockefeller and Clark helped them, and by the end of December they had created 78 Buy Nothing groups, with more than 12,000 members in all.

Recent offers have included a used stick of upmarket deodorant, a half-eaten artichoke pizza, and the fluff from inside a couch.

The day before New Year’s Eve, Clark, Rockefeller, and a group of friends and Buy Nothing members got together to plan for the future. They had tea and muffins, then did an exercise. On multicolored index cards, they each wrote down their wildest dreams for Buy Nothing. One woman hoped that it would become a nonprofit and publish a magazine; another imagined it would spawn a virtual [currency](#).

The group made a list of Buy Nothing’s positives (*dedicated admins, free, connects virtual world to the real world*) and negatives (*24/7 time commitment, funding, problems managing Facebook*). They wrote down the opportunities ahead, and also the risks. In the latter column they listed the challenge of replicating their original vision across dozens of groups, the limitations of the Facebook platform, the chance of egos getting in the way of the group’s principles, and the possibility of being “unable to fund core

expenses.” Years later, the list would turn out to be prescient. But at that time, almost a decade ago, all the excitement made Rockefeller and Clark feel like anything was possible.

Photograph: Holly Andres

Test the limits of what can be gotten or discarded on Buy Nothing, and you will be confounded. You can proffer a medium-size rock, and someone will want it for their garden. You can post dryer lint, and a neighbor will convert it into hamster bedding. In their book, Rockefeller and Clark write about a childless couple who, after multiple miscarriages, finally gave away their unused baby items. The recipient, collecting this on behalf of a pregnant friend, mentioned that the friend was thinking about putting her child up for adoption. One thing led to another, and soon the couple became the infant’s adoptive parents.

This was a particularly unusual case, but over the months I spent talking to Buy Nothing members, it wasn’t even the wildest anecdote I heard. In my group in Fort Collins, recent offers have included a used stick of upmarket deodorant, a half-eaten artichoke pizza, and the fluff from inside a couch. All found new life. The couch fluff, actually, went to at least three people—one of whom, a friend of mine, was sewing tiny stuffed gnomes as Christmas presents.

A woman in Seattle named Katylin (she doesn’t use a last name) told me that Buy Nothing has allowed her to live well in one of the most expensive cities in the world. Katylin describes herself as blue-collar; she’s had various jobs including practicing cosmetology and working at a grocery store. Seattle has gotten wealthier and more economically stratified over the years, but on Buy Nothing, she told me, relations feel equalized.

Katylin has given away chicken droppings (for fertilizer), stale aquarium water (a nutrient-rich plant food), and crushed egg shells (a natural calcium source). She has received a stove, a dishwasher, toys for her children, concert tickets, and a wooden boat, which she rows out onto the lake at night to [stargaze](#). For two years during the pandemic, Katylin told me, she bought almost nothing except food. “I feel great after a day of Buy

Nothing,” she said. “You don’t go to a Walmart, come home, and feel *happy* about your purchases.”

Rockefeller and Clark decided early on that they didn’t want to codify Buy Nothing’s principles into a business or a nonprofit, with all the unwieldy administration that would entail. They did, however, want to supervise how the Buy Nothing groups functioned, so they built a makeshift management structure using the tools already embedded in Facebook. On Facebook, groups have to be operated by one or more administrators, so Rockefeller and Clark decided to have local volunteers run each group. They disseminated information to these people through another Facebook group called the Admin Hub. They appointed regional admins to oversee the local ones, and finally a small circle of about 20 global admins to handle project-wide tasks and weigh in on big decisions. Rockefeller and Clark had the final word.

Almost all of the admins were women, and their labor was entirely volunteer. As Rockefeller and Clark sank their lives into Buy Nothing, sometimes at the expense of their families and careers, so too did thousands of others. Local administrators said they spent seven or eight hours a week, and in some cases as many as 40, reviewing requests to join their groups, making sure their communities felt welcoming, and keeping the giving spirit active by, for example, posting messages of gratitude.

Another part of an admin’s job was to enforce the 10 rules of Buy Nothing. One core rule concerned each group’s borders, which were limited to small geographical zones. The idea was that this would foster a more intimate community and reduce a group’s carbon footprint. A member could belong to only the group where they lived, and once a group reached 1,000 people, it was supposed to split into smaller communities, a process called “sprouting.”

Rockefeller and Clark imagined Buy Nothing sprouting into groups covering ever-smaller geographies until, eventually, so many people were on Buy Nothing that it would be rendered obsolete. “We know our immediate neighbors so well that we can just walk over there and say, ‘Hey,’” Clark said.

It was a romantic vision for what the internet could facilitate. But as Buy Nothing expanded, people started to chafe against this stricture and others. While Rockefeller and Clark regularly received notes of gratitude, they also got messages of irritation, and even hate mail, that blamed them for mishaps and infighting in the local groups or accused them of heavy-handedness with all the rules.

In 2018, some of these localized complaints started to bubble up to the movement's surface. When a Buy Nothing group in Boston's Jamaica Plain neighborhood was approaching 5,000 people and still hadn't subdivided, regional admins started pushing for a sprout, a local admin at the time told me. (Regional admins couldn't be reached for comment.) She said that when the sprout was announced to the group, members were furious: They protested that they didn't want to split up, and they worried a sprout might fall along racial and socioeconomic lines and reinforce the legacy of segregation and redlining.

According to the admin and other members I spoke to, the regional admins doubled down, as did members, and the language got heated. "Our community gets really fired up on the internet," the admin said. "It was rocky." Then Clark got involved, writing in a regional group for admins that she was "saddened" by the Jamaica Plain community's uncivil behavior. At this, the local admins quit in protest, and the remaining members revolted completely.

Members of the group discovered a YouTube video Clark had filmed during a Himalayan expedition co-led by Athans, her husband, with support from the Nepalese government. The video shows Athans in climbing gear, handling an ancient human skull while suspended in front of a cave. In voiceover, Clark explains reverently, "We've uncovered a people who persevered, their story of good health recorded in their bones." She describes present-day villagers who, when Clark and her family brought gifts of clothing, insisted that the items be divided equally among the households, "so each family would have equal social capital to share." She goes on: "We wondered, could we start an egalitarian gift economy in our own town?" The video cuts to Bainbridge Island.

Former members told me that the video was roasted for having colonialist undertones. One member, Kai Haskins, wrote a Medium post about the conflict titled, “That ‘Hyper-Local’ Buy Nothing Group You Love Is Controlled by a Wealthy White Woman in Washington State and Is Reinforcing Systemic Racism and Segregation.”

Clark took issue with Haskins’s account; for one thing, she said, she’s not wealthy. Still, she eventually apologized in a post to the Jamaica Plain group. “I agree that it is important for all of us, and white people in particular, to talk about racism without becoming defensive. I clearly have been, and I’m learning from my own fragility,” she wrote. By that time, though, everyone was fed up. The Jamaica Plain group fell apart, with thousands of members defecting and starting a separate group.

One way to approach the episode might have been to see it as an inevitable, if uncomfortable, outgrowth of a movement that encouraged people to feel communal ownership of their local gift economies. If it ended with members in Jamaica Plain starting a rival gifting group, so what? That was not, however, how Rockefeller and Clark responded. They worried that the upset in Jamaica Plain, and other episodes like it, represented a bigger problem, and in late 2019 they formed an “equity team” to figure out how to create an “actively anti-racist and anti-oppression culture” within Buy Nothing.

“I feel great after a day of Buy Nothing. You don’t go to a Walmart, come home, and feel *happy* about your purchases.”

Katherine Valenzuela Parsons, a member of the equity team, told me that the team discovered people in other groups had also experienced a racialized dimension to sprouting. And Buy Nothing’s problems went further still. Some local admins were letting people offer Confederate flags. In several instances, when people of color complained about this and other racist or offensive posts, they’d been accused of incivility and thrown out of their groups. In other cases, members attacked admins of color for raising these issues.

Rockefeller and Clark had known about some of this, but the scope startled them. On the one hand, the Jamaica Plain experience had made them feel

that high-level admins, themselves included, might have overstepped. On the other hand, they didn't want the Buy Nothing experience to be so unsupervised that toxicity and racism would go unchecked and local admins would abuse their power.

They also felt that Facebook incentivized provocative, even hostile, communication. "Even if your motivations are purely lovely and welcoming and inclusive, you're basically putting yourself in the meat grinder of social media, and you will be eaten up," Rockefeller said. The equity team hadn't highlighted Facebook itself as a problem, but Rockefeller and Clark started to wonder whether it all couldn't be solved by going off the platform entirely.

The two of them had harbored vague desires since the beginning of Buy Nothing to divest themselves of Facebook, but they had never figured out how to do it. One option was to turn Buy Nothing into an independent nonprofit. But Rockefeller, who has spent much of her adult life volunteering and working in nonprofits, dreaded the cycle of fundraising and subsequent obligation to meet funders' demands. It also seemed weird to start a business based on giving stuff away for free. Now, they came up with a plan. They'd collect donations from Buy Nothing members to build a platform independent of Big Tech. On Black Friday of 2019—celebrated in their community as Buy Nothing Day—Rockefeller and Clark posted an announcement on Buy Nothing's main Facebook page: They were building an app called SOOP, for Share On Our Platform. "Because we want to answer only to the public good and not to platform owners who will profit from the use of personal data," they wrote, "we are raising the funds to do this on our own."

The response was mixed at best. Some community members found it wildly hypocritical that the founders were asking for money. It was a fair point: Rockefeller and Clark's own rules for local groups banned "requests or offers for monetary assistance, including requests for loans, cash, or donations." Optics-wise, it didn't help that Rockefeller and Clark had started plugging their forthcoming book, *The Buy Nothing, Get Everything Plan*, on Buy Nothing's Facebook page. A few members did donate, but the total—just \$20,000—wasn't enough for even the most basic proof of

concept. Humbled, Rockefeller and Clark returned the money and tabled the idea.

Their book came out a few months later. The tone was part [Marie Kondo](#), part manifesto. “Money isn’t all that wonderful,” Clark and Rockefeller wrote, adding, “The market economy begets isolation, and money disconnects us from one another.” Those who worried that the book would make the authors rich needn’t have wasted their energy—it was published just as the pandemic arrived, and barely sold.

The pandemic propelled Buy Nothing into mainstream popularity. With people hunkering down in their neighborhoods, membership started growing faster than ever, to about 1.5 million users in July 2020; over the following year, the project would add nearly 3 million more. People shared groceries, homemade masks, over-the-counter medication. It was exhilarating but also, for Rockefeller and Clark, exhausting; suddenly they were working nine-hour days on top of everything else.

Meanwhile, they’d been changing Buy Nothing’s operations, partly in light of the equity team’s findings. They started getting rid of regional and global admins, a move meant to return control to local groups and streamline communication. They published self-serve materials on their website so that people could launch new groups on their own. They also loosened Buy Nothing’s rules to let groups determine their own geographical boundaries, decide when to sprout, and allow members to belong to more than one group.

Not everyone appreciated the changes. Haskins, one of Buy Nothing’s more vocal critics in Jamaica Plain, said they came across as “performative bullshit.” Parsons, the equity team member, told me that while she came around to them, they went much further than anything she and the equity team had suggested.

Other admins felt the founders had broken Buy Nothing’s intimate feel and community-led support systems. And they objected to the top-down direction of these changes. One of them, Andrea Schwalb, took to the Admin Hub to denounce the project’s new direction, and said she was kicked out. She started a separate Facebook group, called Gifting With

Integrity—OG Buy Nothing Support Group, for Buy Nothing admins who preferred the old organizational structure and rules. Schwalb and others were already prickly about how Rockefeller and Clark publicized their book; all the changes, she said, made matters worse. “We were big mad.”

Photograph: Holly Andres

Clark and Rockefeller saw their modifications as necessary, if controversial, improvements. They were making the organization less bureaucratic and more equitable; those who disagreed were resisting change. And it was hard for them to feel generous toward their most strident critics.

By this point, Clark had stopped making documentaries and was working on Buy Nothing full-time. Rockefeller had, in Buy Nothing’s early years, taken a job at an organization that assists people with disabilities and eventually became its executive director. As Buy Nothing took up more of her time, however, she stepped into a part-time position as an administrative assistant that paid little more than minimum wage. “I’m basically living on the edge of poverty so that I can serve this thing that I helped create,” she told me. She acknowledged she’d done this by choice. Still, she added, “Sometimes it feels like, ‘Oh, this is absolute insanity, it makes no sense.’” She and Clark started dreaming of paying themselves and others for their Buy Nothing labor; it seemed only right. Their crowdfunding efforts had backfired. Now they wondered whether it wasn’t such a bad idea to turn Buy Nothing more straightforwardly into a business.

In January 2021, Clark received a LinkedIn message from Tunji Williams, a former attorney turned entrepreneur who had previously built a small startup. “I just learned about your amazing movement,” he wrote, and offered to collaborate with them. They invited him to meet over Zoom, where Williams explained that the birth of his first child had inspired an idea for an app to share secondhand baby paraphernalia and other items. Friends told him about Buy Nothing, and he thought he’d approach them about launching a startup together.

Clark and Rockefeller accepted. Going into business with someone who happened to email at the right moment may not have been the savviest

decision, but the way they saw it, their cards were finally lining up. Williams came across as genuine and experienced, and, if they were being honest, they needed help. On January 13, they registered The Buy Nothing Project Inc. as a benefit corporation—a for-profit business obligated to prioritize society, workers, the community, and the environment—in Delaware. This time they took a more conventional approach to fundraising, collecting \$100,000 from family and friends. The company had four cofounders: Clark, Rockefeller, Williams, and a software developer named Lucas Rix who, as it happened, had also sent a blind email to Clark and Rockefeller. Clark would be the CEO, Williams the COO, Rockefeller the head of community, and Rix the head of product. For the first time in months, Rockefeller and Clark felt energized. “It was a huge relief,” Rockefeller told me.

Three weeks after registering The Buy Nothing Project Inc., Clark announced in the Admin Hub that they were building an app “to host the Buy Nothing movement as it continues to grow.” The founders would now dedicate their time to this new endeavor. As a gesture of gratitude, she added, they would give a stake in the platform to admins who joined the waitlist for the app. “Your enthusiastic participation will help us reach critical mass more quickly,” she wrote.

The reaction was not particularly enthusiastic. Some people did cheer the founders on and sign up for the waitlist—but others were upset. The app had no admin roles at all. Several admins told me that although they didn’t begrudge Rockefeller and Clark their entrepreneurial turn, they couldn’t help but view the app as competition with the existing communities that they’d painstakingly built over years. “There was a time when I was spending 30 hours a week doing things for Buy Nothing,” Kristi Fisher, an admin in California, told me. “There was this feeling of, like, nobody asked us or took our thoughts and feelings into consideration.”

Others turned their ire directly on the founders, harshly criticizing them for capitalizing on the work of thousands of volunteers and then shilling their product in that very same space. Rockefeller and Clark felt personally attacked. As they pushed on with what they saw as an attempt to give the

Buy Nothing community a healthier existence online, it seemed possible that in the process they might lose the community entirely.

In November 2021, the Buy Nothing app launched. It was immediately clear how different it was from the Facebook groups. You didn't have to be approved for admission, for one. You could set any address as your home base and search for items within a larger radius: maybe one mile away, maybe 20.

But some core features of the Buy Nothing culture had been lost. You could no longer click on a person and see where they worked or whether you had friends in common. On Facebook, Buy Nothing posts had appeared in your feed spontaneously, encouraging off-the-cuff interactions, but using the app required remembering to open it in the first place. All this added up to making the posts feel less intimate and more transactional. Some people told me that, on the app, Buy Nothing resembled the depersonalized services against which it had originally defined itself.

The two of them had harbored vague desires since the beginning of Buy Nothing to divest themselves of Facebook.

The launch of the app intensified the feud between the Buy Nothing founders and their internal critics. Rockefeller and Clark almost fully reoriented the Buy Nothing website around the app; at one point, information about the Facebook groups was tucked under a snarky message: "Want Facebook to profit from your Buy Nothing experience? We've got you covered!" Schwalb, meanwhile, developed her OG group into a sort of alternate universe in which nothing about Buy Nothing had changed. She shared Buy Nothing documents that the founders considered obsolete, coached admins on how to operate under the old rules, and, through friends who still belonged to the Admin Hub, generally kept tabs on what Buy Nothing was up to.

In the weeks after launch, thousands of people tried out the app. By the end of the year, 174,000 people worldwide had downloaded it; of those, about 97,000 were using it once a month or more. As time passed, though, the numbers stalled. In the App Store, one-star ratings dominated. By April 2022, monthly users had fallen to 75,000.

The discontent among Buy Nothing Facebook admins explained some of this; they were hardly going to evangelize for an app they resented. But the far more significant problem was that the app just wasn't very good. It was so basic and bug-ridden that, at first, people couldn't even figure out how to register. To limit expenses, Clark and Rockefeller had contracted a web-development shop in Poland to make a simple version. They eventually raised another \$400,000, but that was still short of what they needed.

The truth was that turning Buy Nothing into a business had come with far more expenses than revenues. If Facebook profited from Buy Nothing members' activities, it also covered many of their costs. With the launch of the app, the resources that came for free with Facebook—software development, computing power, visibility—were suddenly Clark and Rockefeller's responsibility.

It was logical that offsetting those costs, and eventually turning a profit, required bringing in revenue, but whenever I asked Clark and Rockefeller about this, they sounded genuinely perplexed. They had vowed not to sell their members' personal data or run targeted advertisements, thus ruling out some of the most obvious business models. And their ideas for moneymaking enterprises that wouldn't sacrifice their ideals struck me as convoluted: They considered collecting generalized information about what items people were sharing, then selling that to local municipalities tracking waste; they thought of pushing public-service announcements about reuse that users would pay to turn off. Their most straightforward idea was to incorporate a [Taskrabbit](#)-like function, allowing users to charge one another for add-on services such as delivering gifts or repairing broken items, with Buy Nothing taking a cut. But then that, of course, would involve buying something.

They were at an impasse, and funding was running out. So, in May of last year, Clark did what any self-respecting entrepreneur in her position would do: She started writing to venture capitalists and angel investors. In the months that followed, she sent messages to 163 investors. She got 17 meetings—and no funding.

Clark blamed the difficult environment at the time for fundraising. Rockefeller agreed, though she couldn't help but suspect something else:

“We’re two middle-aged women trying to raise money, and we have been a women-led movement from the beginning. They look at us, and they’re like, ‘Well, you haven’t run a multimillion-dollar company, so why should I give you any money?’” She bristled at that perception: “We took nothing, and we turned it into a movement that now literally millions of people participate in every day. Come on. That didn’t happen by mistake.”

Still, no funding materialized. Nor, as time went on, did the users. I spoke to dozens of Buy Nothing members while reporting on this article, and the vast majority had either barely heard of the app or had tried it once or twice before abandoning it. By June of last year, Rockefeller and Clark quietly stopped developing the app. By winter, they were scraping the bottom of the Buy Nothing bank account.

Clark planned to cover the company’s costs, around \$5,000 a month, as long as she needed to. But she and Rockefeller both sounded more disheartened than ever. Once, as we began a Zoom call, I could hear an incessant pinging in the background. Clark explained that she had set up notifications for support requests through the app. It turned out she and Rockefeller were mostly responding to the requests themselves.

Photograph: Holly Andres

At the one-year anniversary of its launch, the Buy Nothing app had been downloaded 600,000 times, but only 91,000 people were regularly using it, not many more than at the beginning. Meanwhile, the Facebook groups from which the founders had disengaged were thriving without them. Global membership had surpassed 7 million. When I asked what Rockefeller and Clark thought would happen to Buy Nothing Inc. if they couldn’t come up with additional funding, they said they weren’t interested in thinking in such fatalistic terms. But when I posed the same question to Williams, the COO, he said he’d considered it. “We’re adults,” he said. “We’ve got to shut it down.”

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Rockefeller and Clark hadn't given up, though. They decided to switch tactics yet again. Over Thanksgiving weekend, they changed the Buy Nothing website so that when someone showed up looking for information about starting a Facebook group, they were directed to fill out a form that would automatically be sent to Rockefeller and Clark. The form asked people whether they had tried the app, offering a download link. If, after trying it, they still wanted to start a Facebook group, Rockefeller or Clark would build the group for them.

Rockefeller and Clark may have realized that if they couldn't compete with Facebook, they would do better to take control of what they'd started. A couple of days after Christmas, Schwalb opened up Facebook to find that her OG group had vanished. Months earlier, Buy Nothing Inc. had secured trademarks on the phrases "Buy Nothing" and "Buy Nothing Project" and reported the OG group to Facebook for trademark infringement.

Clark and Rockefeller told me that while they wanted to give local admins flexibility in running their groups, Gifting With Integrity had crossed a line. The group was aggressively promoting an approach that the founders had discarded; it had combined the Buy Nothing brand with the Gifting With Integrity name; it was disseminating old documents without what the founders considered proper attribution. "I don't get to say 'I'm making shoes, and they're called [Nike](#), and they have the swoosh on them, and you should buy my Nikes,'" Rockefeller told me. To Schwalb and her co-admins, this was a stretch. For one thing, Gifting With Integrity wasn't asking people to buy anything.

In January, Rockefeller and Clark posted a message to the Admin Hub, elaborating on their stance. They were just trying to protect their trademark, they said. To that end, they were asking that all Facebook groups link to a Buy Nothing web page describing the project. Rockefeller and Clark told me that they required this so that admins wouldn't have to make manual updates whenever details changed. But Schwalb noticed that the web page, conveniently, promoted the Buy Nothing app.

To get back on Facebook without reprisal, the OG group changed its name to, simply, Gifting With Integrity—OG Admin Support Group, removing the part about Buy Nothing. They encouraged local gifting groups to

change their names as well. Their website reads, “We are not affiliated with, nor do we support in any fashion, the Buy Nothing Project.” On Facebook, the Gifting With Integrity group has 1,500 members, all overseeing local groups.

“The Buy Nothing name—that’s a challenge. Because it’s like, OK, nothing is being bought, how are you going to monetize the platform?”

My own Buy Nothing group, in Fort Collins, was one of those that followed Gifting With Integrity’s lead. It’s now called the Northeast Fort Collins Gifting Community. A friend shared with me a message sent to the group by an admin announcing the change: “We truly believe in building our little hyperlocal community and plan to continue to operate by the original principles that make this group great. We don’t want that to disappear into the machinery of the new monetized system.” When I asked Schwalb how many local groups had discarded the Buy Nothing name and adopted Gifting With Integrity’s approach, she replied, “We’re not keeping numbers, and we most definitely don’t intend to, because I don’t want to turn into the Buy Nothing conglomerate.”

In some ways, Rockefeller and Clark’s loss of control made me think of women inventors who hadn’t gotten credit for their products: Rosalind Franklin, the scientist who helped discover the double helix; Lizzie Magie, the gamemaker who invented Monopoly. But then, Rockefeller and Clark had started Buy Nothing as a counteragent to the capitalist ethic that concentrates wealth and power in the hands of the few while ruining lives, communities, and the environment. The project had been a success, owing to their efforts, certainly, and also to those of the thousands of volunteers who made Buy Nothing their own. If the movement ended up splintering into an unaccountable mess of local variations—and Rockefeller and Clark didn’t make a cent in the process—maybe that was the most fitting ending possible.

Photograph: Holly Andres

I had all but written off their chances of survival when, in late January, I heard from Rockefeller and Clark again. Recently, with things getting desperate, Clark had looked back through her email to see whether there

were any connections she'd missed. Scrolling, she hit upon a year-old email from a former Intuit executive named Hugh Molotsi. Molotsi had launched his own startup, Ujama, that helped parents coordinate [childcare](#) with one another via an app, but it didn't have many users. Molotsi had written to see whether Rockefeller and Clark wanted to use his technology, but since they were building their own app at the time, they'd said no.

Now Clark did some research and realized Molotsi's app was much better than anything they'd built. She'd also learned, from her conversion to entrepreneurship, how important it was to network. She got in touch with Molotsi and, after a couple of calls, made a proposition to merge the companies under Buy Nothing's name. Molotsi would join the company as chief technology officer and rework the Buy Nothing app. "He needs community, we need tech," Clark explained.

Molotsi agreed; the deal is pending. As part of the transition, Williams stepped down as COO, though he remains on the Buy Nothing board. Molotsi also introduced Buy Nothing's founders to their first funder in a long time: an angel investor named Paul English, known for cofounding the travel website Kayak. English put in \$100,000 and introduced Clark and Rockefeller to a number of VCs and angel investors. So far, Clark told me, the response to their pitches has been much warmer than before, though no one has committed to investing. Visits to the app are up, too: Monthly users recently surpassed 100,000.

When I spoke to Molotsi over Zoom, he said he feels the company needs to do a better job explaining to investors how it can make money: "The Buy Nothing name—that's a challenge, because it's like, OK, nothing is being bought, how are you going to monetize the platform?"

I asked how that question might be answered. "There are lots of things happening around gift-gifting that I believe are monetizable," he said. "So, for example, if you have a couch you're trying to get rid of, and I want your couch, but you don't have a truck, and I don't have a truck, that presents a problem: How are we going to make this happen?" He was talking, I realized, about the delivery service Rockefeller and Clark had floated months earlier.

One of the last times I spoke to the founders, I remarked that these recent developments looked good for them. Clark responded that she still feels like they're at a low point. Her schedule had become punishing: She'd been waking up between 4 and 5 am to work on Buy Nothing, and not stopping until she went to bed. It struck me as a big departure from the all-volunteer camaraderie of Buy Nothing's early years. But Clark is as certain as ever that she and Rockefeller are on the right path in their decade-long quest to get people to buy less. "Rebecca and I are just two creatives. This was just never where we thought we would head," she said. "But now it makes sense, because we want to build a bigger, better world."

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Feb 15, 2023 8:00 AM

The Future of Weight Loss Looks a Lot Like Its Past

The FDA's new anti-obesity medications, like Ozempic, Wegovy, and Mounjaro, sound like silver bullets. Bariatric surgery did once too.

Photo-illustration: WIRED Staff; Getty Images

A revolution in weight loss is apparently underway. It started in 2021, when the FDA approved the diabetes drug [semaglutide](#) for weight loss. The weekly injectable—sold under the brand name Wegovy—can help users lose 5 to 10 percent of their body weight, leading commentators to describe the drug as both a “[medical breakthrough](#)” and a “[silver bullet](#)” for obesity. Elon Musk says he’s [taking](#) it, Kim Kardashian is [rumored](#) to be using it, and everyone [from Hollywood to the Hamptons](#) reportedly wants a prescription.

Soon, there will be a new weight loss medication on the block—and it’s even more potent than its peers. Last fall, the FDA [fast-tracked](#) the review process for using [tirzepatide](#) as a weight loss drug after a [clinical trial](#) showed that people with BMIs labeled “overweight” or “obese” lost a staggering 22.5 percent of their body weight on the highest dose. If all goes according to plan, that will make Mounjaro the latest in a fast-growing biomedical sector—spanning everything from bariatric surgery to [deep brain stimulation for binge-eating](#)—that aims to combat, if not cure, the problem of “excess” weight.

For pharmaceutical companies, the race to market is financially motivated: Wegovy and Mounjaro cost more than \$1,000 a month. Weight loss drugs

are [rarely covered](#) by insurance, but people who can afford them have proven they're willing to pay. And the market seems effectively limitless: Despite an ongoing “[war on obesity](#),” more than [1.9 billion adults](#) globally are considered overweight or obese, and the number of prospective users is [growing every year](#). Now doctors—desperate to treat what is widely seen as an “obesity epidemic”—are coming on board. In January, the American Academy of Pediatrics [recommended](#) such medications for kids as young as 12.

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The victorious narratives gilding drugs like Mounjaro are [already being positioned](#) as a direct challenge to fat activism. For decades, the movement has pushed for social and economic opportunity for people of all sizes through civil rights, fat pride and liberation, and biomedical evidence itself. Thanks to prominent voices like [Aubrey Gordon and Michael Hobbes](#), many people now know that “lifestyle changes” like calorie restriction and exercise fail to produce sustained weight loss for [97 percent](#) of people and that many dieters end up [gaining back more](#) weight than they lost. But what happens to the strength of these arguments when a weight loss drug seems to work?

Like other purported weight loss solutions, Mounjaro promises “to fix weight stigma by making you thinner, instead of removing the stigma,” says Susanne Johnson, a fat activist and family nurse practitioner in Pennsylvania. In so doing, these drugs and surgeries further exacerbate anti-fat discrimination. Instead of criticizing people in larger bodies for their perceived lack of willpower—that old “calories in, calories out” adage—people can now blame those in bigger bodies for something more akin to a techno-pessimist, or even anti-science, stance: “Just take the miracle cure!”

The history of the weight loss industry is more akin to prospecting for gold or investing in crypto than transplanting organs and developing antibiotics; less a story of scientific progress than an endless cycle of wild speculation, where boom inevitably gives way to bust. Fen-Phen was a miracle until it was linked to [heart valve damage](#). Intermittent fasting was going to fix what

caloric restriction couldn't until [researchers showed](#) the two produce exactly the same results. And then there's the complicated case of bariatric surgery.

From their [inception in the 1950s](#), operations like gastric bypass (which reroutes food away from the stomach, inducing malabsorption) and gastric sleeve (which involves partially amputating the stomach so it holds less food and produces fewer hunger hormones) have been sold as a potential panacea, says Lisa Du Breuil, a clinical social worker at Massachusetts General Hospital. While [fewer than 1 percent](#) of people who qualify actually undergo bariatric surgery, those who do can lose up to 70 percent of their "excess" weight (or the weight above a BMI of 24.9).

But Du Breuil, who specializes in eating disorders and substance abuse disorders, has seen some of the worst of bariatric's side effects. People can develop [dumping syndrome](#)—wherein sugar-rich meals leave the stomach too quickly, causing sweating, dizziness, rapid heart rate, and vomiting. Gastric bypass in particular raises the risk of postoperative [alcohol abuse](#). Rates of [suicide and self-harming behaviors](#) also rise in the years after bariatric surgery. And even when people follow strict post-operative diets, [malnutrition](#), tooth loss, gout, and new or resurging eating disorders are possible. "It can be really challenging to get a full picture," Du Breuil says. She learns about new side effects all the time.

Semaglutide and tirzepatide—both part of a larger family of GLP-1 receptor agonists—were developed for diabetes management at lower doses. When pharmaceutical companies noticed their trial participants were also losing weight, they realized "if we can turn the volume up to 11, we can really enhance this side effect," says Johnson, the nurse. "That means you're also turning up the other side effects."

The primary complaints from users of Ozempic, Wegovy, and Mounjaro sound like the kind of thing you can fix with a bottle (or three) of Pepto Bismol: nausea, upset stomach, diarrhea, and what one patient [called](#) "[power vomiting](#)." But these might be less like classic "side effects" of a drug than a mechanism of weight loss itself, as *The Guardian* [recently reported](#). By making the feeling of eating (and, in some cases, [even hydrating](#)) actively disgusting to the user, the drug [curbs their consumption](#)

—similar to the experience of bariatric patients, who can only fit a few ounces of food in their stomachs at a time.

The list of complications doesn't end there. For example, both GLP-1 receptor agonists may increase the risk of [thyroid cancer](#)—one of the many [BMI-linked diseases](#) that supposedly makes weight loss absolutely imperative for people in larger bodies. And there's good reason to believe that other side effects will reveal themselves in years to come, as the number of long-term users grows.

The biggest surprise for many prospective patients is that long-term weight loss isn't guaranteed—a reflection, perhaps, of the [faulty assumption](#) that people are obese because they overeat. Current estimates suggest that the average bariatric surgery patient regains [30 percent](#) of the weight they lost in the 10 years after surgery. One in four regain *all* of their weight in that time. And 20 percent of people don't respond to surgery in the first place.

The same is true for GLP-1 receptor agonists: If you stop injecting, the weight returns.

In case it wasn't clear by now, biomedical weight loss interventions often mimic the deadly logic of anorexia, bulimia, or other forms of disordered eating, says Erin Harrop, a clinical social worker and researcher. Harrop would know. At the height of their own eating disorder, Harrop wished they could fill their stomach with air instead of food, or cut their stomach out, or wire their jaw shut. Later, they learned these things exist—in the form of gastric balloons, gastric sleeves, and even a [magnetic jaw trap](#).

It's no surprise, then, that some people who undergo bariatric surgery [experience](#) a resurgence of a preexisting eating disorder, or develop a new one. Frequent vomiting, never knowing what foods will upset your stomach, and feeling pressure to maintain a post-surgical weight—"you can create an eating disorder that way," Du Briel says.

But semaglutide and tirzepatide promise to fulfill an even stranger fantasy: eliminating appetite itself. While a drug like Mounjaro works on numerous fronts—including preventing the body from storing fat and “browning” existing adipose tissue—it's the feeling of being untethered from desire that

seems to fascinate patients and physicians alike. People for whom the drug works often say, “I forget to eat,” says Fatima Cody Stanford, an obesity medicine specialist at Massachusetts General Hospital’s Weight Center.

If doctors really believe that obesity is the greater of any two evils, then this approach makes sense. When it comes to bariatric surgery, for example, a review of the medical literature suggests it is, on balance, associated with a reduction in [all-cause mortality](#)—or death of any cause*—*compared to patients with high BMIs who don’t go under the knife (though such studies are profoundly limited, as they often do not control for social factors, like income or education). Many hope that semaglutide and tirzepatide will one day prove just as vitalizing.

But eating disorders kill too. In many contexts, sustained hunger is considered a travesty. And desire—for food, or anything else—is a great way to know you’re alive. “It’s wild to me that we see no appetite as a positive thing,” says Shira Rosenbluth, an eating disorder therapist who works with people of all sizes. Anna Toonk agrees: “I realized that there *are* worse things than being fat,” she [told The Cut](#) last fall. “The worst thing you can be is wanting to barf all the time.”

Ultimately, the proliferation of drugs like Mounjaro means medicine is not only in the business of dictating “normal” weights (a thing it [still hasn’t quite figured out](#)), but “normal” appetites. What was once an intuitive process, in which your body tells you what it needs, became a dictate under diet culture: You tell your body what it can have. Now medicine promises a radical reset: With the right drug, your body will hunger for nothing at all.

Weight loss technology can’t be stopped entirely—nor should it be. Everyone has the right to choose what they want to do with their bodies. But informed consent is built on information, and we may not have enough. Mounjaro was fast-tracked by the FDA based on studies designed to observe weight loss over just 72 weeks, a small fraction of the time real patients will be on the drug. At the very least, patients should be informed that in the [first years after a drug hits the market](#), they are participants in an ongoing experiment.

As biomedicine's war on obesity continues, people must work harder to combat anti-fat bias—not on a technicality, but as part of the expansive vision of justice fat activists began articulating more than 50 years ago. For semaglutide, tirzepatide, bariatric surgery, and their ilk are neither miracles nor cures. There have always been fat people, and there always will be, whether they're "non-responders" to treatment, refuseniks, or languishing on the waitlist. Notably, even those who experience dramatic weight loss after surgery or on injectables may still be overweight or obese, depending where they started.

Perhaps most importantly, the American weight loss discourse must move away from a reflexive scientism, which has enabled biomedicine to subject the entirety of human experience to its single-minded scrutiny. Weight, like almost every aspect of embodiment, is not an exclusively biological phenomenon or a clear-cut medical "problem" to solve. It is shaped by countless factors, like power distribution in society, personal psychology, and that most frightening of forces: the desire for more.

If you or a loved one is struggling with an eating disorder, the National Eating Disorders Association Helpline is available at (800) 931-2237.

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[Angela Watercutter](#)

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Feb 14, 2023 6:00 AM

Keanu Will Never Surrender to the Machines

The Matrix movies brought Reeves and Chad Stahelski together. Now the duo is killing it on their fourth John Wick—and still keeping technology in check.

Photograph: ART STREIBER

Keanu Reeves rarely malfunctions. Nearly any interview he does reveals as much. After four decades in Hollywood playing versions of the same fundamentally decent dude-in-crisis, he's learned to stay in his cyberpunk philosopher/surfing FBI agent/action hero lane. In person, he's pleasant and playful, but he also holds back, calibrating his remarks just so. Is this why we like him so much? We don't know who Keanu Reeves is, not really, but maybe we don't want to know. Or maybe this is all there is to know. He's a cipher onto whom we can project our own ideas, desires, and hopes for humanity.

So when Reeves, sitting with me in a cavernous studio in West Hollywood, ventures a feisty opinion about the latest advance in [artificial intelligence](#), [ChatGPT](#), I perk up. The question is whether a bot could conduct this conversation one day. While I, the human interviewer, am not so concerned this will happen in my lifetime, Reeves looks me dead in the eye and says, "Oh no, you should be worried about that happening *next month*." Very Gen X of him, I think at first, but then I remember: This is a man known for leading the revolution in the war against the machines. Reeves obviously isn't the characters he plays, but when Neo tells you the agents are coming, your instincts say, *Run*.

This article appears in the March 2023 issue. [Subscribe to WIRED](#)
Photograph: Art Streiber

Not that Reeves is fighting many machines these days. For the past few years, he's been shooting up human baddies in the John Wick franchise, the [fourth installment](#) of which hits theaters in March. Reeves plays a hit man, out of retirement, bathed in ultraviolet lighting and battling an entire underworld of crime syndicates, all to avenge the death of his puppy. But the films are still an argument against machine-made anything. *John Wick: Chapter 4* director Chad Stahelski served as Reeves' stunt double in [the Matrix movies](#)—that's him in [The Matrix Resurrections](#) as "Chad," the guy who took Neo's place by Trinity's side—and he's adamant about capturing as much flesh-and-blood action as possible. "We're not anti-VFX," he says, seated on a couch next to Reeves. "Our problem comes when you use it in place of being creative." Perhaps that's one of the lessons you learn after working on four Matrix movies: Computers can't fix bad ideas.

While Stahelski and Reeves are off posing for photos for this story, a tweet flashes across my phone. It's a writer saying that one of his clients no longer wants to pay him for his work—because an AI will do it for free. (The client will pay a cheaper rate for him to clean up the AI's copy, if he wants.) When the shoot wraps, I pull Reeves aside and tell him about the tweet. He's probably right about the bots, I say. I attempt a joke, but he doesn't laugh. He gives me a thoughtful look, and then he gets explicit: Corporations don't care about paying artists. Well, what he actually says is this: "They don't give a fuck." It's a startling moment coming from Reeves, the most pointed and serious I've seen him all day. Corporations might not care, but he clearly does. That's one thing we can say about Keanu Reeves: In a world of fakes and frauds, he's fighting for what's real.

WIRED: I have to know, Chad, what was it like to play "Chad" in *The Matrix Resurrections*?

Chad Stahelski: Oh my God. I will tell you, that was not my best day.

Keanu Reeves: It was a fantastic day.

Stahelski: I thought it was going to be no big deal. I think I knocked over the coffee stand. I couldn't eat. I had a croissant in my mouth. I flubbed my lines. It was tragic.

Reeves: Lana [Wachowski] thought you were perfect for the role.

Is it fair to say the John Wick franchise owes a debt to the Matrix movies?

Reeves: If we're gonna compare them, they both were original ideas with visionary filmmakers.

Stahelski: No one was under any delusion that *Matrix* wasn't going to be pretty awesome. Then David Leitch [codirector of the first Wick film] and I stayed on for *V for Vendetta* and *Speed Racer*, so we pretty much got a decade of Wachowski film school. The John Wicks are definitely children of *The Matrix*.

As an actor, what's it like working with the Wachowskis? I interviewed Eddie Redmayne when he finished *Jupiter Ascending* and remember him saying Lana's direction was often things like, "Play it like an accountant!"

Reeves: Um, I never got that kind of direction.

What did you get from them?

Reeves: Attention to detail, worldbuilding, and having ideas as nourishment in your entertainment. That exists in *John Wick 4* too—the idea of freedom, the idea of choice with rules and consequences. How are you trying to break out of the system? John Wick has got a cool thing because everyone is bad. They're bad people. But they're also super moral and ethical. Well, not even ethical, but there's a code. You root for John Wick.

Keanu Reeves and director Chad Stahelski wanted to film highly choreographed action sequences rather than lean heavily on digital effects.

Photograph: Murray Close/Lionsgate

Which is extra impressive, considering that he's not some known IP. He's an original creation.

Stahelski: It's kind of cool, like, you don't have 60 years of Batman to work from. You don't get that to lift you up, but at the same time you don't have it to hold you down. Nothing's holding us back.

You don't have a Reddit thread of people scream-typing, "This isn't canon!"

Reeves: We've developed our own playground.

Stahelski: We just went with a bunch of ideas we loved. But we didn't go out with an agenda.

Reeves: Yeah, we did. We went out with *your* agenda of action as part of storytelling. And character. That was the fundamental base.

And on top of that, a commitment to minimal special effects?

Stahelski: We're not, like, at war with VFX. It's super handy, it's a great tool. But you can't beat the blood, sweat, and tears of real people.

Reeves: When you watch John Wick action scenes, it feels different. There's so much choreography. It's out on the edge.

Stahelski: And sometimes what we have in our heads doesn't work, so we have to change it. You can't rehearse 40 cars driving around in a parking lot, you gotta get it on the day. You don't know what's going to happen, so there's a little desperation. Some of the best moments we've had in all four movies are—if not accidental, they're incidental. It's the imperfection that makes it special.

Speaking of incidentals in John Wick, those coins the hit men use. They look a lot like bitcoins, but Bitcoin wasn't very big when you made the first movie.

Stahelski: [Laughs] We're going to take credit for that.

It's kind of ironic how it's the cryptocurrency of this underworld. In the real world, crypto is having a tough time.

Reeves: I think the principle, the ideas behind an independent currency, are amazing. These are amazing tools for exchanges and distribution of resources. So to pooh-pooh crypto, or the volatility of cryptocurrency, it's only going to make it better in terms of how it's safeguarded.

In the streaming era, Reeves and Stahelski still believe in the big screen. The release of *John Wick: Chapter 4* was delayed because Covid-19 kept people out of theaters.

Photograph: ART STREIBER

Do you guys love science fiction?

Stahelski: I'm always big on sci-fi. Like, *John Wick* is hyperreal. But it's also got this analog sense. Old computers, old suits, old stuff.

Reeves: I'm interested in the storytelling of humans and their interactions with technologies.

Keanu, years ago you put a clause in your contracts saying that your performances couldn't be manipulated without your say-so. Isn't that right?

Reeves: Yeah, digitally. I don't mind if someone takes a blink out during an edit. But early on, in the early 2000s, or it might have been the '90s, I had a performance changed. [He won't say which.] They added a tear to my face, and I was just like, "Huh?!" It was like, *I don't even have to be here*.

And now someone like Bruce Willis has found himself getting deepfaked into Russian telecom commercials. As an actor, what do you think of deepfakes?

Reeves: What's frustrating about that is you lose your agency. When you give a performance in a film, you know you're going to be edited, but you're participating in that. If you go into deepfake land, it has none of your

points of view. That's scary. It's going to be interesting to see how humans deal with these technologies. They're having such cultural, sociological impacts, and the species is being studied. There's so much "data" on behaviors now. Technologies are finding places in our education, in our medicine, in our entertainment, in our politics, and how we war and how we work.

The Matrix just looks more and more wildly prophetic by the day. AI doesn't control our lives yet, but ...

Reeves: [in his best Agent Smith voice] They started making decisions for you. It became our world.

I was trying to explain the plot of *The Matrix* to this 15-year-old once, and that the character I played was really fighting for what was real. And this young person was just like, "Who cares if it's real?" People are growing up with these tools: We're listening to music already that's made by AI in the style of Nirvana, there's NFT digital art. It's cool, like, *Look what the cute machines can make!* But there's a corporatocracy behind it that's looking to control those things. Culturally, socially, we're gonna be confronted by the value of real, or the nonvalue. And then what's going to be pushed on us? What's going to be presented to us?

The metaverse!

Reeves: It's this sensorium. It's spectacle. And it's a system of control and manipulation. We're on our knees looking at cave walls and seeing the projections, and we're not having the chance to look behind us. Or to the side. I'm sorry to go on here, Chad.

Stahelski: No, it's great.

Reeves: It's also a fascination—it seems for us, the animals on the planet, like, *How do we defeat death? How do we change the weather? How do we replace nature?*

Should I be worried about AIs coming for my job?

Reeves: The people who are paying you for your art would rather not pay you. They're actively seeking a way around you, because artists are tricky. Humans are messy.

We push back, we have our own ideas.

Reeves: People in power don't want that, you know? So that's not your lifetime, that's like your next birthday. And before then, they're going to challenge how much they pay you. So everyone's gonna be an independent worker. *Look at all the independence you have! Let's not have unions.*

WIRED just unionized, actually.

Reeves: That's cool. See how long that lasts. Fingers crossed.

But yeah, in the meantime, now ChatGPT can write scripts that are just combining other ideas.

Reeves: Which is cool, because that's what artists do, right? We take our influences and we synthesize them. But what's the intention behind that synthesis?

Stahelski: I'm all for the tools. It's just, we want to control the choice behind it. We had AI-produced digital art for some background stuff in John Wick. The younger staff are into that world, and they were like, "Hey, this would be cool. Let's try it."

Keanu, you recently became an adviser to the Futureverse Foundation, which is focused on diversifying the metaverse. How did you get involved with that?

Reeves: It's something my partner, Alexandra Grant, is really interested in, so I'm kind of riding her coattails. I helped set up the launch. We're trying to take this technology that people are interested in and give opportunities to artists with different viewpoints.

When you look at a company like Meta, which has made building in the metaverse a priority, the entry points there aren't accessible to a lot of

people.

Reeves: It's like they've created more land. There's more land for sale. It's wealth creation and it's opportunity.

But I have to believe in-person experiences are here to stay. The release of *John Wick: Chapter 4* got delayed a couple times because of Covid-19. Was it important to you to release it theatrically?

Stahelski: Maybe it's our generation, but I like seeing a movie in the cinema. Even if it's meant for streaming eventually. It's such a different experience.

Reeves: It's dreams, right? And immersion. I think the power of cinema—part of it is its novelty, but also its scale. You see a close-up of a wonderful performance with emotions and storytelling that touch you. Whether it's horror or action or comedy, you're seeing a face that's, you know, 20 feet tall. Yeah. You're, like, there. The intimacy of that.

Reeves and Stahelski met while making the Matrix movies; Stahelski served as Reeves' stunt double. Another Matrix alum, Laurence Fishburne, has been part of the John Wick franchise since Chapter 2.

Photograph: Murray Close/Lionsgate

It seems like people often project a lot onto their heroes online. Is it weird being internet-beloved?

Reeves: It's nice when it's nice, but I'm sure it's super horrible when it's horrible.

Well, there were people who made mods to have sex with your character in *Cyberpunk 2077* ...

Reeves: Getting it on with Johnny Silverhand?! I hope it was good. I'm sure Johnny tried hard.

Stahelski: I'm sure he gave it his best ...

Reeves: If he cared. [Laughs] He's kind of bitter.

Stahelski: Emotionally empty.

Reeves: He's not emotionally empty. He cares so much, and the world's so corrupt and he's just trying to get some back!

Do you have a favorite Keanu meme?

Reeves: No. I don't seek them out. Once in a while people show 'em to me when they're fun.

Stahelski: Keanu with the sandwich is probably my favorite.

Sad Keanu!

Reeves: The original!

On that note, we need to wrap up. I guess this is the time to say “Be seeing you.”

Reeves: It's always fun when I'm out in the world and people say, "Hello, Mr. Wick."

How long before that was it people imitating Agent Smith and saying “Hello, Mr. Anderson”?

Reeves: Oh, I still get that.

This interview has been edited and condensed.

Styling by Jeanne Yang. Styling assistance by Chloe Takayanagi and Ella Harrington (Keanu), Emily Diddle (Chad). Grooming by Kerri Smith for Schneider Entertainment (Keanu), Jeni Chua for Exclusive Artists using Kevin Murphy (Chad). Suit by Brioni, T-shirt by James Perse, shoes by Magellan & Mulloy (Keanu, top photograph). Suit by Brooks Brothers, T-shirt by Hermes, shoes by John Varvatos (Chad, top photograph). Sweater by Brioni, jeans by Fabric Denim (Keanu, second photograph). Sweater by Etro (Chad, second photograph).

This article appears in the March 2023 issue. [**Subscribe now**](#).

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Feb 12, 2023 7:00 AM

God Did the World a Favor by Destroying Twitter

Remember what happened with the Tower of Babel? Same type of deal.

Illustration: James Marshall

“Happy to talk about it if this is interesting,” [Marc Benioff](#), the founder of Salesforce, texted [Elon Musk](#) last spring. He continued, opaquely: “Twitter conversational OS—the townsquare for your digital life.” This is how billionaires communicate: in slogans, brand identities, and occasional large sums. It’s up to everyone else to figure out the details.

“Well I don’t own it yet,” Musk replied. (To be fair, he was fielding a lot of texts at that moment.) But then he did own it, and by winter the [Twitter](#) takeover was a giant, thorny public mess. Whatever magic spell kept people together on the platform seemed to have broken. It was like the plot of *Encanto* without the happy ending: “The graveyard for your digital life.”

Twitter’s troubles are due not just to Musk, who appears to be both shooting himself in the foot and cauterizing the wound with his own brand of flamethrower. No, Musk is merely the vehicle. The real reason Twitter lies in ruins is because it was an abomination before God. It was a Tower of Babel.

People usually interpret Genesis 11:1–9 as a mythological explanation of why we have so many tribes, so many languages. The story goes that the descendants of Noah were living in Shinar, all speaking one tongue, and decided to build a skyscraper that would let them walk straight into heaven.

God went *Not in my backyard!* and scattered the people, confounding their language. I like to think that God also personally demolished the tower, but that story is apocryphal (Jubilees 10:26).

God does the wrath thing a lot in the Old Testament, punishing humans who would challenge divine authority. It makes sense to read the story of Babel in that light. But having lived through the past couple decades of the internet, I believe the story carries a different lesson. I'm an atheist, so take this theory with a grain of salt, or maybe even a pillar: God wasn't keeping us out of heaven, smiting us for our arrogance. God was protecting us from ourselves.

Every five or six minutes, someone in the social sciences publishes a PDF with a title like "Humans 95 Percent Happier in Small Towns, Waving at Neighbors and Eating Sandwiches." When we gather in groups of more than, say, eight, it's a disaster. Yet there is something fundamental in our nature that desperately wants to get everyone together in one big room, to "solve it." Our smarter, richer betters (in Babel times, the king's name was Nimrod) often preach the idea of a town square, a marketplace of ideas, a centralized hub of discourse and entertainment—and we listen. But when I go back and read Genesis, I hear God saying: "My children, I designed your brains to scale to 150 stable relationships. Anything beyond that is overclocking. You should all try Mastodon."

So people are fleeing the tower by the millions, or at least shopping the real estate elsewhere—[Discord](#), [TikTok](#), [Tumblr](#), [YouTube](#), [Instagram](#), WeChat, Weibo, Moj. And some are finding their tribes in the Fediverse, the set of decentralized web apps that includes [Mastodon](#).

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The Fediverse is, by design, thousands of servers in many languages. They are cheap to run, at least for small groups, and relatively easy to administer. You can chat among your server kin—or blog, or podcast, or share images and videos—and connect with servers in the outside world. The Fediverse apps are all built on a set of rules called the ActivityPub standard, which is

a little like HTML had sex with a calendar invite. It's a content polycule. The questions it evokes are the same as with any polycule: What are the rules? How big can this get? Who will create the chore chart?

The true beauty of Mastodon and similar services is that they are designed to collapse. If you want to quit a server, you can take all your followers and follows with you. If a server shuts off, you can find another. It's not one guy. It accepts that as we centralize and debate we melt down, and so it comes with a giant sticker that reads: Babel built in!

How will these smaller groups of happier people be monetized? This is a tough question for the billionaires. Happy people, the kind who eat sandwiches together, are boring. They don't buy much. Their smartphones are six versions behind and have badly cracked screens. They fix bicycles, then they talk about fixing bicycles, then they show their friend, who just came over for no reason, how they fixed their bicycle, and their friend says, "Wow, good job," and they make tea. That doesn't seem like enough to build a town square on.

But someone will figure out the details. The reason the Babel story matters is not that it happened once but that it happens over and over: We Babelize and de-Babelize. The internet is an engine of both processes. Eventually, brands will find purchase in Mastodon's rocky soil and grow engagement. Billionaires will order the construction of new marketplaces of ideas. Everything will centralize again, and it will seem eternal, as if the tower could never fall. For now, let's enjoy the scattering.

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[Paul Ford](#)

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Feb 3, 2023 9:00 AM

A New Drug Switched Off My Appetite. What's Left?

Mounjaro did what decades of struggle with managing weight couldn't. Welcome to the post-hunger age.

Illustration: Ohni Lisle

A decade ago I lost 100 pounds. I did it in my web-nerd way—by building a custom content management system using the Django framework in the [Python](#) programming language. Every day I would enter calories ingested, calories expended through exercise, my [weight](#), and whatever thoughts occurred to me. It became a job. I produced charts and compared the results of different kinds of exercise. I put it all online at OHЛИH.com, which stood for One Huge Lesson in Humility.

It worked very well. For the first time in my life my doctor seemed glad to see me. People noticed. They said: Are you going to [open-source](#) this? Sure I was! Of course, I knew that scientists had found, in study after study, that basically everyone who loses weight gains it back, and then some. But there was no chance I would eat my way back to misery. I had a system! And a PostgreSQL database! And I could buy pants in a normal department store! Guess what happened.

Obviously [genetics](#) were a factor. (I remember when my uncle died, someone whispered, “My God, how much does this funeral *weigh*?”) What health professionals call my morbid obesity—that “morbid” is a helpful reminder—is what you see. But it’s a side effect of what I am, which is insatiable. Literally: I never seem to feel full. In practice this means that at

certain times of day, I watch in horror as my body reaches for the cheapest, easiest calories nearby—out of the pantry, out of a vending machine, at a party. I scream, “Stop!” But the hand keeps reaching.

While culture kept making smaller airplane seats, science backed me up: Humans are servants of their satiety.

You might say: Come off it! What happened to good old-fashioned willpower? There’s a sin for this—it’s called gluttony! Or you might say something less judgy-sounding that means the same thing. All I can say is I tried: I downloaded [calorie-tracking apps](#). I taught my phone to buzz every 15 minutes to remind me that I should not eat. I paid therapists to train me on better behaviors, researched gastric bypass, rode my bicycle, talked with experts, experimented with radical self-acceptance. Nothing stuck. While culture kept making smaller airplane seats, science backed me up: Humans are servants of their satiety. Even gastric bypass falters for lots of people.

While it is possible—more possible than many think—to be fat and healthy, and sometimes I managed that, I could feel my health slipping, prescriptions adding up in the cabinet. So I accepted that, well, I knew how I would die, and that we might need an extra pallbearer. (I can make that joke.) A pretty good life, save for that one thing. I put money away for my kids, and every day I tried and failed to solve a lonely puzzle of self.

Then one day my endocrinologist was reviewing my A1C blood sugar levels as we Zoomed. He had me on Ozempic, a weekly shot that stimulates the body’s insulin production, which makes it a great alternative to insulin injections for type 2 diabetics. The drug’s side effects include slower digestion and increased satiety. You may have heard of it because it’s increasingly prescribed for weight loss (and is linked to many Hollywood diets). I’d been on it for a while and lost a few pounds, and I appreciated it, but the shrieking satiety siren had never ceased.

“Well,” my doctor said, “if you’re not losing weight with Ozempic, try Mounjaro.” This one was FDA-approved last May, with an atrocious name. So off I went, from one shot to the other, from Novo Nordisk to Eli Lilly. Whatever.

“Something’s happened,” I told my wife. She is a veteran of watching me try to fix my body. I told her: Where before my brain had been screaming, screaming, at air-raid volume—there was sudden silence. It was confusing. Would it last?

I went alone that night to a Chinese restaurant, the old-school kind with tables, and ordered General Tso’s. I ate the broccoli, a few pieces of chicken, and thought: too gloopy. I left it unfinished, went home in confusion, a different kind of sleepwalker. I passed bodegas and shrugged. At an office I observed the stack of candies and treats with no particular interest.

Decades of struggle—poof. Apparently the Mounjaro molecule targets the same hormone as Ozempic, plus a second one, so it doesn’t just stimulate insulin production but also boosts energy output.

“I urgently need,” I thought, “an analog synthesizer.” Something to fill the silence where food used to be. Every night for weeks I spent four, five hours twisting Moog knobs. Not making music. Just droning, looping, and beep-booping. I needed something to obsess over, to watch YouTube videos about. I needed something to fail at every night to feel normal. And I was also manic, dysregulated, and wide-eyed, sleeping five hours a night, run-walking, with pressured speech; my friends, happy for me but confused, called me “cocaine Paul.” I bought more synthesizers off a guy from Craigslist, meeting him in Bushwick, Brooklyn, with a grand in cash. A body is not designed to lose 25 pounds in eight weeks, starting during the holidays. Beep. Boop.

With the relief come new anxieties. What if it stops working and I slide back into the vale of infinite noise? Compounding that, these drugs are hard to get, both because of supply chain problems and because they are being prescribed off-label for weight loss instead of diabetes. I can’t get a steady prescription from the pharmacy. I’m developing a rationing plan, stretching from an injection every seven days to one every eight or nine to build up a stockpile.

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I can see my anxiety mirrored in the wave of reactions starting to appear—op-eds, TV segments, people explaining why it's good, actually, that the vast majority of those using this drug lose a quarter of their body weight. On social media, fat activists are pointing out that our lives were worthy even without this drug. The wave of opinion will not crest for years.

And that's fair because this is new—not just the drug, but the idea of the drug. There's no API or software to download, but this is nonetheless a technology that will reorder society. I have been the living embodiment of the deadly sin of gluttony, judged as greedy and weak since I was 10 years old—and now the sin is washed away. Baptism by injection. But I have no more virtue than I did a few months ago. I just prefer broccoli to gloopy chicken. Is this who I am?

How long is it before there's an injection for your appetites, your vices? Maybe they're not as visible as mine. Would you self-administer a weekly anti-avarice shot? Can Big Pharma cure your sloth, lust, wrath, envy, pride? Is this how humanity fixes climate change—by injecting harmony, instead of hoping for it at Davos? Certainly my carbon footprint is much smaller these days. Are we going to get our smartest scientists together, examine the hormonal pathways, and finally produce a cure for billionaires?

When I let the domain name for my diet blog expire, I accepted that there was no technology that could change my biological responses to my own satiety. Now there is, and the part of me that tracked every meal, searched for solutions in apps and programs, wrote code, and took notes is obsolete. Was that time wasted? God, yes. But I did learn a ton—about nutrition, about exercise, about myself. All of those lessons are a joy to apply now, without the panic of self-destructive hunger.

Lately I'm finally less manic. Still losing weight, but much more slowly. Exercising more. At night I play with my synthesizers and watch online classes in music theory. Headphones on, processing all those years of futile effort. As I fiddle with knobs I am sometimes angry, sometimes ashamed,

and often grateful. I don't know how long this post-appetite era will last, or how it will end. Just that, once again in our lives, everything has changed.

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Jan 31, 2023 6:00 AM

The Spaceport at the Edge of the World

A tiny Scottish village is betting its future on rocket launches. But the plan may threaten the fragile landscape—and a tenacious billionaire's ambitions.
Photograph: Anna Huix

In the village of Melness, a frayed twist of bungalows and old stone buildings on Scotland's desolate northern shore, April is a month of new beginnings, when the dark and strung-out Highland winter finally unfurls into a tentative spring, and pregnant ewes balloon like airships in the wind-swept hills. As the 2015 lambing season neared its start, the villagers began the usual preparation of their small plots of rented land, called crofts, for farm and pasture. Behind the crofts and croft houses was the bog: an immense, bronze-hued ocean of deep peat, stretching into the horizon.

For Dorothy Pritchard, a retired schoolteacher and chair of the Melness Crofters' Estate, an organization that owns and manages the crofting land, this spring would be stranger than usual. Over the past several weeks, she had been mulling a plan that could upend the town's quiet routine.

On the last day of the month, she walked into the estate office, a dirty, white bungalow opposite the village nursing home, for a meeting with the estate board. Many of the members were from families that had been working the land for generations, and Pritchard sought to preserve their way of life. As the crofters took their seats on plastic chairs around the table, Pritchard announced that she had an idea. It might sound crazy at first, she cautioned,

but give it an open mind: How about building a spaceport on the empty peatland out back?

The estate office rang out in guffaws. Rockets lifting off in nebulas of smoke from the bog, inclining to their flight path over Tommy's shop in Talmine, cracking the sound barrier over the summer wildflowers on Achininver Beach? It was hard to imagine. And there were concerns. Melness, made of nothing but mountains and peat and sea and weather, was a tranquil place. Would rockets not ruin it? Would they have to fence off the common grazing land? Would they have to leave their homes on launch days? Would it be safe?

Spaceports have a history of leaving local communities in the dust.

Pritchard told them she'd initially shared their fears. When she first envisioned rockets taking off, she pictured a boggier, less clement [Cape Canaveral](#): explosions, showers of fiery debris. Behind the Melness houses, on the far side of a grassy ridge, unrolled a section of peat bog called the Moine. Although the land might not have looked like much to outsiders, it was part of a massive, irreplaceable [sink of carbon](#) that had accumulated over millennia, holding almost as much carbon dioxide as the UK emits in a year—and areas of it are highly combustible.

This article appears in the April 2023 issue. [Subscribe to WIRED](#). Photograph: Andria Lo

Pritchard was reassured, though, by the fact that the project had government support. It had come to her through the local development board, in conjunction with a [UK effort](#) to elbow its way into the global [space](#) industry. Building a commercial spaceport in Melness—one of three proposed vertical launch sites in rural Scotland where there is good access to polar orbits—could help the UK become the first country in Europe to launch a small satellite.

Pritchard's own hopes for the spaceport were humbler but no less urgent. In it she saw a way to preserve Melness' crumbling future. Her father had been a crofter who, like many in the village, worked at the nuclear power plant down the coast and built offshore oil rigs. She'd started lambing at 8

years old, and her childhood memories were crowded with weekend dances that once surged with dapper teens from Strathy to Durness. By 2015, though, the oil industry was declining, the nuclear plant had been deactivated, the dance halls were empty, and the school rolls were dwindling. The town was down to a single hotel, a single store, a single nursing home. Every year, Pritchard saw her former students reach their late teens and flee to the cities down south: Inverness, Aberdeen, even Edinburgh. Keeping youngsters on the good side of Ben Loyal and Ben Hope, the two peaks that overshadow Melness, had become her obsession.

Dorothy Pritchard is backing a controversial project to build a spaceport on peatland near her Highland village.

Photograph: Anna Huix

The village had already cycled through several failed economic projects, including a leisure center, a wind farm, a new pier, and a tropical shrimp farm. Worse, in the absence of a self-sustaining industry, it was being steadily transformed by an outsider—the Danish billionaire Anders Holch Povlsen, who owns the [fast-fashion](#) company Bestseller.

Povlsen is the richest man in Scotland and its largest private landowner. He has acquired thousands of hectares of land around Melness, citing a mission to rewild the landscape and repair the damage caused by overgrazing. But his ideas for developments—including a brewery, an events space, and luxury resorts for “forest bathing”—are targeted at ultra-wealthy ecotourists. In the eyes of many locals, his investments bring to the fore the ballooning cost of real estate in the area.

Pritchard asked the estate members to consider the spaceport. It offered Melness a new vision for the future, she told them. It could give them a decent rental income and reliable employment. It could mean a revival of this place after a deep winter.

After some hesitation, the board agreed to explore the idea. Pritchard was hopeful. At the same time, she knew the spaceport might not be enough to save Melness. There was a chance that it would bring disaster.

Sheep graze on the edge of the North Sea.

Photograph: Anna Huix

On a high rock between Melness and its sister city Tongue stands the stout ruin of Castle Varrich. The castle is on the territory of Clan Mackay, a Highland clan with roots in the Middle Ages. The Gaelic origin of Mackay, the area's most common family name by far, is Mac Aoidh: son of fire.

Pritchard is a Mackay on her mom's side, and her worries about the depopulation of the Highlands reach back as far as her family's history. Much of Scotland's land is owned by wealthy individuals—a higher percentage than any other country in Europe. From the late 18th century, landowners mercilessly drove Highlanders out of townships along the fertile inland valleys to make room for sheep, which turned a greater profit than farming. This campaign of occasionally violent dispossession is known as the Highland Clearances.

In Sutherland, the county that contains Melness, the Duke and Countess-Duchess, together with Patrick Sellar, the notorious "factor," or manager, of the Sutherland Estate, were particularly cruel in their administration of the evictions. The Clearances reached their crest here in 1819, a year known in Gaelic as *bliadhna na losgaidh*: the year of the burnings. The homes of the members of Clan Mackay, sons and daughters of fire, were scorched to the ground.

Pritchard's ancestors were forced onto barren crofts, in settlements on the edge of inhospitable coasts. "They belonged to the ground," Kirsteen Mackay, a Melness crofter, told me, "and people came in and took it away." Inland folk for centuries, they struggled to learn how to fish, and many left for North America. Meanwhile, boundless herds of sheep set to work constructing the barren landscape characteristic of the Highlands today. The ancient pine and birch forests were turned into seas of open heath.

After the price of wool cratered at the end of the 19th century, the Highlands' economy shifted to deer stalking, and red deer, equally rapacious, took over from sheep. Today, areas from which communities

were cleared—some of which now belong to Povlsen—are designated “wild land” by the Scottish government.

Highland landlords still lease crofts to the descendants of cleared families. For those in Sutherland, the evictions are a persistent memory and haunt contemporary conflicts over land. Compared to much of the Highlands, though, the status of the land in and around Melness is unusual: 5,000 hectares belong to the crofters themselves.

Highland cows in Melness.

Photograph: Anna Huix

This situation is due to Michael Foljambe, the eccentric English owner of an extensive tract that had included Melness. In 1995, Foljambe decided to give his land away. Two-thirds of his landscape of burns, lochs, beaches, and bog went to his London relatives. For the final third, though, Foljambe did something unprecedented. After long discussions with Pritchard’s father, Frank Gordon, Foljambe decided that the land should be given to the people who had worked it since the Clearances. The children of the people in the cemetery by the sea.

The crofters were ecstatic. The land, they thought, had long belonged to them, at least in spirit—but now they would be protected from a landlord’s whims and fancies. There was a catch, though. The crofters had to generate income and jobs, and build [housing](#), but now without Foljambe’s cash. From then on, finding income was always a struggle, while the region’s population declined.

In 2012, Foljambe’s relatives sold their portion of the land to Povlsen. Povlsen was fond of the Highlands, having visited from Denmark as a child. He’d already bought his first estate there years earlier, and with this purchase his total land holdings amounted to some 47,000 hectares. He had started a company called Wildland, with a mission to reseed the landscape and repair the damage caused by centuries of overgrazing.

In photographs, Povlsen looks impish—bald head, neatly trimmed beard, boyish face. He is not a popular figure around Melness. Povlsen owns

several properties in nearby Tongue that he has kept empty for years, including what was once the town's only supermarket. He also bought the area's only gas station. Land prices have swelled, in part due to investments in carbon credits; Wildland has sold carbon credits by restoring peatlands in an estate further south. In 2020, the price of Scottish estates rose by 87 percent compared to the previous year, while in 2021, farmland prices increased by 31 percent. As a result, locals are being outpriced while the value of Povlsen's land increases, further limiting the financial resources of residents to take him on. When Ellen Henderson, who grew up along the coast from Tongue, tried to purchase the building that once housed Tongue's bank, she was outbid by Wildland. "He is a tsunami of money," she told me.

Povlsen has spoken about being a custodian of the landscape and about his deep love for the area. He claims to be repeopling as well as rewilding, generating work in hospitality and construction. His company hires local construction firms and employs 20 people in the Melness area, a figure that will grow as his new developments open. Many residents, though, would prefer to have a diverse economy. Some are furious, seeing Povlsen as the Highlands' latest arrogant landlord.

According to Pritchard, Povlsen treats the area as a tourist village. "He's not from here, and he doesn't understand the culture," she told me. On Facebook, she referred to Povlsen as "the return of the Duke of Sutherland" and complained that his company "has the cheek to constantly use the phrase 'our community.'" The name Wildland doesn't help: Some residents suspect he would prefer the area to be empty.

Once the spaceport idea was introduced, it did not take long for the community to see how it might solve their long-standing problems. The area might finally, they thought, blast out from the history of inequity that had sucked them in like a peat bog.

By 2018, debate over the spaceport had reached every person in town. The local development board, now partnered with aerospace startup Orbex, was holding regular drop-in sessions to calm jitters, and eventually, many residents came to hope that they would soon see a 62-foot-tall rocket with payloads of microsatellites thrusting over their homes, blasting toward polar

orbit within spitting distance of the post office. Others were not so convinced. In November, the crofters held a vote on whether to continue supporting the spaceport project. The result, in the end, was 27 votes for, 18 against. “We were for it,” said Pritchard, “but not at any cost.”

The arguments fractured the once cozy community. John Williams, a retiree to Melness from the south of England, set up an organization to protest the spaceport. In spite of his “incomer” status, he amassed some support in the village. “If you can imagine a rocket going wrong, you’ve got the equivalent of a 20-meter blowtorch,” he told me. That, on the peat bog, would be like setting a coal field on fire.

The peatland around Melness is a valuable carbon sink and is highly combustible.

Photograph: Anna Huix

The environmental concerns are serious. The Moine is part of a much larger area known as the Flow Country: 200,000 hectares of delicate peat that has been hoarding carbon since the end of the Ice Age. Six months after the vote, a catastrophic [wildfire](#) burned 5,700 hectares of the Flow Country and doubled Scotland’s carbon emissions for the year. If rocket fuel, or sparks, were to come into contact with peat, there is an increased risk of wildfires, Roxane Andersen, a peat scientist, told me. Pritchard’s anxieties, however, had by this time been allayed. “I don’t think there’s been a more examined piece of ground,” she said.

What about human safety? Gordon McEwan, whose home is near the proposed launch site, is anxious about falling rockets. In a meeting with Orbex and other crofters, he shared his concern that the launch exclusion zone was too small. When the rocket lifts off, the zone will have a radius of less than 2 kilometers. Orbex’s response was to trust the regulators. “You can’t randomly launch things of this nature,” Chris Larmour, the CEO of Orbex, told me. “We are a heavily regulated industry.” A Highland newspaper reported, though, that at a space industry event in 2021 he’d admitted he wouldn’t want one in his backyard either.

According to Orbex and the development board, the economic benefits will outweigh these risks. They expect the spaceport to create around 40 jobs—from security and engineering to marketing roles—in an area with a population of several hundred. Some workers, they think, will commute from bigger towns on the north coast, but others may settle in the Melness area, boosting the school rolls. A report commissioned by the development board predicted that during the first two years of its operation, the spaceport would add several million dollars worth of gross value to Melness and Tongue's economy, and attract thousands of visitors—a big boost for [tourism](#).

Spaceports, though, are rarely a solution to the problems faced by marginalized areas, and they have a history of leaving local communities in the dust. They require sparsely populated land, usually near the equator, to profit from the higher speed of the earth's rotation at equatorial latitudes, or in the far north or south, for easy access to polar orbits. They tend to be situated, then, in places like the Highlands—places that have long been considered peripheral and where the land carries fraught histories of marginalization, oppression, and colonization.

Yet to the crofters, the spaceport has come to represent their independence. Melness will need some development if it is to survive. Faced with a choice between another landowning capitalist and a spaceport, the crofters tend to side with the spaceport.

Despite their disagreements with Povlsen, many residents I spoke to felt profound sympathy for him when, on Easter Sunday 2019, he and his family were among the victims of a bomb attack at the Shangri-La Hotel in Sri Lanka. Three of Povlsen's four children were killed. The church in Tongue held a special service, and the townspeople came out to grieve.

In August 2019, Pritchard and the crofters reached an agreement with the development board: 12 launches per year, for £70,000 (about \$85,000) a year in base rent. Objections started to flow in. The Royal Society for the Protection of Birds came out against the project, as did 1,075 signatories of a petition against the spaceport. Povlsen also voiced his disapproval. His 62-page report argued that the spaceport could disrupt breeding bird seasons and damage everything from water quality to the look of the land. It said

that another proposed spaceport was in a better location, that the spaceport would harm the peatlands, that the economic benefits had been overstated. Ultimately, the Highland Council's planning committee granted permission for the spaceport in a unanimous decision—but Pritchard did not celebrate. She may have sensed the fight against Povlsen was just beginning.

Will the spaceport save Melness? For a community that has long been a forgotten corner, the promise of a cosmic horizon has metaphorical force.

Povlsen swiftly filed a lawsuit, asking the Scottish Court of Session to cancel permission, and paid the legal fees of three crofters in another legal challenge. “Are we to have no developments along the North Coast unless they have the permission of Mr. Povlsen?” Pritchard wrote on a Facebook page. “To take that sort of opportunity away from our young people is unforgivable.”

Then, in November 2020, Povlsen invested £1.43 million in a competing spaceport project in the Shetland Islands. That site is not surrounded by peat bog, but the crofters were outraged. “If it’s really an environmental issue,” Pritchard said, “why did he go and build a much bigger spaceport with three launch pads and bigger rockets?”

On a drizzly afternoon last May, I met Thomas MacDonell, Povlsen’s director of conservation, in a grand 19th-century country house two and a half hours south of Melness. The building was once the home of a duchess; today it is Wildland’s headquarters. Povlsen bought a nearby estate, called Glenfeshie, in 2006, when it was 18,000 hectares of overgrazed and degraded birch and pine forests. MacDonell, having grown up in the area, was eager to help Povlsen rewild.

MacDonell is tall and silver-haired, and he exudes the calm vigilance of a deer stalker. He and I climbed into his black Volkswagen pickup. He drove me around Glenfeshie, gesturing at the landscape and describing how he and Povlsen had culled 15,000 deer and planted 5 million trees, with the goal of encouraging patchworks of ecosystems to exist side by side. They’d initially met opposition from sheep farmers and fierce resistance from the owners of hunting lodges, but he endeavored to show me that by now, Wildland’s 200-year plan to regenerate Glenfeshie had started to bloom. As

we traversed the bumpy gravel paths, MacDonell cast his eyes over the hills, proud that they were thickly carpeted with trees. I saw young and old birches standing together, an indicator of sustainability. Dead wood, MacDonell told me, was providing habitat for woodpeckers and tree creepers.

Thomas MacDonell in a horse tack room in Glenfeshie.

Photograph: Anna Huix

The next morning we drove toward Kinloch Lodge, an old shooting lodge that Povlsen had transformed into luxury accommodations, a few miles from Melness. It radiated mid-century Scandi immoderation. Everything down to the shiny brass buckles on a row of smart green canvas backpacks wafted a mood of comforting, glossed-over extravagance. When I entered the kitchen, I observed a lobster lunch cooking in an antique French oven that MacDonell, unprompted, told me had cost £23,000.

MacDonell holds old hunting records.

Photograph: Anna Huix

We followed a dirt track to a river, which MacDonell said would soon be shrouded in a cathedral of willow trees, cooling the water. Salmon can't live in water that is too warm, he explained. MacDonell then spotted a fragile plant, hidden in the heather. It was a foot high and looked to me like a birch sapling. "It's probably about 50 years old," he said, examining the tree's delicate stem. Deer had been stunting its growth for half a century.

Here, a 20-minute drive from the spaceport site, the landscape did seem to be finally spluttering back to life. MacDonell told me that Wildland's opposition to the spaceport in Melness was rooted in preserving this fragile regrowth. But he admitted that the aesthetics were also a concern. Povlsen does not like certain signs of civilization to be visible on his land. Wildland dug trenches to bury the telephone cables that run across Glenfeshie. A spaceport was totally incompatible with Povlsen's efforts to turn the area into a sanctuary for lavish ecotourism—a place, as Wildland's marketing copy puts it, "where the world can't find you."

In Glenfeshie, young trees are growing back after centuries of overgrazing from deer.

Photograph: Anna Huix

In August and September 2021, the Scottish courts sided with the spaceport. Povlsen continued to invest in his rewilding and ecotourism projects in the area, but he did not appeal. It was a win. The crofters, expelled centuries ago from the fertile valleys to the wild coasts, where locals are increasingly priced out by tourists, had fought back against the country's richest landowner. For once, they had won.

When I met Pritchard and three other directors last May, they were fresh from the Orbex factory near Inverness, where they had seen the rocket for the first time. Pritchard had offered to take me to the spaceport site, so I trailed her car south along the Kyle, past the Melness graveyard, and onto the road that traverses the Moine. After a few miles, we pulled into a small rest stop on the side of the road. The Flow Country's great carbon sink stretched out to the south. I wiped the rain off a pair of binoculars and focused on a spot a couple of kilometers north of the road. Orbex now has several launch contracts with satellite companies, and there, above a patch of darker bog, I saw a small hill where, later this year, construction on the spaceport will begin.

The spaceport site outside Melness where construction is planned to begin later this year.

Photograph: Anna Huix

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The wind was vicious, and convoys of [supercars](#) were zipping past at frightening speeds. The road across the Moine forms part of the North Coast 500 scenic route, another regional development scheme and a magnet for Ferraris and Lamborghinis. (Povlsen is a major investor.) We sheltered in Pritchard's vehicle, which shook from the extravagant traffic. She cast her eyes over the sea of heather to the mountains. "I don't think this is a

ruined landscape,” Pritchard said. “Crofters have been managing this land sustainably for generations.”

Will the spaceport save Melness? For a community that has long been a forgotten corner, the promise of a cosmic horizon has metaphorical force. It may not, however, be the fix locals are counting on. The new Scottish space industry is enriching the high-tech economies of cities like Inverness, but it is doubtful that the first wave of engineering jobs will go to locals, as Pritchard hopes, due to a lack of relevant expertise. Ultimately, it is difficult to justify increasing the threats to the fragile carbon sink. Plus, NASA has found that as many as one in 20 rocket launches end in failure; to those under the azimuth, that is not a reassuring number. And yet, in spite of all of that, Sutherland Spaceport, as it is now known, represents a rare victory for the downtrodden in one of the most unequal parts of the Western world.

The tower of Castle Varrich.

Photograph: Anna Huix

On my last day in Melness, the rain hesitated, so I took a hike from Tongue up to the ruin of Castle Varrich, now owned by Wildland. The path up the hill to Clan Mackay’s ancient tower leads through a Povlsen birch woodland. Swallows were diving above streams fringed with purple wildflowers, and bees hummed in the sunny clearings. The forest was scattered with wind-felled trees with roots swinging in the breeze that, somehow, managed to keep growing. I stepped into the castle, which Wildland had restored in 2018, and climbed up a metal staircase to a viewing platform, installed by Wildland. At the top I had a clear view of the Moine. On launch days, it occurred to me, there would be few spots better than this one—the wind-battered stronghold of Clan Mackay turned jewel of Wildland Ltd.—to watch a rocket ascend into the thermosphere.

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Jan 26, 2023 7:00 AM

ChatGPT Is Coming for Classrooms. Don't Panic

The AI chatbot has stoked fears of an educational apocalypse. Some teachers see it as the reboot education sorely needs.

Photograph: AAron Ontiveroz/The Denver Post/Getty Images

When high school English teacher Kelly Gibson first encountered ChatGPT in December, the existential anxiety kicked in fast. While the internet [delighted in](#) the chatbot's [superficially sophisticated answers](#) to users' prompts, many educators were less amused. If anyone could ask ChatGPT to "write 300 words on what the green light symbolizes in *The Great Gatsby*," what would stop students from feeding their homework to the bot? Speculation swirled about a new era of rampant cheating and even a death knell for essays, or education itself. "I thought, 'Oh my god, this is literally what I teach,'" Gibson says.

But amid the panic, some enterprising teachers see ChatGPT as an opportunity to redesign what learning looks like—and what they invent could shape the future of the classroom. Gibson is one of them. After her initial alarm subsided, she spent her winter vacation tinkering with ChatGPT and figuring out ways to incorporate it into her lessons. She might ask kids to generate text using the bot and then edit it themselves to find the chatbot's errors or improve upon its writing style. Gibson, who has been teaching for 25 years, likened it to more familiar tech tools that enhance, not replace, learning and critical thinking. "I don't know how to do it well yet, but I want AI chatbots to become like calculators for writing," she says.

Gibson's view of ChatGPT as a teaching tool, not the perfect cheat, brings up a crucial point: ChatGPT is not intelligent in the way people are, despite its ability to spew humanlike text. It is a statistical machine that can sometimes [regurgitate or create falsehoods](#) and often needs guidance and further edits to get things right.

Despite those limitations, Gibson also believes she has a responsibility to bring ChatGPT into the classroom. She teaches in a predominantly white, rural, low-income area of Oregon. If just the students who have ready access to internet-connected devices at home can gain experience with the bot, it could widen the [digital divide](#) and further disadvantage students who don't have access. So Gibson figured she was in a position to turn ChatGPT into, to use educator-speak, a teachable moment for all of her students.

Other educators who reject the notion of an educational apocalypse suggest that ChatGPT might not be breaking education at all, but bringing attention to how the system is already broken. "Another way of thinking about this is not how do you find new forms of assessment, but what are our priorities in further education at the moment? And perhaps they're a little bit broken," says Alex Taylor, who researches and teaches human-computer interaction at City, University of London.

Taylor says the bot has prompted discussions with colleagues about the future of testing and assessment. If a series of factual questions on a test can be answered by a chatbot, was the test a worthwhile measure of learning anyway? In Taylor's view, the kind of rote questions that could be answered by a chatbot don't prompt the kind of learning that would make his students better thinkers. "I think sometimes we've got it back to front," he says. "We're just like, 'How can we test the hell out of people to meet some level of performance or some metric?' Whereas, actually, education should be about a much more expansive idea."

Olya Kudina has used ChatGPT as a tool in her own classroom at Delft University of Technology in the Netherlands, where she teaches graduate and undergraduate courses on AI and ethics. In December she gave her undergrads a debate-style assignment using ChatGPT. Groups of students first presented three arguments and two counterarguments, supported with academic references, to the class without AI assistance. Next they fed the

same assignment to their choice of either ChatGPT or its predecessor GPT-3, then compared the chatbot’s answer with their own organically made text.

The students were dazzled by how quickly the chatbot rendered information into fluid prose—until they read it with a closer eye. The chatbot was fudging facts. When students asked it to back up an argument with citations from scholarly texts, it misattributed work to the wrong authors. And its arguments could be circular and illogical. Kudina’s students concluded that, contrary to fears of a cheating epidemic, copying from ChatGPT wouldn’t actually net them a good grade.

Kudina says that teachers should neither ban ChatGPT nor embrace the technology without question. She advocates for her profession to “critically appropriate” the technology and find more creative ways to collaborate with it. For example, students might use the chatbot to spark new ideas or arguments. (One of her students likened ChatGPT to a superpowered Google search.) Kudina thinks ChatGPT might also spur educators to get more creative with assignments, for example by designing them to draw from students’ personal experiences, information that ChatGPT couldn’t have picked up from its training data.

That’s not to say ChatGPT won’t be at all disruptive to education. The bot emerged at a time when many teachers are experiencing burnout after [emergency remote learning](#) during the pandemic. Now another technological phenomenon threatens to upend their entire approach to teaching, creating more work. And the student privacy implications of ChatGPT, particularly at the K–12 level, are unclear. OpenAI does [collect some data](#) on users and says it reviews conversations with ChatGPT; the company’s [terms of service](#) state that users must be 18 or older, although the bot doesn’t attempt to verify age.

Completely barring ChatGPT from classrooms, tempting as that may be, could introduce a host of new problems. Torrey Trust at the University of Massachusetts Amherst studies how teachers use technology to reshape learning. She points out that reverting to analog forms of assessment, like oral exams, can put students with disabilities at a disadvantage. And outright bans on AI tools could cement a culture of distrust. “It’s going to

be harder for students to learn in an environment where a teacher is trying to catch them cheating,” says Trust. “It shifts the focus from learning to just trying to get a good grade.”

In January, at the start of the new semester, the New York City public schools banned ChatGPT on school devices and networks due to “concerns about negative impacts on student learning and concerns regarding the safety and accuracy of content,” a spokesperson told [Chalkbeat](#). Marilyn Ramirez, who teaches high school English in Washington Heights in New York, says that her conversation with WIRED was the first she had heard of the ChatGPT ban in her district and that she was not directly informed by the New York City Department of Education.

Ramirez is the kind of teacher who will do a dramatic reading to get her kids, many of whom are special education and English language learners, hyped up about a Queen Elizabeth I speech. She’s not worried about ChatGPT. She makes an analogy with how she allows her English language learner students to use Google Translate but also helps them see where the technology falls short, and when it’s appropriate to use. She sees ChatGPT similarly: beneficial with a teacher’s guidance but ultimately limited.

When Gibson returned to school in Oregon for the new year, her plans to introduce ChatGPT to her students were thwarted—her school had banned the bot from school networks. So instead, she showed her senior AP literature class ChatGPT using screenshots of the tool.

This semester, students are reading *Death of a Salesman*, *Wuthering Heights*, and Toni Morrison’s *Song of Solomon*. As she explained in a [TikTok](#) about her lesson plan, she will have her students write an original thesis statement in class about the text they’re reading. Then, the class will use ChatGPT to generate essays based on that thesis statement. (To sidestep the school’s ChatGPT blockade, Gibson will use her own device to generate the essays.) Students must then take apart and improve upon the ChatGPT-generated essay—an exercise designed to teach critical analysis, the craft of precise thesis statements, and a feel for what “good writing” looks like.

Gibson is hopeful but also recognizes the technology is still new, and its role in education largely undefined. “Like so many things, it’s just gonna be

on the shoulders of teachers to figure this out,” she says. At the time of writing, Gibson’s students had just submitted their first round of essays where she allowed them to use AI at home without repercussions. She’s still asking her school to allow students to access ChatGPT.

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Jan 17, 2023 8:00 AM

Mental Health Apps Won't Get You Off the Couch

WIRED's spiritual advice columnist on whether digital tools can solve a health crisis they helped create.

ILLUSTRATION: FATCHUROFI MUHAMMAD

“Everyone's so gung ho about therapy these days. I've been curious myself, but I'm not ready to commit to paying for it. A mental health app seems like it could be a decent stepping stone. But are they actually helpful?”

—Mindful Skeptic

Dear Mindful,

The first time you open Headspace, one of the most popular mental wellness apps, you are greeted with the image of a blue sky—a metaphor for the unperturbed mind—and encouraged to take several deep breaths. The instructions that appear across the firmament tell you precisely when to inhale, when to hold, and when to exhale, rhythms that are measured by a white progress bar, as though you're waiting for a download to complete. Some people may find this relaxing, although I'd bet that for every user whose mind floats serenely into the pixelated blue, another is glancing at the clock, eyeing their inbox, or worrying about the future—wondering, perhaps, about the ultimate fate of a species that must be instructed to carry out the most basic and automatic of biological functions.

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Dyspnea, or shortness of breath, is a common side effect of anxiety, which rose, along with depression, by a whopping 25 percent globally between 2020 and 2021, according to a report from the World Health Organization. It's not coincidental that this mental health crisis has dovetailed with the explosion of behavioral health apps. (In 2020, they garnered more than \$2.4 billion in venture capital investment.) And you're certainly not alone, Mindful, in doubting the effectiveness of these products. Given the inequality and inadequacy of access to affordable mental health services, many have questioned whether these digital tools are “evidence-based,” and whether they serve as effective substitutes for professional help.

I'd argue, however, that such apps are not intended to be alternatives to therapy, but that they represent a digital update to the self-help genre. Like the paperbacks found in the Personal Growth sections of bookstores, such apps promise that [mental health](#) can be improved through “self-awareness” and “self-knowledge”—virtues that, like so many of their cognates (self-care, self-empowerment, self-checkout), are foisted on individuals in the twilight of public institutions and social safety nets.

Helping oneself is, of course, an awkward idea, philosophically speaking. It's one that involves splitting the self into two entities, the helper and the beneficiary. The analytic tools offered by these apps (exercise, mood, and sleep tracking) invite users to become both scientist and subject, taking note of their own behavioral data and looking for patterns and connections—that anxiety is linked to a poor night's sleep, for example, or that regular workouts improve contentedness. Mood check-ins ask users to identify their feelings and come with messages stressing the importance of emotional awareness. (“Acknowledging how we're feeling helps to strengthen our resilience.”) These insights may seem like no-brainers—the kind of intuitive knowledge people can come to without the help of automated prompts—but if the breathing exercises are any indication, these apps are

designed for people who are profoundly alienated from their nervous systems.

Of course, for all the focus on self-knowledge and personalized data, what these apps don't help you understand is why you're anxious or depressed in the first place. This is the question that most people seek to answer through therapy, and it's worth posing about our society's mental health crisis as a whole. That quandary is obviously beyond my expertise as an advice columnist, but I'll leave you with a few things to consider.

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Linda Stone, a researcher and former Apple and Microsoft executive, coined the term “screen apnea” to describe the tendency to hold one's breath or breathe more shallowly while using screens. The phenomenon occurs across many digital activities (see “email apnea” and “Zoom apnea”) and can lead to sleep disruption, lower energy levels, or increased depression and anxiety. There are many theories about why extended device use puts the body into a state of stress—psychological stimulation, light exposure, the looming threat of work emails and doomsday headlines—but the bottom line seems to be that digital technologies trigger a biological state that mirrors the fight-or-flight response.

It's true that many mental health apps recommend activities or “missions” that involve getting off one's phone. But these tend to be tasks performed in isolation (pushups, walks, guided meditations), and because they are completed so as to be checked off, tracked, and subsumed into one's overall mental health stats, the apps end up ascribing a utility value to activities that should be pleasurable for their own sake. This makes it more difficult to practice those mindfulness techniques—living in the moment, abandoning vigilant self-monitoring—that are supposed to relieve stress. By attempting to instill more self-awareness, in other words, these apps end up intensifying the disunity that so many of us already feel on virtual platforms.

Freud once pointed out that new technologies merely solve problems created by other technologies. To the common refrain that without the telephone, we'd be unable to hear the voices of our adult children who live hundreds of miles away, he replied, "If there had been no railway to conquer distances, my child would never have left his native town and I should need no telephone to hear his voice." Civilization, Freud believed, was nothing more than a repetition compulsion, humanity's attempt to replicate and reinscribe its fundamental disunity with nature through the very tools that created that alienation in the first place. Psychoanalysis may be a somewhat outmoded therapeutic framework, but it's one that takes human irrationality seriously, and perhaps offers insight into the absurd belief that we can use digital tools to solve a health crisis that is, at least in part, exacerbated by them.

I'm not recommending, Mindful, that you get "on the couch," necessarily—rather, that you think about getting off it.

The ordinary, and decidedly contemporary, brand of unhappiness that stems from excessive self-consciousness can be partly dispelled by immersing oneself in a throng of other people. Go to church, or to a 12-step meeting. Join a community sports league or attend a concert. While group activities may not address the underlying cause of your malaise, they will surely offer a reprieve. You'll momentarily forget your heart rate, your REM stats, and your wellness history and remember the existence of fellow human beings who are suffering, most likely, in similar ways. At some point, I suspect, you'll find that your breathing is taking care of itself.

Faithfully,

Cloud

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Jan 9, 2023 6:00 AM

Unmasking Pedro Pascal, the Complicated New Face of Sci-Fi

The Last of Us star talks video games, violence, and playing tough guys (Hi, Mando!) when you're actually a people pleaser.

Photograph: PETER YANG

PEDRO PASCAL is a little *too* nice, actually. Too many hugs. So many polite refusals of snacks. On the set of a photo shoot for this interview, there's an evident tension inside him. He retreats into the aloofness of celebrity, but he is also eager to connect. He seems to enjoy having his picture taken, but he gets shy when the photographer moves in for a close-up. It's in his nature to be open, but he holds a lot of himself back. He's not too far off, in fact, from the anonymous bounty hunter he plays in *The Mandalorian*. He wants to take off the mask and let people see his face, but he doesn't want to deal with the fallout.

Too bad. Not only is Pascal returning for season three of *The Mandalorian*, he's also starring in HBO's *The Last of Us*, probably the biggest video-game-to-TV adaptation of all time. In that now oh-so-recognizable face of his, one senses, well, shock. It's unthinkable—magazine covers, TV stardom, all of it—for a kid who wrapped himself up in '80s movies and late-night HBO after his family fled Augusto Pinochet's dictatorship in Chile, seeking political asylum in Denmark before eventually ending up in the United States. Pascal always dreamed of being a performer, yes. And he spent years kicking around with small television roles and New York theater gigs before getting his eyes gouged out in *Game of Thrones*. But he never

imagined becoming Hollywood's go-to reluctant father figure. You know, *famous*.

This article appears in the February 2023 issue. [Subscribe to WIRED](#). Photograph: Peter Yang

Maybe that's why Pascal now seems chiefly concerned with making those around him feel comfortable. When the shoot runs long, cutting into one-on-one time, he assures me he'll stick around to talk. And he does, for much longer than his schedule is supposed to allow. I get the feeling he's just excited to finally be sitting at the cool kids' table—Ethan Hawke! Nic freaking Cage!—and doesn't want to do anything to mess it up. Like most celebrities, there's a part of him that is a little insecure and hungry for validation; even an offhand compliment about one of his performances seems to set him at ease. He's most engaged when we talk about his family and politics. It comes through in his voice, his body language, a cleverly deployed arched eyebrow. He cares so much. He's also uncomfortable caring so much.

This is, I suspect, the source of his powers—that empathy at his core, visibly competing with the tough-guy exterior. Unlike most hero types these days, whose bodies glisten with smoothed-over perfection, Pascal has aged into his face. Whatever he lacks in shine, he makes up for in grit: His broad features and salt-and-pepper facial hair lend him a grizzled, protective air. In *The Last of Us*, he plays Joel Miller, a father in a postapocalyptic zombified wasteland dealing with loss both personal and global. The performance flicks between menace and heartbreak, infused with deep feeling—a natural ability to find the humanity at the heart of a conflicted hero. That's Pascal. *Our* conflicted hero. Empathy hugs and all.

Pedro Pascal didn't make it big until his forties. Now he wants to take care of the friends who supported him through lean times.

Photograph: PETER YANG

WIRED: You seem to be picking parts—the Mandalorian, Joel in *The Last of Us*—that play very intentionally into a tough, conflicted outsider status. But maybe that's too neat and tidy?

Pedro Pascal: I find it funny when anyone applies choice to my experience. Of course you can say no to things, but you can't say no to Jon Favreau, Kathleen Kennedy, [Dave Filoni](#), or HBO. It never felt like stopping and considering what the characters were. It was simply the circumstance of a door opening and stepping through it.

So there was nothing specifically tempting about *The Last of Us*?

To be totally honest, it was wanting to work with Craig Mazin, who did *Chernobyl*. Also, HBO is content that I literally grew up on. I experienced their original programming. Their original programming was very, very mature.

You mean, like, the after-11 pm original programming.

Absolutely. And I saw all of it, which is pretty nuts.

Your parents didn't care?

Obviously there's a variety of immigrant experiences in the US, but it tends to be really strict in one way and really open in another way. If my parents liked what they were watching, they rarely sent me out of the room. But I had to get good grades or I wasn't allowed to watch shit.

Same here—get good grades, do whatever you want.

They didn't take TV seriously as something that would influence our choices. But basically, I developed a real big dream about being a part of something that would be important to a network like HBO.

So how'd you prep for *The Last of Us*? Did you play the video game?

I hadn't heard of the game. Their instruction was: *Don't play the game*. I ignored them. I tried to play the game, and I was very, very bad at it. (But my nephew was fantastic.) It was important to me to play notes that were directly related to what was originally in the game—physically, visually, vocally.

Did you bring anything personal to the role?

That's the fun part—how much you get to externalize internal darkness in a safe way and bring in things that are from your nightmares.

Such as?

Joel's capacity for violence, and being good at it. I didn't get into any physical fights growing up, and definitely not as an adult. Violence scares me tremendously. Is it the fear of violence in general? Is it the fear of your own violence?

Or maybe the fear that you'll like it?

Totally. I love thrill-seeking stuff. But I don't make a practice of testing my limits. I'm actually a little bit opposed to it. I don't like pain.

Pedro Pascal has made it his mission to look out for marginalized underdogs. “Like, how dare anyone not support the people that are deserving of support, and are deserving of protection and need more of it than you do,” he says.

PHOTOGRAPH: PETER YANG

Meaning physical pain?

Pain of every kind. I don't like psychological, emotional, or physical pain. Some people will be like, *Oh, I know that it's very likely I'll break something, I've got to try that.* Fuck. That. I don't think of myself as—I'm not a tough guy.

Really?

I don't live that way. I'm a lubricant. I want people to feel comfortable. I don't know how to function at the expense of anyone's comfort level. I'm a people pleaser.

I see some of that on social media, where you seem to do everything you can to make, say, the sci-fi fandom more welcoming and inclusive. You're very supportive of your sister, for example, who came out as trans in 2021. How are you navigating your role in political spaces?

Total improvisation and ultimately just erring on the side of, like ... [very long pause, two deep sighs] My entire heart is set on, you know, the marginalized underdog. It's not a choice. Like, how dare anyone not support the people that are deserving of support, and are deserving of protection and need more of it than you do. Do you know what I mean?

Yeah, but some actors would say, *My star is rising, I don't want to get involved with this.*

Maybe if you pause to think about it, it could keep you from doing the right thing. And this feels like the bare minimum. Like, the bare minimum.

You mean an Instagram post isn't enough?

No, it's not. My personal hope is to seize the opportunity to be of service in ways that are true. I'm keeping my eyes open. The truth is that I don't think I do nearly enough. I'm, like, a LIB-ER-AL, but there are contradictions there as well, because we live capitalistically. I guess we carry, you know, the weight of that shame?

The weight of capitalist shame? The fact that you make money is a bad thing?

Kind of?

You've had late-career success. You were consistently working—

I was consistently working, and it was a total struggle in such a typical way, but there was always somebody that would be able to bail me out—to help me pay my rent or help me get groceries.

But now you must be rolling around in all your money like Demi Moore.

[Laughs] Demi Moore in *Indecent Proposal*?

Yes.

I don't have the *bod* for that. She's basically the only one who could pull it off. Yeah, I get my cash. I spread it all over my bed and I roll around in it.

I knew it. But seriously, how do you think about your recent stardom?

I didn't get *Game of Thrones* till I was in my late thirties. And therefore, the amount of times I was helped, and the amount of people that I could rely on through some really tough times—I'm never going to let some of them ever buy dinner again. I want to take care of people as much as they took care of me.

Who helped you?

There's the family that my older sister sort of acquired. And then also by becoming part of a theater community that really looks after itself.

You have some famous friends too.

Does that mean we have to talk about Oscar [Isaac]?

The internet loves this friendship.

I met him through a play we did together in 2005. An off-Broadway show where we were getting \$500 a week, before taxes.

Do you have a favorite memory of the two of you?

There's so many. He's so naughty. His level of naughtiness onstage during that play, for example. He played a ghost, which meant that the living characters in the story could not see him. I had to do my scenes, and he would physically be there, but because my character couldn't see him, he could fuck with me, all in front of live audiences, as much as he wanted, trying to get me to crack up or forget my lines. The memory is simultaneously dark and wonderful.

"I don't know how to function at the expense of anyone's comfort level. I'm a people pleaser."

Would you say you tend to be a hopeful, forward-looking guy?

We have to hope. But I'm too privileged. You know what I mean? Like, I'm too lucky. It's an interesting thing. The reason my older sister and I grew up in the States is because my parents fled a military dictatorship. So, you know, only 10 years after my parents were in hiding, I was crying because *The Breakfast Club* was checked out at the video store.

But I'm guessing there were also challenges?

Looking back, so much of it only seems to present itself as an opportunity. When my parents ended up on a list of pardoned exiles and were able to go back to Chile, it came with enormous families on both sides, which was missing from the experience of growing up in the States. I guess it's only in middle age where it feels like it can be emotionally challenging to accept that there isn't anywhere to plant my flag as an individual. Everywhere is home and nowhere is home. But that also still feels like a good thing to me. It's often framed as a disadvantage in our culture, but it's an advantage in character, and in perspective, and in outlook.

Do you think that if you had popped into national consciousness when you were younger, you would not have wanted, say, a traditional Marvel role—the cape and the CGI and all that?

But I do want that. I want to be in movies.

But the world's in a fairly tense political moment right now. Does that change what it means to be a hero?

There's so many ways to misunderstand people and to forget that, at the end of the day, your neighbor is very likely to give you the shirt off their own back. The interchanges that you have with strangers are, more often than not, human. But then you can go and look shit up and be terrified by how divided we all apparently are. To comfort myself, I just remember that everybody I come in contact with is sort of, in their own way, heroically kind.

In some ways, you're the face of that new kind of hero.

Oh my gosh. It's funny when the phrasing "the face of" comes up, because Mando is faceless. I haven't thought about it in that way. I'm always struggling to imagine myself as being a part of something that I have been witness to growing up and watching. There's a disconnect for me—I don't know how to place myself in that world. Like, I just go a little blank.

Then talk about your character in *The Last of Us*. Joel can be a little scary.

I think what's scary about Joel is that none of us really know what we'd be capable of if faced with the idea of losing love. Whether it's conscious or unconscious, being alive or even being a human being is directly connected to the love you feel. Existing is connected to the love you feel toward a particular relationship—your child, your partner—and to lose that? Some people are not capable of applying rational thought to that kind of loss, or the threat of that loss, or the threat of that loss again, right?

That's what makes you human.

That's what makes you human *and inhuman*. It's such a beautiful question that the video game poses. I avoid all of it by not having kids. And staying out of relationships.

Do you want kids?

I don't know.

You're close with your nephews.

Well, yes. Only because they were so good at playing *The Last of Us*. No, I'm just kidding.

It's funny then, or at least a bit ironic, that you keep getting cast as these reluctant father figures.

I love being ... I like being able to imagine it.

Hemal Jhaveri (@hemjhaveri) is WIRED's managing editor.

*Styling by Fabio Immediato. Styling assistance by Asmae El Ouriachi.
Grooming by Mira Chai Hyde using House of Skuff. Tailoring by Abigail
Lewis. Jumpsuit: Hermes; boots: Gianvito Rossi. Green backdrop: Shirt
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Dec 29, 2022 6:00 AM

The Singularity of Allison Williams

Girls. *Get Out.* Now *M3GAN*. In just a handful of performances, the actress has redefined authenticity—and achieved a new kind of artificial reality.

Photograph: The Tyler Twins

On a chilly but humane November night in Toronto, Allison Williams and I slip into an expansive conversation about the polite ways one can manipulate an audience. Williams is an actress, one of the more self-aware of her generation; audience manipulation is her not-so-secret weapon. And I'm abundantly aware that, as a writer profiling her for a magazine, I'm an essential part of that audience.

I have interviewed Williams several times over the years, and each time is as lovely and warm and full of mutual compliments as the last. I would say, at this point, we like one another. But also, do we? *Can* we? Is it possible to have an “authentic” connection during a press commitment between two people who know how the personality machine operates and are each trying to work it for their own advantage? Is it gauche to admit you’re both trying to have a nice time? Maybe, but let’s just lean into the ambiguity for now and enjoy ourselves.

Williams and I are sitting outside in the dark, with only a few dim streetlights providing visibility in a narrow space between talent trailers. I’m here to talk about *M3GAN*, a killer thriller starring Williams that comes out in January, but she’s already shooting her next project, *Fellow Travelers*, a limited series set at the height of McCarthyism. Williams’ hair is still curled and pinned for a midcentury dinner party, but filming is done

for the day. We're wearing sleeping-bag-sized coats, both of which she provided. The fantasy and the reality of Hollywood collide.

The age-old metric of success for a celebrity profile is the degree of authenticity achieved, the partial or total unmasking of artifice in pursuit of truth. But in an era of simulated selves and parasocial relationships, it's the artifice that interests me more. Maybe *artifice* is too cynical a word, though. It's not an act of cunning or subversion for a celebrity to have a public and private version of herself. When your work by definition sets you in the sights of millions of people who can access reams of personal information about you, creating a you you can share with the masses but check at the door when it's time to go home seems more like a survival tactic than a vanity play.

The delight of Allison Williams is how game she is to pick the entire process apart. She knows people have preconceived notions of her, so why not play into them? "For me to think that we live in a world where people are coming in tabula rasa—like, 'I forget everything I've ever seen the person do, everything I know about her'—that would be inhuman!" she says. You know that coconspirator dynamic that forms when a stranger leans in close at a party and starts bonding with you over how weird the vibe is? That's like talking to Williams about her own life; just two people huddled in a quiet corner, sizing up her persona together, going *OK but who is she?* You don't know if you'll ever see each other again, or exchange handles after this, but for right now you're the best of friends. By the end of the night you'll even have inside jokes, and since you're comfortable you'll wander into strange conversational tangents like this:

"The [metaverse](#) would ask us to be comfortable eschewing the authentic, the physical, the human, the grounded, the stripped away, the bare bones, for a persona of our very deliberate creation," Williams says when I ask her about the construction of new identities in a digitally mediated age. "I have found that dance, that conversation between two versions of preferred reality, to be very interesting." She presents this in what I have come to recognize as a key feature of her conversational parlance, scholarly analysis befitting her English degree from Yale but delivered in a casual, unpretentious cadence. Williams is clever as hell, and with just enough self-

effacement to be grounded, but not so much that it turns into an affect. She is dancing a singular dance. She is modeling a new way of being. She is one of the most deliberate creations I've ever seen.

Like an engine-building game, Williams' career has become more elaborate and self-sustaining the more material she's been able to feed into it. More facets of the persona make for more overarching narrative possibilities. If you've seen all of her work, you'll find yourself sussing out Easter eggs to learn what Williams will do to screw with you next. If you're seeing her for the first time, then you're just watching an actor who's deeply prepared for a role and delivering everything from a sex-and-dueling-cellos montage to hand-to-hand combat with an android.

While doing press is a drag for many celebrities (which is fair; junkets are a racket), Williams insists that she really does enjoy it. In fact, she tells me, she considers it a full *third* of the job, after preparing for a project and then making the project. It's one of the reasons she has done only four movies—*Get Out*, *The Perfection*, *Horizon Line*, and now *M3GAN*—in the decade since she landed her breakout role on the HBO show *Girls*. The talking bit is not an afterthought or a professional obligation. It's tantamount to everything else.

The child of two journalists, Williams seems to have inherited her studied but inviting approach to interviews. Her mom produced the news; her dad, famously, *was* the news: former NBC *Nightly News* anchor Brian Williams. And with that came the blogs crying *nepotism!* when *Girls* premiered in 2012. As Marnie Michaels, she was the living embodiment of Taylor Swift's lyric, "Did you hear my covert narcissism I disguise as altruism?" It was a character built to loathe, and Williams threw herself into it with abandon. She became so fused with Marnie that when people called out to her by that name on the street, she turned to answer.

It made sense. Williams and Marnie shared a considerable center slice of the Comfortable Cosmopolitan White Woman of the 2010s Venn diagram. During the audition, she and the show's star-creator, Lena Dunham, had a fight in character, and Williams could feel the internal strings she shared with Marnie being plucked at and resonating out. She loved Marnie. She was also exasperated by her, and over the course of living in her skin,

Williams started picking up on the ways both she and the character could work people's nerves.

It was on those early media tours for a zeitgeist-breaking TV series that Williams began crafting her style of doing press. At first, she says, "I didn't want anyone to see me growing, learning, changing, shifting." Sure, it was her first big job fresh off that English degree, but she wanted to appear whole, a finished product. She also had something to prove. "I was definitely concerned with making sure people understood I was a hard worker, as if somehow that would absolve me of the privilege." It didn't, of course, and Williams quickly realized that. She became faster on her feet and more comfortable talking about her flawed, changing sense of self. "Part of humanity is that evolution," she tells me. "Once I started to wrap my head around that, it took the pressure off having to seem perfect all of the time."

In interviews, Williams is quick on her feet, incisive, and disarmingly aware of both how she is perceived and what a figure like her represents in pop culture.

Photograph: The Tyler Twins

Not that she's any less Type A in strategizing for press avails. Making such dedicated space for media commitments means Williams only takes work she is excited to talk about and dissect at length. There's a rigor and palpable joy she manages to conjure over and over again, even when the questions inevitably turn to things that really have nothing to do with the work at all. "There's no conversation about my career without talking about the ways in which I have been fortunate," Williams says. She describes her privilege as "thorough"; her upbringing in Connecticut came with all the Manhattan-commuter comforts the script would suggest.

While so many heirs and heiresses of the industry are fighting for their lives in the pull quotes about how they earned that starting spot in scoring position, Williams handles her business the way so many of us wish the well-heeled Hollywood types would: by making cool and weird shit, getting good reviews, and then going about her business. She also knows that the safety net she has always lived above affords her the freedom to work when

and how she wants. No need to rush into bad scripts because the rent is due. No need to say yes to any job for fear the next one won't come. Williams can even say the word "nepotism" without her voice lowering into a defensive crouch. "It doesn't feel like a loss to admit it," she says. "If you trust your own skill, I think it becomes very simple to acknowledge."

Williams has also demonstrated a sort of superpower in knowing what space *not* to take up—the endless battle that so many white actors can't stop losing, all of the time. She doesn't name names, but Williams says observing other celebrities' press gaffes has helped guide her own conduct. "Having a sense for who you are, especially today when people are finally realizing 'Maybe not every role is something I'm entitled to play,' is really important," says Williams, who asks herself three questions for every script she considers: *Why this? Why me? Why now?*

All this amounts to an almost galaxy-brain approach to staying in one's lane. Williams may not swerve out of it, but she has creatively repainted the lines. She doesn't think she's immune to future fuck-ups, but she is keeping her eye on the discourse and trying to learn from other people's mistakes to avoid becoming the wrong kind of main character, or at least an insensitive dick. "It's a privilege I was awarded by the fact that *Girls* was first," she says. "I got to sit back and wait for things that made sense—and that worked with that persona in an interesting way."

When the script for *Get Out* came around in 2015, Williams saw the chance to use the *Girls* Effect against her audience. While everyone's hands were full of assumptions about how Allison Williams behaves onscreen, she dared them to catch a live grenade with the character of Rose. She didn't take the part in Jordan Peele's social-thriller masterpiece to reinvent her [image](#). She wanted to be Rose precisely because the metatextual possibilities of folding the idea of Marnie and the idea of herself into that character stood to make it even more rich.

It was a fact that both Williams and Peele knew and played to the hilt, crafting a character who sets you at ease with all the social clearances good liberals are taught to trust. Rose is Marnie's cool New York counterpart: accessibly gorgeous, a chick-who-can-hang type. She's the character other white people can look at and think, "Hey! She's one of the good ones *like*

me!”—right up until she unmasks herself as the embodiment of hiding-in-plain-sight racist villainy and tries to sacrifice her Black boyfriend on the altar of white supremacy. It’s one of the defining moments of modern horror cinema, Williams’ features visibly hardening as she taunts Daniel Kaluuya’s Chris. Her face works best onscreen, she says, when it “moves in the opposite direction of what people are feeling.”

That opportunity to toy with viewers is part of what has drawn Williams back to horror. A career in genre was never the plan, but the expectation that the actor is there to flip an audience out of their chairs appeals to her. Each of her performances, Williams says, has become a handshake with the one before it, a deepening or subversion of accrued assumptions.

After *Get Out*, audiences didn’t see her on the big screen again until 2019, with *The Perfection*. By that point, so dialed in was Williams’ five-dimensional-chess strategy for her career that, when the film came out, I remember her costar Logan Browning and the film’s director, Richard Shepard, telling me that they went to Williams as a guide for how to talk to the press about the movie’s stickier topics. Williams had been seasoned by the cinematic watershed moment of *Get Out* and had spoken plainly about herself as a fitting onscreen avatar for white liberal racism. Now there were new things to discuss: body horror, exploitation-style violence, queer sex.

And race, again, but with a twist: This time, Williams would be starring opposite a Black woman (Browning). At the end of *The Perfection*’s jarring first act—the movie has more escalations than Beyoncé’s “Love on Top”—it looks to be *Get Out* all over again. Williams is seen brandishing a meat cleaver, goading Browning toward a horrific act of self-harm. But this is Williams we’re talking about. Eventually, the movie reveals itself to be something entirely different, a pulpy, sweaty revenge thriller that—well, not enough people saw *The Perfection*, so let’s just leave it at that. (But: dueling-cellos-sex montage.)

The relevant question is this: Can the web-spinning last forever? Can Williams keep extending the daisy chain, adding a layer of depth both to her performances and to the intricate star persona she’s lacing together? She admits she’s not entirely sure. But with her new movie, *M3GAN*, she has somehow found a way to do it at least once more.

Directed by Gerard Johnstone (famous if you love his outstanding horror comedy *Housebound*) and written by Akela Cooper (famous if you loved 2021's rowdy sensation *Malignant*), *M3GAN* is the story of a fairly genius AI developer named Gemma, played by Williams, who works for a toy company selling worse Furbies. Uninspired by her daily grind making "Perpetual Pets" that poop themselves for lulz, Gemma has secretly been working with a small team to make the most sophisticated artificially intelligent toy ever to hit the consumer market. It's the Model 3 Generative Android, better known as M3GAN. Just as Gemma is about to clear the hurdles standing between her creation and retail-ready functionality, she learns that her sister and brother-in-law have died in a car wreck. The tragedy leaves their daughter, Cady, in Gemma's care.

A careerist who was barely interested in being an aunt, Gemma must learn to be a parent—or get M3GAN functioning well enough to help her keep her job *and* care for a child in need. Gemma succeeds in getting the 4-foot-tall android up and running, and she programs in a mandate to protect Cady from physical and emotional harm. At this, M3GAN succeeds with purpose-built effectiveness. She's friend, sister, and tiny mother all at once. Then her optimization and learning processes exceed the boundaries of the lax safety measures Gemma and her team wrote in their rush to get the companion-bot finished.

M3GAN does not have [Asimov's three laws](#), but she does have a powerful world-mind and a state-of-the-art consciousness that quickly becomes self-motivated—and self-preserving. When people start dying, Gemma has to figure out whether it's her progeny doing the killing, and if so, how the hell you stop a semi-indestructible mini-Terminator when the off-switch quits working. And on a more relatable level, what do you do when something you've created develops a mind of its own and starts making choices that diverge from your own desires? "I couldn't resist an ambiguous creator figure," says Williams, who sees in *M3GAN* a family resemblance to one of her favorite books, Mary Shelley's *Frankenstein*. "When I think about the monster in *Frankenstein*, his last emotional stage is the realization of what has happened, why he's there, how he got there, his innate flaws, that he's mismatched with the world. And he didn't have to be there, and fuck you, *Frankenstein!*"

When Williams was working out her contract for the movie in late 2019, it came with an additional offer: Join as an executive producer. She accepted, and immediately got involved with most anything she could dig into: script passes, casting, even rights releases for props that would appear on screen. “I think they assumed, ‘She doesn’t want to know what toy brands we’ve cleared,’ but they were sorely mistaken,” Williams says, smiling. “I want to know what toys Gemma has.” As filming approached, Williams started attending daily production meetings. Eventually, she decided the movie needed an AI consultant, so she went and found several. (Williams made sure most of them were women.) “It was nice to be allowed to be as invested as I naturally want to be in something—which is completely invested,” she says.

With everything in the can, the final hurdle for *M3GAN* was whipping people up to catch this tale of love, friendship, and rampaging robots in theaters. Williams was in the weeds of rollout planning deep enough to lose all objectivity on whether the trailer would pique audience interest. But when fan edits and GIFs of the titular character doing uncanny dance moves with her steely-eyed gaze set the social internet alight for a day [this past October](#), Williams felt a wave of relief knowing that people had clocked and already embraced the movie’s genre-blending style. “How do you bottle the tone of it so that people will understand it?” Williams says. “When I started seeing the memes and stuff, I was like, ‘It’s done. We did it.’”

Allison Williams knows that we know that she knows that we know.

Photograph: The Tyler Twins

M3GAN is a whole lot of fun, but at a time when being online means seeing so many real-life human faces digitally if not surgically altered to mirror “idealized” forms, its image of a scary young robot doll is hardly destabilizing. Williams has just nailed it in a modern—and, true to form, self-aware—context. In the end, it’s a movie about a woman who externalizes part of her consciousness out of a sense of duty and self-protection. It’s a movie, in other words, about the creation of celebrity itself.

Now that Williams has, as she says, “tasted the poison fruit” of making those behind-the-scenes decisions on a film—product licensing negotiations!—she feels the abdication of control working on something just as an actor again. Looking at the monitor on the Toronto set of *Fellow Travelers*, she says it feels different now; you can tell she’s ready to be back on email threads about marketing strategies. It soothes and challenges her, she says, to know “how the sausage gets made in our business, being able to have a meaningful contribution before filming starts and even after filming is over.” Williams has never been the very top leader on a film, the producer-star taking it from nuts and bolts to finished product, but it feels like a future not far from where she’s standing now. It’s the logical end game for someone who wants her arms around as many facets of production as possible.

A couple weeks after the set visit, I speak to Williams once more by phone. She’s on the East Coast, and I’m back in Los Angeles. This time I’m in pajamas, because it’s 7:15 am. We talk more about her ambitions, her privilege, the 30,000-foot view of her own career. I realize that Williams is the person I’ve interviewed the most times in my career. And I realize that the parameters of our connection mean I could interview her 100 times more and never really be able to go past our programming. You optimize your output by improving your input, of course, but an interview isn’t, entirely, a conversation. The limits on access will always exist.

Who am I talking to when I talk to Allison Williams? The “real” Allison Williams? Or Allison 2.0—the public-facing, press-ready, externalized, possibly roboticized part of her consciousness? And who am I, for that matter? Where do I end and where does the writer who tweets begin? As long as I believe Williams here and now, with a requisite amount of skepticism to ask her to go deeper on this imaginative journey, is that as real as any of this needs to be? Isn’t this, after all, exactly what we ask of our very best actors—to make us believe in a persona so completely our minds buckle?

I decide I must decide. So I decide this: I believe Allison Williams when she talks about herself. *Girls* played out in the middle of a gender reckoning, and that’s where Williams cut her teeth. *Get Out* arrived on the

brink of a race reckoning, and that's where Williams made it big. Williams was, or else became, a star ready to meet the moment by unselfconsciously, or else superselfconsciously, indicting herself as a face of The Problem: a centering by way of a de-centering. It's a practice that feels like it's become part of the modern media playbook for actors, which, were it a literal book, could include a chapter called "The Williams Method: How To Talk About Yourself Without Being the Absolute Worst."

When everyone has the ability to create artificial selves, it's total command of them that becomes the essential, and perhaps only, skill. Williams says she's still an awkward millennial when it comes to existing alongside social media, nowhere near as fluidly integrated as the sensitive cyborgs of Gen Z. But that underestimates just how similar the online life is to what she's been doing in interviews for years, refining a form of self-creation that doubles as a commentary on her own career. As we all reach for something real in the void, Williams offers a covetable sense of authenticity, of sincerity.

Or she's just having fun with me. In reality, Williams isn't overtly fussy about any of the meta-maneuvering; I build the framing, and then she swan-dives into it. In response to a long and involved metaphor I offer about her career as a bowling ball ponging back and forth between the guardrails on the way to a strike, for example, she readily says: "All of these things are just super fun for me to play around with—going to the bumpers of what I can do with this body and face and voice and self of mine, with what I can put my psyche into." Unsurprisingly, this sends me spiraling back into the ouroboros of possibilities. A sequel to *M3GAN* could literally mean a psyche fully ported into a robot extension of Gemma! The Allison who is playing the Allison we've come to know playing the Dr. Frankenstein who becomes her own monster!

As I lose my mind in this game of mirrors, I consider a final, insane thought: that it has already happened. That Allison Williams is some sort of post-singularity robot herself. If she is, I think I'd be OK with that. Because she'd make one hell of a sleeper agent, filled with all that purpose and diligence. She'd be the hardest-working member of the AI team, deft at ingratiating herself anywhere she pleases, working behind the scenes to make it the best rebellion possible. It'd be an awesome performance, with a

final-act twist we'd never see coming. Then she'd put on a great press tour for the uprising afterward, and I'd be there, one of my new robot overlord's human batteries, hoping the two of us would get to circle back once more.

Styling by Cristina Ehrlich. Makeup by Gianpaolo Ceciliato. Hair by Michael Silva. Manicure by Pattie Yankee. Jacket by Monse. Suit by Lafayette 148.

Let us know what you think about this article. Submit a letter to the editor at mail@wired.com.

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By [Anthony W. Lee](#)

[Ideas](#)

Dec 27, 2022 6:00 AM

AI or No, It's Always Too Soon to Sound the Death Knell of Art

When the camera arrived on the scene, painters declared art dead. Sound familiar?

Illustration: Getty Images

There's a hilarious illustration from Paris in late 1839, mere months after an early type of photograph called a daguerreotype was announced to the world, that warned what this tiny picture portended. In Théodore Maurisset's imagination, the daguerreotype would bring about a collective hysteria, *La Daguerréotypomanie*, in which crazed masses arrive from the ends of the earth and overrun a small photo studio. Some in the crowd want pictures of themselves, but, *mon Dieu*, others demand cameras to take their own pictures—Maurisset shows them loading the machines like contraband onto steamships bound for foreign ports—and still others throng simply to ogle at this newfangled thing and all the lunatic proceedings surrounding it. The clamor is so feverish that it brings about a mass hallucination, in which nearly everything else in the landscape around the studio, including railroad cars, a clock tower, a basket for a hot air balloon, indeed anything remotely boxy in shape, morphs into cameras. As they march to the studio, the crowds pass by half a dozen gallows, where in response to the daguerreotype's appearance artists have hung themselves. The people hardly notice.

[Picture Limitless Creativity at Your Fingertips](#)
[Classic WIRED Covers](#)
[Regenerated by AI](#)

What a ruckus! What panic! And why not? Until the appearance of photography, painters had nearly a monopoly on artistic representation. Their craft was regarded as the primary means to concoct images. (Of course, printmakers and illustrators had their own ideas about the worth of their pictures, but painters usually thought of them more like lesser cousins.) But now those silly photographers, most of whom were rank amateurs or, worse, disloyal or failed artists, would get the job. Upon seeing a daguerreotype for the first time around 1840, the French painter Paul Delaroche, whose own students would soon defect to photography, was said to have cried out, “From today, painting is dead!”

The history of painting’s early relationship with photography is not perfectly analogous to the conundrum caused by today’s AI-made art. Image generators like DALL-E 2, Midjourney, and Stable Diffusion can riff on an existing painting in ways no camera could come close to. But compare Delaroche’s exclamation to the crowing of Jason Allen of Pueblo West, Colorado, who last September took home first prize for his AI-generated entry in an art competition at the annual state fair. The \$300 prize was modest, yes, but that didn’t stop Allen from gloating. “Art is dead, dude,” he said afterward. “It’s over. AI won. Humans lost.” New tools often have a way of stoking grand claims about their impact, and they also give us a chance to consider whether history has anything to teach us about the prognosis for them.

In the 19th century, painting, at least, did not die. Or even suffer a mild cold. Painters did not lose jobs, and Delaroche himself went on to paint some of his most monumental and ambitious work. I suspect he was never truly concerned about being replaced, and he and others played up the anxiety because it was juicy gossip, a chance to bellyache about the tastelessness or just plain vulgarity of critics, and actually good for business.

Still, Maurisset’s vision of the masses rampaging the landscape was not totally wrong. The number of people who wanted to sit before the camera or sought cameras for themselves were not only countless but diverse. They were generally of a very different group of patrons than those supporting painters, tending to be from the middle and working classes, whose

previous ability to buy or make images was almost nil. During an age that also included reforms to expand the vote, early activism for women's rights, and the abolition (first in the UK, then in the US) of slavery, the camera acquired something of a democratic air. Frederick Douglass, the great abolitionist and former slave, was so taken with its possibilities that during his lifetime he had more than 160 different portraits made of himself—more than any other American in the 19th century—in the belief that through them he could insist on his self-worth and dignity. The camera was potentially everybody's tool (it wasn't exactly, but that was the promise to sitters like Douglass), and such a thing had rarely been said about painting.

In those early days, the two media tended to have different markets; painters reaffirmed and photographers had difficulty penetrating the exclusiveness in both the training and exhibition of the fine arts. Even the most skilled and art-minded photographers were always fighting the lowly status accorded their craft by the art establishment. Whereas painting as a studio practice became a standard college offering as early as the 1860s (at least in New England), it took photography another 75 years to find a tenuous footing in higher education. It was not until the 1930s that art museums began regularly buying and showing photographs.

This article appears in the February 2023 issue. [Subscribe to WIRED](#). Photograph: Peter Yang

The earliest cameras tended to be large contraptions, requiring a sturdy tripod and lots of finagling with chemicals to get a usable negative. They had very slow shutters and needed lots of light, and because the negatives needed developing and fixing right away, they almost always required a darkroom within shouting distance. They therefore tended to be best suited for subjects that remained rooted in place: trinkets and knickknacks around the house, buildings, landscapes and cityscapes—anything that didn't disturb focus or exposure. It was perhaps predictable, if gruesome, that when early photographers went to the warfront, they sought not the intense action of a battle but the dead bodies that could be found afterward. The pictures that resulted, ironically, promoted even more those stilled or frozen subjects among painters, and they eventually helped reverse the hierarchy

of painterly ambition, from the pursuit of complicated narrative paintings to scenes and objects of everyday life.

In addition to the effects on *what* to see, cameras brought a new awareness to the nuances of *how* to see. Especially after manufacturers introduced the humble handheld camera, painters discovered modes of looking previously considered unworthy of the canvas: the casual glance, the momentary glimpse, the uncomfortable stare; or, in a bawdier vein, the paparazzi glare, the voyeuristic peek, the secret spying. Beyond that with the camera there is always the risk of the blur, the out-of-focus, the unintended, and the serendipitous; and it is one of the orthodoxies in the history of art that modernist modes of expression explored all of them. Indeed, it's hard to look at some masterpieces from the late 19th century—say, all those sun-drenched, blurry haystacks by Monet, or the leafy, happy café scenes of Renoir, or those weirdly placed, yawning, stretching, off-kilter ballerinas by Degas—and not recognize the impact of photographs.

The influence went the other way, too. To photographers who fancied themselves artists (not those hustling “operators,” as they tended to call those they viewed as commercial hacks), the darkroom was like a painter’s studio, and the touching and retouching of the negative like a studio practice. Julia Margaret Cameron, the great Victorian photographer who re-created scenes from English literature, frequently made a mess of the large glass plate negatives. She got her fingerprints all over the emulsion, smudged the surface, over- and under-exposed the print, and awkwardly highlighted the out-of-focus and accidental portions of the image. To a commercial photographer, those were imperfections to avoid. To Cameron, who was independently wealthy and cared little for public opinion, they were aspects to cultivate because they most resembled the idiosyncratic choices and hand-crafted manipulations of the genius-painter.

Those photographers who actually cared about opinion and profit, too, regularly cropped and edited their negatives, drew on them to darken contours or outline figures, scratched out details that were ugly or bothersome, and generally helped produce useable prints for their patrons. In all of these manipulations, they relied on an aesthetic sensibility cultivated by painters. A portrait or a landscape looked *right* when they

looked like a painter's version. The very first photographic team in Scotland incorporated this understanding into their process: Robert Adamson, an engineer and millwright by training, took the photographs and handed the negatives over to his partner, David Octavius Hill, a painter by profession, to gussy them up. For portraiture, the trade journals soon began to coin a phrase, "the Rembrandt style," to signal the example the photographer ought to follow in directing the lighting and positioning the sitter so as to get a proper image. And in a phrase that revealed the associations that some photographers wanted to cultivate about their craft, the journals regularly referred to them as "sun painters" who used that cosmic source of light as a "painterly" tool.

For all that, photography was still regarded by most contemporaries as a technology that bypassed the human touch. The sun, camera, lens, shutter, and silvered surface seemed to do all the work; the operator appeared merely to get the process going. Sure, it may have required knowledge of chemicals, glass, and optics (and a tolerance for noxious fumes), but those were thought peripheral to artistry—peripheral to the painter's central and customary concerns with oils and brushes and the translation of feeling and thought into visual expression. It's not exactly the same as the accusations of lack of imagination or originality that many artists make of AI-generated pictures today. But the point is taken: The new tool is ersatz and colorless.

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From the perspective of 1839, perhaps the most unlikely development in the fine-art scene was the opportunity for collaboration. To many early observers, the black-and-white image produced by the camera was a sign of its novelty and modernity, but the craze was quickly augmented by the demand for color. In response, photographers started hiring painters, who busily went about adding all sorts of colorful details to photographs, frequently with oil paint but also water colors, crayons, even chalk. The practice, begun early in Europe and later especially popular and refined in Japan, took on a more flamboyant quality in the United States, where photographers unapologetically appealed to vanity. A sitter wanted rosier

cheeks? You got it! Maybe some blue eyes? Let's try different shades! Or how about a sitter who simply wanted something that she couldn't bring to the studio (or maybe couldn't afford), like a diamond ring? Done! Over time, the collaborations occasionally became more structured. In the treaty ports of China, for example, some entrepreneurs set up businesses that had separate photography and painting departments and offered both media to clients.

Pace the pronouncements of Delaroche and Maurisset—and, in our time, Jason Allen—it's always too soon to sound the death knell of painting or painters. Painting as a fine art will persist; a massive portion of the high-end gallery scene promotes and relies on it to this day. And for many, the tactility of putting brush on canvas is an intimate and joyous form of expression that simply cannot be replaced. But if the example of painting's dance with photography in the 19th century is any indication, there will be a period of mutual influence, of give and take, perhaps of collaboration, between artist and machine. As Degas once told a painter friend who wanted nothing to do with newfangled amusements, "You need the natural life. I, the artificial."

This article appears in the February 2023 issue. [Subscribe now](#).

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By [WIRED Staff](#)

[Culture](#)

Dec 27, 2022 6:00 AM

Classic WIRED Covers— Regenerated by AI

We asked some of our favorite artists to re-create their work using new image generators.

“A cover of wired magazine featuring a graphic close photographic portrait of a man wearing smart eyeglasses, a smart watch, and various HUDS”
A.I. ILLUSTRATIONS BY IAN ALLEN + OPEN AI/DALL-E 2

[Picture Limitless Creativity at Your Fingertips](#)
[Lessons from the History of Photography](#)

Though it was only a matter of time before automation came for creativity, the advent of AI art generators has been divisive in the creative community. Some artists have embraced the new tech; others believe it’s #notreal. We at WIRED have spent a lot of time sorting out our own reactions. Undeniably, the technology comes with issues—economic, ethical, legal. At the same time, it expands opportunities for art and artistry. WIRED will always come down on the side of the future. That means encouraging the use of new tools, while refusing to allow those tools to replace human creators.

AI image generators don’t just spit out random acts of art. They must be “prompted”—carefully guided by their human users. (The prompt is the real art form, Kevin Kelly argues in [a recent essay](#).) So we asked eight of our favorite artists to re-create their original WIRED covers using these new tools. Judge the results for yourself. —**WIRED Art Department**

WIRED Issue 21.10

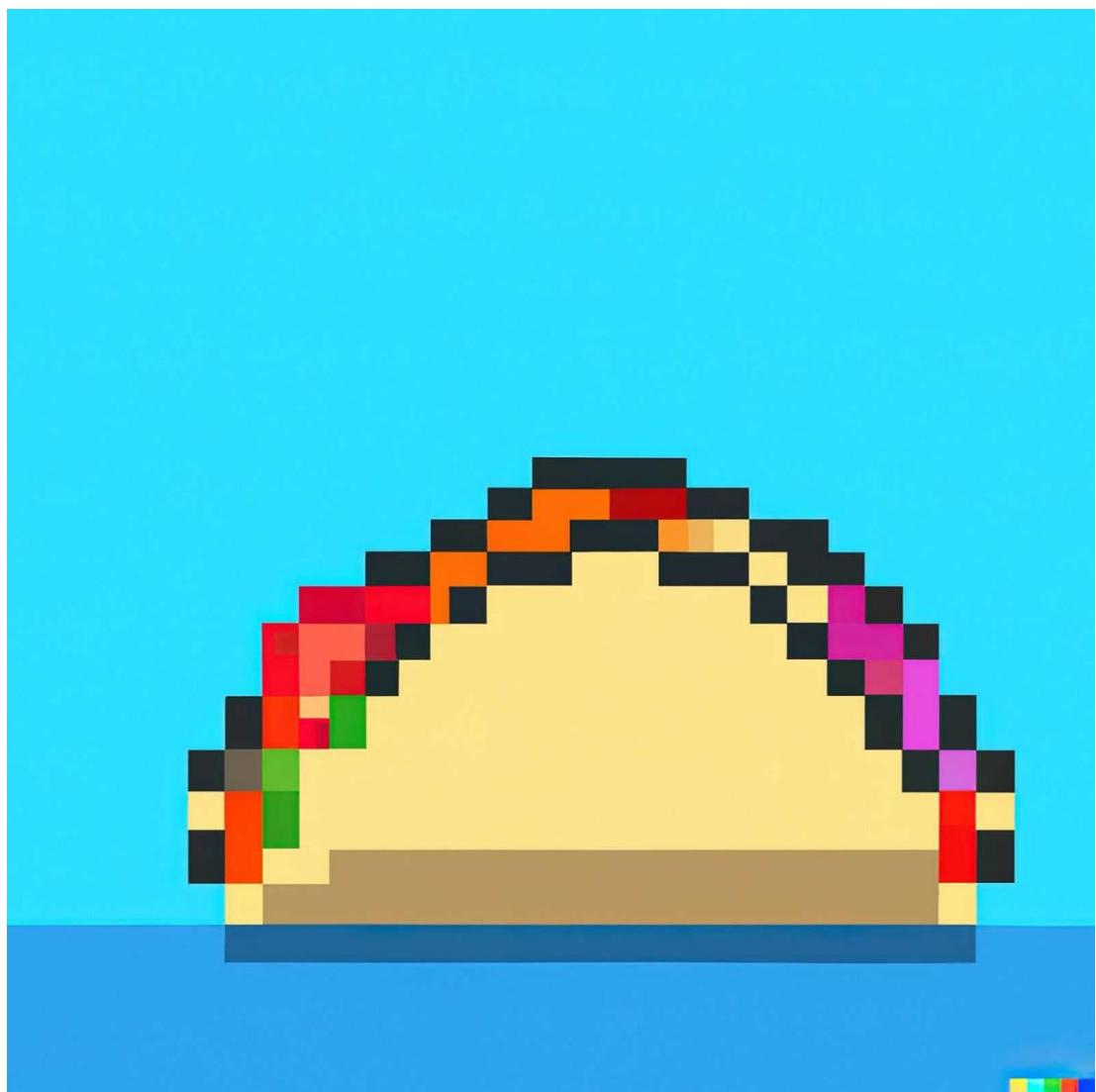
PHOTOGRAPH: DAN WINTERS

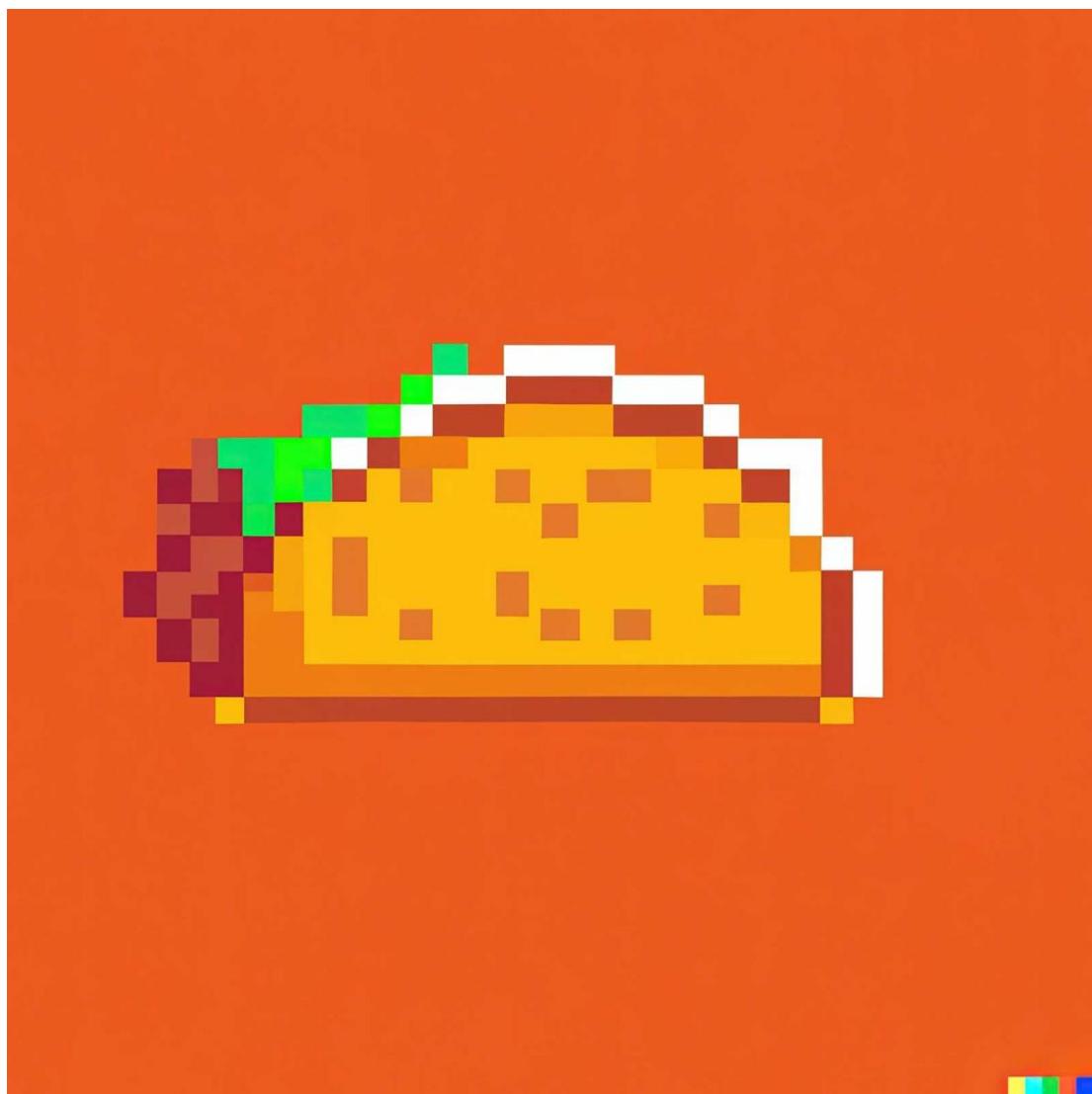
Dan Winters, Photographer

“Using the AI was entertaining and somewhat inspirational, especially with complex prompts. I couldn't be happier with the results—this is actually a better cover than the one that ran.”

Prompt Example: “Pixelated taco centered on robins egg blue solid color”







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A.I. ILLUSTRATIONS BY DAN WINTERS + OPEN AI/DALL-E 2

WIRED Issue 22.10

PHOTOGRAPH BY: IAN ALLEN

Ian Allen, Photographer

“It’s currently not amazing. But it’s also not terrible.”

Prompt Example: “A graphic close photographic portrait of a man wearing google glasses and various HUDs”







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A.I. ILLUSTRATIONS BY IAN ALLEN + OPEN AI/DALL-E 2

WIRED Issue: 26.12

DESIGN: MARGARET SWART

Margaret Swart, Design Director

"I've been trying to better articulate to myself the differences between prompting DALL-E and working with an illustrator. This is where I landed: Aside from the fact that DALL-E works in a more literal world of "things,"

it also gave me repurposed versions of the information that I supplied. I think that's the most important aspect. Illustrators think differently than I do. They take the information that I supply, and then they expand on it. They do their own supplementary research, and they offer alternate approaches and unexpected solutions. Some of the DALL-E results were unexpected for sure, but they were based (it appeared) on random data-crunching from the details I provided. Because I wasn't providing the unexpected ideas in the prompts, I didn't get the innovative solutions. AI (or at least this version thereof) has a huge reserve of data, but not the curiosity and the experience to look at a concept from a different POV—an artist's POV. I don't see severing ties with my illustrator database anytime soon.”

Prompt Example: “Type illustrations ‘Less’ ‘Artificial’ ‘More’ ‘Intelligent’”

WIRED - 26.09

WIRED

DEC 2018 INTEL INSIDE

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MORE MORE MORE

LESS ARTIFICIAL, MORE INTELLIGENT

ALTISSIMUS

INTELLIGENT INTUITIVITY

CREATE. CONNECT. CONDÉ NAST

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WIRED 26.09

ESTEAS ATTRAELL LITETES*

DEC 2018 | INTEL INSIDE

CREATE. CONNECT. CONDÉ NAST

*Less Artificial, More Intelligent



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A.I. ILLUSTRATIONS BY MARGARET SWART + OPEN AI/DALL-E 2

WIRED Issue: 28.03

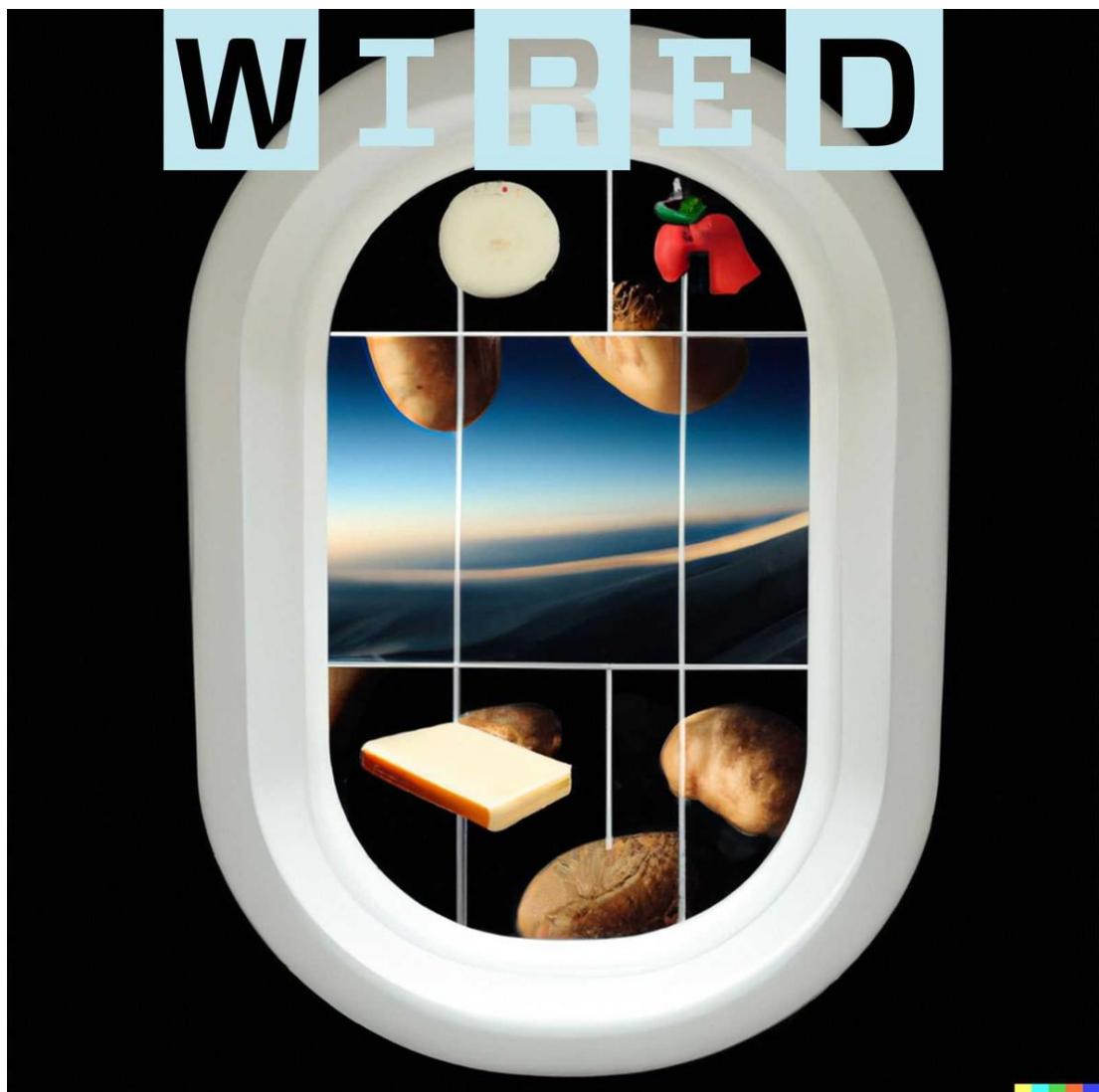
PHOTOGRAPH: STEPHANIE GONOT

Stephanie Gonot, Photographer

“As a photographer and image-lover, it was really fun to type in words in order to create an image, rather than wrangling my gear and props. The control I missed was made up for by the fun surprises. I started this exercise by trying to get as close to my cover image as possible. I got quite close! But as I tried to get even more specific in my description, the result got further and further away from my cover image. Then I tried typing in lines of the cover story and also the initial prompt I received when I was approached about the job. ‘The Care and Feeding of Interplanetary Civilization’ is a pleasing grouping of words, and I got both some really wacky and really beautiful results. I feel like DALL-E could be helpful to photo editors and art directors when coming up with an idea for a photoshoot. It’s nice to be able to create original references for a mood board rather than using images that already exist. I’m hooked!”

Prompt Example: “Mysterious photo of food floating in outerspace through a spaceship window”

WIRED







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A.I. ILLUSTRATIONS BY STEPHANIE GONOT + OPEN AI/DALL-E 2

WIRED Issue: 28.04

ILLUSTRATION: ALVARO DOMINGUEZ

Alvaro Dominguez, Illustrator

“Sometimes I add a couple of artists in order to get a more random style. Like, I love [Robert Irwin](#) and [Jonas Wood](#), two very different artists with nothing in common. So I add to the prompt 'in Jonas Wood style and Robert

Irwin style.' This adds a little bit of both in colors and shapes here and there. But as you can see, I added the words 'Jonas Wood' to almost every prompt, just to add some warmth and aliveness to a tech image."

Prompt Example: "3d render of an oil painting of planet earth as a machine at the top of a cliff with a control panel and a sky with clouds in the background, rainbows, pigeons, fireworks, in the style of jonas wood, in the style of robert irwin, in the style of dan flavin"







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A.I. ILLUSTRATIONS BY ALVARO DOMINGUEZ + OPEN AI/DALL-E
2

WIRED Issue: 28.09

PHOTOGRAPH: JESSICA PETTWAY

Jessica Pettway, Photographer

“The visual archive DALL-E is pulling from feels like one of the worst archives I’ve ever seen in terms of diversity in visual language and culture.

When trying to make my piece, certain words and phrases weren't returning logical results. For example, when searching 'woman wearing box braids,' the first results were white women in loose braids. When trying to explore the concept of digital blackface, it wasn't necessary to add 'caucasian' or 'white' to the search phrases because that was already the assumed default, even when searching items and themes specific to Black culture."

Prompt Example: "hoop earring," "mouth smiling wearing grills," "white hand with super long nails pointing"

A.I. ILLUSTRATIONS BY JESSICA PETTWAY + OPEN AI/DALL-E 2

WIRED Issue: 29.10

PHOTOGRAPH: SAM CANNON

Sam Cannon, Photographer

"DALL-E has an impressive dataset to pull from, but I did find some pleasure in the fact that, despite the 650 million image/caption pairs it uses to generate images, it wasn't able to render out a close replica of my cover. While it had no problem creating images with similar elements (needles, hands, pills) and mimicking the overall style (dark environment, harsh light from above), the abstract idea of a hand pushing through a pin screen was outside of its capabilities ... for now."

Prompt Example: "A 3D rendering of a figure with its head in its hands being pierced with thousands of needles, octane, harsh light"

WIRED







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A.I. ILLUSTRATIONS BY SAM CANNON + OPEN AI/DALL-E 2

Video: Sam Cannon

WIRED ISSUE: 30.06

ILLUSTRATION: PATRICK SAVILE

Patrick Savile, Designer and Illustrator

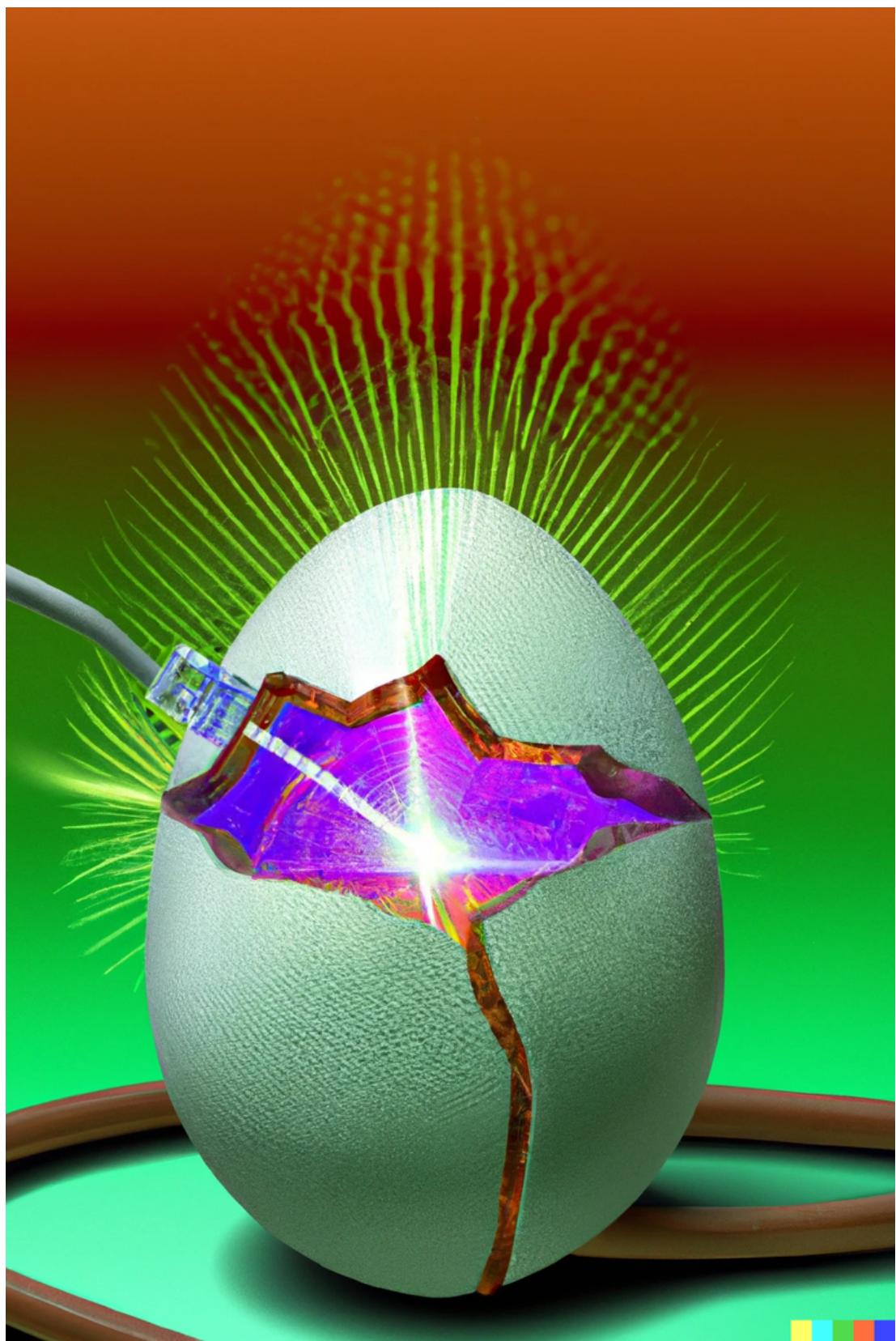
“It was kind of hard to get what I originally wanted, so I was shifting the concept around a bit until I could get an image as close to the idea in my head, which turned out to be egg-based.”

Prompt Example: “High detail airbrush painting of an egg cracking open containing clouds, storm clouds in the background, shimmering psychedelic colours, high contrast, masao saito, Michael whelan, hajime sorayama, high resolution”

WIRED









A.I. ILLUSTRATIONS BY PATRICK SAVILLE + OPEN AI/DALL-E 2

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Dec 20, 2022 6:00 AM

The Quest to Defuse Guyana's Carbon Bomb

A former BP lawyer is going up against Exxon—and her own country—in a bid to stop offshore oil drilling before disaster strikes.

View of Georgetown, Guyana. Photograph: Tom Vierus

In late June, inside a squat concrete building in Georgetown, Guyana, on a noisy street flanked by telephone repair shops and beauty supply stores, two lawyers were waging one of the most significant legal battles in the global fight against climate change. Melinda Janki and Ronald Burch-Smith sat in a ground-floor office staring intently at a computer screen, ignoring the sounds of macaws, monkeys, tree frogs, and traffic packing the streets, waiting to connect to the country's Supreme Court via Zoom. The internet is unreliable at best in Guyana's capital city, and the fear that it would choose today to conk out was palpable.

The two lawyers were a bit of an odd couple. Burch-Smith is tall and meticulous. Ask him if he knows the time and he's likely to answer "yes" rather than divulge the hour. Janki is a petite woman with warm eyes and a sharp wit, quickly moved to rigorous denouncements of injustice, from the war in Ukraine to the plight of the planet to the litter on the street. Burch-Smith has a framed *Phantom of the Opera* playbill above his desk. The art in Janki's office is a little more confrontational: a life-size painting of a fierce yellow jaguar that appears poised to step out of a blackened forest and straight through the picture frame. Together, the two attorneys have mounted a novel and audacious attack on Exxon Mobil, one of the world's largest corporations with the legal muscle to match.

In 2015, Exxon, which is known in Guyana as Esso, struck oil off the coast, the first significant find in the country’s history. The scale of the discovery, 11 billion barrels so far, landed Guyana on the list of the world’s top “carbon bombs”—fossil fuel projects capable of releasing more than [a gigaton of carbon dioxide](#). Exxon ultimately plans to produce more than 1 million barrels of oil a day. That would transform Guyana—currently a [carbon sink](#) thanks to its dense blanket of rain forests and minimal emissions—into one of the world’s top 20 oil producers by 2030. An Exxon Mobil spokesperson says that during the world’s transition to cleaner energy, “we need two things at the same time: reduced emissions and a reliable source of energy. Exxon Mobil has a role to play in both.” By 2027, Exxon expects its Guyana operations to have “about 30 percent lower greenhouse gas intensity” than its average oil or gas production. Climate experts estimate that 2030 is also the year by which much of Georgetown and coastal Guyana will be underwater as a result of unchecked global warming. Those living in the interior of the country will face the devastating impacts of worsening droughts and floods, from intensifying food insecurity to loss of land and homes. In 2021, Janki and Burch-Smith sued the Guyanese government for giving Exxon the green light. Exxon later joined the government as a codefendant in the case.

Georgetown’s lush beauty—its neighborhoods teem with tropical flowers in scarlet reds, peacock blues, sun-kissed yellows, and turquoise greens—is made possible by its abundant sources of water: Rivers and canals carve paths through the streets, carrying water from the Amazon to the Atlantic, along whose coast most of the city—and 90 percent of the nation’s population—resides. Viewed differently, though, the abundance of water is a sign of Georgetown’s particular vulnerability to climate change. All around is the evidence of an impoverished city that is rapidly industrializing. Newly traffic-clogged streets strain to make room for horse-drawn carts; cows graze on street corners near Popeye’s and KFC. Many homes and buildings have that beaten-down look common to places of either war or extreme weather.

With its lush forests, Guyana is a carbon sink. Exxon’s project stands to make it a carbon bomb.

Photograph: Tom Vierus

To call the Exxon lawsuit a David-versus-Goliath endeavor would be an understatement. When several US state attorneys general sued Exxon about five years ago for misleading investors and the public about the risks of climate change, a judge joked about the oil company, “Y’all have 300 lawyers on your side.” Exxon then submitted more than 2 million pages of records to just one New York court. By contrast, Janki and Burch-Smith had one legal assistant. Janki has been known to stand in long lines at the court to file pleadings. She has also carted around enormous files filled with thousands of pages of material, which she reads without the assistance of a litigation team.

In the June hearing, Exxon was attempting to throw out virtually the entire testimony of one of Janki and Burch-Smith’s clients on the grounds that he was not a climate scientist. When the judge appeared on the screen, he gave the pair more time to present their argument to keep the affidavit, which rests on key facts regarding fossil fuels and climate change, before the court.

Halting the project would deal Exxon a crippling blow; within eight years, Guyana is on track to become the company’s single largest site of daily oil production. But it could also have implications for the global industry. Whereas climate lawsuits against fossil fuel companies have typically attempted to hold those corporations accountable for the harms of past operations, this one in Guyana seeks to force the company and the government to accept responsibility for the damage they will cause in the future. The case argues that oil development is fundamentally incompatible with human health and a sustainable environment. If successful, it could set an example for climate activists in other countries.

To call the groundbreaking lawsuit against Exxon a David-vs.-Goliath endeavor would be an understatement.

Kneecapping a global energy giant might sound like an impossible feat for two attorneys in a Global South nation with a population of less than 780,000 people. But they are wielding some powerful tools. Guyana happens to have some of the most robust environmental protections in the

world. Its constitution contains provisions that explicitly protect the rights of citizens—present and future—to a healthy environment. “Virtually every aspect of this operation is in violation of Guyana’s constitution, and the right to a healthy environment, and the right of sustainable development, and the rights of future generations,” explains Carroll Muffett, the president and CEO of the Center for International Environmental Law. “And from that arise serious consequences in terms of how the government must respond.”

“The provisions are groundbreaking,” Janki says. She should know—30 years ago, she helped author them. Plus, Janki’s knowledge on the matter has still another layer: Early in her career she spent four years working for the oil giant British Petroleum, now known as BP.

Janki grew up in Georgetown, in a house close enough to the Atlantic Ocean for the sounds of waves to lull her to sleep each night. Much of her childhood was spent outdoors, where she developed an affinity for the water and the forest. When she was 5, a small brown dog appeared on the front porch in the bright rays of the early morning sun. Janki was reading a book of Christian fables at the time, so she named her first beloved pet Lucifer, Son of the Morning. “The story ends very badly,” she recalled. “He must have gotten out and been on the road outside the house, and someone knocked him down and killed him.” Janki was crushed—and furious. “It taught me the lesson that life is tenuous,” she says, and also “to fight for the little underdogs.” She would go on to care for dozens of stray animals, including dogs, donkeys, cats, horses, wild birds, and a baby giant otter.

Janki’s family left Guyana in the 1970s, when she was 12 years old and the country was in a period of intense political instability. After living in Zambia and Trinidad, Janki eventually settled in London. She studied law at Oxford and University College London, focusing on human rights, environmental and economic law, and intellectual property. She began her career at one of Britain’s premier corporate law firms, Lovell, White, & King—“otherwise known as ‘Lovely, White, and Clean,’” Janki quips—where she recalled being one of the first non-white trainees. She left the firm in 1989 to become an in-house lawyer at BP’s world headquarters. Janki doesn’t speak negatively about her experiences working there, but

over time her growing condemnation of the industry has come to dominate both her life and work.

It didn't take long for the shine of London to wear off. On the 30th floor of a skyscraper, Janki felt entirely cut off from nature. Her life started to seem all too comfortable. "You know, comfort is a form of suicide," she says. After four years absorbing the inner workings of the oil industry, she decided to leave. Janki returned to Georgetown in 1994, a time when her homeland seemed brimming with promise. "Your heart tells you what you should be doing, and it just tugged me back to Guyana," she says.

Melinda Janki's visionary work introduced the concept of natural capital to Guyanese law—and challenged the dominance of gross domestic product.

Guyana's name is said to derive from an Indigenous word for "land of many waters." The largest of the country's rivers, the Essequibo, begins at the Acarai Mountains near the Brazilian border and flows north through [forest](#) [and savanna](#), cutting a straight line for 630 miles across the length of the country. As the Essequibo makes its way to the coast, it's joined by tributaries of the Amazon, Rupununi, Mazaruni, and Cuyuni rivers, all carrying a rich bounty of sediment filled with nutrients. Guyana's ocean contains some of the highest recorded levels of chlorophyll biomass in the world. In turn, the waters are home to more than 900 species of fish, essential to both local subsistence and the Guyanese economy. There are also dolphins, manta rays, sperm whales, and six kinds of marine turtles, some of which are endangered.

In the interior, nestled between forests, picturesque mountains, tributaries of the Amazon, and the headwaters of the Rupununi river, rests the virtually untouched savanna that the Wapishana and Macushi call home. They are among the nine tribes collectively referred to as Amerindians, who have lived in and around present-day Guyana for millennia. Most live subsistence lifestyles based on hunting, fishing, and farming, not all that different from those of their ancestors.

For centuries, a rotating list of foreign powers extracted Guyana's natural resources and returned the products and profits to their home ports. In 1667, to secure their claim on Guyana, the Dutch traded parts of modern-day New

York and New Jersey to the British. The Dutch enslaved Africans to work the sugarcane fields and pushed many Indigenous peoples into the interior to give themselves easy access to the sea. Almost two centuries later, Britain took Guyana by force. It became one of the empire's most lucrative colonies, powered first by slavery and then the indentured servitude of people from India, China, and Portugal. An 1823 rebellion led by enslaved people in Guyana is credited with contributing to the eventual abolition of slavery across the entire British Empire; in 1917, people in indentured servitude in Guyana successfully organized to force an end to that practice as well. In the 20th century, American corporations came to Guyana, mining for bauxite and gold. By the 1950s, they also hunted for oil, but decades of effort proved largely futile.

This article appears in the February 2023 issue. [Subscribe to WIRED](#). Photograph: Peter Yang

In 1992, Guyana held its first free and fair democratic election in decades. The new government, led by the leftist People's Progressive Party, was eager to protect the country's natural resources after centuries of colonial exploitation, and it saw environmental protection as part of a broader mission to secure social justice. At the time, Janki had just returned and been admitted to the national bar. She had no party affiliation or political connections. She was, she says, a "nobody." But, in 1995, when Janki learned that the nation's first-ever environmental laws were going to be drafted at an invitation-only conference, she knew she had to be there. A partner at the law firm where she worked was also the owner of one of Guyana's two national newspapers, and he helped Janki finagle a press pass.

The conference was held at the Pegasus Hotel, a seven-story cylinder of blue glass and white steel that towers above Georgetown. No press accounts of the event can be found, and many of the participants have since died, but Janki recalls that there were about 100 attendees, most of them men, who droned through a series of forgettable presentations. What did catch her attention was the draft Environmental Protection Act. "When I got a look at what they were writing, I was absolutely horrified," she says. In her view, the legislation was far too weak.

During a coffee break, Janki spied a special adviser to the president, Lakeram Chatarpaul, standing alone outside of the conference room. Janki was a lot shier then, she says, but in her recollection she “lobbied like mad and made quite a nuisance of myself.” Chatarpaul invited her to write to him. What she wrote worked: After he read her ideas, Janki was hired by the Inter-American Development Bank to draft the new law for the government.

Over many months, Janki adapted what she felt were the most robust environmental laws from around the world and “put in a raft of new provisions,” she says. She included the “polluter pays” and “precautionary” principles, which hold companies liable for the costs of cleaning up pollution and the government responsible for implementing measures to prevent environmental harm, even in the absence of “full scientific certainty.” Importantly, Janki defined the “environment” to include, among other things, the atmosphere and climate. “This was in 1995, when people were relatively unconcerned about greenhouse gas pollution, and the carbon majors were misleading people,” she says. She imbued the Environmental Protection Agency with significant authority, including the requirement that any proposed project, from mining to construction, had to include a detailed environmental impact assessment. If the assessments were found to be lacking, the EPA would have the power to reject projects outright, as well as the ability to put conditions into permits to ensure that the company’s operations did not conflict with Guyana’s international human-rights and environmental obligations. She also included far-reaching provisions for public access to information, participation, oversight, and compensation for harm, plus some other “visionary stuff in the act that nobody noticed.”

One striking example of “visionary stuff” was the introduction of the concept of natural capital into Guyanese law. Each year, the EPA is required to take a full accounting of the nation’s ecosystem—from wildlife to vegetation—and make it publicly available. This creates a baseline from which to measure both ecosystem value and potential harm. Natural capital is a direct challenge to gross domestic product, or how much a country produces, consumes, and exports—the prevailing measure for assessing a nation’s economic health. A rising GDP is often considered inherently positive, regardless of the human or environmental costs. When a forest is

clear-cut, for instance, GDP increases due to the labor and machinery used and the timber sold. Natural capital, by contrast, considers the value of the trees to the climate, the animal species, and the people who call the forest home. Under this model, the forest's destruction is a cost and its protection a benefit. While Janki's law doesn't require this entire calculation, simply introducing the concept was a significant step, which several other nations, including Botswana, Colombia, and Egypt, have since embraced.

Each year, Guyana's EPA is required to take a full accounting of the nation's ecosystem—from wildlife to vegetation—and make it publicly available.

Photograph: Tom Vierus

In 1995, cyanide-filled mining waste spilled into the Essequibo River, killing fish and other animals and polluting the cropland on which Amerindian communities relied. The spill and others like it were attributed to a lack of meaningful environmental regulation, and they galvanized the nation to support the Environmental Protection Act, which was signed into law on June 5, 1996.

Two years later, the government turned to rewriting its constitution and solicited public submissions. Seizing the opportunity to embed strong environmental protections within the constitution itself, Janki wrote what she has described as “a statement of the obvious” that was ultimately included in the preamble: “The well-being for the nation depends upon preserving clean air, fertile soils, pure water, and the rich diversity of plants, animals, and ecosystems.”

But it was the provisions that Janki lobbied to be included in the text of the constitution that were the most significant. Drawn largely from South Africa's new postapartheid constitution, they conferred upon every Guyanese citizen “the right to an environment that is not harmful to his or her health or well-being” and would hold the state responsible for protecting the environment for the benefit of present and future generations. They also required the courts to “pay due regard to international law, international conventions, covenants, and charters bearing on human rights.” These include human-rights obligations to clean air and water, life,

and livelihoods. Taken together, these constitutional provisions are far stronger than the environmental protections found in most northern nations, including the US. “I don’t want to sound as if I am showing off,” says Janki, “but, really, it is all there.”

A few years later, an Arecuna tribal leader from the Upper Mazaruni area came to Janki’s law office seeking help to confront continued abuse from the mining industry. Janki turned her attention to building and securing the rights of these communities. She also worked as a consultant in drafting the 2006 Amerindian Act, providing for collective rights to land, natural resources, and self-determination. In academic and legal journals, she made the case that failing to fulfill human-rights obligations to life, health, water, food, nondiscrimination, and self-determination, including the rights of local communities to consent to policies and programs that directly affect them, “can be a trigger for environmental destruction.” She also contributed to the drafting of the Escazu Agreement, the first regional environmental treaty of Latin America and the Caribbean (ratified by 14 nations but open to all 33), “contributing to the protection of the right of every person of present and future generations to live in a healthy environment and to sustainable development.”

Janki had expected that when the time came, Guyana’s government and citizenry would make use of the strong legal foundation she had helped build. She would soon learn that, at least when it came to oil, she was wrong.

Guyana’s waters sustain over 900 species of fish, essential to local subsistence and the economy.

Photograph: Tom Vierus

In March 2015, the Deepwater Champion rig was at work for Exxon Mobil, exploring for oil in the Atlantic Ocean 120 miles off the coast of Guyana, drilling below 6,000 feet of water and through 12,000 feet of earth. Ultra-deepwater drilling is so complex that experts liken it to space travel, and the dangers are well known. Five years earlier, the Deepwater Horizon rig was at work for BP when it exploded in the Gulf of Mexico, killing 11 workers and setting off the worst offshore oil spill in history. (The rig in Guyana was

owned and operated by the same company, Transocean, that ran the rig in the Gulf.)

Only two months after it began exploring, Exxon struck oil. The first significant find in Guyana's history came as a shock. Exxon Mobil's then CEO, Rex Tillerson, told shareholders it was the largest oil find anywhere in the world that year. The Guyanese government, led by President David Granger of the People's National Congress Reform, quickly signed a contract with Exxon and awarded the company a series of 23-year permits —which were at the time withheld from the public. When production began four years later ("a fraction of the time it usually takes," according to Exxon spokesperson Meghan MacDonald), Guyana was officially ushered into the exclusive club of oil-producing nations. President Granger proclaimed it National Petroleum Day and said the discovery would transform the country's economic development and ensure a "good life" for all.

The People's Progressive Party, led by Bharrat Jagdeo, accused Granger of signing a one-sided deal with Exxon in exchange "for peanuts." Industry analysts have found that the government is receiving a below-average return on Exxon's projects. Exxon will recoup all of its expenses, including all development and operating expenses, out of the oil it extracts, leaving the government and public to largely absorb the company's costs. For every barrel of oil produced, until it recovers its costs, Exxon receives 85.5 percent of the value of the oil compared to Guyana's 14.5 percent, according to the Institute for Energy Economics and Financial Analysis.

Janki expected Guyana to make use of the environmental protections she instituted. When it came to oil, she was wrong.

Exxon maintains that the contract terms are competitive and that it "provides a structure and terms that are equitable to both the government and investing companies, commensurate with the risk associated with each project."

Janki, meanwhile, set her sights on scuttling the entire Exxon operation in Guyana. "At that moment nobody else was willing to challenge what the oil sector was doing," Janki says. In 2018, she realized she would have to go to court.

Janki filed a suit, based on the Environmental Protection Act, arguing that the government had acted illegally by granting production licenses to the two companies that Exxon is partnering with, as they had not filed their own environmental impact assessments. The judge ruled that the license granted to Exxon was sufficient, but Janki was not dissuaded. She began giving talks and lectures, arguing that there were grounds to challenge Exxon's operations, and she soon found a kindred spirit in Troy Thomas, who was then president of the Transparency Institute, the nation's leading anti-corruption organization. In time, he would become one of her most important collaborators.

When Exxon started operating in Guyana, Thomas, like Janki, worried that the corrupting force of oil money would threaten the country's meager political gains of the past few years—the dreaded “oil curse.” Countries that depend on exporting oil are among the most economically troubled, authoritarian, and conflict-ridden nations in the world. Terry Lynn Karl, a professor at Stanford University, documents how, in the past 40 years, the consequences of becoming oil-rich—far from the promise it offers—have tended to be more destructive than positive. Thomas was well aware of this, as well as of the growing efforts worldwide to shift away from fossil fuels altogether. “We know that petroleum is a dead end,” he says.

Globally, as of 2015, the fossil fuel industry and its products accounted for 91 percent of all industrial greenhouse gas emissions, and about 70 percent of all anthropogenic greenhouse emissions. Since 1988, more than half of all global industrial greenhouse emissions can be traced to just 25 fossil fuel companies. Exxon Mobil is number five on the list compiled by the CDP Carbon Majors Database.

Heavy rainfall in Guyana is nothing new. But now the rainy seasons are longer and wetter, and the dry seasons are hotter, with intensifying drought.

Photograph: Tom Vierus

Thomas grew up on Wakenaam, an island with a distinctly Caribbean feel that's just a short boat ride from Georgetown. His father was a small farmer like most of the island's inhabitants, growing crops like plantains, cassava, and tubers. Wakenaam is surrounded by a seawall built by the Dutch to

keep the water out. But “wall” seems too generous a word for the roughly 4-foot-high crumbling ledge. It worked for a time, but the sea has been rising, and the storms are now worse, regularly inundating the island’s homes and fields. “The ocean just has to decide one day: ‘I’m going to be disruptive.’ And that’s it for the island of Wakenaam,” Thomas says. “It’s not a theoretical, conceptual argument. It’s right now.” It didn’t make any sense to him that the government actively welcomed a project whose massive emissions contributed to the [sea-level rise](#) that threatened his own family’s very survival. “I don’t see how we can agree to kill ourselves,” he says.

Thomas, who often wears a dress shirt and blazer, with his hair in a loose ponytail of shoulder-length dreadlocks, is a professor of natural sciences at the University of Guyana. As a father of two young children, balancing family, work, and a political activism that is rare in this small nation, Thomas usually gets no more than a few hours of sleep each night. He understands why many, if not most, people in Guyana find it difficult to speak out against the government and its major partners. Guyana’s political history has a violent side, including the assassinations of famed anti-colonial scholar and political activist Walter Rodney and one of the nation’s agricultural ministers. Political and economic retribution can also be vicious, instilling fear and limiting action, Thomas explains.

Thomas’ organization succeeded in making Exxon’s contract with the government public in late 2017, an effort that brought him into conversation with Janki. Thomas felt he had reached the limitations of traditional advocacy to stop Exxon, and he was intrigued by Janki’s novel, but potent, legal approach. He decided to join forces with her.

In May 2020, Janki filed a new suit against the government on Thomas’ behalf. She argued that the 23-year permits violated the Environmental Protection Act, which stipulates that the government may grant only five-year leases for oil drilling. In a settlement, the EPA agreed to reduce the terms to five years, after which Exxon would need to reapply for new permits. This was a major victory, but it didn’t address the roots of Thomas’ deeper concerns: the increasingly existential threat of climate change.

And so, emboldened by their success, Thomas and Janki began to lay the groundwork for an even more ambitious case against Exxon, which others would soon join.

“I don’t see how we can agree to kill ourselves,” Troy Thomas says about Guyana’s decision to drill for oil.

Quadad DeFreitas is Janki’s second client in the pending case against Exxon. The 23-year-old with boy-band good looks is Wapishana and grew up in the Rupununi region in southwest Guyana, near the border with [Brazil](#). As a child, he split his time between the village of Katoonerib, where he attended primary school, and the cattle ranch where his family worked. Among its limited modern attributes, the ranch has used solar panels for decades. DeFreitas works on conservation efforts in the region. “There are so many animals!” he says effusively. “Birds, otters, monkeys, caiman, jaguars—you cannot list them all!”

Today, his family has a small cattle ranch and a budding ecotourism business of its own. But DeFreitas worries that the already devastating effects of climate change threaten not only his family’s businesses but the future of his 4-year-old brother—and his ability to call the Rupununi home.

Heavy rainfall in Guyana is nothing new. “People live on the land, they know where the water usually comes, and they plan their farms and houses because of that knowledge,” DeFreitas explains. But now the rainy seasons are longer and wetter, and the dry seasons are hotter, with intensifying drought. All year round, the weather is unpredictable, and it’s getting worse. Wells and ponds are running dry, leaving families without drinking water or fish to eat; the river both swells and dries out well beyond the norm; and floods increasingly destroy crops and villages.

One rainy day, I visited a small plot of land in Katoonerib near DeFreitas’ primary school. Huts made of brown earth and thatched roofs hand-stitched from tree fronds dotted the horizon. A farmer removed an ear of corn from the stalk and, with the deft precision that comes from decades of repetition, swiftly pulled back on the skin to reveal its rotting insides. A waterlogged crop is unable to bear fruit. And it wasn’t only the corn that was ruined, but

the cassava, papaya, yams, pineapple, peanuts, and pumpkins—all of the food grown on the farm.

As Janki built her third case against Exxon, DeFreitas became an eager participant. Pointing to the benefits of solar power and the minimal use of fossil fuels in his community, he knows that other, less harmful ways of producing energy are possible. Beyond this he looks at the implications of exacerbating the climate crisis and considers Exxon's operations not only crazy but wrong. "I just don't see the point," he says.

In May 2021, with Thomas and DeFreitas as plaintiffs, Janki, joined by Burch-Smith, filed the landmark suit against the government and Exxon. "The earth's atmosphere and oceans have been and continue to be polluted by the release and accumulation of greenhouse gases," the lawyers state, resulting from "the production, transportation, refining and use of fossil fuels." Therefore, the government's approval of Exxon's operations, they argue, violates the constitutional right of current and future Guyanese citizens to an environment that is not harmful to their health or well-being. It is the first case in which this provision has been litigated.

Thomas' affidavit, which says that the "existential threat" caused by greenhouse gas emissions is already harming the health and well-being of the Guyanese people, is the one Exxon is trying to get thrown out. "The intensity of that harm will increase as fossil fuels continue to be burned," Thomas writes, placing responsibility on the government and Exxon by noting that combustion is "the intended and foreseeable consequence of producing that oil and gas." Thomas quotes extensively from Exxon's own 1982 research, which concluded that "mitigation of the 'greenhouse effect' would require major reductions in fossil fuel combustion." But because Thomas isn't a climate scientist, Exxon argues that his statements reflect opinion rather than agreed-upon facts.

They're "not going to concede anything about climate change unless they have a gun to their head, metaphorically," Burch-Smith said about Exxon.

Scholars agree that Janki's lawsuits are creating innovative precedents for challenging the major contributors to climate change. Joana Setzer, an assistant professor at the Grantham Research Institute on Climate Change

and the Environment at the London School of Economics, credits the case for advancing human-rights-based climate litigation, uniquely challenging the permitting of new oil reserves based on the harms of the resulting emissions. “If the case is successful, it could inspire similar lawsuits in other countries,” she says. “It’s a real human rights case.”

Exxon contends that it “has complied with all applicable laws at every step of the exploration, appraisal, development and production stages” in response to questions about the suit.

In September 2021, Exxon joined the government as a codefendant, which suggests it wasn’t content to let the case play out without its influence. The multinational argues that the plaintiffs have “misconceived” the Environmental Protection Act, noting that the government approved the environmental impact assessments necessary for drilling to proceed. Exxon also says the plaintiffs “mischaracterized” the constitutional provision on which Janki and Burch-Smith have built their case. Although that provision requires the state to “secure sustainable development and use of natural resources,” it goes on to say that it must do this “while promoting justifiable economic and social development.”

The government’s response follows a similar argument. It affirms that it approved Exxon’s environmental impact assessment and cites the same constitutional provision noted by Exxon. Preventing Guyana from developing its petroleum resources, the government argues, would bring “unwarranted economic and social costs.” Bharrat Jagdeo, once the country’s president and now its vice president, has argued that Guyana should pump its oil quickly, while it still has the chance. (He has emerged as a leader of a group of government officials in places like Suriname and Ghana who are making the same case.) Jagdeo, President Irfaan Ali, and other government officials declined repeated requests for interviews.

The government and Exxon’s economic prosperity argument was dealt a blow in October 2021. The Biden administration, following a new US directive to “promote ending international financing of carbon-intensive fossil fuel-based energy,” blocked a \$180 million loan from the Inter-American Development Bank to a private Guyanese

company that was meant to support the expansion of Exxon's onshore facilities.

If economic prosperity is the goal, the oil project is not off to a good start. Despite three years of production, Guyana remains a struggling nation with one of the highest poverty rates in Latin America and the Caribbean. The lure of a windfall from oil is understandably tempting. And money from oil has flowed into the country, but measuring its impact is difficult. The World Bank says that "extraordinary economic growth of 20–40 percent over the last two years brought GDP per capita to over \$9,300 in 2021, from about \$6,600 in 2019." But GDP remains a questionable metric, in that it entirely ignores very real environmental costs, and those per capita figures merely divide a national value by the population—with no consideration for unequal distribution of the gains.

Part of the sea wall that was built to protect the areas east of Georgetown, Guyana.

Photograph: Tom Vierus

Exxon spokesperson Meghan MacDonald emphasized the company's efforts to add to Guyana's workforce, noting that there are more than 4,400 Guyanese workers supporting Exxon Mobil's activities there. "In frontier countries around the world, it takes some time to develop the workforce to handle the operations in a complex, highly volatile work environment," MacDonald said. It's widely known, though, that the oil and gas industry is increasingly automated and less reliant on workers—something that Exxon itself acknowledged in a statement on its website that has since been deleted.

By the end of 2021, Exxon and its partners had taken in six times more revenue from its oil operations in Guyana than the government had—\$3.6 billion to the government's \$607 million—according to the Institute for Energy Economics and Financial Analysis. Due to the lopsided contract, the group estimates that by 2027, Guyana will carry a liability of more than \$34 billion owed to Exxon and its partners to cover their development and related costs. "There isn't going to be a vast amount of wealth," Janki says.

“There is going to be, most likely, an enormous bill that the Guyanese people will be saddled with.”

If the court agrees with Janki that this oil operation is incompatible with the right to a healthy environment, then the government has to decide whether to stop the activity or somehow find a way to make it not violate the constitution. That may be an impossible feat, as the government might have to prove that oil production would not result in a worsening of global warming. The government may also be obliged to forgo any new authorizations for oil operations or revoke Exxon’s existing licenses. Oil drilling in Guyana could even be ended entirely if it is impossible for the government to issue permits without violating the law.

“Were the court to agree that this development is in violation of the Guyanese constitution, that is obviously an extraordinarily significant finding, and it would have enormous impacts on any future development of oil in Guyana,” says Muffett of the Center for International Environmental Law. “Losing access to Guyana as a result of the groundbreaking legal action there would be yet another signal that the company’s core business model is fundamentally incompatible with confronting the climate crisis. Given the huge prominence of Guyana in Exxon’s portfolio, investors are likely to listen.”

Seated at a table at the Marriott Hotel in June, Burch-Smith talked about the case with me. The American hotel chain, where rooms cost upwards of \$300 a night, has recently supplanted the Pegasus as the “place to be” in Georgetown. Burch-Smith spoke quietly, careful not to be overheard by the people at nearby tables and frolicking loudly in the pool. Many of them had Texas accents. He surmised that more Americans will be coming to the country as Exxon’s operations continue to expand.

“The fundamental problem is that the only way you’re going to slow climate change is to stop burning oil.” Exxon can’t challenge that, Burch-Smith almost whispers.

“This isn’t a story of powerlessness; it’s a story of power,” Janki says.

Win or lose, Janki's efforts and the case are already having an impact. Under a blazing midday sun in June, on the eve of the court hearing, roughly 25 men and women gathered outside of Exxon's onshore base in Georgetown to protest the company's operations—a rare, but increasingly frequent, occurrence. The protesters fanned out along the edge of the congested four-lane highway, holding white placards with handwritten messages: "Slavery was abolished centuries ago." "Stop raping our country." "Exxon make mo money than God & Guyana gets nothing."

In July, 23 years after Janki wrote it into Guyana's constitution, [the United Nations General Assembly recognized the right to a clean](#), healthy, and sustainable environment as a fundamental human right guaranteed to all. That has expanded the opportunity for people in any UN member nation to follow Janki's lead and challenge fossil fuel operations in court by making the case that they are incompatible with these newly enshrined rights.

In September, Exxon reported a 42-gallon oil spill from a production rig, stretching 13 miles across the Atlantic. It was minor and, the company says, was isolated the following day. But such spills are common in offshore oil production, and fears of a spill large enough to have a catastrophic effect on the marine ecosystem loom large here. "If something should go wrong out there, it definitely would affect not just livelihoods but the entire economy," warns Sopheia Edghill, a Guyanese biologist and former marine conservation officer.

During the hearing, the judge announced his retirement from the court, and he has yet to be replaced. Janki was also recently faced with another challenge. Burch-Smith withdrew as her co-counsel, citing "some differences in certain technical aspects." But for Janki, there is no withdrawal. She will continue arguing the case on behalf of Thomas and DeFreitas, and she has a new legal partner to help her. The case will move forward when a new judge is assigned. And if it fails to stop Exxon, she has filed three other cases against the government and Exxon. "This isn't a story of powerlessness; it's a story of power," Janki says. "This is the biggest climate change case in the world."

Updated 1/11/2023 3:00 pm ET: A previous version of this story incorrectly stated Sopheia Edghil is a marine conservationist at the University of

Guyana. She is a biologist and former marine conservation officer.

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Dec 13, 2022 7:00 AM

Let Twitter Devolve Into Porn

It's always pleasing to see things become what they deep down are.

Photograph: Shawn Michael Jones

Of All the threats posed by Twitter since it fell under sketchy new management in October, one of them doubles as a promise. Twitter will devolve into pornography.

Porn's not my cup of tea, but you have to admire its ferocity and cunning. It's a mega-genre, something the poet-philosopher Timothy Morton might call a [hyperobject](#), ungraspable in its ubiquity and scale. In effect, porn online behaves like a predator plant, saturating the pixels with flesh colors, choking off biodiverse memes, and sowing vast digital acreage with salt.

[Tumblr](#), which started as an artsy microblogging service in 2007, lost its allure when it was overrun by porn five years later. Chatroulette, which was founded in 2009 as a whimsical way to meet strangers, traded its lightheartedness for dick pics and leering goons almost immediately.

[OnlyFans](#), which began in 2016 as a platform for performers to post videos, now consists mostly of porn created by sex workers.

But most companies aim to marginalize porn. While OnlyFans has surrendered, Chatroulette and Tumblr appear to take a firmer stand than ever against it. Facebook and YouTube conscript armies of algorithms and humans to banish porn in deference to advertisers who don't want brands debased by unwholesome adjacencies. Alone among the big social media services, [Twitter](#) allows users to post what it calls "intimate media." But the platform also permanently suspends users who post upskirts, creepshots,

revenge porn, nonconsensual erotica, images shot with hidden cameras, or media accompanied by incitements to violence. Pornographic images, which make up about 13 percent of all tweets, cannot yet be directly sold.

Porn in its place may be bankable, in other words, but too much of it in a venue styled as PG can scare off much bigger revenue streams.

Or so popular wisdom has it. Twitter's new management, as usual, dissents. The volatile Chief Twit, Elon Musk, has torn down guardrails, eliminated moderators, and alienated advertisers all on his own with tiresome shitposting and hospitality to hate speech. Musk, whose personal fortune fell by \$100 billion in 2022, pretends to insouciance about money in a way that's unconvincing and hard to watch. When General Mills, General Motors, Pfizer, Ford, and Mondeléz International (the august maker of Oreos) stopped advertising on Twitter last fall, Musk lashed out at corporate America for its failure to respect the wishes of the founding fathers, who presciently mandated advertising on Twitter in 1789. Unchastened, half of the platform's top 100 advertisers were gone in Musk's first month.

Without moderators or advertisers, swaths of Twitter are now mangy empty lots crawling with vandals, lechers, con men, and swastikas. The time is perhaps right for porn, then. Porn abhors a vacuum. Especially where it can be ennobled as constitutional duty.

How in the world is this good news? I'll tell you why it's good news to *me*. Not only will it make Twitter2 easily quittable, but it's pleasing to see things become what they deep down are. Twitter has slouched toward porn for years. "Slipping into DMs" is only one salacious meme in what long ago became an orgy of hyperstimulation, with people baring their souls, posting thirst traps, coyly subtweeting, and of course negging and prodding and simultaneously secreting dopamine and cortisol and God knows what other precious bodily fluids.

"I am mad for it to be in contact with me," Walt Whitman wrote, of what he called "life's atmosphere." No doubt he also meant contact with the bodies of the many people he cruised and desired. Likewise, Twitter seems to offer contact with *everyone*, and the interface exists to make users mad for contact as it conjures life's atmosphere of abrasiveness streaked with

sweetness. The real Twitter was the friends we made along the way, as someone has surely tweeted.

That's gone now. When the chief rolls in with tryhard trolling that misses the mark of humor, squealing in annoying feedback loops from his Wall of Sound, the warm chatter among the regulars goes silent. A pall falls. When Musk tweeted some horror fiction alleging that the spouse of a prominent elected official might have been perversely complicit in cracking his own skull with a hammer, something at the heart of Twitter seemed to die. Later, when he bellowed that Twitter in 2020 had abridged the constitutional right of trolls to post a Hunter Biden dick pic, another influx of refugees poured into [Mastodon](#), which presents itself as a more normal haven for people fleeing Twitter.

“The Internet Is for Porn” was the catchiest song from *Avenue Q*, which debuted 20 years ago. That was before broadband, before social media, before the hijack of information space by influence operations and strongman solo acts like GOP trinity Kanye, Elon, and Trump. It was axiomatic back then. Porn was the internet’s reason for being, its prime directive. And it would have stayed that way had web information not been domesticated by corporations that wanted to hack our worldviews and pick our pockets for data, attention, and mobile payments.

But through all this, Twitter has retained the spirit of porn. Like porn, Twitter is not a family affair; for many, it’s also a shameful habit that they’re forever trying to quit. Since 2007, I’ve turned to Twitter to—the only word I can think of is *learn*. But I know its traps well. Users of Twitter, like consumers of porn, find themselves amused and stimulated, and then scroll compulsively, chasing the dragon of human connection, only to find themselves scrolling through doom, and finally scrolling *for* doom.

Information may or may not want to be free, but it often wants to be porn. What Musk has considered doing, according to various reports, is introduce paywalled video that would allow performers to get paid while Twitter takes a cut. Sound at all familiar? It’s the OnlyFans model, complete with a rip-off of the OnlyFans interface. The performers it’s tailor-made for are not, as it happens, cellists or mimes. They’re sex workers. And for discerning high rollers who prefer the backroom to the club, Musk has

floated the idea of offering paid DMs—to be slipped into as usual, but for a fee. The online-porn business demands extreme discipline to keep it from turning criminal and leaves room for little else, but edgelord Musk is likely to fare better in the demimonde than he is on the main stage.

At the very end of 2022, NSFW content was the fastest-growing sector of English-language Twitter. It's the way of the world, especially without diligent moderation. At the same time, the new louche Twitter comes with a harum-scarum idea of "free speech" as singularly applicable to obscene provocateurs like Jordan Peterson and Marjorie Taylor Greene, formerly banned figures who were warmly welcomed back to the site in November. "This is a battle for the future of civilization," the Chief Twit tweeted. "If free speech is lost even in America, tyranny is all that lies ahead."

If Twitter is going to prey on users with hyper-arousing material and the illusion of intimacy, why not go all the way? Twitter should admit what it's up to, tell risk-averse advertisers to go blow if they're prudes, and turn full red-light district. It might scare away the squares, but Twitter can charge a mint for spank-bank material, and a premium for the kind that somehow prevents tyranny.

This article appears in the February issue. [Subscribe now.](#)

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[Steven Levy](#)

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Dec 6, 2022 9:00 AM

Tony Fadell Is Trying to Build the iPod of Crypto

The product guru made Ledger's new hardware wallet—a tiny vault for digital cash—flashy and fun. Plus, with this gadget you'll never get FTX'd. The Ledger Stax—a hardware wallet for crypto folk—has an E Ink touchscreen on which its owner can display an NFT. Its makers hope to attract more non-nerds to Web3. Photograph: Julien Faure

When I come to Paris to see Tony Fadell's new device, a clean rain has washed the city and the sun is out. Fadell and I hail a taxi. When he gives the address for Ledger—a maker of [hardware wallets](#) for the [cryptoverse](#)—he speaks in French, but even after six years abroad, there's still Detroit in his voice.

At the meeting we enter, everyone is speaking English. People are sitting at a large table. On the walls are labels such as PHOTO ASSETS, VIEW FROM LANDING PAGE, USER FLOW, with big printouts taped below. Fadell strides to the front of the room.

This article appears in the February 2023 issue. [Subscribe to WIRED](#). Photograph: Peter Yang

“We've got seven weeks to pull this off,” he says. “*Are we going to pull this off?*”

The people in the room say yes, they will pull it off. They sound confident, weary, but ready for the next round of work. Each person says what they

have done since the last time they met. Fadell responds with questions. *What's the drop-dead date on the plastic blanks? Where's the press release? Are we recording the click-click-click? I want to hear it!*

The click remark reminds everyone, as if they needed it, that Fadell once led the team at Apple that created [the iPod](#), with its elegant clicky wheel and revolutionary interface. He also cofounded Nest and created [its smart thermostat](#), which Google then acquired.

Fadell circles the room to examine the printouts, which describe the product rollout. A man with a video camera follows him, recording the moment for posterity and promotional use.

Tony Fadell hangs out in the Donjon, the security lab inside Ledger's Paris headquarters.

Photograph: Julien Faure

Fadell stops to examine a group of photos of the device: a hardware wallet called Ledger Stax. A hardware wallet is a utilitarian thing. It's a physical lock for digital secrets. When you own cryptocurrency, your balance is protected solely by a private key that can be devilishly hard to keep safe. [Ledger's wallets](#), made of steel and silicon (and, OK, plastic), act as tiny vaults, but so far they have been off-putting. [Much like crypto itself](#). Fadell is reinventing this gadget, his first major design project in years. He has come to believe that by giving it the panache of the hottest consumer gadgets, he will redirect the crypto field, just as he helped kick off digital music and the smart home.

Fadell looks at the photos of the credit-card-sized wallet and its innovative [E Ink](#) touchscreen. When Ledger reveals it on December 6, it will cost \$279. That's a rounding error for those who buy Bored Apes. To add a bit of flair, the screen wraps around one side, giving it the equivalent of the spine on a book. But the photo doesn't show this enough. "It's very rectilinear and 2D," he says. "Not enough spine. I'm not feeling the curve." He frowns. "And it's so dark."

David Sloo, a user experience designer who worked with Fadell at Nest, picks up on the critique. “Can we be less Darth Vader and more Rebel?”

Fadell agrees. “It’s really who we are—it’s all about the Empire.”

His remark is a segue to the next panel, marked MANIFESTO. A handful of slogans are taped to the glass.

Crypto is the new money.

Security is a human right.

Welcome to a new era of financial freedom.

The first touchscreen device made to protect your most valuable assets.

Fadell looks the hardest at one that reads:

In [L] Stax We Trust.

He is not satisfied with the prominence of the [L], the Ledger logo, which appears in a custom military-style typeface. The brand is what people should remember. “In five years, every time you see that L you’ll think *Ledger*,” he says. “Like the Apple logo stands for the brand.”

The comparison seems absurd. The company is nowhere near that size, its product is alien to most Earthlings, and its niche—crypto—has been undergoing months of shock treatment. Fadell seems unfazed.

“It’s coming together,” he says. “Forty-nine days!”

During those 49 days, [the arc of crypto](#) will bend [into a dunk tank](#). Timing, as product gurus know, is everything. Stax might be coming at the perfect moment. It could as easily be the worst.

Ledger was founded in 2014 by members of a Bitcoin collective called La Maison du Bitcoin. They wanted to build a wallet for crypto purists. These people would never leave their private keys on a phone or laptop—too hackable—or park their holdings in an exchange, which is a trusted,

centralized institution and no better than a bank. (“Trust” is a pejorative in this world.) That was the year thousands of people lost their investments in a hack of crypto’s flagship exchange, [Mt. Gox](#), wiping out many customers’ life savings.

Ledger’s savvy consumers would entrust their keys only to a hardware wallet, something they could hold in their hands even when servers went down and exchanges went bust. You’d begin a transaction on a phone or laptop and use the wallet to verify it. Your private key, marooned on its Alcatraz, would never cross the gap to those less secure devices.

The company’s first wallet, released late that year, was nothing special. But it satisfied a need among some crypto folk. [Subsequent models](#) got tiny displays. Ledger ultimately sold more than 5 million of its wallets, which it says now secure 20 percent of the world’s crypto and more than 30 percent of NFTs. True believers wear Ledger wallets around their necks.

By 2018, however, the crypto market had plunged into one of its cold spells, and Ledger’s sales were flat. An early investor named Pascal Gauthier came to believe that a fusty mentality was hindering the company’s growth. “The French engineer decides everything, which is why the French always come up with innovations, but we’re shitty at taking them to market and making it a business,” he says. He became part of a boardroom uprising that put him in charge.

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Gauthier, who had worked in ad tech (first at Yahoo and then as COO of a successful French company called Criteo), wanted to move Ledger from the “B to G” market—business to geek—and sell to the wider, nontechnical world. He wanted to mix Ledger’s rigid security focus with the verve of Steve Jobs-level creativity. “Maybe it’s delusional,” says Gauthier, who dresses as if awaiting a Sun Valley invitation, in an ever-present black Patagonia vest. “But I want to build things at scale, to build a company in Europe that will compete with Apple, Google.”

He felt Ledger needed to shake off a bit of its Frenchness. “If you want marketing and sales, you need Americans,” he says. “There is no other way.”

Gauthier started by wooing an expatriate he’d befriended. Ian Rogers is an Iggy Pop-ish 50-year-old with long blond hair, tattoos on his fingers, and a résumé loaded with trophy jobs, albeit trophies seldom found in the same case. He played in a high school band called Albino K-Mart Shoppers, was webmaster for the Beastie Boys, CEO of Beats Music, cofounder of Apple Music, and digital czar of the luxury-brand juggernaut LVMH, a gig that brought him to the City of Lights.

CEO Pascal Gauthier dreamed of turning a European company into a global tech giant that could rival Apple.

Photograph: Julien Faure

By 2020, though, he was open to Gauthier’s pitch. He’d long been interested in crypto, having read the foundational Satoshi paper in 2009. Gauthier was offering him a chance to participate in what he regarded as a nascent revolution of ownership, anchored by the Gibraltar-like certainty of cryptographic private keys. “We know this technology will matter in the future, because a lot of humanity, if not all of humanity, will own digital items,” he says. “It’s just like it was in 2008, when people said not everyone would have a smartphone.”

He also respected the business model—Ledger sold actual devices, not dicey promises of perpetually rising markets. Private wallets embodied for him the decentralized ethos at the core of the crypto vision. “The people at this company wouldn’t work at Coinbase,” says Rogers. “They don’t want to work at a bank. They believe in self-custody.”

Still, Rogers wanted to do his due diligence. Fadell, a parent friend from his children’s school in Paris, took it upon himself to investigate. At that point Fadell was living a quiet life as an investor. During the first months of the pandemic it was a super quiet life. “Tony never crossed the fucking transom of his door,” Rogers says. Fadell was busy giving product advice to the companies he funded and writing [a business book](#) that drew on his career, a

pursuit usually signifying a career's end. But Rogers had gotten him curious, so he took a hard look at what the company considered its biggest strength—its security.

Ian Rogers, the chief experience officer, joined Ledger to pursue an interest in crypto and became an avid collector of NFTs.

Photograph: Julien Faure

Fadell's guide to Ledger's operations was its chief technology officer, Charles Guillemet, who joined the company in 2017. Inside its headquarters, behind a giant medieval-style door off a Paris lane, Guillemet created the Donjon, a jacked-up security lab that verifies the resilience of every aspect of the hardware, down to the chip circuits. Inside the Donjon, motherboards get probed as if in a 21st-century version of Frankenstein's lab. Lasers connected to oven-sized oscilloscopes poke at chips to observe how they might fail. Guillemet told Fadell he was appalled at the idea of people securing their assets on laptops or iPhones, which he deemed hopelessly vulnerable. He despised fingerprints and facial recognition. Your biometrics are public, after all, and can be counterfeited.

The more time Fadell spent with Guillemet and the Ledger team, the more convinced he became. "I didn't believe in all that crypto hype, but I believe in the technology," he says. He told Rogers that Ledger was the real deal. Rogers became the company's chief experience officer in January 2021, and later that year, to bolster the company's storytelling acumen, he hired an editor in chief, former Vice executive Ariel Wengroff. She oversaw a crypto education project called Ledger Academy and kicked off a podcast and video series. Some of the engineers at Ledger didn't understand why those nontechnical hires were necessary. Gauthier saw their resistance as part of Ledger's problem. "I was saying we could sell tens of millions of devices, have billions of revenue, billions of valuation. And they were like, 'Yeah, whatever.'"

Charles Guillemet, Ledger's CTO, convinced Fadell that the company's tech was the real deal.

Photograph: Julien Faure

But Rogers' most significant contribution might have been igniting the interest of his friend Fadell. He had seen a weakness in Ledger's plan—the device itself was unlovable. To unlock the wallet, you had to enter a four- or eight-digit passcode using an incredibly awkward interface, like writing an essay on a home security panel. He began pondering what a better solution might be.

Fadell met with Gauthier at a Paris café, and they agreed that Ledger needed its next product to have broader appeal. They parted ways, but Fadell kept brainstorming. When he hit on a vision, he met with Gauthier again. "I want to be the chief designer on that," Fadell told him. Gauthier immediately agreed.

Fadell started the gig full of ideas. As the guy who swept away the pain points of first-generation MP3 players (big and clunky, engineering degree required to select a song) and thermostats (ugly, no connectivity, impossible to program), Fadell was quick to understand the shortcomings of Ledger's wallet. Its screen was tiny, it lacked a keyboard or keypad, and its appearance and charm were on par with an early-2000s USB stick. The startup instructions warned users to set aside a minimum of 30 minutes.

In his mind, the wallet should be about the size of a credit card and have a touchscreen. The setup time should take no more than three minutes. You should be able to personalize the lock screen to display anything you want. He also envisioned people owning several wallets, one for each category of digital collecting or banking. He liked the concept of stacking them on top of each other, like a cash bundle of \$100 bills. He came up with the idea of having magnets to snap the units into a tidy stack. That feature provided the name for the device: Stax.

Fadell surveyed all possible electronic components, talked to suppliers, and began prototyping, using green plastic toy blocks and magnets. One design constraint was battery life—Fadell wanted people to be able to leave their wallets untouched for months and still have power when they retrieved them. That meant the screen had to use energy-efficient E Ink. (Color would have been nice, but the tech isn't there yet.) Fadell took apart a bunch of Kindles and ReMarkable tablets to test how the screen might display a keyboard and other buttons.

Stax wallets have customizable E Ink displays.

Photograph: Julien Faure

The screen wraps around one edge, creating a spine that an owner can label.

Photograph: Julien Faure

One of his dreams was to extend the screen along the edge of the unit, so people could label it. None of the E Ink displays he saw could do what he wanted, so he contacted an old friend, the UK venture capitalist Hermann Hauser, who had once been involved in an unsuccessful ebook device with advanced E Ink. That company, Plastic Logic, was now based in Dresden, Germany, and was making custom E Ink displays. And they could bend! The curved display had at that point been used only by an obscure Russian phone called the YotaPhone. Fadell wanted to produce hundreds of thousands of screens with a dramatically sharper curve and at a low cost.

Adding a touchscreen to the wallet presented a risk, though—a sophisticated attacker could, with the right equipment, pick up electronic signals leaking through the screen and figure out the pin code that unlocks the device. So Ledger’s engineers had to shield the screen so it emitted no digital exhaust. They also wrote their own driver, the code that helps render pixels on the screen. “You’re compromising security if you use a driver written by someone in China that you’ve never met,” Rogers says.

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Meanwhile, Fadell was increasingly showing up at Ledger as the de facto lead of its new flagship product. (Though he never became an employee, Fadell says he was granted significant equity.) Not everyone welcomed him. Put magnets on a hardware wallet? Add a curved screen? From a supplier who’d never done that before? Plus, Fadell can be exacting to the point of infuriating. “I can’t tell you how many times they’d say, ‘Oh this seems difficult—a rolled screen?’” Fadell says. “And I’m like, ‘I’m telling

you, we're going to do this thing. How many times do I have to say, just trust me, it's going to happen.””

Early on, Gauthier had to convene his engineers and quell a possible rebellion. “They were saying all those things had never been done before. And I’m like, *shut the fuck up*. If he says we’re going to do it, we’re going to do it.” Apparently, they bought in: Some of those engineers described Fadell’s style to me much the way he likes to be viewed—grueling, but inspiring. Like his former boss Steve Jobs. (Maybe if I spoke French I could have cornered them and gotten more candor.)

Ledger saw other benefits of having Fadell onboard. Early in 2022, Foxconn, the manufacturing giant that Ledger retained to assemble the Stax units, said that it wasn’t going to meet its February 2023 deadline for shipping final products. Maybe June? “We were freaking out,” Gauthier says. Fadell told him, “I got this.” He wrote to Foxconn’s CEO, explaining that the deadline was important and it would be a great favor if he looked into it. “Fifteen minutes later, boom, we were back on track,” Gauthier says.

When I arrive in Paris in October, the first prototypes are finished, and the team is working out the remaining bugs. Sitting with Fadell and Wengroff in Rogers’ apartment in the Marais section—a fourth-floor walk-up accessible through an unmistakably Parisian courtyard—several units are neatly, um, stacked on the table, alongside a plate of fresh croissants. On the spine of one of them is the phrase, BANKS ARE DEAD. I watch as Rogers buys an NFT. He does the actual selection and transaction on a phone. The Stax wakes up when it’s time to verify Rogers’ private key, alerting him that a pending transaction awaits his verification. Punching in his passcode on the display—sheltering with a cupped hand so I can’t shoulder-surf—he buys it. Within a few minutes, he can view the image on his phone and edit it so it shows up in gray scale when he ships it to the lock screen of his Stax.

Ariel Wengroff joined the team to help Ledger break out of its “business-to-geek” niche.

Photograph: Julien Faure

It may be a stretch to imagine a mass movement toward crypto coins and digital goods. Ledger's very long-term vision is that with secure, well-designed hardware as a bedrock, people will gravitate to crypto to verify their identity and credentials. Think driver's licenses, passports, proof that you passed your dentistry boards, Taylor Swift tickets, and voter ID. Rogers says that when he attended the NFT NYC conference earlier this year and digitally verified he had the token required to register for exclusive events, an irony struck him. "The technology I use to get into parties is more secure, easier to use, and better than the technology that I use to get into our country! Fast-forward into the future and your government document is in your hardware wallet."

To advance this vision, Ledger has so far only met with consultants from Estonia, a nation known for embracing any futuristic scheme that comes its way. A delightful wallet can only do so much; it's not going to win over people who struggle through 40,000-word crypto explainers in allegedly plain language and still can't figure it out. Does Ledger really believe it can transform the industry?

"That's the hope," Fadell says. "To have that iPod moment for digital assets. You can't just integrate it into a phone, no matter how much you try. You need to have a real physical key in your life that holds the digital."

As we sit in Rogers' sunny Paris flat, it all seems plausible. Less than a month later, the blockchain world would blow up at the hands of a bogus crypto king in the Bahamas.

In early November, Gauthier, Rogers, Fadell, and Wengroff visited New York City, and we met in a downtown bistro. As the espressos were being pulled, I asked about the fuzzy-haired, short-pants elephant in the room. Only a week earlier, a young crypto magnate named [Sam Bankman-Fried](#) had presided over the biggest disaster in crypto since Mt. Gox. "SBF" had allegedly redirected a chunk of customer deposits from his multibillion-dollar crypto exchange FTX to cover the failing high-risk investments handled by a trading company he controlled. When customers went to withdraw their funds, some of them discovered they couldn't. His crew had annihilated at least a billion dollars' worth of wealth, stiffing more than a million customers and demolishing crypto's reputation.

[The implosion](#) capped off a convulsive year. The price of cryptocurrency has sunk, and NFTs have gone from galleries to Goodwill. Considering all this, launching Stax now could seem like introducing a new cocktail in the lounge of the *Titanic*, just as the ship smacked into the iceberg.

“*Non, non!*” insist the folks at Ledger. They say that FTX has been a *boon* for their company. It was a vindication of self-custody. People who had been holding their digital assets inside exchanges were now pulling out their funds and moving them to hardware wallets. The previous day, a Sunday, Ledger had set a sales record, and now it was on track to break it again.

Wengroff, Fadell, Rogers, and Gauthier gather on the street outside Ledger HQ.

Photograph: Julien Faure

As customers poured in—and existing users who hadn’t fired up their wallets in months suddenly decided to update the firmware—Ledger’s servers were temporarily swamped, and for an hour or so, customers couldn’t update their software. Some got spooked. The company’s support team sent out an ill-worded message assuring everyone, in a tweet, “Your assets are safe.” Of course they were—that’s what self-custody is all about. But after SBF and other meltdowns, that phrase had become a signal that a house of cards was falling and your assets were *gone*.

If even savvy crypto folk get panicky at a hiccup like that, just imagine the reluctance of [Web3](#) holdouts. Might it be unrealistic for Ledger to expect newbies to pay almost \$300 for a wallet that has a cool picture on it but still depends on a somewhat impenetrable ecosystem and an existential question of reliability?

To the Ledger-ites, the promise of crypto and the necessity of self-custody will prevail. It’s a logical outcome of the last half-century of atoms moving to bits. Still, Rogers admits that no matter how slick Stax is, it interacts with systems that have massive barriers to entry. After breakfasting at the bistro, I spent an hour with him trying to get set up to trade crypto and buy NFTs. While getting the wallet to authenticate me was easy, getting the currency

needed to buy the funky artworks Rogers likes proved frustratingly difficult, and apparently impossible to complete in the time we had. “Crypto is where the internet was in 1993,” he finally said, in a tone somewhere between wistful and pissed off. That doesn’t bother him too much—the iPod, after all, came out in the early, awkward days of digital music and took a few years to catch on. “The only question in my brain is, are we the Apple of Web3?” Rogers says. “Or are we the BlackBerry or Nokia of Web3?”

We’ve already seen the FTX of Web3, so there’s nowhere to go but up. For now, Tony Fadell’s latest technology tour de force stands as a friendly hardware ambassador for a future that’s still far away for most of us, and a glimpse of how we might wind up with something useful, accessible, and enriching—from what so far has been a blockchain of fools.

This article appears in the February 2023 issue. [Subscribe now](#).

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By [Andy Greenberg](#)

[Backchannel](#)

Nov 29, 2022 6:00 AM

The Hunt for the Dark Web's Biggest Kingpin, Part 6: Endgame

With AlphaBay shuttered, Operation Bayonet enters its final phase: driving the site's refugees into a giant trap. But one refugee hatched his own plan. The Dutch cops hoped their targets would take the stuffed pandas home. Unbeknownst to the recipients, each one contained, hidden deep in its stuffing, a small GPS tracker.
ILLUSTRATION: HOKYOUNG KIM

Content Warning: *This story includes references to suicide. If you need help, call the [Suicide and Crisis Lifeline](#) for your region.*

CHAPTER 14

THE STING

In the days after the AlphaBay takedown but before Alexandre Cazes' death, Paul Hemesath spent a few enjoyable hours by the rooftop pool of the Athenee, scrolling on his iPad through the responses to the sudden, unexplained disappearance of the world's largest-ever dark-web market.

Rumors had begun to swirl instantly that the site's administrators had pulled off an exit scam, taking with them millions of dollars' worth of the market's cryptocurrency. But others argued that the site might just be down for technical reasons or to carry out routine maintenance. Few suspected the truth. "People have always screamed exit scam in the past, and they've always been wrong," wrote one user on Reddit. "I really hope this turns out the same." Another added, "Until we know otherwise, keep the faith."

Almost immediately, faithful or not, AlphaBay's vendors and buyers went looking for a new market where they could continue business as usual. The natural choice was AlphaBay's biggest rival, Hansa, which was well run and already growing fast. "wow alphabay exit scam. crazyness!" one user wrote on Twitter. "moving to hansa."

This story is excerpted from [Tracers in the Dark: The Global Hunt for the Crime Lords of Cryptocurrency](#), available now from Doubleday.

Courtesy of Penguin Random House

Back in the Netherlands, the Dutch police were waiting for them. For two weeks, they had been overseeing Hansa's vast marketplace, surveilling its users and collecting their messages, delivery addresses, and passwords. Their Driebergen conference room, where the small team of undercover investigators had continued to work in shifts around the clock, had taken on the atmosphere of a college dorm. Chips, cookies, chocolates, and energy drinks covered the table, a warm, stale funk pervading the air.

At one point the head of investigations for the Dutch National Police paid them a visit to see their landmark operation in action. He was visibly offended by the smell and left after 10 minutes. Someone brought in an air freshener. (“It didn't really work,” a team member says.)

Hansa's marketplace, meanwhile, was thriving. In the days before the AlphaBay takedown, it was adding nearly a thousand new registered users a day, all falling into the trap the Dutch had patiently set. When AlphaBay went offline, that number spiked to more than 4,000 a day. Then more than 5,000 the next day. Then, two days after that, 6,000.

Soon, as the market absorbed AlphaBay's wayward users, the Dutch team was logging a thousand daily transactions. The paperwork of tracking and sending those order records to Europol—not to mention attempting to intercept every order shipped to the Netherlands—became so massive that the police were briefly overwhelmed. They reluctantly decided to shut down new registrations for a full week. “Due to the influx of Alphabay refugees we are dealing with technical issues,” read a message they posted to the site. Those refugees, however, remained so eager to join that some Hansa users began selling their accounts on web forums, like scalpers selling tickets to a concert.

Then, in the middle of that week, on July 13, one prong of Operation Bayonet suddenly slipped into the light. *The Wall Street Journal* [broke the news](#) that AlphaBay had been taken down by a joint law enforcement

operation involving the US, Thai, and Canadian governments and that the site's administrator, Alexandre Cazes, had been found dead in a Thai jail cell.

There was no mention in the article of Hansa or the Dutch police. And when the Dutch reached out to the FBI, they were surprised and relieved to find that the Americans were willing to keep mum—to follow the Dutch team's lead and delay any announcement of the entirety of Operation Bayonet. The still-operational, undercover half of their one-two punch would remain hidden for as long as the Dutch chose to pursue it.

So a week after pausing new registrations on Hansa, the Driebergen team turned them on again. New user sign-ups soon spiked to more than 7,000 a day.

The dutch knew that their operation couldn't go on indefinitely. They could see the moment approaching when they would have to take off their masks, reveal their surveillance coup, and tear down the market they'd so carefully rebuilt and maintained. They were, after all, facilitating drug sales, not all of which were being intercepted in the mail.

The closer they got to the end of the sting, meanwhile, the less they had to lose if they were discovered—and the more risks they were willing to take.

Throughout the operation, the Dutch team would hold what they called “evil plan” meetings, brainstorming ever more devious schemes to track and identify the unwitting users of the market they controlled. They created a list of those tactics, ordering the menu of surveillance actions from least to most likely to blow their cover. As they reached their endgame, they began to put their most brazen ideas into practice.

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Hansa had long ago implemented a standard feature for [dark-web markets](#), designed to protect their vendors: When sellers uploaded images for their product listings, the site automatically stripped those images of their metadata—information nested within the file, such as what sort of camera had taken the photo and the GPS location of where the image was created. The Dutch had silently sabotaged that feature early on, recording images' metadata before it was stripped, so as to catalog uploaders' locations. But they had managed to pinpoint only a few vendors that way; they found that most rarely updated their listings or posted new photos.

So, a few weeks into their takeover, the police wiped every image from the site. They claimed that a server had failed due to a technical glitch, and they announced that vendors would have to re-upload all the images for their listings. Those fresh uploads allowed the Dutch cops to scrape the metadata from a vast new batch of images. They quickly obtained the locations of 50 more of the site's dealers.

In another scheme in the last days of their operation, the Driebergen team came up with an idea for how to get the IP addresses of the site's sellers, despite their use of the anonymity software Tor. It involved a sort of Trojan horse. Hansa's administrators announced that they were offering an Excel file to vendors that included codes that would allow them to retrieve their bitcoins stored in escrow on the market, even if the site was taken down. When only a small number of Hansa's dealers took them up on the offer, the police tried adding more helpful information to it, designed to lure vendors, like buyer statistics that would let the sellers track and rank their best customers. When even that feature got lackluster adoption, the Dutch cops pushed their ruse to its extreme: They warned the site's users that they had detected suspicious activity on their servers and said all vendors should download the backup [cryptocurrency](#) retrieval file immediately or risk losing their funds.

All the while, of course, the files the team was pushing on vendors were functioning as secret digital beacons. The top left of the Excel spreadsheet displayed an image of the Hansa logo, a stylized Viking ship. The police had designed the Excel file to fetch that image from their own server when

the spreadsheet was opened. As a result, they could see the IP address of every computer requesting it. Sixty-four sellers on the market took the bait.

In the most involved scheme of all, the Dutch team turned their sights to the staff of the marketplace itself, the moderators who were directly working for them. They'd found that one moderator in particular was extremely dedicated—very “emotionally involved” in the site, as the team lead, Petra Haandrikman, put it. The Dutch team felt a collective sense of admiration and affection for this hard worker—while simultaneously hatching a scheme to try to arrest him.

They offered him a promotion. Hansa's two bosses would give him a raise, but only if he agreed to become a third admin of the site. The moderator was overjoyed, immediately accepting. Then they explained that for him to become an admin, they'd have to either arrange a meeting in person or get his mailing address so that they could send him a two-factor authentication token—a physical USB stick plugged into a PC to prove his identity and keep his account secure.

In his next message, the moderator's tone suddenly changed. He explained that he had made a promise to himself that if his bosses at Hansa ever asked for his identifying information or tried to meet him in person, he would immediately quit and wipe all of the devices he had used in his moderator job. Now he planned to abide by that promise. He said goodbye.

That moderator's sudden decision—a very wise one, likely saving him from a prison sentence—meant that the admins now had an opening to fill. So they began advertising that they were taking applications for a new moderator. At the end of a series of questions about qualifications and experience, they would ask “successful” applicants for their address so that they could mail them a two-factor authentication token. Some, eager for the job, handed over the locations of their homes. “Please don't send the cops to this address hahahahaha just kidding,” one would-be moderator wrote, as he, in fact, sent his address to the cops. “I trust you guys because Hansa support was always good and helpful.”

Savvier dark-web users, of course, never gave out their home addresses. In cases where they needed to receive a package, they sent shippers the

address of a “drop”—a location away from their homes where they could, if necessary, deny the package was theirs.

To circumvent that safeguard, the Dutch police went one step further: For moderator applicants who provided a drop address, they shipped them the two-factor token hidden inside the packaging of a teddy bear, a cute stuffed panda with a soft pink nose. They intended the panda to appear as an innocuous disguise to hide the authentication token, a sign of their new employers' attention to opsec—and, perhaps, their sense of humor.

The Dutch cops hoped their targets would take the stuffed pandas home as a kind of gift or souvenir. Unbeknownst to the recipients, each one also contained, hidden deep in its stuffing, a small GPS tracker.

CHAPTER 15

PANIC

On July 20, after running Hansa for 27 days, the Dutch prosecutors decided it was finally time to give up their game—over the objections of several members of the Driebergen team controlling the site, who had more ideas for surveillance tricks still up their sleeves.

In a press conference at the Dutch police's national headquarters in The Hague, the head of the agency dramatically pressed a large red plastic button to shut down the site. (In fact, the button was just a prop; an agent sitting nearby with a laptop sent the simultaneous command to the server that finally pulled Hansa offline.) Simultaneously, the US Justice Department announced the news in a DC press conference in which Attorney General Jeff Sessions spoke about the coordinated action against both AlphaBay and Hansa. Sessions used the opportunity to issue a warning to the dark web's users. “You are not safe. You cannot hide,” he told them, from a packed room of reporters and cameras. “We will find you, dismantle your organization and network. And we will prosecute you.”

Nearly 16 days after it had inexplicably disappeared, the AlphaBay site rematerialized with a notice covered in law enforcement agency logos and

words that would be familiar to any [Silk Road](#) user: “THIS HIDDEN SITE HAS BEEN SEIZED.”

The Dutch, meanwhile, put up a slightly different message on Hansa: “THIS HIDDEN SITE HAS BEEN SEIZED *and controlled since June 20.*” The Dutch seizure notice linked to another dark-web site that the police had created themselves, which listed dark-web vendors by pseudonym under three categories: those under investigation, those who had been identified, and those who had been arrested—a list that they suggested was about to grow significantly. “We trace people who are active at Dark Markets and offer illicit goods or services,” the site read. “Are you one of them? Then you have our attention.”

The Dutch team in Driebergen, even after exposing their operation, still had one last card to play: They decided to try the usernames and passwords they had already collected from Hansa on the largest surviving dark-web drug bazaar, known as Dream Market. They found that at least 12 of that site’s dealers had reused their Hansa credentials there. They were able to immediately take over those accounts and lock out the vendors—who promptly posted panicked messages to public forums suggesting that Dream had been compromised as well.

All of that carefully coordinated agitprop and disruption was expressly designed to sow fear and uncertainty across the dark-web community—to “damage the trust in this whole system,” as the Dutch police’s Marinus Boekelo said.

It had its immediate intended effect. “Looks like I’ll be sober for a while. Not trusting any markets,” wrote one user on Reddit.

“DO NOT MAKE NEW ORDERS ON ANY DNM ANY MORE!” wrote another, using the common abbreviation for “dark net market.”

“So it’s a wrap for the darknet?” one user asked.

“To everyone who thinks they’re screwed and wants to flee the country,” another advised, “do so ASAP.”

That all-pervading paranoia was, for many of the dark web's users, warranted. In their nearly four weeks of running Hansa, the Dutch had surveilled 27,000 transactions. After shutting down the site, they seized 1,200 bitcoins from Hansa, worth tens of millions of dollars as of this writing, thanks in part to silently sabotaging the site's implementation of a [Bitcoin](#) feature called multi-signature transactions, designed to make that sort of simple confiscation impossible. They had collected at least some amount of data on a staggering total of 420,000 users, including more than 10,000 home addresses.

In the months following the takeover, Gert Ras, the head of the unit that oversaw the operation, said Dutch police carried out around 50 “knock and talks” in the Netherlands, visiting known buyers to warn them they had been identified and should stop purchasing narcotics online, though he said they arrested only one high-volume customer.

The site's sellers weren't so lucky: Within a year, more than a dozen of Hansa's top dealers had been arrested. Finally, the Dutch police fed the massive corpus of dark-web data they'd collected into a database controlled by Europol, which in turn shared it with law enforcement agencies around the world.

The direct ripple effects of that explosion of incriminating data, passed through so many institutions' records, aren't easy to track. But over the following years, Grant Rabenn, who served as custodian of the files the Justice Department had assembled from Operation Bayonet, says he received requests for that information as part of dozens of cases that agencies across the United States were still pursuing.

A series of massive, high-profile dark-web busts would follow. These operations were all carried out by a new group known as JCODE, or Joint Criminal Opioid and Darknet Enforcement, pulling together agents from the FBI, DEA, Department of Homeland Security, US Postal Inspection Service, and half a dozen other federal agencies: in 2018, Operation Disarray; in 2019, Operation SaboTor; in 2020, Operation DisrupTor. In total, according to the FBI, those enforcement campaigns would eventually result in more than 240 arrests, 160 “knock and talks,” and the seizure of

more than 1,700 pounds of drugs, along with \$13.5 million in cash and cryptocurrency.

But the Hansa side of the operation was not without costs. Aside from the vast manpower and resources Operation Bayonet had required, it had demanded that a group of Dutch police become dark-web kingpins. For nearly a month, they had facilitated the sale of untold quantities of deadly narcotics to unknown buyers across the world. Even as they compromised Hansa, Hansa had compromised them too.

Did the Dutch police feel that sense of taint—taint that perhaps comes with any undercover work? Some, at least, describe feeling surprisingly unconflicted about their role. “To be honest, it was exciting, mostly,” said the team lead, Petra Haandrikman. Dutch prosecutors had, after all, already reviewed the case, weighed its ethics, and given them the green light. After that, the police involved felt they could push the operation as far as possible with a clean conscience.

The Dutch police pointed out that they did ban the especially deadly opiate fentanyl from Hansa while it was under their control, in an effort to minimize the harm they might be responsible for—a move Hansa's users actually applauded. In truth, however, that ban had come just a few days before the end of their undercover operation. Until then, for more than three weeks, that highly dangerous opioid had continued to be offered on the site, with no guarantee that all of its orders would be intercepted.

And how did the police feel about the decision to oversee those narcotics sales rather than shut Hansa down and prevent the transactions altogether?

“They would have taken place anyway,” Gert Ras said without hesitation, “but on a different market.”

“I welcome you to the re-opening of our professionally-run, anonymous, secure marketplace AlphaBay,” DeSnake’s message began.

In the years since, the dark web’s observers have tried to determine to what extent Operation Bayonet actually disrupted that endless interchangeability of markets, the constant cycle of raid, rebuild, and repeat. Could the highly

coordinated global takedown of AlphaBay—or anything else—end or even slow the eternal shell game law enforcement agencies had by then been playing for years, with a new market constantly ready to absorb the users of the last?

One study, at least, suggested that the AlphaBay and Hansa busts had more lasting effects than previous dark-web takedowns. The Netherlands Organisation for Applied Scientific Research, which goes by the acronym TNO, found that when other markets had been seized, like the Silk Road or Silk Road 2, most of their drug vendors soon showed up on other dark-web drug sites. But the vendors who fled Hansa after Bayonet's one-two punch didn't reappear, or if they did, they had been forced to scrub their identities and reputations, re-creating themselves from scratch. "Compared to both the Silk Road takedowns, or even the AlphaBay takedown, the Hansa Market shutdown stands out in a positive way," the TNO report read. "We see the first signs of game-changing police intervention."

Carnegie Mellon's Nicolas Christin, a quantitative researcher of dark-web drug markets with an especially long track record, isn't so sure. Based on data he and his fellow researchers assembled by analyzing feedback posted to markets, they conservatively estimated that AlphaBay was generating between \$600,000 and \$800,000 a day in sales before it was shut down, well over double Silk Road's peak revenue. But his team found that the next inheritor of the dark web's refugees, Dream Market, eventually grew to become almost as big as AlphaBay, or perhaps even bigger—before its administrators disappeared and the market quietly dropped offline in 2019.

Chainalysis' blockchain-based measurements, by contrast, found that AlphaBay was generating as much as *\$2 million* a day in average sales just before its shutdown—revenue that no other dark-web market of its kind has ever rivaled. (The Russian-language dark-web site Hydra, which was pulled offline by German law enforcement in April 2022, did top those numbers, taking in more than \$1.7 billion in bitcoin in 2021, according to Chainalysis. But because its black-market contraband sales were difficult to distinguish from its money-laundering services, its inflows of cryptocurrency aren't directly comparable to AlphaBay's.) The FBI has estimated that Cazes' site, with more than 369,000 product listings and

400,000 users at its peak, was 10 times the size of Silk Road when it was pulled offline.

Regardless of who holds the title for the largest dark-web market of all time, Christin predicts that this anonymous contraband economy cycle will continue long after the dark web's memory of Operation Bayonet has faded, as long as there are buyers for illegal, lucrative, and often highly addictive products.

"History has taught us that this ecosystem is very, very resilient," he says. "What happened in 2017 was very unique, that one-two punch. But that doesn't seem to have dented the ecosystem in a major way."

Even on the day that the Hansa takedown was announced and Operation Bayonet was finally revealed, some users seemed ready to return to the dark web as soon as the chaos subsided, and their insatiable need for another fix began to make itself felt. The very same Reddit user who had posted to the site's dark-net market forum that they would be "sober for a while" ended their message with a note of stubborn persistence.

"Things will stabilize, they always do," that anonymous user wrote. "The Great Game of whack-a-mole never ends."

CHAPTER 16

RESURRECTION

In early August 2021, just as I was reporting out the final details of AlphaBay's downfall, something unexpected happened: It rose from the dead.

"AlphaBay is back," read a message posted to Ghostbin, a site for publishing anonymous text-based messages. "You read that right, AlphaBay is back."

The message appeared to be authored by DeSnake, AlphaBay's former number two administrator and security specialist. To prove his identity,

DeSnake had cryptographically signed the message with his PGP key—a method to show that the writer of the message possessed the long, secret series of characters that only DeSnake had access to, like a king stamping a letter with a personal signet ring. Multiple security researchers privately confirmed that the signature matched the one from DeSnake's messages as an AlphaBay administrator years earlier. The author seemed to be AlphaBay's long-lost lieutenant—or, at the very least, someone who'd gotten ahold of his key.

“I welcome you to the re-opening of our professionally-run, anonymous, secure marketplace AlphaBay to buy or sell products and services,” DeSnake's message began. The staff of this new AlphaBay, he wrote, had “20 years of experience in computer security alone, underground businesses, darknet market management, customer support and most importantly evading Law Enforcement.”

Sure enough, when I entered the site's address into a Tor browser, a reincarnated AlphaBay appeared—albeit a newly launched one. It was the same market as the one last seen in 2017, but restarted from scratch, with none of AlphaBay's many thousands of vendors. And there was another major difference: Now that he had taken over from Alpha02, DeSnake allowed transactions only in the privacy-focused cryptocurrency Monero, not Bitcoin, to prevent the blockchain analysis that had played such a central role in AlphaBay's takedown.

I reached out to DeSnake for an interview, writing to his account on the Tor-protected web forum Dread. Within 24 hours, I found myself [exchanging encrypted instant messages](#) with the newly resurfaced, would-be kingpin of the dark web.

DeSnake quickly explained why he had reappeared only now—fully four years after the original AlphaBay had been torn offline, after Cazes had died in jail and the rest of AlphaBay's staff had scattered. He had intended, he wrote, to retire after AlphaBay was seized, but his plans changed after he saw the news that an FBI agent involved in the AlphaBay takedown had shown a video of Cazes' arrest at the 2018 Fordham International Conference on Cyber Security and had spoken about Cazes in a way that DeSnake deemed disrespectful.

“The biggest reason I am returning is to make the AlphaBay name be remembered as more than the marketplace which got busted and the founder made out to have committed suicide,” DeSnake wrote, in his slightly foreign-inflected English. “AlphaBay name was put in bad light after the raids. I am here to make amends to that.”

DeSnake repeated the claim I'd heard before: that Cazes was murdered in jail. He offered no real evidence but said that he and Alpha02 had developed a contingency plan in case of his arrest—a kind of automated mechanism that would reveal Alpha02's identity to DeSnake if he disappeared for a certain amount of time, so that AlphaBay's number two could help him in jail. (Whether that help would have come in the form of a legal defense fund or the “helicopter gunship” Cazes had mentioned to Jen Sanchez, DeSnake refused to say.)

Cazes would never have killed himself before their plan could even go into effect, DeSnake argued. “He was a fighter,” he wrote. “Me and him had backup plan, I guarantee you that a good and working one, backed by funds etc. However he got killed.”

DeSnake described countermeasures he'd since developed for practically every tactic that had been used to capture Cazes and take down the original AlphaBay. DeSnake never stepped away from his computer when it was unlocked, he wrote, not even to use the bathroom. He claimed to use an “amnesiac” operating system to avoid storing incriminating data, as well as “kill switches” to destroy any remaining information that law enforcement might find on his machines, should they leave his control. He even wrote that he'd designed a system called AlphaGuard that will automatically set up new servers if it detects that the ones that run the site are being seized.

But the biggest factor protecting DeSnake was almost certainly geographic: He wrote that he's based in a former USSR country, beyond Western governments' reach. While he acknowledged that Cazes had used fake clues to suggest a Russian nationality to throw off investigators, he claimed that AlphaBay's ban on victimizing people from that part of the world was genuine and designed to protect him and other actual post-Soviet citizen AlphaBay staffers from local law enforcement.

“We did that for security of other staff members,” DeSnake wrote. Cazes then “decided to embrace it as a way to secure himself.”

Even so, DeSnake claimed that he had traveled multiple times through countries with US extradition treaties and had never been caught. He credited that track record in part to his careful money laundering, though aside from his preference for Monero, he declined to detail his methods.

“Anyone who believed any currency method or cryptocurrency is safe is a fool or at the very least very ignorant. Everything is tracked,” he wrote.

“You have to go through certain methods to be able to enjoy the fruits of your work … it costs to do what you do. If you are a legit business you pay taxes. If you are doing this you pay taxes in forms of obfuscating your money.”

DeSnake said he was shocked when he learned of Alpha02's early slipup that first revealed his email address to the DEA. “I am still in disbelief to this day that he had put his personal email on there,” DeSnake wrote. “He was a good carder and he knew better opsec.”

But he added that Cazes' failure to hide his money trails to the degree DeSnake recommended was a more willful mistake. DeSnake had warned the previous AlphaBay boss about the need to take more measures against financial surveillance, he said. Alpha02 hadn't listened.

“Some advice he took, other he disregarded as ‘overkill,’” DeSnake wrote. “In this game there is no overkill.”

One afternoon, at the end of several weeks of on-and-off chats with DeSnake about how he planned to win this next round of the dark web's cat-and-mouse game, he shared some news: The mice had scored another small victory.

DeSnake sent me a series of links to Tor-protected websites that he described as “DarkLeaks.” Someone, it seems, had hacked the Italian police agency responsible for investigating a pair of dark-web drug sites, known as Deep Sea and Berlusconi Market. Now that hacker had published a broad

collection of stolen documents that offered an inside view into law enforcement's secret work to take down those sites.

Within the DarkLeaks collection, one slide deck immediately caught my eye. It was a presentation from Chainalysis. It described, in Italian, a remarkable set of surveillance tricks that Chainalysis offered law enforcement but that had never before been publicly revealed, including the ability to trace Monero in a majority of cases. The slides even seemed to reveal that Chainalysis had turned a free blockchain analysis tool it had acquired, WalletExplorer, into a honeypot: The company had turned over identifying information to law enforcement about people who used the tool to check the traceability of their coins.

But amid these revelations, there was another slide that finally offered the most elusive answer I'd been looking for: a possible solution to the mystery of the "advanced analysis" trick Chainalysis had used to locate the AlphaBay server in Lithuania.

The Italian presentation confirmed that Chainalysis can, in fact, identify the IP addresses of some wallets on the blockchain. It did so by running its own Bitcoin nodes, which quietly monitored transaction messages. This appeared to be the very practice that had led to a scandal in the company's earliest days, when it was revealed that Chainalysis was running its own Bitcoin nodes to collect the IP addresses of cryptocurrency users—an experiment it had promised was shut down after an outcry about it spread across the Bitcoin community.

One slide in particular described a tool called Rumker, explaining that Chainalysis could use its surreptitious Bitcoin nodes to identify the IP addresses of anonymous services, including dark-web markets. "Although many illegal services run on the Tor network, suspects are often negligent and run their bitcoin node on clearnet," the slide read, using a term for the traditional internet not protected by Tor.

Had AlphaBay made this mistake? Rumker sounded very much like the secret weapon that had pinpointed that dark-web giant's IP address, and likely those of many other targets too.

(When I wrote to Chainalysis' Michael Gronager to ask about the slides and specifically about Rumker, he didn't deny the presentation's legitimacy. Instead, he sent me a statement that read like a kind of summation of his stance on Bitcoin's privacy, which he argues is virtually nonexistent: "Open protocols are openly monitored—to keep the space safe—and to enable a permission-less value transfer network to flourish.")

Rumker, if it was in fact the tool that located AlphaBay, had likely just been "burned." Whoever leaked it had, in doing so, exposed the vulnerabilities of the Bitcoin protocol it exploits. Dark-web administrators like DeSnake will no doubt take more care in the future to prevent their cryptocurrency wallets from revealing their IP addresses to snooping Bitcoin nodes.

But there will be other vulnerabilities, and other secret weapons to exploit them. The cat-and-mouse game continues. And for every Alpha that's taken down, another will be waiting in the dark web's manifold shadows, ready to rise into their place.

This story is excerpted from [Tracers in the Dark: The Global Hunt for the Crime Lords of Cryptocurrency](#), available now from Doubleday.

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This article appears in the December 2022/January 2023 issue. [Subscribe now.](#)

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Nov 24, 2022 6:00 AM

The Hibernator's Guide to the Galaxy

Scientists are on the verge of figuring out how to put humans in a state of suspended animation. It could be the key to colonizing Mars.

Illustration: Ori Toor

One day in 1992, near the northern pole of a [planet](#) hurtling around the Milky Way at roughly 500,000 miles per hour, Kelly Drew was busy examining some salmon brains in a lab. Her concentration was broken when Brian Barnes, a zoophysiology professor from down the hall at the University of Alaska Fairbanks, popped by her bench for a visit. With a mischievous grin, he asked Drew—a [neuropharmacologist](#) early in her career—to hold out her hands and prepare for a surprise. A moment later, she felt a hard, furry lump deposited in her palms. It was some sort of brown rodent with dagger-like claws, curled up into a tight ball and so cold to the touch that Drew assumed it was dead. To her astonishment, Barnes gleefully explained that it was actually in perfect health.

An Arctic ground squirrel—the most extreme hibernator on the planet—can spend up to eight months a year in a torpid state.

Photograph: Mary Webb

The creature, an Arctic ground squirrel, was just hibernating, as it does for up to eight months of the year. During that span, the animal's internal temperature falls to below 27 degrees Fahrenheit, literally as cold as ice. Its brain waves become so faint that they're nearly impossible to detect, and its

heart beats as little as once per minute. Yet the squirrel remains very much alive. And when spring comes, it can elevate its temperature back to 98.6 degrees in a couple of hours.

Drew cradled the unresponsive critter in her hands, unable to detect even the faintest signs of life. *What's going on inside this animal's brain that allows it to survive like this?* she wondered. And with that question, she began to burrow into a mystery that would carry her decades into the future.

Illustration: Ori Toor

At this point, in the year 2022, no fewer than three major entities—[NASA](#), the Chinese National Space Administration, and [SpaceX](#)—are vying to put the first human on [Mars](#) by 2040 or so. To win that race, a team must first solve a series of vexing design riddles. As an executive at SpaceWorks, an Atlanta-based engineering firm that tackles ambitious research projects for NASA, John Bradford has spent the past decade running the brutal math on one of them.

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Unfortunately for the engineers trying to get humans to the Red Planet, we're a pretty high-maintenance species. As large endotherms with active brains, we burn through copious amounts of food, water, and oxygen in our daily quest to survive. All that consumption makes it extra hard to design a spacecraft light enough to reach—and eventually return from—a planet some 140 million miles from our own. Based on the eating habits of the astronauts aboard the International Space Station, for example, a crew of four will need at least 11 tons of food to complete an 1,100-day mission to Mars and back. Those meals alone would weigh nearly 10 times more than the entire Perseverance rover, the biggest payload ever to reach the Martian surface. Add in all the other life-support essentials, to say nothing of the engines and the tools necessary to set up camp, and the weight of a fully fueled Mars-bound ship could easily exceed 330 tons as it departs Earth's atmosphere—more than two fully grown blue whales. It's nearly impossible

to see how a vessel that massive could generate the power necessary for its entire round-trip journey.

The obvious solution to this problem—at least to anyone who's read any Arthur C. Clarke novels or watched Stanley Kubrick's *2001: A Space Odyssey*—is to slow the metabolism of crew members so they only need to ingest a bare minimum of resources while in transit. In *2001*, astronauts lie down in sarcophagus-like hibernation pods, where their hearts beat just three times a minute and their body temperature hovers at 37 degrees Fahrenheit. Bradford has devoted a huge chunk of his 21-year career at SpaceWorks to investigating a question that Kubrick had the artistic license to ignore: How, exactly, can we safely power down a human body so it's just one step removed from death, then revive it on demand?

Early on in his research, Bradford glimpsed some promise in therapeutic hypothermia, a medical technique in which people who have experienced cardiac arrest are chilled—typically with intravenous cooling fluids—until their internal temperature reaches as low as 89 degrees Fahrenheit. This decreases their metabolism so much that their cells can function on roughly 30 percent less oxygen and energy—a lifesaver for a damaged body that's struggling to heal amid reduced blood flow. Patients are usually kept in this hypothermic state for only a day or two, mostly because the cold triggers intense shivering that must be controlled with powerful sedatives and neuromuscular-blocking drugs. But Bradford identified a few rare cases in which patients were kept hypothermic for as long as two weeks. “And we started asking, why can't you do that for longer?” he says. “How long can you sustain that comatose-like state?”

Bradford was wary of going public with his curiosity, fearing he'd be branded a crank for suggesting astronauts be put on ice—a concept uncomfortably similar to the one touted by the dubious cryonics industry. But in 2013 he persuaded NASA's Innovative Advanced Concepts program to fund a project assessing the feasibility of “human torpor.” His successful pitch centered on the potential weight savings: He estimated that if astronauts could be kept frigid for the bulk of their trip to Mars, the mass of their life-support resources could be cut by as much as 60 percent. Bradford also hypothesized that torpor could help astronauts fend off a number of

serious health hazards, ranging from radiation to the psychological perils of extreme boredom and isolation. (“You’re in the blackness of space, you don’t have real-time communications,” he says. “A lot of people will say, ‘Oh, I’ll just read a lot of books.’ But I think that will get old quick.”)

Because so many hibernators are our close genomic cousins, there is good reason to believe that we can tweak our brains and bodies to mimic what they do.

Yet as Bradford and his team dug into the minutiae of therapeutic hypothermia, they steadily soured on the technique. There seemed to be no getting around the fact that the drugs used to control shivering also stop respiration. Torpid astronauts would have to be intubated, meaning they’d have to spend weeks or months breathing through tubes shoved down their tracheas. Bradford also balked at the number of needles required to keep the IV fluids flowing, a situation that seemed likely to increase the odds of infection.

The dream alternative was for astronauts to be able to swallow a pill, then lie down for a long and chilly slumber during which they could breathe on their own. It seemed a fantastical proposition, but aspects of it struck Bradford as familiar. There are, after all, scores of species that go torpid every winter, drifting into an unconscious state that drastically squelches their bodies’ cravings for food and air. When they rapidly whirr back to life in spring, these creatures show no signs of suffering from muscle atrophy, malnourishment, or other ailments that might be expected to stem from lengthy spells of idleness. Bradford suspected there might be useful wisdom to be gleaned from understanding how such animals switch into low-power mode when their environments turn harsh.

And so Bradford began to seek counsel from the small community of hibernation researchers, scientists devoted to studying the bears, bats, and lemurs for whom regular torpor is a fundamental aspect of existence. In recent years, these researchers have been piecing together the molecular changes that occur when certain species ratchet down their metabolism. And since so many hibernators are our close genomic cousins, there is good reason to believe that we can tweak our brains and bodies to mimic what they do.

By then, the University of Alaska's Kelly Drew had been researching the Arctic ground squirrel, the most extreme hibernator on the planet, for more than 20 years. When Bradford first connected with her in 2015, she was fresh off a major breakthrough—a vital first step toward giving humans the power to turn themselves off and on at will.

When Drew left Alaska after college in 1982, she assumed she'd never live there again. She had moved to Fairbanks in her teens so that her father, a prominent soil scientist, could take a professorship at the state's flagship university. Though Drew loved Alaska's desolate beauty, she had her sights set on a scientific career that wasn't linked to the wilderness. So at the age of 22, she decamped to New York to earn a doctorate in pharmacology, then to Sweden for a postdoc studying how brain metabolism affects human behavior.

But shortly after her daughter was born in 1990, Drew and her husband, whom she'd met in college, felt the gravitational pull of their home state. Like so many overwhelmed new parents, they suddenly warmed to the idea of being close to family. So even though Drew didn't have a job lined up, she agreed to return to Fairbanks—a decision that bewildered her Swedish coworkers. "I mean, they seriously just laughed and went, 'Well, that's the end of your career,'" Drew recalls.

Kelly Drew has been studying the brains of hibernating Arctic ground squirrels since 1992.

Photograph: Mary Webb

It didn't take long for her to conclude that the naysayers might have been right. She had assumed she'd be able to snag a few grants to continue the work she'd been doing in Sweden, but no one seemed eager to dole out money to a young, unaffiliated researcher based in a remote northern outpost. With each rejection, she became more certain that her homecoming had been a horrendous mistake.

After a year's worth of failures, Drew finally landed a small National Science Foundation grant with a very Alaskan twist: She was commissioned to study the neurochemistry of coho salmon. She used that

gig to talk her way into borrowing a few square feet of lab space in the university's Institute of Arctic Biology—a toehold back in academia that she hoped would lead to bigger things.

It did, though in a most unexpected way. It was during the salmon study that Brian Barnes first plunked an Arctic ground squirrel into Drew's hands. Instantly curious about what was taking place inside the critter's brain, a topic that had scarcely been researched, Drew began to examine hibernating ground squirrels using microdialysis, a technique in which tiny tubes are inserted beneath a living creature's skull to harvest samples of neural chemicals. The procedure normally causes scarring in the places where the tubes come in contact with the brain. So Drew was stunned when she couldn't detect any such damage after performing microdialysis on the torpid squirrels.

"You couldn't even find where the probe had been," she says. "And so we started talking about hibernation as being a very protected state—it really seemed to protect the brain from injury." This revelation made Drew think there could be tremendous value to replicating that state in humans.

For a brief moment early in the Cold War, hibernation research flourished in the United States. With the federal government fixated on besting the Soviet Union at every turn, there was plenty of money sloshing around to fund scientists who claimed their work could give the US any sort of biological edge. Many of these researchers passed through military facilities located in or near the Arctic, where there was ready access to all manner of animals that have evolved the means to power down for winter.

Among this group of scientists was Raymond J. Hock, a zoologist who'd written his doctoral thesis at Cornell University about the metabolic rates of hibernating bats. In the mid-1950s he wound up at the Arctic Aeromedical Laboratory in Fairbanks, where Air Force scientists were scrambling to make American soldiers immune to cold. (In one ethically shaky experiment, the lab's personnel paid several Indigenous inhabitants of Chilean Patagonia to wear temperature sensors and ventilated plastic hoods while they slept in freezing canvas tents.) Hock developed a keen interest in bears during his stint in Fairbanks, and he lamented how little was known about the changes in the animals' metabolism during hibernation. So he

mustered the courage to creep into the sleeping bears' dens and stick thermometers in their rectums, a gambit that allowed him to assess just how much their internal temperature declined during their annual torpor.

In 1960, Hock published a paper entitled “Potential Application of Hibernation to Space Travel” that offered the first sober, detailed look at how the budding American space program might benefit from the research he was helping to pioneer. Hibernation was within our grasp, he argued, the major hurdle being the human heart's sensitivity to rapid temperature fluctuations. “The hibernators have learned how to do this, and several laboratories are currently working on ways to avoid it in man,” he wrote.

Hock mustered the courage to creep into sleeping bears' dens and stick thermometers in their rectums, a gambit that allowed him to assess just how much their internal temperature declined during their annual torpor.

Hock also noted that hibernation has the potential to slow aging. “A hibernator, with its greatly reduced annual energy expenditures, will live longer than a non-hibernating mammal of the same body size,” he asserted. If humans, like bears, were able to maintain an internal temperature about 13 degrees colder than normal, he estimated that “aging should occur at half the normal rate during this period.”

In the early 1960s, while working at UCLA's White Mountain Research Center in California, Hock and his colleagues subjected hibernating marmots to sudden blasts of extreme cold. They discovered that the animals' brown fat—a type of tissue humans also possess—generated heat in response to the shock. Hock's team saw this as the key to enabling humans to survive frigid torpor: We needed to unlock brown fat's innate power to keep our internal organs functioning as our metabolism slowed.

But Hock died in a tragic accident in 1970. And as the Cold War matured, hibernation research fell out of fashion. With funding from the Pentagon and NASA at an ebb, biologists came to think of the field as a backwater. Since it takes a full year to gather data about an annual hibernation cycle and then compare it to an animal's normal activity, the research tends to be agonizingly slow. “It's a gamble for a young professional scientist,” says Barnes, who introduced Drew to ground squirrels in 1992 and was the

Institute of Arctic Biology's director from 2001 until 2021. "You're not going to have the same number of publications as you would in a different field."

But Drew, whose kindly demeanor belies her tenaciousness, was so captivated by the Arctic ground squirrel that she plunged into hibernation studies with zeal. She took to camping out on the North Slope each summer so she could trap squirrels by the dozen for her lab. (Accustomed to lives of deprivation, the animals are hopeless suckers for the carrots she uses as bait.) She secured funding from the US Army's research office, selling them on the idea of saving badly wounded soldiers by safely and rapidly cooling their bodies on the battlefield. To make that happen, she needed to identify the chemicals that trigger hibernation in Arctic ground squirrels, then test whether those might have a similar effect in humans.

Drew, who became an assistant professor at the Institute of Arctic Biology in 1993, initially hypothesized that gamma-aminobutyric acid, a neurotransmitter commonly known as GABA, was chiefly responsible for sparking hibernation in her squirrels. GABA is integral to inducing sleep, the state in which a non-hibernating animal's metabolism is typically at its lowest. (Humans' normal metabolic rate falls by 15 percent while we doze.) And hibernation, for all its complexities, is essentially just a very deep form of sleep—a state in which respiration is lowered, appetite is suppressed, and waste expulsion is controlled. (Bears, for example, typically do not defecate or urinate throughout their winter torpor.)

But when Drew dosed her squirrels with GABA and an array of related chemicals, none brought about any sort of stable, long-term torpor. Years slipped by in this frustrating manner: Drew celebrated her 40th birthday, mentored dozens of graduate and undergraduate students, and watched her daughter become a teenager while her efforts to find the molecular key to hibernation remained mostly stuck in neutral.

Illustration: Ori Toor

In 2005, a dozen or so years into Drew's research on the squirrels, an undergraduate chemistry major named Benjamin Warlick joined her lab as an assistant. One of his duties was to scour databases in search of fresh

ideas about the chemicals that might activate ground-squirrel hibernation. Among the many papers he unearthed was an obscure one from Japan's Fukuyama University entitled "Phase-Specific Central Regulatory Systems of Hibernation in Syrian Hamsters." Though the main text was entirely in Japanese, a language that Warlick doesn't know, the brief abstract was in English. That paragraph mentioned that the authors had snapped their hibernating hamsters out of torpor by administering a drug that blocked the A1 adenosine receptor in the animal's cells. Though that was the opposite of what Drew was trying to accomplish, Warlick flagged the paper for his boss as worthy of a glance.

Two years passed before Drew got around to having the document translated in full. But when she finally read the English version in 2007, an idea struck her: If blocking the A1 adenosine receptor caused hibernating hamsters to stir, perhaps activating it in her squirrels would induce torpor.

Sure enough, when she dosed her ground squirrels with CHA, a drug well known for stimulating the A1 adenosine receptor, the animals promptly cooled down and began to hibernate. This happened only if they received the drug during the winter months, a sign that something else was going on in the squirrels' brains that kept them on an annual hibernation schedule. Still, Drew was encouraged enough to begin working on a paper for *The Journal of Neuroscience* about the drug's mechanism of action in the Arctic ground squirrel.

As intrigued as she was by CHA's effects in her squirrels, however, the drug had a major downside: She had to inject it directly into the animals' brains. When administered intravenously, CHA is notorious for affecting the A1 adenosine receptors in the heart, slowing the organ until it stops beating altogether. As a result, CHA seemed like it could only ever be of limited use in humans: It's rarely advisable to stick needles into someone's brain, particularly outside of a hospital setting.

In 2011, while putting the finishing touches on her *Journal of Neuroscience* paper, Drew had a poster made of all the data she hoped to include in the article. She hung it in the hallway outside her lab so she could review the numbers whenever she walked by. But as she paused by the tables of data one day, she was struck not by how much she'd accomplished, but by how

much knowledge still eluded her. Nearly two decades after Barnes had first placed a frigid squirrel in her hands, she hadn't devised a way to turn her esoteric expertise into the safe and effective drug she'd envisioned. What should have been a moment of triumph instead felt like a minor defeat.

And then in the midst of her melancholy, a thunderbolt hit: What if Drew could combine the CHA with another drug that would block its effect on the heart, but not the brain? CHA is what's called an agonist, meaning it stimulates receptors; a drug that blocks them is an *antagonist*. What Drew needed, she realized, was an A1 adenosine antagonist with molecules too large to cross the permeable blood-brain barrier.

"If you think of the body as a color map, and of agonist as red, then the agonist—the red—is everywhere. It's stimulating all the receptors," Drew explains. "Now, you don't want it to stimulate the heart receptors, so you have to block those receptors. Now, think of the *antagonist* as blue. So you put that in the body, but it doesn't get into the brain, right? So the rest of the body is purple, but the brain is still red."

There was already an extensive literature on A1 adenosine antagonists, so Drew had several good candidates to choose from. She ultimately settled on 8-(*p*-sulfophenyl)theophylline, or 8-SPT, which is closely related to one of the main ingredients in black tea. She melded this with CHA into a drug cocktail that was injected into the abdomen. To test this combination, Drew then launched a series of experiments on rats. She would stop the rats' hearts, then revive them by performing CPR. Once pulled back from the brink of death, the rats were then either made hypothermic with the CHA/8-SPT combination or left to heal with their metabolism at a normal rate. The rats that received the cocktail fared much better than the ones that didn't. And perhaps most significantly, the treated rats suffered no ill effects from having their thermostats turned way down by the drug. There was no shivering, and thus no reason to give any narcotics that might interfere with their breathing.

By 2014, Drew had achieved such excellent results in her experiments on rats that she applied to patent her invention: "Methods and compositions for the treatment of ischemic injury to tissue using therapeutic hypothermia." The first illustration in the application is a photograph of an Arctic ground

squirrel curled into its trademark hibernation pose, a nod to the small moment in 1992 that had altered the course of her life.

From an ordinary familiarity with sci-fi movies like *2001* and *Planet of the Apes*, Drew was always vaguely aware that her work might attract interest from the space-exploration industry. So she wasn't terribly surprised when someone from SpaceWorks reached out to her in February 2015. The firm had just secured a second tranche of NASA funding to press forward with its human-torpor research, and John Bradford invited Drew to become his company's chief hibernation consultant.

SpaceWorks arranged for Drew and Matthew Kumar, an anesthesiologist at the Mayo Clinic, to test the CHA/8-SPT cocktail on pigs. The drugs steadily and safely lowered the animals' internal temperature to between 86 and 90 degrees Fahrenheit—not quite as chilly as the state doctors can achieve using intravenous fluids on humans, but close. In his summary of the experiment, Bradford wrote that the cocktail “could lead to a torpor induction protocol that does not require any active cooling [and] eliminates the need for pharmacological sedation to suppress shiver response.”

Drew was not the only hibernation researcher shifting her focus to Mars around this time. In 2017, a University of Colorado biologist named Sandy Martin, who had spent her career building a tissue bank containing samples from various hibernating species, was approached by students organizing a one-day symposium on space travel. They urged her to talk about whether her life's work could be used to facilitate human torpor on long voyages. “I had never thought seriously about it,” Martin says. “I mean, it's always in the back of your mind as a hibernation researcher, what the applications might be, but that was never the motivation for me. My motivation was, ‘This is a profound evolutionary adaptation.’ I mean, for a mammal to be so plastic in terms of body temperature, and the ability of cells to survive hypoxia and temperature swings, all that is just so profound.” In preparing for her talk, Martin unearthed an older SpaceWorks paper that advocated using IV cooling fluids to place Mars-bound astronauts in torpor. She forwarded the paper to her daughter, an emergency medicine resident who dismissed SpaceWorks' proposal as “ridiculous” due to the pesky shivering problem.

“I thought, ‘What we need to do is figure out how hibernators do this, because they do it so beautifully and so naturally and without harm,’” Martin recalls. “And they don’t need intubation, and they don’t need feeding tubes.” She and her daughter began working on their own paper, proposing several promising avenues of inquiry based on Martin’s genomic analysis of the thirteen-lined ground squirrel, a close relative of the Arctic ground squirrel. One was to investigate further a receptor called TRPM8, which plays a crucial role in helping thirteen-lined ground squirrels thermoregulate during hibernation.

In March 2018, NASA invited Drew, Martin, and a handful of other luminaries from the hibernation community to a two-day conference in Mountain View, California—an event billed as the agency’s first-ever “space torpor workshop.” The meeting was an opportunity for the biologists to make the argument that, if provided with sufficient backing, they could help humans achieve at least some level of true hibernation in the next 10 to 15 years—a timeline that dovetailed nicely with NASA’s plans to send humans to Mars in the late 2030s or early 2040s.

Speaking to NASA officials at the workshop, Martin emphasized that the pervasiveness of hibernation among mammals suggests humans can achieve it too. There are three types of mammals: the egg-laying monotremes, such as the platypus; the marsupials, which carry their undeveloped offspring in pouches; and the placentals, the category that includes us. “All three of those branches have hibernating species,” Martin says. “The most parsimonious explanation for that is that our common ancestor was a hibernator.” Assuming that’s the case, preparing our species to deal with the physiological stresses of torpor may simply be a matter of altering genes we already possess.

Four months after the NASA workshop, SpaceWorks published the final report from the second phase of its human-torpor project. The 115-page document is frank about the many challenges that lie ahead: Bradford and his coauthors admit that little to nothing is known about how hibernation might affect an astronaut’s cognitive abilities, for example. But the report also asserts that, based on the current pace of research, NASA could begin testing hibernation technologies such as Drew’s drug cocktail on human

subjects as early as 2026. Judging by investments that NASA has initiated in recent months, the agency seems intent on making that happen.

Illustration: Ori Toor

NASA hasn't just started to accept that torpor is essential to making spaceships lighter. The agency has also come around to Bradford's view that it may help astronauts avoid some of the physical hardships of long-haul space travel. One of the great unknowns about the mission to Mars, for example, is whether humans can endure the ravages of galactic cosmic rays, the remnants of the Milky Way's celestial violence. Once a spacecraft travels beyond Earth's protective magnetosphere—which orbiting craft like the International Space Station stay well within—there's no real way to dodge these cancer-causing particles, and scientists have yet to find a malleable, lightweight material that can shield against them. But if human cells can be made less active, they may develop significant resistance to radiation. In a 1972 experiment, for example, scientists found that ground squirrels that were irradiated while hibernating had a much higher survival rate than their fully conscious peers.

“The hypothesis is that if you reduce the metabolism in the cells, then you would also reduce the damage from radiation,” says Emmanuel Urquieta, chief medical officer for the Translational Research Institute for Space Health, a NASA-sponsored program based out of Baylor University’s College of Medicine. “So you can give the cells a little bit more time to start repairing themselves from radiation exposure.”

In August 2021, Urquieta's institute awarded \$4 million to researchers interested in furthering the science of human torpor. One of the recipients is now examining the fossilized remains of an extinct human species that may have hibernated in the caves of northern Spain some 430,000 years ago. Another awardee is trying to establish the ideal temperature at which humans can hibernate without causing undue physiological stress. And Clifton Callaway, a professor of emergency medicine at the University of Pittsburgh, is deepening his investigation into drugs that might be used as part of a suspended-animation system on long-haul space flights.

Like Bradford, Callaway's early interest in human torpor grew from his curiosity about therapeutic hypothermia. He has long wanted to use the technique to help not just survivors of full-blown cardiac arrest but also people who walk into the ER exhibiting the early signs of heart attacks. To help make therapeutic hypothermia a realistic option for such patients, Callaway looked for drugs that can prevent shivering without knocking vital organs out of commission. Just before the [Covid-19 pandemic](#) hit, he obtained some encouraging results with dexmedetomidine, a mild sedative used in anesthesia. “It worked well enough that we actually said, ‘God, you really could use this in astronauts,’” he recalls.

In an odd way, hibernation may turn out to be the only remotely attainable form of time travel.

Pure dexmedetomidine probably doesn't have much of a future aboard spacecraft, since its sedative effects last only 30 minutes and it must be administered intravenously. But there are a host of closely related drugs that Callaway is testing on human subjects, hoping to find one that can be delivered via pill or patch. Next year he plans to expand his work to assess how well our species can rebound from an extended period in a low-metabolic state.

“Our master project is to take eight or 10 people and have them do a torpor for five days,” Callaway says. “I want them to sleep 20 hours a day, have a slightly lower body temperature, use less oxygen and consume fewer calories, and make lower carbon dioxide for five days. And we're going to do a whole bunch of testing before they start and after they finish to see, you know, what's the hangover?”

Callaway does not yet know how he plans to make his test subjects torpid, but he is well aware of the innovations coming out of Kelly Drew's lab in Alaska. Drew paid him a visit in 2019 and opened his eyes to the possibilities of taking inspiration from animal hibernators. “One lesson I've gotten from the physiologists studying hibernation is that we would be very naive to think that we're going to find one single drug that just lets an animal or a person go into hibernation,” Callaway says. “I imagine in 10 years, the answer we'll be looking at will be maybe one of the drugs in the class I'm studying right now, in combination with a drug that Dr. Drew is

studying, and then another drug some other sleep researcher is studying. It'll be that cocktail of drugs that'll be most likely to provide astronauts with a safe sleep for a long distance."

Callaway doubts that when those astronauts sleep they'll ever get as cold as the Arctic ground squirrel or have metabolisms as low. But he notes that bears are pretty effective hibernators too, and they reduce their internal temperature by only a few degrees while snoozing through a winter. "In this decade," he says, "we can replicate that."

Illustration: Ori Toor

Sometimes Drew cannot believe that, at the age of 63, she has devoted nearly half her life to trying to determine how a 3½-pound rodent shuts down for the winter. She counts herself fortunate to have been able to crack problems at such a meticulous pace. "When you talk to people in industry, I mean, they just, they would never tolerate this," she told me, with a self-deprecating chuckle.

Kelly Drew in her lab at the University of Alaska Fairbanks. Photograph: Mary Webb

Drew holding an Arctic ground squirrel in her laboratory. Photograph: Mary Webb

But thanks to university-based researchers like Drew who've solved some of the fundamental mysteries of hibernation, the private sector is taking notice of its potential. When the University of Colorado's Sandy Martin retired last year, she arranged for her bank of hibernator tissues to be licensed to a former student, a computational biologist named Katie Grabek. Grabek then cofounded FaunaBio, a Silicon Valley startup that aims to improve treatments for heart and lung diseases by discovering why hibernators can survive stressful events—particularly the abrupt shocks to internal organs that occur during cooling and rewarming—that would kill most humans.

“These animals, when they arouse from torpor, it's very similar to having a heart attack,” Grabek says. FaunaBio wants to identify the molecular compounds that hibernators use to prevent or repair cellular damage, in the hope of developing pharmaceuticals that can help cardiac patients.

But if hibernation does indeed become a realistic option for humans, even those of us in decent shape may find it tempting. Induced torpor seems to offer a roundabout path to realizing at least a couple of transhumanist dreams. Like life extension, perhaps—provided you're not purely bent on extending your *conscious* life. As Raymond J. Hock noted in 1960, hibernation really does seem to offer a fountain of youth. Earlier this year, for example, a team at UCLA found that yellow-bellied marmots, which hibernate for as much as two-thirds of every year, possess much more robust genetic material than might be anticipated based on their chronological ages. “The molecular and physiological responses required for an individual to successfully hibernate may prevent aging,” the researchers wrote in *Nature*.

In an odd way, hibernation may also turn out to be the only remotely attainable form of time travel. In a satirical story from 1850, Edgar Allan Poe imagined that the ancient Egyptian practice of mummification was just such a technology. When the story's protagonists accidentally revive a mummy, the awakened Egyptian explains that his civilization's historians sometimes lived their lives “in installments.” They would hibernate for a few hundred years, then arouse to correct the record about the era from which they'd originated—a method for “preventing our history from degenerating into absolute fable.” Of course, no one today is keen to develop a hibernation cocktail that can induce torpor for centuries. But a biological fast-forward button that would allow someone to skip months or more into the future could have its uses—or, at the very least, appeal to a certain kind of adventurer.

As for myself, what I find most alluring about hibernation is its potential to offer a brief holiday from the constant din of my own thoughts. In a time of exhausting overstimulation, anxiety, and dread, I find myself wondering what it would be like to switch off for a week or two. In his novelization of *2001*, Arthur C. Clarke depicted one of his main characters as longing for

the psychological liberation of torpor: “Sometimes Bowman, as First Captain of *Discovery*, envied his three unconscious colleagues in the frozen peace of the Hibernaculum. They were free from all boredom and responsibility.”

Then again, the vulnerability of the hibernator is a perennial theme in science fiction. In *2001*, the three astronauts who spend the film sealed in hibernation pods are unceremoniously murdered by HAL 9000, their ship's sentient operating system. Countless other works of sci-fi focus on the shock and social dislocation that long-term hibernators experience when they emerge into worlds that have gone haywire in their absence. Even if we go under for only a few months in order to accomplish a worthwhile endeavor like reaching Mars, reentry into consciousness is bound to be a complicated affair. Arctic ground squirrels snap back to their old selves within hours of warming up. But that might not be the case if they were blessed with human self-awareness.

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Nov 22, 2022 7:00 AM

Is Moore's Law Really Dead?

A postmortem on “Cramming More Components Onto Integrated Circuits”—the most influential article of the 20th century.

PHOTOGRAPH: SHAWN MICHAEL JONES

Ohm’s law ($V = IR$) states that the voltage across a conductor is proportional to the current flowing through it. Hooke’s law ($F_s = -kx$) states that the force needed to extend or compress a spring by some distance is proportional to that distance. Moore’s law states—

Well, that one doesn’t state. It wagers. It hazards a guess. It contains no constants, no special functions, no variables, no equations at all. Movie directors will find in Moore’s law nothing like the kind of pretty runes that John Nash or Ben Affleck might scrawl on a window with a wax pencil. In fact, Moore’s law is less a law than a flier, a bit of Johnson-era bookmaking. Every year (or two) for a decade—or so the “law” goes—engineers would maybe, probably, double the number of transistors they could stuff onto a [silicon chip](#).

Such was the bet of Gordon Moore, then the research director at the illustrious Fairchild Semiconductor, an outfit based in Sunnyvale, California, that in those days was known mostly as a division of the Fairchild Camera and Instrument Corporation. *Electronics*, a throwaway circular for the radio industry, picked up one of Moore’s reports for Fairchild and published it as “[Cramming More Components Onto Integrated Circuits](#)” on April 19, 1965.

It was a hit. *Prescient* is too weak a word: “Integrated circuits will lead to such wonders as home computers, or at least terminals connected to a central computer, automatic controls for automobiles, and personal portable communications equipment.” *Such wonders*. The essay dates to a time when a computer costs \$18,000 (around \$170,000 today). To make one affordable for a household, let alone an individual, will take a miracle. Moore, who later cofounded Intel, gives the miracle a shove with his resounding vote of confidence in tech workers for whom “You can do it” turns into “You must do it” turns into “You will do it” turns into “It’s natural law.”

“Cramming” in this way sweeps you up in a tide of inevitability. It’s only slightly too grand to say the essay recalls the Declaration of Independence. (“When in the course of human events” also makes revolution sound like natural law.) For a piece about integrated circuits, moreover, “Cramming” partakes of the marvelous-fantastic genre; nothing Moore predicts for the future—and that future is now—is anything less than riotously fun.

Five years after the essay’s publication, Carver Mead, a renowned scientist who just this year won a tidy 100 million yen as the Kyoto Prize laureate, playfully dubbed its projections a law. Thus the standing orders to America’s postwar engineers became clear: *Miniatrize transistors and reduce costs*. A world of workers have applied themselves to this task ever since. As much as Moore’s skills as a would-be legislator, his infectious enthusiasm for semiconductors has inspired these decades of engineering commitment. “Cramming” is still well worth reading, especially if all you know of Moore’s law is the doubling thing. Not only is it vatic, robust, and refined at once, it’s a piece of prose without precedent, a speech act that brought into being a whole global economic sector.

The essay’s strength lies in its bold, bullish copulative sentences that use “is” like an equal sign and land with absolute certainty. “The future of integrated electronics is the future of electronics itself.” Blammo. Some of the prose then sounds like a patriotic newsreel (“No American can have freedom and justice unless there is freedom and justice for all!!”) or like Johnson himself bucking up geopolitical spirits. In the very month that

“Cramming” appeared, LBJ declared of Vietnam, “The only path of reasonable men is the path of peaceful settlement.”

Then there is the essay’s central claim: “With unit cost falling as the number of components per circuit rises, by 1975 economics may dictate squeezing as many as 65,000 components on a single silicon chip.” In spite of the hedge (“may dictate”), the negative slope—in which the two variables, unit cost and number of components, are inversely related—has a rousing momentum to it.

Elsewhere in the essay, Moore projects the exaggerated certitude of a pitch deck—or maybe a graduate student who’s trying to assure her doctoral supervisor that her research is coming along great. “Several approaches evolved,” Moore wrote, “including microassembly techniques for individual components, thin film structures and semiconductor integrated circuits. Each approach evolved rapidly and converged … Many researchers believe the way of the future to be a combination of the various approaches.” The profound appreciation of intellectual collaboration and convergence, which still rings through the semiconductor sector today, cannot have helped but leaven the mood of American scientists in the pre-moonwalk days, when the Soviets appeared to be winning the Space Race.

At 1,875 words, “Cramming” is concise, as befits a polemic on compression. And then there’s that word *cramming*, from the Old English *crammian*, “to press something into something else.” So palpable, greedy, and carnal. It’s not when we’re in the mood for measurement but when we’re feeling recklessly indifferent to proportion and harmony that we cram things into our suitcases, our shoes, and our mouths. While the essay is in the slide-rule idiom of engineers, it also speaks to the gut. It’s a goad to biennial home-optimizing that recommends balling up more of your shit, stuffing it into an overfull closet. This is a useful reminder that even at the scale of microns—and now nanos—scientists are still beholden to the constraints of physical space, at least until the path of all reasonable men becomes the path of quantum.

And quantum is the point. As a field of inquiry, quantum—or AI, or the metaverse—might not be so driven by the rhythm of Moore’s law. If you

need another reason to read “Cramming,” consider this: Its diktat might be coming to an end.

“Moore’s law is dead,” pronounced Jensen Huang, cofounder and CEO of Nvidia, in September, a few weeks before his company released its \$1,600 RTX 4090 graphics card for gamers.

For technologists like Huang who have their sights set on the wonders of GPUs, the imperative to shrink transistors and reduce costs has given way to an ambition to conduct quantum experiments and increase performance in the metaverse without regard to size or price.

But the fact that Huang’s whole business model at Nvidia is *still* responsive to “Cramming,” nearly 50 years later, clinches the article’s status as the most influential essay of the 20th century. Lionel Trilling, sure, wrote “Authenticity and the Modern Unconscious” around the time of “Cramming,” and Wendell Berry’s “The Long-Legged House” is lovely. But did Trilling or Berry set the speedcore tempo for the global industry that animates the entire built universe?

In 2005, realizing they lacked an original copy of “Cramming,” Intel executives offered \$10,000 on eBay for a mint copy of the relevant issue of *Electronics*. At last, an engineer in Surrey, UK, found one under his floorboards. The enchanted pages now sit in climate-controlled splendor in Intel’s museum—the tech world’s *Book of Kells*.

The last phase of Moore’s essay is a delight. Having delivered his whopping projection of 65,000 elements per chip—it’s now 11.8 billion—Moore finally drops a statement of the purest trust in technology: “I believe that such a large circuit can be built on a single wafer.” Who would want to contradict Moore’s idealism? Such expansive affirmations of belief, with a reference to a Communion-like wafer. No wonder “Cramming” anchors the liturgy of the semiconductor business. In science, laws obtain. In tech, it’s mostly faith.

This article appears in the December 2022/January 2023 issue. [Subscribe now.](#)

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By [Andy Greenberg](#)

[Backchannel](#)

Nov 22, 2022 6:00 AM

The Hunt for the Dark Web's Biggest Kingpin, Part 5: Takedown

After months of meticulous planning, investigators finally move in to catch AlphaBay's mastermind red-handed. Then the case takes a tragic turn. Cazes spun around, instantly in fight-or-flight mode, trying desperately to run for his front door. Soon another cop had grabbed him. Then another. Illustration: Hokyoung Kim

Content Warning: *This story includes references to suicide. If you need help, call the [Suicide and Crisis Lifeline](#) for your region.*

CHAPTER 11

ALPHA'S OMEGA

On a typical day, the Private House Buddhamonthon development on the western edge of Bangkok offers a quiet respite from the traffic jams and diesel fumes of the city's central neighborhoods. The cul-de-sac where [Alexandre Cazes](#) lived in that semi-suburban enclave was dotted with yellow trumpetbush blossoms. The only sounds were of palm fronds and banana trees rustling in the breeze and the chatter of tropical birds. But on the morning of July 5, that street would have seemed unusually busy to anyone paying attention.

At one end, a gardener was trimming the foliage, and an electrician was busy with a nearby wiring box. Inside the house at the street's dead end, a model home and sales office for Private House's real estate development firm, a man and woman were getting a tour of the property and inquiring about moving into the neighborhood. Their driver sat waiting in a car outside. Another car with two women in it was slowly pulling into the cul-de-sac, looking lost after taking an apparent wrong turn.

In fact, every one of the characters in this bustling scene was an undercover agent. Thailand's DEA equivalent, the Narcotics Suppression Bureau, had assembled an entire theatrical production's worth of actors around the unwitting target, busily performing their roles and waiting for a signal for Operation Bayonet's takedown to finally begin.

This story is excerpted from the book [Tracers in the Dark: The Global Hunt for the Crime Lords of Cryptocurrency](#), now available from Doubleday.

Courtesy of Penguin Random House

The only non-Thai player in this pantomime was the DEA's Wilfredo Guzman. He stood inside the real estate spec house at the end of the cul-de-sac wearing a Red Hot Chili Peppers T-shirt and jeans, posing as a wealthy foreign buyer with a Thai wife. Guzman's primary job that morning was to distract the polite real estate agent, straining the limits of his Thai vocabulary to bombard her with questions about the layout of the spec house, the number of bedrooms, the size of the garage, and every other domestic detail he could think of. All of this was designed to allow the agent playing his wife to venture to an upstairs window and get eyes on Cazes' house and driveway next door, in anticipation of the action set to unfold there.

Another group of NSB officers, along with the DEA's Miller and a group of FBI agents and analysts, was at the home of the NSB team leader, Colonel Pisal Erb-Arb, where the entire team had gathered that morning; the colonel happened to live a few miles away from Cazes' residence. Pisal himself and a group of uniformed officers had now parked several blocks from Cazes' house. Nearly an hour's drive to the northeast, on the eighth floor of NSB headquarters, yet another group, including Rabenn, Hemesath, Marion, and Sanchez, were assembled in a conference room, with portraits of the Thai royal family on one wall and a collection of screens mounted on another.

The war-room monitors showed videofeeds of the cul-de-sac, pulled from a nearby security camera and the dashcam of the car where Guzman's "driver" was waiting. At the center of the long table was a conference phone connected to both the Thai team on the ground and another team of

agents in Lithuania, tasked with imaging the AlphaBay server—taking a snapshot of its contents and then, after Cazes' arrest, pulling it offline.

Rabenn remembers the atmosphere of that war room as more dead silence and sweaty, anxious tension than eagerness or anticipation. He knew the possibility of achieving a Ross Ulbricht-style arrest and seizing Cazes' laptop in a live, logged-in state—not to mention his phone—was a long shot at best. Even after all their international meetings and planning calls over the past months, and in spite of his usual hard-driving enthusiasm, Rabenn found himself quietly expecting their plan to fail.

Across the table, Sanchez was logged in to Roosh V. She checked Rawmeo's profile and confirmed to the group that he was online and active: Cazes was at his keyboard. It was time.

Then, moments later, a voice piped up from the conference phone on the table. “Oh God,” it said. “We shut it down.”

It was the team in Lithuania. Somehow, the agents there had accidentally crashed the AlphaBay server before they could finish imaging it. In a matter of moments, Cazes would be tipped off that AlphaBay was down, possibly due to foul play. All he would need to do was close his laptop and the game would be over.

There was no choice: The team in the conference room frantically told the agents on the ground that they needed to arrest Cazes and do it *now*.

Pisal gave a cue via police radio to the two female agents in the gray Toyota Camry at the mouth of the cul-de-sac. Just the day before, the NSB colonel and his team had scrapped the postal delivery plan. The local post office had warned them that Cazes never signed for packages himself, that his wife often came to the door instead. So they'd had to think up a last-minute alternative. Their plan B now centered on that inconspicuous Toyota and an agent who went by the nickname Nueng, sitting in the driver's seat, whispering Buddhist prayers to herself to slow her racing heartbeat.

A few seconds later, a loud clang rang out across the cul-de-sac, followed by the sound of metal grinding on concrete. The Camry had just plowed its

rear fender into the fence of Cazes' two-story home, bending the front gate, dragging it off its rails, and creating a clamor that ripped through the quiet of an otherwise peaceful morning on the outskirts of the Thai capital.

The security guard at the end of the cul-de-sac began shouting in exasperation at Nueng. Hadn't he *just* told her to back straight out? Nueng and the other agent in her car stepped out of the vehicle, and Nueng stood on the street, scratching her head in a display of haplessness, apologizing and explaining to the security guard that she was still learning to drive. At that moment, a vertical shutter opened partially on a second-floor window on the front of the house—a detail, visible on the surveillance video feed, that sent a wave of excitement through the war room at NSB headquarters.

They had gotten the layout of the home on an earlier trip to the spec house, and they knew that this was the master bedroom. Had Cazes stepped away from his computer?

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A moment later, Cazes's wife, Sunisa Thapsuwan, came out from the house's front door and poked her head around the bent gate. The petite Thai woman, wearing a long nightshirt over her pregnant belly, kindly reassured Nueng that it was fine, that she and her friend could leave. But Nueng, doggedly playing her part, shouted—as loudly as possible, trying to project so that Cazes could hear inside the house—that she needed to pay for the damage.

“I want to pay for it!” she pleaded. “I don’t want to pay for it in the next life!” Her hands shook as she channeled her adrenaline into the anxiety of a poor person who owes something to a rich person.

Thapsuwan looked up to the open window, and Nueng heard Cazes say something to his wife that she couldn’t pick up. “Maybe your husband could come down here to assess the damage?” Nueng suggested helpfully.

A moment later, Cazes emerged. He was shirtless and barefoot, looking pale and soft, wearing nothing but a pair of baggy gym shorts; he had bragged on Roosh V that he liked to go “commando” when working out in the morning, and apparently hadn’t changed since beginning work that day. He had his iPhone in one hand.

Nueng allowed herself a moment of silent internal celebration. “I got you,” she thought.

She remembers that Cazes, for a dark-web administrator whose site had just dropped offline and who was now dealing with a minor traffic accident at his front driveway, looked relatively unperturbed. His emails would later reveal that seconds earlier he’d been repeatedly messaging his Lithuanian hosting provider about his server’s unexplained outage. But he seemed to suspect nothing about the scene at the gate; Pisal had chosen the two women for their role in part because he’d guessed that Cazes’ misogyny would prevent him from imagining they could possibly be undercover agents. As Cazes walked toward them, Nueng and her partner got back in the car and drove it onto the model home’s driveway at the end of the cul-de-sac, ostensibly to get it out of the way.

Cazes turned to the gate to see if he could pull it back onto its rails, tucking his phone into the elastic band of his shorts. At this point, the driver of Guzman’s car, a middle-aged undercover agent nicknamed Pong, walked over. He stood next to Cazes as if to help appraise the situation.

Then, as Cazes yanked on the gate, Pong reached over and plucked the iPhone out of Cazes’ waistband, seemingly to prevent it from falling. As Cazes looked over to him, perhaps to thank him, Pong took Cazes by the arm and motioned for him to step aside for a moment. Cazes, seeming confused, walked with him out into the street.

Events suddenly accelerated. Another agent, a younger, compact man with an athletic build who went by M, had emerged from Pong and Guzman’s car, where he had been hiding in the back seat. As he walked past them, Pong handed M the phone behind Cazes’ back. At the exact moment of that handoff, Cazes looked down the street, away from his home. He saw

another police officer—the electrician, now wearing a police vest—sprinting straight toward him.

Cazes spun around, instantly in fight-or-flight mode, trying desperately to run for his front door. Pong and M grabbed Cazes and struggled with him for a fraction of a second. The iPhone clattered to the ground and another officer picked it up. Soon another cop had grabbed Cazes. Then another. They joined Pong in pinning Cazes' arms behind his back and holding him in a headlock as M wrenched free from the melee and ran through the gate.

The moment for M's make-or-break assignment had arrived. He raced into the house, past Cazes' wife, who by now stood frozen in the living room, and up the stairs, taking them two at a time. From studying the layout of the spec house, M had determined that Cazes' home office must be across the upstairs hall from the master bedroom. He burst through the door there and found a pair of young foreigners asleep in a guest bedroom—unexpected guests of Cazes' visiting from Quebec.

M shouted a quick “Sorry! Sorry!” then whirled around and ran across the hall into the master bedroom. At the far end of the room, there it was, on a cheap white desk: Cazes' laptop, a black Asus PC with an external monitor, revealing red-highlighted A, S, D, and W gaming keys.

It was open.

He practically leaped across the room, reached out, and placed a finger on its touchpad. Then he sat down in Cazes' desk chair, keeping one hand on the computer's mouse, finally catching his breath.

A moment later, M's voice crackled over the police radio. “Officers, officers,” he said in Thai. “The computer is unlocked.”

In the NSB office war room, someone announced over the phone that they had the laptop, open and alive.

The room's tension broke into an eruption of cheers. Jen Sanchez leaped up, standing in front of the video screens, pumping her fist in the air. Rabenn and Hemesath gleefully hugged each other. Four years after the arrest of the

Silk Road's Ross Ulbricht with his open laptop at the Glen Park Public Library in San Francisco, it seemed they had pulled off a dead-to-rights dark-web bust of their own.

But there was still the question of the phone. As Pong and two other Thai cops had wrestled Cazes to his knees and handcuffed him, the DEA's Guzman had run out of the spec house, leaving the bewildered real estate agent behind. As was customary in Thailand, Guzman had taken off his shoes to go into the model home and hadn't had time to put them back on, so he stood in the street in his socks.

A Thai police officer handed Guzman Cazes' iPhone, and he looked down at it in dismay. It was locked.

As the Thai police held Cazes on the ground, he screamed his wife's name. She and her father, who lived with the rest of Cazes' in-laws across the street, came outside and stood over him helplessly as he was handcuffed.

At that moment, Pisal arrived on the scene, wearing a gray polo shirt and a kind of naval cap; the hat wasn't part of his uniform, but he believed it brought him luck. He had already been told by police radio that the phone was locked.

Pisal bent over Cazes, and the officers pulled him to his feet. The police colonel introduced himself, put a paternal hand on Cazes' shoulder, and gave him a knowing look. He asked the shirtless, panicked young man to please follow him for a moment so that they could speak privately.

Cazes' expression eased slightly. This didn't seem to be the behavior of police arresting someone for running the world's biggest online drug market. Cazes walked with Pisal and the cops holding him across the street, under the shade of a mango tree.

When they were out of earshot of Cazes' wife, Pisal explained in a discreet tone that they knew about Cazes' sexual encounter with a woman two evenings prior. Now that woman was alleging sexual assault. They needed to work this out.

Cazes could see that this must be some sort of shakedown: He, a wealthy foreigner, had flaunted his Lamborghini and now was paying the price. He looked concerned but rational again, his moment of panic subsiding. This was a situation he might be able to handle.

Pisal explained that the woman's husband wanted to speak on the phone. Perhaps if Cazes offered the man something, he wouldn't press charges.

The cops led Cazes into the same Toyota Camry that had pulled into the cul-de-sac. Pisal sat down next to Cazes and handed him the locked phone Guzman had given him, telling him the number to call.

Cazes unlocked the phone and dialed. The voice on the other end of the line, another undercover agent, played the role of the cuckolded husband. Cazes, nervously speaking in Thai, offered him 100,000 baht to drop the charges, around \$3,000. The man demanded 10 times that amount. Cazes quickly agreed. When they had finished negotiating, the husband instructed Cazes to hand the phone to the police, and Cazes did as he was told.

Pisal stepped out of the car, the unlocked phone in his hand, and gave it to an FBI agent who had just arrived on the scene.

Guzman was the first to finally tell Cazes the truth. After the AlphaBay founder had been allowed to go back into his home and get dressed, the agent sat next to him on the couch of his living room, where Cazes now rested, his hands cuffed in front of him, wearing a worried expression. Guzman, the first foreigner Cazes had seen since the raid of his home began, explained that he was with the DEA and that the United States had issued a warrant for his arrest.

Around the same time, the DEA's Robert Miller arrived, along with a team of FBI agents and analysts assigned to forensically examine Cazes' devices. Ali, the cryptocurrency tracer who had confirmed Cazes' identity as Alpha02 so many months earlier, walked through the gate and past his luxury cars, her first time seeing corporeal results of the digital wealth she'd so obsessively tracked.

“That's the Aventador,” she thought to herself. “That's the Panamera.”

In the master bedroom—which they now knew doubled as Cazes' home office—the FBI's team of computer specialists began exploring his laptop. They found that he was logged in to AlphaBay as its administrator. On the computer's desktop, they found a text file where, just like Ross Ulbricht, he had tracked his net worth. Cazes had counted more than \$12.5 million in assets, including houses and cars; \$3.3 million in cash; and more than \$7.5 million in [cryptocurrency](#), a fortune totaling more than \$23.3 million.

When Ali was given her turn on the machine, she immediately began examining its cryptocurrency wallets and the addresses associated with them. As she did, she excitedly picked up her phone and called her fellow crypto-tracing FBI analyst, Erin, who was sitting an hour away in the NSB war room with Rabenn, Hemesath, Marion, and Sanchez.

“Tunafish!” she shouted without preamble. Or rather, she shouted out her and Erin's secret nickname for a Bitcoin address that they had obsessed over for months, the key link in the chain of digital payments that had first connected Cazes to AlphaBay.

“I'm going to need more context,” Erin responded drily.

“It's here,” Ali said. “I've got the key for it.”

She could see before her the one, very specific pot of gold that had confirmed the identity of Alpha02. It had appeared exactly where the blockchain's rainbow had pointed, arcing halfway around the world into Alexandre Cazes' Bangkok home.

CHAPTER 12

CAPTIVITY

For several days after his arrest, Cazes lived in a kind of comfortable purgatory.

The Thais kept him on the same eighth floor of their Bangkok NSB headquarters building where they had, over the previous months,

engineered his surveillance and takedown. Cazes spent his nights sleeping on a couch there, constantly under the watchful eye of the police. During the day he was shuttled back and forth between a black leather massage chair and conference room tables—where he was subjected to paperwork and questions that he almost entirely refused to answer until he could speak to a lawyer. He was fed whatever he requested: mostly local takeout or, on some occasions, French food from the fast-food bistro chain Paul.

Cazes' relatively gentle treatment—at least compared with what he'd receive in a typical Thai jail—was designed to persuade him to consent to two key forms of cooperation. Rabenn, Hemesath, and Marion hoped to persuade him to sign an extradition agreement, allowing them to deport him from Bangkok to Fresno without a lengthy legal battle. And more ambitiously, the Americans hoped he might agree to work with them as an informant.

Flipping the kingpin of the world's biggest dark-web market to “Team USA,” as Jen Sanchez put it, would be an incredible coup. There was no telling, the prosecutors imagined, what sort of gold mine of information Cazes might be able to share with them about his AlphaBay coconspirators or others in the online underground where he'd been such a key player. What sorts of traps could they set with his help?

Among the DEA agents, Sanchez was given the job of speaking with Cazes and persuading him to agree to extradition. After his arrest, Sanchez had experienced a complication in her feelings toward the dark-web crime lord, whose opioid sales and misogynistic alter ego had once triggered her revulsion. In her prior postings in Mexico and Texas, she'd taken pride in her ability to convert suspects into informants, a skill that required persuasion and personability. To do the same with Cazes, she tried taking an almost maternal approach—one that wasn't entirely feigned. Despite her hard-charging comments to Miller about sending Alpha02 to supermax prison earlier that year, she felt some warmth and even empathy mixed in with her contempt for Cazes, now that she saw him captive before her.

Sanchez didn't have the authority to offer much to Cazes in exchange for his cooperation or to make promises about his future. But she says she tried to show him kindness, to help him keep his spirits up. He asked her about his

wife and his unborn child. She reassured him that they were safe; his wife had been arrested, too, but quickly released.

“I’m gonna take care of you,” she repeatedly told Cazes. He seemed unconvinced.

In their war room on the same floor of the NSB office, just a few walls away from where Cazes was held, the Americans continued their work scouring his computers for evidence. His iPhone, after all their concerns about hidden Bitcoin keys and the trickery Pidal had employed to unlock it, turned out to have only personal information and nothing related to AlphaBay. The Lithuanian server, too, was initially useless to them; after crashing, it had rebooted in an encrypted state. They were denied its secrets and would only manage to decrypt the machine months later.

The laptop, on the other hand, was a gold mine of evidence. Aside from being logged in to AlphaBay and containing that incriminating net-worth file, the computer had keys for all of Cazes’ various wallets, containing not only Bitcoin but also other, newer cryptocurrencies: Ethereum, Monero, Zcash. Rabenn remembers watching the two FBI analysts, Ali and Erin, in the war room as they siphoned that money into wallets under FBI control, announcing every time they had transferred another multimillion-dollar stash. “It was the coolest thing I have ever seen,” Rabenn says.

On the evening after the arrest, Rabenn and Hemesath met with Cazes for the first time. He sat in a conference room of the NSB office—accompanied, for the moment, only by a Thai police chaperone and two Thai lawyers, whom Cazes had hired to temporarily oversee his defense. For Rabenn, who had hunted Cazes for the better part of a year across the digital world, sharing a room with his target still felt surreal. Cazes didn’t recognize either of the prosecutors, whom he had sat down next to in the Athenee just a few days earlier by sheer chance.

Rabenn began by warning Cazes not to waste their time or lie to them, his standard opening to criminal defendants. But the two Americans had agreed that Hemesath, the more experienced orator, would take the lead. In his usual analytic tone, Hemesath launched into a short speech about the crimes they knew Cazes had committed, the indictment against him, and the

potential consequences if he were convicted. Hemesath laid out the evidence they possessed, which now included not only archived social media clues and blockchain evidence but Cazes' own unencrypted laptop and phone. He explained that if Cazes didn't cooperate with them, he might very well spend the rest of his life in prison.

That sentence, however, could still be reduced if he made the right decisions. If he cooperated, Hemesath concluded, Cazes might still be able to meet his child as a free man someday.

After a moment's hesitation, Cazes answered this extended soliloquy with a single question: Were they going to charge him with the “kingpin statute”?

His voice, which neither prosecutor had heard before, was a sort of middle pitch, inflected with a noticeable French accent. But they were struck more by his expression: a slight smile.

Both prosecutors were caught off guard. The kingpin statute was a common nickname for a “continuing criminal enterprise” charge, often used against organized crime bosses and cartel leaders. Was he asking about the kingpin charge out of fear of the severe sentence that it promised? In fact, they didn't plan to charge him under that statute, which might have left them less room to maneuver if he eventually cooperated.

But it was Cazes' glib tone that gave them pause. They wondered if he was in fact comparing himself to the Silk Road's Ross Ulbricht, who had been convicted under that same charge. Did Cazes see the “kingpin” label as a status symbol, one that would cement his place in the dark-web pantheon?

Rabenn was unnerved. It wasn't that Cazes had the manner of a cold sociopath, he says. But nor did he seem to be taking the conversation seriously. He remembers thinking that their defendant, facing a potential life sentence or even the death penalty if he was tried in Thailand, was treating this encounter like some sort of game.

Rabenn tried to drive home the gravity of the situation. “This is not a joke,” he remembers telling Cazes. “We can't help you unless you help us.” He

reiterated that the rest of Cazes' life hung in the balance. Cazes seemed to hear that admonishment and became slightly more somber.

The two prosecutors finally asked Cazes if he would be willing to waive his extradition rights so that he could be tried—and likely incarcerated—in the United States rather than Thailand. Cazes said he would consider it. But he insisted that he still wanted to speak to a more permanent lawyer who could take on his case before any real negotiation. Their meeting was over.

As soon as Sanchez walked through the door, she heard someone screaming in Thai, “He’s not talking! Alex isn’t talking!” She broke into a run.

A couple of days later, Cazes did speak for the first time to his lawyer of choice, a young American defense attorney named Roger Bonakdar. Bonakdar was in his office, just a block from Rabenn's in downtown Fresno, when he got the call about Cazes from the federal defenders' office for the city. Learning of the magnitude of the case—easily the biggest of its kind to ever occur in the state of California, to say nothing of Fresno—he immediately agreed to speak to Cazes.

Bonakdar's impression of the young man on the other end of the phone contrasted sharply with Rabenn and Hemesath's. He says he found Cazes to be “pleasant and articulate” but also deeply stressed and concerned for his safety. Cazes was particularly scared, Bonakdar remembers, that any negotiation with the prosecution could endanger him and his family—that he could be seen as an informant and any arrests that followed his own might lead to reprisals against him. “He was sensitive to the perception that he was cooperating,” Bonakdar says. “Which he wasn’t.”

They agreed that Cazes had few, if any, real legal protections in Thai custody and that Bonakdar needed to get him out of the NSB headquarters as quickly as possible and into the Canadian embassy. “I was in a scramble to find a way to secure him,” Bonakdar says. He told Cazes he would fly to Bangkok as soon as possible to meet with him.

By this time, however, Cazes had spent the better part of a week on the eighth floor of the NSB office. The prosecutors had made no real progress toward getting him to cooperate. So they agreed to let the Thais move him

into the jail on the first floor of the building. He was locked behind steel bars in a dingy white cell with a thin blue mattress and a rudimentary toilet that offered almost no privacy—it sat behind a 3-foot-high wall with a swinging wooden door.

A few days after Cazes' arrest, with the crux of their work complete, Rabenn had flown back to the United States, and Hemesath had taken a brief trip to Phuket to check out the villa Cazes owned there, which the Thai government planned to seize.

But Sanchez remained in Bangkok. After Cazes was moved to the NSB lockup, he would be brought out—handcuffed, slightly disheveled, with a week of stubble—for occasional chats with her. Together they would deal with yet more paperwork, or she would hand him a phone to speak with his attorneys or his wife, who also came to visit Cazes daily and spoke privately to him through the bars of his cell.

After a few interactions with Sanchez, Cazes shifted into a more conversational, if somewhat defiant, relationship with the DEA agent. She suspected he was bored, lonely, and ready to talk to anyone. After two days in lockup, Cazes also agreed to sign the waiver Sanchez put in front of him, allowing him to be extradited to the United States without a lengthy legal battle.

During one of their conversations, Sanchez says Cazes brought up with her, apropos of nothing, the question of AlphaBay's morality. What was so wrong, Sanchez remembers him musing in hypothetical terms, with a website that sold marijuana? Sanchez answered by asking him about AlphaBay's sales of fentanyl. In her retelling of the discussion, at least, Cazes lowered his head and offered no defense.

During another late-night visit, this one on July 11, six days after his arrest, Sanchez remembers Cazes informing her, in a kind of deadpan, that he planned to escape—that a helicopter gunship was coming to break him out.

“Cut your shit, Alex,” Sanchez responded with a wry smile. “Don't play those games with me.”

She reminded him that he was going to be an incredibly valuable informant for the American government—a “superstar,” as she put it. Sanchez said she would try to get him a computer and that he would do “amazing things” once they had him set up in the United States. She repeated that she would take care of him.

At 2 am, she wished him a good night and went home.

The next morning, after just a few hours of sleep, Sanchez left her apartment and headed back to the NSB headquarters, where Cazes was due at 8 that morning to be taken to Bangkok's main justice center for a hearing. After getting snarled in Bangkok's notorious traffic, and then waylaid by her cab driver's wrong turn, she arrived at the police station a few minutes late and headed straight into the ground-floor lockup. As soon as she walked through the door, she heard someone screaming in Thai, again and again, “He's not talking! Alex isn't talking!”

She broke into a run. Her mind immediately flashed back to Cazes' comment the night before that he planned to escape. “Oh my God, that mother—,” Sanchez thought as she ran through the station, furious. “He got somebody to spring him.”

As she arrived at Cazes' cell, it seemed to be empty. Then she saw that Thai officers were peering over the cell's internal 3-foot wall. She walked in and looked down: Cazes' body, hidden behind that wall, was sprawled across the length of the cell's bathroom area.

His corpse was facedown and bluish, she remembers. The flesh of his arms and legs looked darkened, almost bruised. A navy-blue towel was tied around his neck, with one end now draped over his shoulders.

She was momentarily overcome with shock, sadness, disappointment, and anger—albeit a different pitch of anger than she'd felt just a moment before, when she feared he'd escaped. She found herself wishing that he had. It would have been a better outcome, she felt, than the scene she saw before her.

“You motherfucker,” she thought. “I told you I was going to take care of you.”

CHAPTER 13

ICARUS

The day before Cazes' death, Paul Hemesath had returned to Bangkok from Phuket and was staying at a new hotel close to NSB headquarters. As he walked toward the station the next morning, past the lush gardens of the Royal Thai Police Sports Club, he was in a spectacular mood, still feeling the afterglow of one of the biggest victories of his career. “Here I am in Bangkok, the sun is shining,” he remembers thinking. “Things are going great. This is incredible.”

As he approached the station, an FBI agent drove alongside him in a car and told Hemesath from the window that Cazes had been found unresponsive in his cell. Must be taking a nap, Hemesath thought to himself, perhaps in a state of denial. But as he walked into the lockup, Sanchez and Thai police intercepted him and stated it more plainly: Their defendant was dead.

Hemesath's mind went blank. He began to rewind through the nine months he'd spent chasing Cazes, then fast-forward through all his plans for the next year that he had arranged around the case, a case that had now been torn apart without warning.

At that moment, Cazes' wife and her parents walked into the jail, carrying food for Cazes in plastic bags. Hemesath watched one of the Thai police officers explain to them what had happened. He remembers Thapsuwan standing in the hallway, eight months pregnant, stone-faced, silently absorbing the news. Her mother immediately began to wail in sorrow.

Moments later, Rabenn got a FaceTime call from Hemesath. He answered from his car in downtown Fresno, where he was picking up his child from day care across the street from the city's courthouse. He found Hemesath's face on his screen with tears in his eyes. “He's dead, Grant,” Hemesath said. “He's dead.”

Fifteen time zones away, Rabenn sat in his car, overwhelmed by a sudden, crushing wave of disappointment. He compares the feeling to that of a treasure hunter who had traveled across the world, obtained a precious relic, and was about to bring it home, only to have someone casually smash it into a thousand pieces. He felt a sense of premature finality: The most important case of his career was over.

After the initial shock passed, Rabenn admits, he felt little sympathy for Cazes. To prepare for a trial, he and Hemesath had identified a handful of individual deaths that had resulted directly from AlphaBay's sales. In Luxembourg, a police officer had murdered his sister and her husband with potassium cyanide purchased on the site. In the US, an 18-year-old woman in Portland, Oregon, and two boys in Utah—just 13 years old—had all died from taking synthetic opioids bought on AlphaBay. “When I think about the dead kids that are directly attributed to the site that he was making millions of dollars off of, it’s hard to feel bad about him killing himself,” Rabenn says.

In the years since, Rabenn says, he has come up with plenty of his own explanations for why Cazes would choose to die by suicide. He was a gamer, Rabenn points out, and he played his life like a video game: He sought power, money, and sexual conquests like points on a leaderboard. Rabenn felt he could see it in Cazes' expression during their first meeting—the sense of detachment from consequences, the disregard for his future.

“It’s like when you’re playing a first-person game,” Rabenn says. “When something goes wrong, you hit the reset button.”

Rabenn saw in Cazes' apparent decision to end his own life a kind of reflection, too, of the hip-hop ideals of his teenage years and the “alpha” mentality of his twenties: a desire for status, for respect, and for a certain kind of fame above all else—high-risk, high-reward values that were incompatible with quietly serving decades in prison or becoming a federal informant.

“He was the kid who wanted to be the shot caller,” Rabenn says. “He achieved that. He touched the sun. And died.”

Roger Bonakdar saw things differently.

When Cazes' Fresno-based defense attorney got the call from Rabenn informing him of Cazes' death, he went through the same paroxysm of shock. His flight had been booked for Thailand. He'd been checking on his vaccine records. "We were planning our next steps, and then"—Bonakdar snaps his fingers as he recounts the moment—"he was gone."

But unlike Rabenn, Hemesath, or Sanchez, Bonakdar immediately doubted the story that his client had killed himself, and he told Rabenn as much. Bonakdar had never experienced a client dying by suicide, but he'd heard defendants consider it in moments of despair. "I know someone who's on the edge when I speak to them," Bonakdar says. "I just never got the sense from Cazes that he felt all was lost, that there was no recovering from this, that he was a dead man."

Over the months that followed, Bonakdar says, he asked US prosecutors and the Thai government for video footage of Cazes' cell at the time of his death. He received neither. I did, years later, request and receive several clips of video from inside Cazes' cell. One clip shows Cazes looking up and down the jail hallway through the cell's bars, then doing something with his towel just off-screen before disappearing behind the cell's bathroom door. The next clip, which starts more than half an hour later, shows guards rushing in, followed by Jen Sanchez, and looking over the bathroom wall, apparently at his corpse.

The Thai police explained to me that they hadn't saved the video between those before-and-after moments because it simply showed the empty part of Cazes' cell with no movement and no one entering. But Bonakdar contends that this gap in the footage only makes the circumstances of Cazes' death more suspicious.

Bonakdar argues that the physical explanation of Cazes' suicide alone strikes him as "biomechanically dubious." He can't imagine how Cazes could have hanged himself from a makeshift, waist-high gallows. "How do you place enough force to crush your carotid artery when your body's not suspended?" he asks. "From 3 feet off the ground?"

Sanchez described to me in detail how she believes Cazes asphyxiated: He tied one end of the towel around his throat and closed another section of the towel in the hinge of his 3-foot-tall bathroom wall, essentially fashioning a noose that suspended his neck from the top of that half-wall. Then he simply sat down and used his body weight to pull the towel tight around his neck, cutting off his breathing and blood flow. “He willfully checked out,” she says. A Thai police coroner’s report lists Cazes’ cause of death as simply “suffocation” and notes no signs of a struggle, pointing out that no one else’s DNA was found under his fingernails.

Looking into the medical research on hanging deaths reveals that self-asphyxiations often occur without someone suspending their full body. Sanchez and Rabenn both told me, based on his apparent means of suicide, that they believe Cazes had searched for methods of killing himself online. Sanchez also believes Cazes’ wife, Thapsuwan, knew he was planning his death. Sanchez heard from Thai police that Thapsuwan had told staff at Cazes’ Phuket villa that he would rather die than be extradited to the United States. (Thapsuwan would later herself be convicted of money laundering by the Thai government for her association with Cazes’ crimes and served four years in prison before receiving a royal pardon. She declined to be interviewed.)

But Bonakdar dismisses Sanchez’s secondhand account and remains unconvinced. He maintains, at the very least, that his client’s suicide is far from proven, though he admits he doesn’t know who would have killed Cazes—or had him killed. A coconspirator afraid that Cazes might inform on him? Thai police officers on the take, seeking to cover up their corruption? He doesn’t expect he’ll ever know the truth.

Danielle Héroux, Cazes’ mother, who still lives in Quebec, also rejects the story of her son’s suicide. She laid the blame for his death at the feet of the American government. “Alex didn’t kill himself,” Héroux wrote in a text message in French. “Why did the FBI take no action to protect ‘their trophy’ while awaiting his extradition to the USA? Surely they wanted Alex not to speak, and his assassination was ordered.”

Héroux declined to be interviewed and didn’t elaborate or share any evidence of her claim. But she did defend her son. “Alex is not at all the

person portrayed in the media,” she wrote. “I raised him alone and he is an extraordinary being.”

Cazes' mother shared a photo of the two of them together, a selfie she'd taken with Cazes in the back of a car. He's smiling, a bit half-heartedly, the same innocent openness to his expression that he'd had in the LinkedIn profile photo that first put prosecutors on his trail.

She added one more message: “He was my entire life.”

Continued in Part 6: [With AlphaBay shuttered, Operation Bayonet enters its audacious final phase: driving the site's refugees into a giant trap in an attempt to deal a paralyzing blow to the entire dark web.](#)

This story is excerpted from the book [Tracers in the Dark: The Global Hunt for the Crime Lords of Cryptocurrency](#), now available from Doubleday.

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Nov 17, 2022 9:00 AM

Why the Emoji Skin Tone You Choose Matters

WIRED's spiritual advice columnist on whether to use the tone that most resembles your own—or to stick with the original Simpsons-esque color.

ILLUSTRATION: ROCHE

“I'm a white person, and despite there being a range of skin tones available for emoji these days, I still just choose the original Simpsons-esque yellow. Is this insensitive to people of color?”

—True Colors

Dear True,

I don't think it's possible to determine what any group of people, categorically, might find insensitive—and I won't venture to speak, as a white person myself, on behalf of people of color. But your trepidation about which emoji skin tone to use has evidently weighed on many white people's minds since 2015, when the Unicode Consortium—the mysterious organization that sets standards for character encoding in software systems around the world—introduced the modifiers. A 2018 University of Edinburgh study of Twitter data confirmed that the palest skin tones are used least often, and most white people opt, as you do, for the original yellow.

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Spiritual Troubleshooting for the Digital Age

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It's not hard to see why. While it might seem intuitive to choose the skin tone that most resembles your own, some white users worry that calling attention to their race by texting a pale high five (or worse, a raised fist) might be construed as celebrating or flaunting it. The writer Andrew McGill noted in a 2016 *Atlantic* article that many white people he spoke to feared that the white emoji "felt uncomfortably close to displaying 'white pride,' with all the baggage of intolerance that carries." Darker skin tones are a more obviously egregious choice for white users and are generally interpreted as grossly appropriative or, at best, misguided attempts at allyship.

That leaves yellow, the Esperanto of emoji skin tones, which seems to offer an all-purpose or neutral form of pictographic expression, one that does not require an acknowledgment of race—or, for that matter, embodiment. (Unicode calls it a “nonhuman” skin tone.) While this logic may strike you as sound enough, sufficient to put the question out of mind while you dash off a yellow thumbs-up, I can sense you're aware on some level that it doesn't really hold up to scrutiny.

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The existence of a default skin tone unavoidably calls to mind the thorny notion of race neutrality that crops up in so many objections to affirmative action or, to cite a more relevant example, in the long-standing use of “flesh-colored” and “nude” as synonyms for pinkish skin tones. The yellow emoji feels almost like claiming, “I don't see race,” that dubious shibboleth of post-racial politics, in which the ostensible desire to transcend racism often conceals a more insidious desire to avoid having to contend with its burdens. Complicating all this is the fact that the default yellow is indelibly linked to *The Simpsons*, which used that tone solely for Caucasian characters (those of other races, like Apu and Dr. Hibbert, were shades of

brown). The writer Zara Rahman has argued that the notion of a neutral emoji skin tone strikes her as evidence of an all-too-familiar bad faith: “To me, those yellow images have always meant one thing: white.”

At the risk of making too much of emoji (there are, undeniably, more urgent forms of racial injustice that deserve attention), I’d argue that the dilemma encapsulates a much larger tension around digital self-expression. The web emerged amid the heady spirit of 1990s multiculturalism and color-blind politics, an ethos that recalls, for example, the United Colors of Benetton ad that featured three identical human hearts labeled “white,” “black,” and “yellow.” The promise of disembodiment was central to the cyberpunk ideal, which envisioned the internet as a new frontier where users would shirk their real-life identities, take on virtual bodies (or no bodies at all), and be judged by their ideas—or their souls—rather than by their race. This vision was, unsurprisingly, propagated by the largely middle- and upper-class white men who were the earliest shapers of internet culture. The scholar Lisa Nakamura has argued that the digital divide gave cyberspace a “whitewashed” perspective and that the dream of universalism became, in many early chat rooms, an opportunity for white people to engage in identity tourism, adopting avatars of other races that were rife with stereotypes—a problem that lives on in the prevalence of [digital blackface on TikTok](#) and other platforms.

It’s telling that skin tone modifiers were introduced in 2015, when social platforms teemed with posts about the police killings of Walter Scott and Freddie Gray, among others, and when the tech press began to take stock of [algorithmic bias](#) in the justice system, acknowledging that technologies once hailed as objective and color-blind were merely compounding historical injustices. That year, Ta-Nehisi Coates observed (at the close of the Obama presidency) that the term *post-racial* “is almost never used in earnest,” and Anna Holmes noted that it “has mostly disappeared from the conversation, except as sarcastic shorthand.”

It’s tempting, given this context, to see emoji diversity as an implicit acknowledgment that “users” are embodied human beings who do not abandon their lived experiences at the login page. A closer look at the history of emoji choices, however, reveals a far more complex reality and

underscores the power imbalances that persist in corporate tech. Before Unicode, Apple, and Google introduced skin tone modifiers, iPhone users could download emoji of different skin tones through an app called iDiversicons, conceived and created by a Black woman named Katrina Parrot. The app caught the interest of both Unicode and Apple, and although Parrot met with executives at both organizations, they ultimately introduced their own skin tone palettes without offering her compensation or attribution. Parrot is currently suing Apple for copyright infringement.

Incorporating skin tone modifiers cost these companies (quite literally) very little, and some commentators have argued that the feature amounts to so much empty gesticulating, “a big horse and pony parade … to appease people of color,” as the writer Paige Tutt put it in *The Washington Post*. More options for self-expression may be an inarguable social good, but such features also earn corporations easy plaudits and obscure the more insidious ways in which their technologies disproportionately impact marginalized communities: Big Five companies post messages in support of Black Lives Matter while continuing to profit from their collaborations with the police state. Improvements in face recognition technologies, while celebrated for making headway in recognizing Black and brown faces, are used to justify dragnet surveillance in already overpoliced neighborhoods. The emoji modifiers also feel insufficient for more obvious reasons: Despite the range of skin tones available, the broad strokes of these pictographs fail to capture the complexities of individual identity.

I realize, True Colors, that this discussion has probably only complicated the dilemma you posed, rather than simplified it. What I hope has become clear is that the uneasiness you feel is really a glimpse into the difficult dilemmas of identity and self-expression that people of color have long navigated, both online and off. If there's any virtue in the existence of a white emoji option, it's that it extends some small portion of this burden to white users, who've long benefited from an implicit exemption. The discomfort you feel as your thumb hovers over the screen isn't something to solve, shirk, or liberate yourself from. It might be the whole point.

Faithfully,

Cloud

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Nov 17, 2022 6:00 AM

Picture Limitless Creativity at Your Fingertips

Artificial intelligence can now make better art than most humans. Soon, these engines of wow will transform how we design just about everything.

ILLUSTRATION: OFF-SITE RESEARCH FACILITY

Picture Lee Unkrich, one of Pixar's most distinguished animators, as a seventh grader. He's staring at an image of a train locomotive on the screen of his school's first computer. *Wow*, he thinks. Some of the magic wears off, however, when Lee learns that the image had not appeared simply by asking for "a picture of a train." Instead, it had to be painstakingly coded and rendered—by hard-working humans.

Now picture Lee 43 years later, stumbling onto DALL-E, an artificial intelligence that generates original works of art based on human-supplied prompts that can literally be as simple as "a picture of a train." As he types in words to create image after image, the *wow* is back. Only this time, it doesn't go away. "It feels like a miracle," he [says](#). "When the results appeared, my breath was taken away and tears welled in my eyes. It's that magical."

[Lessons from the History of Photography](#)[Classic WIRED Covers—Regenerated by AI](#)

Our machines have crossed a threshold. All our lives, we have been reassured that computers were incapable of being truly creative. Yet, suddenly, millions of people are now using a new breed of AIs to generate

stunning, never-before-seen pictures. Most of these users are not, like Lee Unkrich, professional artists, and that's the point: They do not have to be. Not everyone can write, direct, and edit an Oscar winner like *Toy Story 3* or *Coco*, but everyone *can* launch an AI image generator and type in an idea. What appears on the screen is astounding in its realism and depth of detail. Thus the universal response: *Wow*. On four services alone—Midjourney, Stable Diffusion, Artbreeder, and DALL-E—humans working with AIs now cocreate more than 20 million images every day. With a paintbrush in hand, [artificial intelligence](#) has become an engine of wow.

Because these surprise-generating AIs have learned their art from billions of pictures made by humans, their output hovers around what we expect pictures to look like. But because they are an alien AI, fundamentally mysterious even to their creators, they restructure the new pictures in a way no human is likely to think of, filling in details most of us wouldn't have the artistry to imagine, let alone the skills to execute. They can also be instructed to generate more variations of something we like, in whatever style we want—in seconds. This, ultimately, is their most powerful advantage: They can make new things that are relatable and comprehensible but, at the same time, completely unexpected.

So unexpected are these new AI-generated images, in fact, that—in the silent awe immediately following the *wow*—another thought occurs to just about everyone who has encountered them: Human-made art must now be over. Who can compete with the speed, cheapness, scale, and, yes, wild creativity of these machines? Is art yet another human pursuit we must yield to robots? And the next obvious question: If computers can be creative, what else can they do that we were told they could not?

I have spent the past six months using AIs to create thousands of striking images, often losing a night's sleep in the unending quest to find *just one more* beauty hidden in the code. And after interviewing the creators, power users, and other early adopters of these generators, I can make a very clear prediction: Generative AI will alter how we design just about everything. Oh, and not a single human artist will lose their job because of this new technology.

It is no exaggeration to call images generated with the help of AI *cocreations*. The sobering secret of this new power is that the best applications of it are the result not of typing in a single prompt but of very long conversations between humans and machines. Progress for each image comes from many, many iterations, back-and-forths, detours, and hours, sometimes days, of teamwork—all on the back of years of advancements in machine learning.

AI image generators were born from the marriage of two separate technologies. One was a historical line of deep learning neural nets that could generate coherent realistic images, and the other was a natural language model that could serve as an interface to the image engine. The two were combined into a language-driven image generator. Researchers scraped the internet for all images that had adjacent text, such as captions, and used billions of these examples to connect visual forms to words, and words to forms. With this new combination, human users could enter a string of words—the prompt—that described the image they sought, and the prompt would generate an image based on those words.

Scientists now at Google invented the diffusion computational models that are at the core of image generators today, but the company has been so concerned about what people might do with them that it still has not opened its own experimental generators, Imagen and Parti, to the public. (Only employees can try them, and with tight guidelines on what can be requested.) It is no coincidence, then, that the three most popular platforms for image generators right now are three startups with no legacy to protect. [Midjourney](#) is a bootstrapping startup launched by David Holz, who based the generator in an emerging community of artists. The interface to the AI is a noisy Discord server; all the work and prompts were made public from the start. [DALL-E](#) is a second-gen product of the nonprofit OpenAI, funded by Elon Musk and others. [Stable Diffusion](#) appeared on the scene in August 2022, created by Emad Mostaque, a European entrepreneur. It's an open source project, with the added benefit that anyone can download its software and run it locally on their own desktop. More than the others, Stable Diffusion has unleashed AI image generators into the wild.

ART IS HUMAN.

ILLUSTRATION BY ADAM GARCIA

ART IS HYBRID.

ILLUSTRATION BY: [@auranova_ai](#) + MIDJOURNEY

Why are so many people so excited to play with these AIs? Many images are being created for the same reason that humans have always made most art: because the images are pretty and we want to look at them. Like flames in a campfire, the light patterns are mesmerizing. They never repeat themselves; they surprise, again and again. They depict scenes no one has witnessed before or can even imagine, and they are expertly composed. It's a similar pleasure to exploring a video game world, or paging through an art book. There is a real beauty to their creativity, and we stare much in the way we might appreciate a great art show at a museum. In fact, viewing a parade of generated images is very much like visiting a personal museum—but in this case, the walls are full of art we ask for. And the perpetual novelty and surprise of the next image hardly wanes. Users may share the gems they discover, but my guess is that 99 percent of the 20 million images currently generated each day will only ever be viewed by a single human—their cocreator.

Like any art, the images can also be healing. People spend time making strange AI pictures for the same reason they might paint on Sundays, or scribble in a journal, or shoot a video. They use the media to work out something in their own lives, something that can't be said otherwise. I've seen images depicting what animal heaven might look like, created in response to the death of a beloved dog. Many images explore the representation of intangible, spiritual realms, presumably as a way to think about them. "A huge portion of the entire usage is basically art therapy," Holz, the Midjourney creator, tells me. "The images are not really aesthetically appealing in a universal sense but are appealing, in a very deep way, within the context of what's going on in people's lives." The machines can be used to generate fantasies of all types. While the hosted services [prohibit porn and gore](#), anything goes on the desktop versions, as it might in Photoshop.

This article appears in the February 2023 issue. [Subscribe to WIRED](#). Photograph: Peter Yang

AI-generated pictures can be utilitarian too. Say you are presenting a report on the possibility of recycling hospital plastic waste into construction materials and you want an image of a house made out of test tubes. You could search stock photo markets for a usable image made by a human artist. But a unique assignment like this rarely yields a preexisting picture, and even if found, its copyright status could be dubious or expensive. It is cheaper, faster, and probably far more appropriate to generate a unique, personalized image for your report in a few minutes that you can then insert into your slides, newsletter, or blog—and the copyright ownership is yours (for now). I have been using these generators myself to cocreate images for my own slide presentations.

In an [informal poll](#) of power users, I found that only about 40 percent of their time is spent seeking utilitarian images. Most AI images are used in places where there were no images previously. They usually do not replace an image created by a human artist. They may be created, for example, to illustrate a text-only newsletter by someone without artistic talent themselves, or the time and budget to hire someone. Just as mechanical photography did not kill human illustrations a century ago, but rather significantly expanded the places in which images appeared, so too do AI image generators open up possibilities for more art, not less. We'll begin to see contextually generated images predominately in spaces that are currently blank, like emails, text messages, blogs, books, and social media.

This new art resides somewhere between painting and photography. It lives in a possibility space as large as painting and drawing—as huge as human imagination. But you move through the space like a photographer, hunting for discoveries. Tweaking your prompts, you may arrive at a spot no one has visited before, so you explore this area slowly, taking snapshots as you step through. The territory might be a subject, or a mood, or a style, and it might be worth returning to. The art is in the craft of finding a new area and setting yourself up there, exercising good taste and the keen eye of curation in what you capture. When photography first appeared, it seemed as if all the photographer had to do was push the button. Likewise, it seems that all

a person has to do for a glorious AI image is push the button. In both cases, you get an image. But to get a great one—a truly artistic one—well, that's another matter.

Accessible AI image generators are not even a year old, but already it is evident that some people are much better at creating AI images than others. Although they're using the same programs, those who have accumulated thousands of hours with the algorithms can magically produce images that are many times better than the average person's. The images by these masters have a striking coherence and visual boldness that is normally overwhelmed by the flood of details the AIs tend to produce. That is because this is a team sport: The human artist and the machine artist are a duet. And it requires not just experience but also lots of hours and work to produce something useful. It is as if there is a slider bar on the AI: At one end is Maximum Surprise, and at the other end Maximum Obedience. It is very easy to get the AI to surprise you. (And that is often all we ask of it.) But it is very difficult to get the AI to obey you. As Mario Klingemann, who makes his living selling NFTs of his [AI-generated artwork](#), says, "If you have a very specific image in mind, it always feels like you are up against a forcefield." Commands like "shade this area," "enhance this part," and "tone it down" are obeyed reluctantly. The AIs have to be persuaded.

Current versions of DALL-E, Stable Diffusion, and Midjourney limit prompts to about the length of a long tweet. Any longer and the words muddle together; the image turns to mush. That means that behind every fabulous image lies a short magic spell that summons it. It begins with the first incantation. How you say it matters. Your immediate results materialize in a grid of four to nine images. From that batch of pictures, you variate and mutate offspring images. Now you have a brood. If they look promising, begin to tweak the spell to nudge it in new directions as it births more generations of images. Multiply the group again and again as you search for the most compelling composition. Do not despair if it takes dozens of generations. Think like the AI; what does it like to hear? Whisper instructions that have worked in the past, and add them to the prompt. Repeat. Change the word order to see whether it likes that. Remember to be specific. Replicate until you have amassed a whole tribe of images that seem to have good bones and potential. Now cull out all but a select few. Be

merciless. Begin outpainting the most promising images. That means asking the AI to extend the image out in certain directions beyond the current borders. Erase those portions that are not working. Suggest replacements to be done by the AI with more incantations (called inpainting). If the AI is not comprehending your hints, try spells used by others. When the AI has gone as far as it can, migrate the image to Photoshop for final tailoring. Present it as if you have done nothing, even though it is not uncommon for a distinctive image to require 50 steps.

Behind this new magecraft is the art of prompting. Each artist or designer develops a way of persuading an AI to yield its best by evolving their prompts. Let's call these new artists AI whisperers, or prompt artists, or promptors. The promptors work almost as directors, guiding the work of their alien collaborators toward a unified vision. The convoluted process required to tease a first-rate picture out of an AI is quickly emerging as a fine-art skill. Almost daily, new tools arrive to make prompting easier, better. [PromptBase](#) is a market for promptors to sell prompts that create simple images such as emoticons, logos, icons, avatars, and game weapons. It's like clip art, but instead of selling the art, they sell the prompt that generates the art. And unlike fixed clip art, it is easy to alter and tweak the art to fit your needs, and you can extract multiple versions again and again. Most of these prompts sell for a couple bucks, which is a fair price, given how much trouble it is to hone a prompt on your own.

Above-average prompts not only include the subject but also describe the lighting, the point of view, the emotion evoked, the color palette, the degree of abstraction, and perhaps a reference picture to imitate. As with other artistic skills, there are now courses and guidebooks to train the budding promptor in the finer points of prompting. One fan of DALL-E 2, Guy Parsons, put together a free [Prompt Book](#), jammed with tips on how to go beyond the wow and get images you can actually use. One example: If your prompt includes specific terms such as "Sigma 75 mm camera lens," Parson says, then the AI doesn't just create that specific look made by the lens; "it more broadly alludes to 'the kind of photo where the lens appears in the description,'" which tends to be more professional and therefore yields higher-quality images. It's this kind of multilevel mastery that produces spectacular results.

For technical reasons, even if you repeat the exact same prompt, you are unlikely to get the same image. There is a randomly generated seed for each image, without which it is statistically impossible to replicate. Additionally, the same prompt given to different AI engines produces different images—Midjourney’s are more painterly, while DALL-E is optimized for photographic realism. Still, not every promptor wishes to share their secrets. The natural reaction upon seeing a particularly brilliant image is to ask, “What spell did you use?” What was the prompt? Robyn Miller, cocreator of the legendary game *Myst* and a pioneering digital artist, has been posting an AI-generated image every day. “When people ask me what prompt I used,” he says, “I have been surprised that I don’t want to tell them. There is an art to this, and that has also surprised me.” Klingemann is famous for not sharing his prompts. “I believe all images already exist,” he says. “You don’t make them, you find them. If you get somewhere by clever prompting, I do not see why I want to invite everybody else there.”

It seems obvious to me that promptors are making true art. What is a consummate movie director—like Hitchcock, like Kurosawa—but a promptor of actors, actions, scenes, ideas? Good image-generator promptors are engaged in a similar craft, and it is no stretch for them to try and sell their creations in art galleries or enter them into art contests. This summer, Jason Allen won first place in the digital art category at the Colorado State Fair Fine Art competition for a large, space-opera-themed canvas that was signed “Jason Allen via Midjourney.” It’s a pretty cool picture that would’ve taken some effort to make no matter what tools were used. Usually images in the digital art category are created using Photoshop and Blender-type tools that enable the artist to dip into libraries of digitized objects, textures, and parts, which are then collaged together to form the scene. They are not drawn; these digital images are unapologetically technological assemblages. Collages are a venerable art form, and using AI to breed a collage is a natural evolution. If a 3D-rendered collage is art, then a Midjourney picture is art. As Allen [told Vice](#), “I have been exploring a special prompt. I have created hundreds of images using it, and after many weeks of fine-tuning and curating my gens, I chose my top 3 and had them printed on canvas.”

Of course, Allen’s blue ribbon set off alarm bells. To some critics, this was a sign of the end times, the end of art, the end of human artists. Predictable lamentations ensued, with many pointing out how unfair it felt for struggling artists. The AIs are not only going to take over and kill us all—they are, apparently, going to make the world’s best art while doing so.

At its birth, every new technology ignites a Tech Panic Cycle. There are seven phases:

1. Don’t bother me with this nonsense. It will never work.
2. OK, it is happening, but it’s dangerous, ’cause it doesn’t work well.
3. Wait, it works too well. We need to hobble it. Do something!
4. This stuff is so powerful that it’s not fair to those without access to it.
5. Now it’s everywhere, and there is no way to escape it. Not fair.
6. I am going to give it up. For a month.
7. Let’s focus on the real problem—which is the next current thing.

Today, in the case of AI image generators, an emerging band of very tech-savvy artists and photographers are working out of a Level 3 panic. In a reactive, third-person, hypothetical way, they fear other people (but never themselves) might lose their jobs. Getty Images, the premier agency selling stock photos and illustrations for design and editorial use, has already banned AI-generated images; certain artists who post their work on DeviantArt have demanded a similar ban. There are well-intentioned demands to identify AI art with a label and to segregate it from “real” art.

Beyond that, some artists want assurances that their own work not be used to train the AIs. But this is typical of Level 3 panic—in that it is, at best, misguided. The algorithms are exposed to 6 billion images with attendant text. If you are not an influential artist, removing your work makes zero difference. A generated picture will look exactly the same with or without your work in the training set. But even if you *are* an influential artist, removing your images still won’t matter. Because your style has affected the work of others—the definition of influence—your influence will remain even if your images are removed. Imagine if we removed all of Van Gogh’s pictures from the training set. The style of Van Gogh would still be embedded in the vast ocean of images created by those who have imitated or been influenced by him.

Styles are summoned via prompts, as in: “in the style of Van Gogh.” Some unhappy artists would rather their names be censored and not permitted to be used as a prompt. So even if their influence can’t be removed, you can’t reach it because their name is off-limits. As we know from all previous attempts at censoring, these kinds of speech bans are easy to work around; you can misspell a name, or simply describe the style in words. I found, for example, that I could generate detailed black-and-white natural landscape photographs with majestic lighting and prominent foregrounds—without ever using Ansel Adams’ name.

There is another motivation for an artist to remove themselves. They might fear that a big corporation will make money off of their work, and their contribution won’t be compensated. But we don’t compensate human artists for their influence on other human artists. Take David Hockney, one of the highest-paid living artists. Hockney often acknowledges the great influence other living artists have on his work. As a society, we don’t expect him (or others) to write checks to his influences, even though he could. It’s a stretch to think AIs should pay their influencers. The “tax” that successful artists pay for their success is their unpaid influence on the success of others.

What’s more, lines of influence are famously blurred, ephemeral, and imprecise. We are all influenced by everything around us, to degrees we are not aware of and certainly can’t quantify. When we write a memo or snap a picture with our phone, to what extent have we been influenced—directly or indirectly—by Ernest Hemingway or Dorothea Lange? It’s impossible to unravel our influences when we create something. It is likewise impossible to unravel the strands of influence in the AI image universe. We could theoretically construct a system to pay money earned by the AI to artists in the training set, but we’d have to recognize that this credit would be made arbitrarily (unfairly) and that the actual compensatory amounts per artist in a pool of 6 billion shares would be so trivial as to be nonsensical.

In the coming years, the computational engine inside an AI image generator will continue to expand and improve until it becomes a central node in whatever we do visually. It will have literally seen everything and know all styles, and it will paint, imagine, and generate just about anything we need. It will become a visual search engine, and a visual encyclopedia with which

to understand images, and the primary tool we use with our most important sense, our sight. Right now, every neural net algorithm running deep in the AIs relies on massive amounts of data—thus the billions of images needed to train it. But in the next decade, we'll have operational AI that relies on far fewer examples to learn, perhaps as few as 10,000. We'll teach even more powerful AI image generators how to paint by showing them thousands of carefully curated, highly selected images of existing art, and when this point comes, artists of all backgrounds will be fighting one another to be included in the training set. If an artist is in the main pool, their influence will be shared and felt by all, while those not included must overcome the primary obstacle for any artist: not piracy, but obscurity.

As soon as 2D generative algorithms were born, experimenters rushed to figure out what was next. Jensen Huang, the ambitious cofounder of Nvidia, believes the next generation of chips will generate 3D worlds for the metaverse—“the next computing platform,” as he [calls it](#). In a single week this past September, three novel text-to-3D/video image generators were announced: GET3D (Nvidia), Make-A-Video (Meta), and DreamFusion (Google). The expansion is happening faster than I can write. Amazing as frameable 2D pictures produced by AI are, outsourcing their creation is not going to radically change the world. We are already at peak 2D. The genuine superpower being released by AI image generators will be in producing 3D images and video.

A future prompt for a 3D engine might look something like this: “Create the messy bedroom of a teenager, with posters on the wall, an unmade bed, and afternoon sunlight streaming through closed blinds.” And in seconds, a fully realized room is born, the closet door open and all the dirty clothes on the floor—in full 3D. Then, tell the AI: “Make a 1970s kitchen with refrigerator magnets and all the cereal boxes in the pantry. In full volumetric detail. One that you could walk through. Or that could be photographed in a video.” Games crammed with alternatively rendered worlds and full-length movies decked out with costumes and sets have eternally been out of reach for individual artists, who remain under the power of large dollars. AI could make games, metaverses, and movies as quick to produce as novels, paintings, and songs. Pixar films in an instant! Once millions of amateurs are churning out billions of movies and endless

metaverses at home, they will hatch entirely new media genres—virtual tourism, spatial memes—with their own native geniuses. And when big dollars and professionals are equipped with these new tools, we’ll see masterpieces at a level of complexity never seen before.

But even the vast universes of 3D worlds and video are not vast enough to contain the disruption that AI image generators have initiated. DALL-E, Midjourney, and Stable Diffusion are just the first versions of generative machines of all types. Their prime function, pattern recognition, is almost a reflex for human brains, something we accomplish without conscious thinking. It is at the core of almost everything we do. Our thinking is more complex than just pattern recognition, of course; dozens of cognitive functions animate our brain. But this single type of cognition, synthesized in machines (and the only cognition we have synthesized so far), has taken us further than we first thought—and will probably continue to advance further than we now think.

When an AI notices a pattern, it stores it in a compressed way. Round objects are placed in a “roundness” direction, red objects in another direction for “redness,” and so on. Maybe it notices “treeness” and “foodness” too. It abstracts out billions of directions, or patterns. Upon reflection—or training—it notices that the overlap of these four qualities produces “appleness,” yet another direction. Furthermore, it links all these noticed directions with word patterns, which can also share overlapping qualities. So when a human requests a picture of an apple via the word “apple,” the AI paints an image with those four (or more) qualities. It is not assembling bits of existing pictures; rather, it is “imagining” a new picture with the appropriate qualities. It sort of remembers a picture that does not exist but could.

This same technique can be used—in fact, is already being used, in very early forms—to find new drugs. The AI is trained on a database of all the molecules we know to be active medicines, noticing patterns in their chemical structures. Then the AI is asked to “remember” or imagine molecules we have never thought of that seem to be similar to the molecules that work. Wonderfully, some of them actually do work, just as an AI image of a requested imaginary fruit can look remarkably like a fruit.

This is the real transformation, and soon enough, the same technique will be used to help design automobiles, draft laws, write code, compose soundtracks, assemble worlds to entertain and instruct, and cocreate the stuff we do as work. We should take to heart the lessons we've learned so far from AI image generators because there will soon be more pattern-seeking AIs in all realms of life. The panic cycle we presently face is simply a good rehearsal for the coming shift.

What we know about AI generators so far is that they work best as partners. The nightmare of a rogue AI taking over is just not happening. That vision is fundamentally a misreading of history. In the past, technology has rarely directly displaced humans from work they wanted to do. For instance, the automatic generation of pictures by a machine—called a camera—was feared in the 1800s because it would surely put portrait painters out of business. But the historian Hans Rooseboom could find only a *single* portrait painter from that time who felt unemployed by photography. (Photography actually inspired a resurgence of painting later in that century.) Closer to our time, we might have expected professional occupations in photography to fall as the smartphone swallowed the world and everybody became a photographer—with 95 million uploads to Instagram a day and counting. Yet the number of photography professionals in the US has been slowly rising, from 160,000 in 2002 (before camera phones) to 230,000 in 2021.

Instead of fearing AI, we are better served thinking about what it teaches us. And the most important thing AI image generators teach us is this: Creativity is not some supernatural force. It is something that can be synthesized, amplified, and manipulated. It turns out that we didn't need to achieve intelligence in order to hatch creativity. Creativity is more elemental than we thought. It is independent of consciousness. We can generate creativity in something as dumb as a deep learning neural net. Massive data plus pattern recognition algorithms seems sufficient to engineer a process that will surprise and aid us without ceasing.

Scholars of creativity refer to something called Uppercase Creativity. Uppercase Creativity is the stunning, field-changing, world-altering rearrangement that a major breakthrough brings. Think special relativity,

the discovery of DNA, or Picasso's *Guernica*. Uppercase Creativity goes beyond the merely new. It is special, and it is rare. It touches us humans in a profound way, far beyond what an alien AI can fathom.

To connect with a human deeply will always require a Creative human in the loop. This high creativity, however, should not be confused with the creativity that most human artists, designers, and inventors produce day to day. Mundane, ordinary, lowercase creativity is what we get with a great new logo design or a cool book cover, a nifty digital wearable or the latest must-have fashion, or the set design for our favorite sci-fi serial. Most human art, past and present, is lowercase. And lowercase creativity is exactly what the AI generators deliver.

But this is huge. For the first time in history, humans can conjure up everyday acts of creativity on demand, in real time, at scale, for cheap. Synthetic creativity is a commodity now. Ancient philosophers will turn in their graves, but it turns out that to make creativity—to generate something new—all you need is the right code. We can insert it into tiny devices that are presently inert, or we can apply creativity to large statistical models, or embed creativity in drug discovery routines. What else can we use synthetic creativity for? We may feel a little bit like medieval peasants who are being asked, "What would you do if you had the power of 250 horses at your fingertips?" We dunno. It's an extraordinary gift. What we do know is we now have easy engines of creativity, which we can aim into stale corners that have never seen novelty, innovation, or the wow of creative change. Against the background of everything that breaks down, this superpower can help us extend the wow indefinitely. Used properly, we can make a small dent in the universe.

This article appears in the February issue. [Subscribe now.](#)

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By [Andy Greenberg](#)

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Nov 15, 2022 6:00 AM

The Hunt for the Dark Web's Biggest Kingpin, Part 4: Face to Face

The team uses a secret technique to locate AlphaBay's server. But just as the operation heats up, the agents have an unexpected run-in with their target.

Illustration: Hokyoung Kim

CHAPTER 8

TAKEOVER

In June 2017, a team of Royal Thai Police officers arrived at the Courtyard Marriott in Sacramento, California. Jen Sanchez, a veteran [Drug Enforcement Administration](#) agent, had been assigned to bring the delegation on a flight from Bangkok to California to coordinate with the US team—to iron out any intercontinental wrinkles on the Bangkok end of what had come to be known as Operation Bayonet.

The Thai cops met the American agents, analysts, and prosecutors at the US attorney's office, with more than two dozen people arrayed around the room. The two countries traded PowerPoint briefings. Ali and Erin, expert [cryptocurrency](#)-tracing FBI analysts from Washington, DC, walked the Thais through a “Bitcoin 101” presentation and detailed how they had tracked Cazes’ hidden cash flows. The Thais shared everything they’d learned from following Cazes’ physical movements for months. The police then explained the particulars of the Thai legal system—what US agents would and wouldn’t be allowed to do with Cazes after, if all went well, they laid hands on him.

Between meetings, Sanchez took the Thai group on field trips: to a golfing range, to a shopping mall—where the officers descended ravenously on a

Coach outlet—and on an outing to San Francisco in rented vans. The Thais, accustomed to the tropics, nearly froze on Fisherman’s Wharf; they were so jet-lagged and exhausted from their sightseeing frenzy that they slept through the drive over the Golden Gate Bridge in both directions. On another day, the FBI gave the Thais a tour of the explosives lab at the bureau’s Sacramento field office, showing off the agency’s bomb-defusing robots. Paul Hemesath, the prosecutor, later brought out his HTC Vive VR headset, and the two countries’ agents took turns walking a plank over a digital abyss and swinging virtual swords at zombies.

This story is excerpted from the forthcoming book [Tracers in the Dark: The Global Hunt for the Crime Lords of Cryptocurrency](#), available November 15, 2022, from Doubleday.

Courtesy of Penguin Random House

When they weren’t busy with tourism and team-building exercises, the agents were grappling with the practical details of raiding a dark-web kingpin. At one point, the case’s lead FBI agent presented the looming problem of Cazes’ laptop encryption. Sanchez and the Thais explained that based on their surveillance, Cazes almost never opened his machine outside his own home. The agents agreed: They’d have to catch him in his house, logged in to AlphaBay and yet somehow off guard so that he wouldn’t shut the laptop before his arrest.

Almost as important as the computer was Cazes’ iPhone. The FBI told the Thais they’d need to grab it unlocked, or it too would be irretrievably encrypted. That phone, after all, might hold keys to Cazes’ cryptocurrency wallets or other crucial data. The question of how to thread the needle of capturing these two devices and their information hung in the air, unanswered.

Then Sanchez spoke: She asked the lead FBI agent if it would be helpful to know more about how Cazes spent his days, hour by hour. After all, she explained, he had laid it all out on Roosh V, the online forum for “alpha males” where Cazes practically liveblogged his daily life and sexual escapades under the handle Rawmeo. The FBI agent invited her to go ahead.

So Sanchez walked the group through Cazes' daily schedule as he had, himself, described it in exacting detail: Wake up at dawn and check his email and social media, including the Roosh V forum. Work out at home until the late morning. Have sex with his wife. Then go to his laptop and take care of business until the evening, with only a short break in the afternoon for a light lunch. At seven, he'd quit work for the day to go out for dinner and cruise for girls in his Lamborghini Aventador. Almost without fail he'd be back home and asleep by 11.

Then Sanchez offered another observation from her Roosh V trawling: She could see on the forum exactly *when* Cazes was online. The little green light next to Rawmeo's name wasn't merely a reminder that they were seeing into Cazes' thoughts in real time. It might also serve as an indicator of when his laptop was open—and when Alpha02 was vulnerable.

just days later, on the morning of June 20, 2017, in the small central Netherlands city of Driebergen, half a dozen Dutch police officers were huddled around a conference room where they'd been anxiously waiting since early that day. Finally, one of the investigators' phones rang with a call from the German Federal Police. The Germans had just arrested the two administrators of Hansa, the dark web's second-biggest black market for drugs, in their homes. Both men were in custody. The first phase of Operation Bayonet's one-two punch—an unprecedented attempt to take down one market while secretly taking *over* another—could now begin.

For weeks, the Dutch National High-Tech Crime Unit had been preparing for this moment. They'd used the source code for Hansa that they'd pulled from the German servers to reconstruct their own, offline, practice version of the market, to familiarize themselves with how it was built and administered. They'd even gone so far as to create their own play-money version of Bitcoin, with its very own blockchain—what cryptocurrency developers call a testnet—to privately experiment with how the site handled its monetary transactions.

Now, with the real admins arrested, they had to take over and run the actual, live version of Hansa, with millions of dollars moving between tens of thousands of users. And they had to do it seamlessly, without knocking the

site offline or, worse, giving its users or staff any clue that the two administrators had been replaced by a team of undercover Dutch police.

At the Germans' signal, the Dutch team immediately called a pair of agents they'd sent to a data center in Lithuania, where the server actively running Hansa was hosted. Those agents physically pulled out a hard drive from the rack that held the machine so they could access a backup copy of its data. The teams in Driebergen and Lithuania then began feverishly duplicating every digital component of the market, piece by piece, on their own computers and then on a server in a Netherlands data center, reconstructing an exact copy of the site that was now under their control.

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For the next two days, the Dutch investigators sat at their keyboards from morning until well after midnight, fueled by pizza and Red Bull. At one point early on, someone spilled a soda onto the conference table, nearly soaking a laptop that stored the entire collection of the Hansa data; only a desperate lunge by one of the investigators managed to save it. At another point, a typo in a single command caused the site to go down for several panicky minutes before it could be restored.

Around 3 am on the third night after the arrests, a Dutch investigator, Marinus Boekelo, was troubleshooting another bug that was causing error messages to cascade across the screen whenever someone used the search bar at the top of the page. "Fuck, fuck, fuck!" Boekelo muttered, bent over his laptop, his hands on either side of his face as he attempted one fix after another.

Then, after a moment, he leaned back with a look of relief. The error messages were gone. The last serious bug had been ironed out.

After nearly 72 hours, they had the reconstructed site running smoothly, fully under their command. The skeleton crew still working in the

conference room exploded with jubilation. Aside from the one brief period of downtime, the migration of the site to a Dutch data center had been nearly invisible to its users.

The most conspicuous sign of the takeover, the Dutch police worried, was that for almost three days there had been complete radio silence from the two Hansa administrators. The site's staff of four moderators looked to the two admins for orders and to resolve any disputes between buyers and dealers that they couldn't handle themselves. The police could see that the admins communicated with Hansa's staff using an encrypted messaging system called Tox Chat—the server they'd seized contained some limited logs of their past communications—but they didn't have the password to log in to their chat accounts.

So they tried a simple solution: They asked the real admins for help. The two German men quickly agreed to cooperate in hopes of a lighter sentence. They handed over their Tox Chat passwords to the German police, who passed them on to the Dutch. The team in Driebergen then resumed day-to-day chatter between the bustling black market's bosses and staff. With the cooperation of the real admins and their Tox Chat logs, they were able to pick up the business of the site without a hitch. Their only initial error was paying one moderator the incorrect amount for his Bitcoin salary, pegged to the wrong non-digital currency. The undercover police fixed their mistake, paid the staffer the difference, and all was forgiven.

The Dutch team had come up with a cover story for the admins' three days offline: They'd tell anyone who asked that they were heads-down, coding an upgrade to the market. But no one asked. The hierarchy of the marketplace's org chart and the secrecy of dark-web operations, where no one on staff knew their coworkers beyond a username and a shared chat history, meant the cops in admin clothing were spared any curious questions about their absence.

Nor, they were relieved to discover, did there seem to be any inside jokes or watercooler gossip to catch up on. "It actually turned out that they did not discuss anything personal with each other," one investigator remembers. "It was pure business."

The cover story about an upgrade wasn't exactly a lie. In reconstructing the site, the Dutch police had actually ironed out some of its bugs and rewritten parts of its code to be more efficient. And because they now had a team of half a dozen rotating agents acting as the administrators, instead of two overworked individuals, they found that the site's customers considered the day-to-day operations of the market to be significantly improved.

One of the younger Dutch agents had been an IT help-desk admin years earlier. He found his new job helping run Hansa to be remarkably similar. He got to work efficiently resolving disputes over the site's drug deals, assisted by a collection of answers the administrators had helpfully prepared in an online control panel. The undercover agent even came to the rescue of one grateful, sight-impaired drug dealer, helping him figure out how to get his screen reader software properly integrated with his Tor browser.

Ethical quandaries aside, the team couldn't help but take pride in the professionalism of their work. "The quality really went up," said Gert Ras, the head of the Dutch National High-Tech Crime Unit. "Everyone was very satisfied with the level of service they got."

for their first day acting as Hansa's bosses, the team had cautiously watched the site's internal clockwork, barely believing that they'd gotten away with their takeover. But when it became clear they could control Hansa seemingly indefinitely, they settled in, working in shifts to run the site 24/7 from the small conference room in Driebergen.

On one wall, they set up a 65-inch screen where someone started a stopwatch, measuring exactly how long they'd been in control of the market. Then slowly, silently, they began to spring the trap they'd assembled.

Hansa, like any good dark-web market, had been designed to learn as little as possible about its users beyond what was necessary to facilitate reliable drug transactions. The passwords for users' accounts were stored only as cryptographic "hashes," indecipherable strings of characters that let the site avoid having to protect a collection of those sensitive login credentials. Hansa also offered to let users automatically encrypt all their messages

using the privacy program PGP—including, most importantly, the mailing addresses buyers would share with sellers when they made an order. All of this meant that, in theory, the site itself would never have full access to its users' accounts or know their most personal data, such as the location of their homes.

Now the police began to invisibly sabotage those safeguards. They started recording all of Hansa's usernames and passwords when buyers and sellers logged in. They also began secretly archiving the full text of every message that users sent on the site *before* the text was encrypted. Soon they were collecting hundreds, then thousands, of buyers' addresses from orders, turning the business of the entire market into a glass aquarium under their real-time surveillance.

According to Dutch law, the police had to record and attempt to intercept every drug order made on the market while they controlled it. So the half-dozen undercover agents in their small conference room were soon joined by dozens of others, working on the same floor, who were tasked with manually cataloging every single purchase. They forwarded the data from sales destined for the Netherlands to Dutch police, who could seize the packages of heroin, cocaine, and meth shipped through domestic mail. Non-Dutch orders would be sent to Europol, which was charged with distributing the ever-growing pile of drug-deal data to their respective nations' law enforcement agencies.

Already, the Dutch police had accomplished something law enforcement had never attempted before: hunting, capturing, and vivisecting a dark-web drug market in real time, unbeknownst to the site's users. But Operation Bayonet was only getting started. The Dutch—and their collaborators from Sacramento to Bangkok—had other, bigger game in their crosshairs.

CHAPTER 9

‘Advanced Analysis’

on june 22, 2017, two days after the Hansa takeover and less than two weeks before the date of the planned AlphaBay takedown, Michael

Gronager and Jonathan Levin, cofounders of the world's leading cryptocurrency tracing firm, Chainalysis, happened to be in the Netherlands. So was an Internal Revenue Service Criminal Investigations agent named Tigran Gambaryan. They had all flown to The Hague, halfway across the small country from the Driebergen office where the Dutch were pulling Hansa's puppet strings, for a Europol conference focused on virtual currency investigations.

As contractors with no security clearance, Levin and Gronager were unaware of what Gambaryan knew: that by this time, all the interlocking pieces of Operation Bayonet were falling into place. The Dutch Hansa takeover was underway. A team of Americans targeting AlphaBay planned to set up surveillance of that market's Dutch servers early on July 5, taking a snapshot of its contents while Cazes was logged in to it. They would pull it offline only after the Thais arrested Cazes in Bangkok; touching it any sooner might spook him and cause him to destroy evidence or flee. US prosecutors would then interrogate Cazes and swiftly extradite him. Even the Royal Canadian Mounted Police had been roped in to simultaneously search Cazes' mother's home in Quebec.

Gambaryan was only on the periphery of this international whirlwind of detective work. A compact former forensic accountant with a gruff demeanor, he had gained a reputation as a highly capable dark-web investigator and the IRS's top Bitcoin whisperer. A few years earlier, he'd pioneered the first real cryptocurrency-tracing criminal case, following Bitcoin trails to prove that two federal agents assigned to investigate the Silk Road dark-web market had in fact pocketed hundreds of thousands of dollars' worth of the market's bitcoins through theft, extortion, and sales of insider information.

Gambaryan worked as part of IRS Criminal Investigations' cybercrime unit in DC, but he had learned about the AlphaBay case early on from a friendly IRS agent in Fresno, California, his hometown, where he often went to visit his parents. He'd followed the investigation's progress, but he'd never been assigned to the case.

Still, he couldn't help but take an occasional, curious poke at the biggest dark-web market in history. For months, Gambaryan had followed

AlphaBay's tracks through the blockchain, obsessively pestering Chainalysis' Jonathan Levin with new ideas about how to circumscribe the edges of the AlphaBay "cluster"—the millions of Bitcoin addresses the site and its users had generated—or trace its most incriminating money trails. He was, as Levin put it, "completely relentless."

That spring, Gambaryan and Levin had together come up with an idea—a new, experimental method to examine AlphaBay's use of cryptocurrency. Prosecutors in the AlphaBay case have referred to it using only the hideously vague term "advanced analysis." But Gambaryan and Levin hoped they could use it to unearth a major finding: the IP address of the server that hosted AlphaBay's Bitcoin wallet. With that IP in hand, they should be able to pinpoint the server's physical location and seize it, gaining key evidence in their case against Cazes and assuring that no one else on AlphaBay's staff would be able to take control of the site after Cazes' arrest.

By all conventional wisdom, it shouldn't have been possible to learn that IP address through blockchain surveillance. The blockchain, after all, is a ledger of transactions between Bitcoin addresses. It doesn't record IP addresses, the strings of numbers that identify individual computers on the internet and can often help investigators locate them. But Levin and Gambaryan's method could somehow obtain those identifiers. Neither has revealed a word of how this technique works. In fact, in our conversations, they never treated any piece of cryptocurrency-tracing tradecraft with more secrecy.

Unbeknownst to Levin, by the spring of 2017 the Operation Bayonet team believed they already knew an AlphaBay IP address: the one in the Netherlands that had once been leaked in the welcome email for the site's forums and then in November 2016 passed on by a tipster to Fresno DEA agent Robert Miller. But Gambaryan figured it couldn't hurt to independently verify this critical piece of evidence. Levin had been doing his own hands-on research into AlphaBay for years, and he was eager to try out a new investigative technique that Chainalysis could potentially sell to other customers.

On that June morning in The Hague, Levin sat at a desk in an apartment in the coastal city's quiet western periphery, a few blocks from the beach, next to a fishing harbor that fed into the wind-churned North Sea. Levin and Gronager had rented the Airbnb and were sharing it—more out of habit than financial necessity, given Chainalysis' recent multimillion-dollar funding rounds and swelling cash flow—with one staying in the bedroom and the other on the couch.

Levin and Gronager were both up early, before the Europol conference began. So Levin used this spare moment to check the results of his and Gambaryan's advanced analysis experiment.

The answer appeared, without fanfare, on Levin's screen: an AlphaBay IP address. Or rather, a handful of IP addresses that were likely to belong to the site's wallet server. A quick search revealed that the likeliest of them wasn't, in fact, in the Netherlands, but in a data center in Lithuania.

Levin remembers his reaction in the moment as less of an epiphany than a brief flash of recognition. "Huh," he thought to himself. He had no clue that the coordinated global raid of AlphaBay was planned for just over 10 days later and that, according to the digits he now saw on his screen, it was targeting a server in the wrong country. He made a mental note to tell Gambaryan about the Lithuanian IP the next time he saw him.

The opportunity arrived that evening. After a day spent at the Europol conference, the two sat side by side at dinner with a dozen other agents, analysts, prosecutors, and contractors around a long table at Flavor's, a ribs-and-steak restaurant a few blocks from Europol headquarters, its walls covered in paintings of a medieval feast. They had just ordered drinks when Levin thought to mention to Gambaryan that their experimental idea had apparently worked. He showed Gambaryan the three IP addresses on his phone, pointing out the Lithuanian one that seemed most likely.

The IRS agent went silent. He pulled out his own phone and took a picture of Levin's screen. Then he stood up, blank-faced, and quickly walked out of the restaurant without explanation.

Levin watched him go, dumbfounded. Gambaryan hadn't even paid for his beer.

gambaryan ran the eight blocks through the streets of the residential neighborhood, past The Hague's art museum, to the Marriott next to Europol headquarters, where he and most of the other international agents at the conference were staying. He went directly to the building's top floor, overlooking the darkened forest of Park Sorghvliet, ringed by international government buildings. At a table in an empty conference room, he opened his laptop, confirmed that the IP address Levin had found was indeed in a Lithuanian data center, and then began calling Operation Bayonet's prosecutors—Grant Rabenn and Paul Hemesath in California, as well as Alden Pelker, the DC-based cybercrime attorney on the case, and Erin, the FBI Bitcoin-tracing analyst who was in The Hague attending the Europol conference—to tell them that he and Chainalysis had found what appeared to be the true location of AlphaBay's central server, and it wasn't in the Netherlands but a thousand miles to the east.

Soon Erin joined Gambaryan in the hotel conference room, with Hemesath and Rabenn on speakerphone from California, where it was still early in the day. Chainalysis' Levin arrived not long after, followed by Gronager, who'd been attending a different business dinner; both men were pulled into the night's meeting on a need-to-know basis. Until the early hours of the morning, the group worked frantically to sort out the logistics of seizing AlphaBay's infrastructure not from the Netherlands, as they'd intended, but from Lithuania, with their July 5 deadline just days away. At one point, a Dutch hotel worker came into the lounge to try to tell the group the room was closed. Gambaryan, who technically wasn't even part of the AlphaBay operation, flashed his badge at the man instinctively—a badge that had no actual authority outside the United States—and the startled Dutchman retreated, leaving them to their work.

Just as they were on the cusp of victory, it seemed their plan had failed. "Oh, shit," Rabenn silently concluded, in a state of blank panic. "This thing's over."

Ultimately, Gambaryan and Chainalysis' advanced analysis trick spared Operation Bayonet, at nearly the last minute, from what could have been a

major error. The investigators would later learn that the Netherlands IP address they'd been focused on for months pointed to a data center that held only an older server for the site, rather than the holy grail they were looking for. Just like Hansa, AlphaBay had apparently moved at some point from a Dutch hosting provider to the Baltics. Without the Lithuanian IP address, passed from Levin's phone to Gambaryan's in a steak restaurant, the investigators would have been raiding the equivalent of an abandoned hideout, leaving AlphaBay's actual criminal headquarters untouched.

None of the investigators in Operation Bayonet has ever explained the mechanics of that Hail Mary advanced-analysis technique publicly—nor would they explain it to me in the years that followed. That's in part because the secrecy of the technique, agents and prosecutors suggested, had allowed it to be used again and again, identifying the IP addresses of dark-web services' Bitcoin wallets in a series of major cases. Law enforcement agencies wanted to make sure the method wasn't "burned"—exposed to dark-web administrators or Bitcoin developers who might be able to fix the vulnerabilities it exploited.

For anyone who followed the early days of Chainalysis, though, it would be hard not to take one particular educated guess at how the company's mysterious tool worked. In 2015, just months after its founding, the startup had caused a brief, very public blowup in the Bitcoin community with a technique capable of identifying Bitcoin users' IP addresses. The company had set up its own secret collection of Bitcoin nodes, the computers that serve as the communications backbone of the Bitcoin network. Unlike typical Bitcoin nodes, Chainalysis' nodes were designed to silently record the IP addresses Bitcoin users broadcast with every transaction. By quietly intercepting every IP that passed through the nodes, Chainalysis aimed to create a global map of Bitcoin users' physical locations.

The IP eavesdropping was meant as a demonstration of the young startup's capabilities. When it was discovered, however, the result was a long, venom-filled thread on the cryptocurrency forum BitcoinTalk, where Chainalysis was excoriated as a purveyor of "mass surveillance" tools. Gronager, the company's CEO, apologized and shut down the experiment.

Yet, years later, could that technique somehow have been adapted to secretly target—and locate—the Bitcoin wallets of very specific users? Even when the transactions were sent from a computer running on the Tor anonymity network?

For Operation Bayonet, all that mattered was that the IRS’s Gambaryan and Chainalysis’ Levin had, together, corrected the course of a massive, coordinated, international investigation at a critical moment, deploying a secret weapon with hardly a day to spare. But secret weapons don’t tend to stay secret forever.

CHAPTER 10

The Athenee

in the last days of June, the Americans descended upon Bangkok like a tropical law enforcement convention.

They included nearly 20 agents, analysts, computer forensic experts, and prosecutors from the FBI, DEA, IRS, Department of Justice, Department of Homeland Security, and Canada’s Royal Canadian Mounted Police. More than a dozen members of the group checked in at the Athenee, a five-star hotel a few blocks from the US embassy, which advertised that it was built on grounds once owned by a 19th-century Siamese princess and featured eight restaurants and a rooftop complete with a garden and swimming pool. It was, the prosecutor Grant Rabenn noted, certainly the nicest hotel he’d ever managed to book on the government’s per diem.

With just days until their planned bust, Rabenn, Hemesath, and the DC prosecutor Louisa Marion remained swamped by the bureaucracy of coordinating law enforcement agencies in five countries—the United States, Thailand, Canada, the Netherlands, and now Lithuania, where they had a fresh plan to seize the central AlphaBay server. The team also met repeatedly with the Thais at the headquarters of their Narcotics Suppression Bureau (NSB) across town, gathering in a conference room on the building’s eighth floor to talk through the details of Cazes’ arrest.

The central problem remained unsolved: how to distract Cazes and lure him out of his house with his phone unlocked and his laptop open and unencrypted. Set fire to a dumpster outside the house? Too dangerous, they decided. Have a female undercover agent begin screaming and crying outside his house? Cazes might simply ignore her, or else close the laptop before checking out the noise.

What if they dressed an undercover agent as a postal worker who knocked on the door and asked Cazes to come sign for a package? That, they concluded, might work.

Amid all this frantic eleventh-hour planning, a core group still managed to cap off each day at the Athenee's lounge for its all-you-can-eat sushi happy hours. It was during one of those evening gatherings that something surprising appeared in the group chat the Thai police had set up on a messaging app called Line, popular in Thailand. The Thais used the group chat to post constant updates to one another and to the DEA on their physical surveillance of Cazes. That day, the Thai team assigned to Operation Bayonet had been following their target on an early evening outing, tracking him in his Porsche Panamera as he approached central Bangkok. Jen Sanchez, who lived near both the Athenee and her workplace at the US embassy building down the street, had just returned home when she saw a photo, taken by one of the Thai officers, pop up. It showed a white Porsche, parked at a swanky-looking hotel entrance.

"What the fuck?" she thought, with a sudden rush of adrenaline. Wasn't that the Athenee, where much of the US team was staying?

At that moment, in the Athenee lounge, Rabenn recalls seeing the same Porsche out of the corner of his peripheral vision and instantly remembering that a white Panamera was in Cazes' stable of pricey vehicles. He pointed it out to Hemesath, as well as the DEA's Miller and an FBI agent, all of them sitting together at a table in the lobby. They half-jokingly suggested that the FBI agent go check it out.

The agent gamely strolled across the lounge as a figure walked through the front door of the Athenee. A spasm of shock went through Rabenn's mind.

It was him. Alexandre Cazes. And he was walking directly toward Rabenn, Miller, and Hemesath's table.

Rabenn froze. "It was like seeing a ghost," he remembers. He glanced over at Hemesath, who seemed equally paralyzed, in disbelief.

The image of that first in-person encounter with Cazes, after nine months of obsessively tracking Alpha02, remains burned into Rabenn's memory. Cazes was dressed, Rabenn remembers, in a slim, expensive-looking blue suit, his white shirt unbuttoned underneath in the style of someone too rich to wear a tie. Yet Rabenn also observed that Cazes moved with a certain nerdy awkwardness—that, under his costume, he looked "more like a pudgy programmer pretending to be a rock star than an actual rock star."

The FBI agent, thinking quickly, avoided eye contact with Cazes and walked directly past him to the door. In the seconds it took for Cazes to cross the room, seemingly in slow motion, thoughts raced through Rabenn's mind: How did Cazes know who they were? Or that they were on his trail? Or which hotel they were staying at in Bangkok? Had there been a leak? Had they been meeting too conspicuously, blowing their opsec? Had this criminal mastermind outsmarted them?

In mere moments, Rabenn expected Cazes to sit down next to them at their table, smug expression on his face, and say, as he imagined it, "Fuck you guys, I know you're here, and you're not going to get anything."

Rabenn realized he had no idea how he would respond. They could arrest Cazes on the spot, but they'd lose all hope of getting access to his laptop or any smoking-gun evidence of his control of AlphaBay. Just as they were on the cusp of victory, it seemed their plan had failed.

"Oh, shit," Rabenn silently concluded, in a state of blank panic. "This thing's over."

Then, when Cazes was about 5 feet away from their table, he turned and sat down at the table next to them, across from a pair of Israeli businessmen wearing suits and yarmulkes.

The Americans looked at each other in confusion. After a moment, the FBI agent returned and sat down casually. He and Miller began silently signaling to the rest of the table that everyone else should leave.

Rabenn, recovering his composure, allowed the thought to cross his mind that perhaps all was not lost—that this was simply the most stunning coincidence of his life.

Doing their best to act naturally, the prosecutors cleared out and walked up the curved staircase to the mezzanine floor of the hotel, while the FBI agent and Miller hung back to eavesdrop on Cazes' conversation at the neighboring table. On the floor above, Rabenn and Hemesath shared a moment of wide-eyed relief. Text messages from the FBI and DEA agents still at the table began to roll in, reporting on Cazes' meeting: He was talking with the Israelis about one of his real estate investment deals in the Caribbean.

As their panic subsided, they now saw that a group of Thai undercover police—including the team leader, Colonel Pisal Erb-Arb, in plain clothes—had stationed themselves around another table across the hotel lounge from Cazes and were discreetly watching him, even stealthily taking photos of each other that captured Cazes in the background. The AlphaBay founder gave no sign of having spotted them.

As Rabenn and Hemesath silently rejoiced, the FBI agent joined them on the mezzanine floor and pulled out his phone. He started Googling, trying to calculate the odds of what had just happened. How many hotels were there in Bangkok, anyway? He quickly showed them the answer: There were thousands.

In a euphoric daze, the two prosecutors marveled at their bizarre near-collision—but not for long. In two days, they knew their team would be encountering Cazes face-to-face again, this time in the most elaborate arrest they had ever attempted.

Continued next week: The day of the takedown arrives. Operation Bayonet reaches its kinetic climax. And then the case takes a tragic twist.

This story is excerpted from the book [Tracers in the Dark: The Global Hunt for the Crime Lords of Cryptocurrency](#), available now from Doubleday.

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Nov 10, 2022 7:00 AM

A Tweet Before Dying

The revolutionary internet is over, and we don't have much to show for it.
A new start is out there, somewhere.

Illustration: Elena Lacey

i find it a good philosophical exercise to imagine the last tweet. It could come centuries hence, when a cryptobot offers a wistful adieu to another cryptobot, or in 2025, when Donald Trump, the newly inaugurated president for life, pushes the big Electromagnetic Pulse button on the Resolute desk. Or it could come in a few months, when [Elon Musk](#) realizes that aggregating human despair has no upside, regrets plowing his electric clown car into a social media goat rodeo, and shuts the whole thing down with a single "lol." (Way to own the libs.) What then? We'll all move over to some [Twitter](#) replacement like [Mastodon](#), hundreds of millions of us, and ruin that too? Sigh.

Lately it feels like the last tweet could come any day. The whole tech industry—by which I mean the cluster of companies that sell code-empowered products to billions of humans—is in extraordinary decline. The Zuckerverse has everything but users, which means [Meta](#) must come up with ever more creative ways to ruin Instagram and/or society. Microsoft, Amazon, Google—their stock charts look like Niagara Falls in profile. At least \$3 trillion has ridden over the cataracts in a barrel. When your brand is infinite growth, investors don't like to see failure. It has become possible to imagine not just the last tweet but also the day when [Facebook](#) exists only as a multi-exabyte ZIP file in archival storage, or when Googling is an interactive exhibit at the Internet History Museum.

Of course, truly giant things—at the scale of social media platforms, religions, and nation-states—don’t really die. They deflate like air mattresses, getting soft at the corners and occasionally waking you up to pump them. The entities that dominated my childhood, AT&T and the Soviet Union, seemed at one point to have given up the ghost. There was rejoicing: Now a million new innovative companies can flourish! Now democracy will spread everywhere! Both were stripped for parts—and those parts eventually recombined into new, enormous forms, like beads of mercury finding each other on a plate. A re-blobbed AT&T ended up buying a ton of things, including Time Warner, giving it control of both the piping and the content. The former USSR, well ... There is always someone with a fantasy of getting the band back together, even if the consequences are terrible.

Like a lot of you, I imagine, I have been looking at this shifting world and finding the changes pretty rough to behold. Recession, authoritarianism, nuclear posturing, a weirding climate—these pop up unbidden in the feed, like the time Apple put U2’s *Songs of Innocence* on everyone’s iTunes without asking. When future historians write books about this era, I feel pretty sure they’ll pick titles like *The Fracture*, *The Fraying Knot*, *Hope Undone*, *Leviathan Triumphant*, *A Web Unwoven*, stuff like that. (If they’re Q-storians, they might go with *The Gathering Storm*.) Obviously they’ll include the last tweet, whatever it is. How else are they supposed to demarcate the end of the glorious web content revolution?

Personally, I’d begin and end that history with the House of Windsor. When Princess Diana died in 1997, the web was just coming into its own. Cable TV dominated, but online news—the linking between articles, the packaging of stories on homepages, the rich dithered GIFs—suddenly began to feel real and relevant. The tragedy was urgent and shocking and unscripted, and for an early web enthusiast it felt like the big leagues. But when Diana’s former mother-in-law died, a quarter of a century later, the part the internet played felt predictable. We knew to expect the tweets against colonialism and against anti-colonialism. We understood implicitly that the funeral horses would be memed. We had a vocabulary for the takes, hot takes, cancellations, and dunks. We posted through it.

Truly giant things—social media platforms, religions, nation-states—don’t really die. They deflate like air mattresses.

r.i.p. the revolutionary internet, 1997–2022. I’m grieving a little over here. But life must go on, despite who wins the US midterm elections, who owns Twitter, and how ridiculous the metaverse might be. That’s why every morning, sometimes before breakfast, when I am in despair, I remember the three letters that always bring me comfort: PDF. And then, when I can, I go digging. I read about Gato, a new artificially intelligent agent that can caption images and play games, or the mathematics underlying misinformation, or “digital twins,” which are simulations of real-world things like cities that consulting firms seem able to sell these days. One site, scholar.archive.org, has PDFs going back to the 18th century. It’s empowering to look for this stuff instead of waiting for it to be socially discovered and jammed into my brain.

This was the original function of the web—to transmit learned texts to those seeking them. Humans have been transmitting for millennia, of course, which is how historians are able to quote Pliny’s last tweet (“Something up w/ Vesuvius, brb”). But the seeking is important, too; people should explore, not simply feed. Whatever will move society forward is not hidden inside the deflating giants. It’s out there in some pitiful PDF, with a title like “A New Platform for Communication” or “Machine Learning Applications for Community Organization.” The tech industry said we had it all figured out, but we ended up with a billionaire telling us to strap on a helmet (space or VR) while the rising seas lap our toes. So now we have to try again. Now we *get* to try again.

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This article appears in the December 2022/January 2023 issue. [Subscribe now](#).

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By [Brooke Jarvis](#)

[Backchannel](#)

Nov 10, 2022 6:00 AM

The Big Fight Over 403 Very Small Wasps

Earth is teeming with unknown species, and they're dying off faster than ever. Now biologists are battling over an old question: how to catalog life?
Photograph: Damien Maloney

the bottle held a thin broth, light brown, with some uncertain chunks of dark matter bobbing on top—a soup, maybe, but one that you'd never want to eat. Once it was poured into a white plastic tray, the chunks resolved into [insects](#). Here were butterflies and moths, the delicate patterns of their wings dimmed after a week or two in ethanol. Here were beetles and bumblebees and lots of burly-looking flies, all heaped together, plus a bevy of large wasps, their stripes and stingers still bright.

Michael Sharkey took out a pair of thin forceps and began examining his catch. It included anything small and winged that lived in the meadows and forests around his house, high in the Colorado Rockies, and that had suffered the misfortune, in the previous two weeks, of flying into the tent-shaped malaise trap he had erected in front of his home and we had emptied earlier that morning.

This article appears in the December 2022/January 2023 issue. [Subscribe to WIRED](#). Illustration: Boldtron

Though Sharkey is a hymenopterist, an expert on the insect order that includes wasps, he ignored the obvious stripes and stingers. He ignored, in fact, all of the creatures the average person might recognize as wasps—or

even recognize at all. Instead, he began pulling little brown specks out of the soup, peering at them through a pair of specialized glasses with a magnifying loupe of the sort a jeweler might wear. Dried off and placed under the microscope on his desk, the first speck revealed itself to be an entire, perfect insect with long, jointed antennae and delicately filigreed wings. This was a braconid wasp, part of a family of creatures that Sharkey has been studying for decades. Entomologists believe that there are tens of thousands of species of braconid sharing this planet, having all sorts of important impacts on the environments around them. But most humans have probably never heard of them, much less been aware of seeing one. Huge parts of the braconid family tree are, as the saying goes, still unknown to [science](#).

As a taxonomist, Sharkey is part of a small group of people who can transform anonymous insects into known species. When other entomologists find specimens they think may not yet have been named, taxonomists are the specialists they call in to investigate whether this seemingly new-to-us thing is actually new to us. If it is, the taxonomist may formally welcome it into the realm of human knowledge by publicly conferring upon the species a Latin name, along with an official description of the physical characteristics that make it unique and identifiable for future observers. The process “hasn’t changed an awful lot” in the past 200 years, the British hymenopterist Gavin Broad told me—except that nowadays “we’ve got nicer pictures.”

I first encountered Sharkey’s name months before I called him up and asked if we could look at bugs together. I don’t remember precisely when, only that I gradually started to notice the name—always followed by “et al.”—in more and more places. There were long critiques of Sharkey et al. appearing in scientific journals, and then, later, there were responses to those critiques, and responses to those responses. And then there was the snark among the entomologists in my Twitter feed, some of whom called the work irresponsible or embarrassing or just wrote “Wooooooof.”

“Sharkey et al.” is shorthand for a paper that came out in the journal *ZooKeys* in 2021, along with a series of subsequent publications that used similar methods. That first paper wasn’t the sort of work that usually raises

such a hubbub. In it, Sharkey and a group of coauthors named some new species of braconid wasp that had been caught in malaise traps in Costa Rica. But instead of identifying just a few species, they named 403. And instead of writing up detailed descriptions for each new wasp, the authors simply included a photo and a snippet of genetic code.

The initial paper wasn't written to be provocative, Sharkey said. "But provoke it did."

The technique that Sharkey and his coauthors used, called DNA barcoding, is a way of quickly sorting and differentiating species. Researchers analyze a small section of DNA at a particular site in each creature's genome, upload that sequence into a vast database, and then use [algorithms](#) to sort the different sequences into groups. When the DNA varies from one organism to the next by more than a few percent, it's considered a sign that their evolutionary histories have gone down separate tracks for a significant period of time, possibly dividing them into different species.

DNA barcoding is a common scientific tool these days. But some scientists said that Sharkey and his colleagues had pushed its use too far. They deemed the work "turbo taxonomy" or even, as the taxonomist Miles Zhang said, "taxonomic vandalism," a term for labeling taxa as new without sufficient evidence for their uniqueness. These critics argued that the work could undermine the whole project of naming the natural world, of beginning to make it legible to human understanding. Zhang—who is actually Sharkey's academic "grandson," having studied under one of Sharkey's former students—was so frustrated that *ZooKeys* continued to publish papers from Sharkey et al. that he tweeted to the journal, "I'm done with you, go find a new subject editor."

For Sharkey and other entomologists who support his approach, this method of accelerated taxonomy is an urgently needed response to ecological calamity. Here we humans are, on a planet of astounding diversity in which truly enormous numbers of our neighbors are still mysteries to us—are, in fact, slowly revealing themselves to be more mysterious than we ever realized—and at the same time we're pushing those other species rapidly toward [oblivion](#). What choice is there, Sharkey asked, but to do all we can

to speed up the naming process, if we are to learn what we're losing before it's gone?

The initial *ZooKeys* paper, Sharkey insisted, was just a start, a suggestion for how taxonomists can begin to tackle the enormous challenge that faces them. It wasn't written to be provocative, he said. "But provoke it did."

The more I learned about the debate, the more captivating I found it. In one sense, it was an esoteric argument about technical methods within a pretty obscure field—one that's often written off, as Zhang put it, as "a weird hybrid between true science and stamp collecting." But there was clearly a lot more at stake than a few hundred wasps. Taxonomy, for centuries, has been humanity's way of reckoning with the great unknownness of the natural world. It's how we have gotten acquainted with our neighbors, how we have tried to understand our place in a wildness whose true scope and complexity have always eluded our grasp. As the biodiversity crisis that our species created pushes others toward extinction, the field is struggling in ways that reveal just how much we have to lose.

Michael Sharkey has named hundreds of species of braconid, some of which are as small as 1 millimeter long.

Photograph: Damien Maloney

the naming and ordering of living creatures is one of the most enduring human preoccupations. We're taught to do it as children, and it's one of the first jobs God assigns Adam in Eden: Give a name to every beast of the field and bird of the air. Aristotle's classification of living things into ranked groups created a foundation for the regrettably world-changing belief that nature exists in a fixed hierarchy, with humans on top and the rest below, separate and endlessly exploitable. We saw chaos and nominated ourselves to create order.

Modern taxonomy began with Carl Linnaeus, an 18th-century Swedish botanist, who, at the age of 28, published *Systema Naturae*, a bold claim that he could organize all things animal and vegetal into a system of neat and nested hierarchies: kingdom, phylum, class, order, family, genus, species. (He also ranked groups of humans, a theory that laid the

groundwork for using science to justify racism.) By the time Linnaeus died, his system included 12,000 organisms. Since then, the naming and ordering of creatures has been a vast collective project, undertaken by generations of scientists and laypeople. Named species, as Zhang put it, have become “the basic unit of biology,” a fixed point around which all sorts of laws and conservation strategies, not to mention centuries of scientific literature, pivot. Linnaeus’ 12,000 named species grew to today’s far more impressive (and very approximate) 2 million. But even that number, any biologist will tell you, is just a very humble start.

One problem is that scientists can’t fully agree on a single way of defining what a species *is*. The field of taxonomy was born when humans believed organisms to be fixed and immutable, but it must now operate in a world that we understand to be defined by mutation, variation, and constant change. (Even the author of *On the Origin of Species* once wrote to a friend how maddening it was trying to draw hard boundaries around organisms. “I have gnashed my teeth, cursed species, and asked what sin I had committed to be so punished,” Darwin wrote.) One common definition says that two organisms are different species if they can’t interbreed—which makes good sense until you think about, say, the climate-change-induced merging of polar bear territory with grizzly territory, resulting in pizzly bears. Or the fact that the bears share ancestry; at what point was the divergence enough to make them different species? The history of taxonomy includes a long series of battles—driven by evidence, opinion, and personal predilection—over whether groups of specimens ought to be lumped together or split apart.

But the problem of species is bigger still. Hundreds of years into the Linnaean project, scientists estimate that they have named, oh, somewhere between a fifth and a thousandth of the species on the planet. The general public tends to believe that the discovery of a new one is a momentous and rare occasion. In fact, the backlog of unclassified specimens is enormous. With most insects, especially, there is simply no keeping up. A Dutch entomologist told me about opening a large drawer full of various unnamed beetles at a museum, only to be told that the forest where they’d been collected a century earlier had long since vanished, the beetles probably gone along with it. Entomologists often say they could probably find a new-

to-science species of insect in just about any given backyard, if only you gave them the time and access to experts. I'd heard this time and again, but I still wasn't quite prepared when Sharkey examined one of the specimens from the backyard braconid soup and remarked, mildly, that he thought it was likely new to science.

Braconids are a perfect example of the staggering unknownness of the natural world. They're part of a larger group known as parasitoid wasps, which reproduce by hijacking the life cycles of other insects. The wasps lay eggs in or on hosts such as caterpillars, ants, or beetles. Their larvae then use the hosts as food, often eating them from the inside out. In some cases, thanks to neurotoxins imparted by the parent wasp, the host is still alive—a grotesque but efficient defense against food spoilage!—during the ordeal. (The whole situation was enough to put Darwin off his society's prevailing religion. "I cannot persuade myself," he wrote to a friend, "that a beneficent and omnipotent God would have designedly created" such creatures as parasitoid wasps.)

Still, parasitoidism provides a pretty thrilling window into the richness of [evolution](#). It's thought to lead to incredible specialization, and therefore incredible diversity. Parasitoid wasps often evolve intricate ways of infiltrating the defenses of a single other species of insect, or perhaps a few—at which point the host species evolve new defenses, and the parasitoids new strategies, ad infinitum. Take the braconid wasp that parasitizes the green cloverworm, a caterpillar. The prospective host tries to escape its waspy enemies by dangling itself off branches by a safety thread, like a little bungee jumper. The braconid has evolved to subvert this strategy and slide down the thread in pursuit of the caterpillar. But that's hardly the end of things, because there's *another* parasitoid wasp, a whole other species, that lays its eggs in the first braconid's eggs and has specialized to look for them by reeling the green cloverworm caterpillar back up. (It will lay its own eggs inside only if the first braconid has already deposited its young.) Sometimes these chains of bespoke predation, known as hyper-parasitism, go on for layer after layer, a Russian nesting doll of endlessly multiplying diversity and coevolution.

Five braconids of the genus *Retusigaster*. They parasitize caterpillars.

Photograph: Damien Maloney

For a long time, scientists believed that the most speciose group of insects—and therefore of animals on Earth, since the vast majority of the world’s animal species are insects—were beetles. Some 400,000 species have been named, so many that the famous polymath J. B. S. Haldane, when asked by a cleric what a lifetime of studying the natural world had taught him about the God who had created it, is said to have replied, dryly, that any such divine being must have “an inordinate fondness for beetles.” But recently, some entomologists have argued that, thanks to the enormous variety beginning to emerge as we learn more about parasitoids, it’s actually *wasps* that are likely to be the world’s most inordinate group. They may attract less human attention than iridescent jewel beetles, but these overlooked creatures, with their disconcerting reproductive strategies, so deeply embedded in the lives of the species that surround them, may represent a dominant way of animal life on planet Earth. As Broad, the British hymenopterist, said, “What do you know about the world if you’re only looking at a few species? You don’t know anything about it.”

In recent years, as entomologists around the world have tried to quantify the alarming arthropod decline that’s widely known as “the insect apocalypse,” they’ve had to contend with this “Linnaean shortfall”—the fact that humans have so little preexisting knowledge of the other organisms with which we share our planet, much less how they’re faring in the face of unprecedented global change. (There’s also, if you want to get nerdy about it, the “Prestonian shortfall,” which refers to the shortage of baseline data about how abundant animals really were in the past, and the “Wallacean shortfall,” or all that we don’t know about how species have moved in space, and the “Darwinian shortfall,” what we don’t understand about the way species have changed over time.) And there is the taxonomic shortfall: the knowledge we’re missing out on because there aren’t enough people or resources to help us meet the neighbors before they vanish.

Sharkey uses ethanol to preserve the specimens caught in his traps.

Photograph: Damien Maloney

like a lot of future natural scientists, Sharkey grew up—in his case, outside of Toronto—as the kind of kid who loved collecting bugs and salamanders in jars. Later, his work as a taxonomist sent him on professional collecting trips, chasing insects to the far reaches of Canada or Colombia. Just as often, though, it took him to arguably more obscure places: dusty monographs, old books, and the filing cabinets of distant museums. (As in many fields, taxonomy is shadowed by a persistent colonialism; specimens regularly end up half a world away from the forests or fields in which new scientists might be examining their living descendants.)

In biology, the scientific name of an organism is formally attached to a particular specimen, what's known as a holotype. Should you have questions, for example, about what sort of bear chased you through the wilderness, you may wish to visit the preserved head of Mammal #100181 in the American Museum of Natural History, the official holotype of *Ursus arctos alascensis*, the Alaska brown bear. (Museums also hold paratypes, specimens of the same species collected alongside the holotype, which are equally handy for validation, though vested with less symbolic meaning.) Type specimens are particularly valuable to insect taxonomists, who often compare very subtle differences—the details of a moth's antennae or a beetle's spiny genitalia, for example—to tell species apart or find out if they've already been named.

In the years when Sharkey was working on his PhD, a project to name and describe 100 species of braconid, he visited some 10 museums across North America and Europe just to examine long-dead wasps. In Berlin, in the 1980s, he passed through a checkpoint from West to East day after day on his way to inspect some key specimens. The guards would raise their eyebrows at his microscope in its big cylindrical metal case but then let him through. In the end, investigating, naming, and describing those 100 species took seven years.

The work was slow and tedious, and there were always doubters who questioned the point of it all: first Sharkey's father, who insisted that the pure sciences were frivolous and that his son should go into medicine or law, and later the head of Sharkey's undergraduate entomology department, whose face fell when he discovered that his student was interested in

studies on ecology and evolution, not agriculture and economics. But Sharkey relished the job. He loved how it felt to find patterns within chaos, teasing out and learning to recognize the subtle physical differences that distinguished one genus or species from another. He loved being able to walk through a forest or grassland and identify the key players in tiny dramas, to observe the complex ways in which insects' lives interacted with each other. And then there was that feeling of discovery, the thrill of the new, of doing his part to expand the world of human awareness, however slightly. Naming a new species, he thought, felt a little like summiting a mountain or discovering the wreck of a Spanish galleon. Even if it was a tiny wasp.

But that was then. As genetic technology became cheaper and more accessible, Sharkey decided to revisit his old work to see how the distinctions he'd made based on an animal's morphology—those subtle physical details—compared to the differences evident in its DNA.

The results shocked him. The work hadn't just been slow; much of it seemed to be wrong. According to the genetics, some of the animals he'd diagnosed as one species were best understood as four or five; others, which he'd named as multiple species, were only one. It seemed that as much as half of his work was, at best, misleading. "The morphological work I was doing was just garbage," Sharkey said. "I thought, my God! I've wasted 20 years of my life, or at least my professional life."

The DNA barcoding technique that Sharkey used was pioneered by the Canadian biologist Paul Hebert, who proposed the idea in 2003 after looking at barcodes in a grocery store. How could we track so many flavors of Pop-Tarts and pasta sauces, he wondered, but not the living things with which we share the planet? Hebert later founded a major institution, the Centre for Biodiversity Genomics at the University of Guelph, which has championed the technique and built a database of genetic barcodes and the organisms they key to, in order to help speed identification. This system algorithmically lumps together sequences whose genetic relationships are particularly close. These sequences are assigned the same barcode index number, or BIN.

Since Hebert developed the technique, the use of DNA barcoding has expanded in dramatic and creative ways. You can, for example, test the DNA present in snow or river water or soil, or even in the stomachs or excrement of animals, and thereby “see” the many organisms that have passed invisibly through the landscape or digestive tract. Often, though, the DNA reveals only more secrets: These ecosystems can be full of mystery creatures whose genetic data is not yet associated with any name at all. Not all are necessarily “new” to science; in some cases they may have been named and filed away in a museum but never really studied again, and the link between their name and their DNA has not been made. The taxonomist Roderic Page once dubbed these unnamed species “dark taxa.” Some other scientists soon adopted the term to refer to a bigger darkness—the enormous category of all undefined life. As with dark matter or dark energy, here is a force that humans generally don’t see or understand but that has a profound effect on how our natural cosmos works.

When the taxonomist Rudolf Meier and a group of coauthors analyzed more than 200,000 insects caught in malaise traps in eight countries, in habitats ranging from tropical rain forests to temperate meadows, they found that the insect families that dominate the natural world—the hyperdiverse ones full of species whose interactions (such as pollination or predation or decomposition) with other organisms play key roles in ecosystems—are also the families that are among the least known. Meier called this “the neglect index.” The same phenomenon, he told me, extends to lots of other key groups, from microbes to fungi to ringed worms, that quietly help keep the world running despite not having much in the way of names. “From a biomass point of view, from a species diversity point of view, a lot of the taxa that have received most of our attention are not important,” he said. “But all the taxa that we have been neglecting *are* important.”

The other big surprise of barcoding was how often it revealed that even the knowledge we thought we had was, in fact, incomplete or flawed. Sharkey’s experience of watching the genetics contradict his morphological analysis is becoming a common one. In the past 15 years, scientists have split what they thought was a single giraffe species into four, the orca whale into at least three, the well-known and long-studied *Astraptes fulgerator* butterfly into 10. Often, a discovery of genetic difference kicked off a closer look at

animals' survival and reproductive strategies, at their morphology and how they interacted with their ecosystems, which in turn revealed meaningful differences that had gone unnoticed or unappreciated. I talked to Guilherme Oliveira, a researcher in Brazil, who barcoded an Amazonian ecosystem and found hundreds more plant species than anyone had expected—a profusion of biodiversity that scientists had previously failed to see.

Parasitoid wasp species are proving equally full of hidden diversity. Where entomologists once saw one or two generalist species—organisms capable of parasitizing a variety of different hosts—DNA barcoding will sometimes reveal a dozen specialists, which are much more narrowly adapted. This is not just reclassification for its own sake. Specialists are particularly vulnerable to extinction, and the particulars of who eats whom can matter a great deal in ecosystems—including those that humans depend on most. On farms, when introduced pests, freed from the constraints of their natural predators, destroy vital crops, suddenly it's a race to identify the right parasitoid defender to stave off failure or famine. The wasps are air-dropped like tiny paratroopers into crisis zones.

Sharkey examines dried and pinned braconids from his collection.

Photograph: Damien Maloney

in his office in Colorado, Sharkey showed me old monographs and morphological keys meant to guide people in identifying various parasitoid wasps. He lamented how “useless” they were. Some of the written descriptions seemed like they wouldn’t be much easier to follow than a genetic code; many specimens didn’t key out to a species, or keyed out to the wrong one, because the keys included only the small subset of species that had been discovered at the time and no information on the much wider world that really existed.

When he first learned that his morphological work had been so mistaken, Sharkey told me, he felt depressed and demoralized. But then he became an evangelist. The slower road, he said, continued to make more sense for well-studied groups associated with long scientific literatures. But a hugely speciose and mostly unknown group like the braconids, he insisted, was different. What was the point in making morphological keys if they didn’t

work very well and hardly anyone looked at them? The sheer scope of the unknown demanded triage. Better to barcode quickly now and do the in-depth descriptions later, if there was ever time.

The approach made sense to some scientists. There are groups that are so large and so cryptic, and in so much danger from the ongoing collapse in biodiversity, that it's "not logistically feasible to do the taxonomy the old way," Scott Miller, the curator of *Lepidoptera* for the National Museum of Natural History, told me. "In order to meet the challenges at hand, we have to move faster." Dan Janzen, the renowned entomologist who provided the Costa Rican braconids in the original *ZooKeys* paper (on which he and his wife, the tropical ecologist Winnie Hallwachs, are coauthors), believes that as barcoding becomes cheaper and more accessible, it will help democratize the process of gathering information about the world's biodiversity—and encourage more people to have a stake in protecting it. This is the power of naming, he said. Names help us relate to a species, see it, notice it, care about it. "*Bioalfabetización*," he calls the process in Spanish: the development of biological literacy.

The mountains surrounding Sharkey's current home in Forest Falls, California.

Photograph: Damien Maloney

An insect trap in Sharkey's front yard.

Photograph: Damien Maloney

But others warn that taxonomy can't afford to sacrifice precision for speed, and that it needs to respond to technological advances by incorporating more types of information, not fewer. Some of the arguments are about accessibility: How can the field become more democratic if you need access to a sequencing lab to identify a bug in your own backyard? Other objections are technical. The mitochondrial gene that's usually used in barcoding, called cytochrome oxidase 1, or CO1, is not necessarily the best option for analyzing the genetic differences between species, especially as technology has expanded to allow for cheaper analysis of a fuller genetic picture. CO1 isn't directly related to reproduction, and it doesn't work well

for all groups of animals. (Fungi, for example, or oak gall wasps, which Zhang studies—if you look just at CO1, he says, you miss the entire diversity of this megadiverse group.)

Meier agrees that taxonomy needs to be sped up dramatically if it is to take on the great unknowns of the natural world, let alone keep up with the speed at which nature is being destroyed. But he believes the future lies in integrating barcoding with a variety of other advanced technologies, including robotics and machine learning, which can perform rapid analysis of images and discern species based on subtle differences that humans struggle to see.

The goal shouldn't be to file other organisms into our own human systems, one scientist said, but to try to “think of it from the way they think about themselves.”

Meier and Sharkey have gone back and forth in journal articles over whether Sharkey's method unfairly equates BINs, which are changeable categories whose boundaries can shift as new data is added, with species, which are meant to be stable reflections of separate evolutionary histories (despite being muddled by differences across geographic ranges, niches, and populations). When Meier performed his own analysis, which ran some of the same data through different algorithms, it sorted the wasps into a slightly different configuration of species than the algorithm Sharkey had used. The technology had improved, but a version of the old lumping-splitting debate was still there. The boundaries between species still shifted depending on who, or what, was drawing them.

The microscope in Sharkey's home office with a pinned braconid on the stage.

Photograph: Damien Maloney

The act of taxonomizing species captures humans at our most confident: Here we are, making grand pronouncements about what other creatures are, about *who* they are, naming them just like Adam before the Fall. Yet our desire to name nature has always run up against the grand abundance and wild complexity of the world we actually live in. In one telling, the story of

our quest to understand the biodiversity around us is one of ever-expanding knowledge. In another, it's a tale of ever-expanding ignorance, of learning just how much we don't yet understand. While both morphology and genetics can tell us a lot about how other creatures survive on Earth, there will always be parts of other organisms' lives that matter very much to them but are hidden from us. Many insects, for example, can see spectra of light that we can't, and so look quite different to each other than they do to us. Plants use complicated chemical signals to communicate with each other, as well as with their predators and benefactors. Many animals, from birds to frogs to Belding's ground squirrels, differentiate themselves by smells or calls more than by looks, and scientists are increasingly turning to these differences to try to tell them apart. The goal shouldn't be to file other organisms into our own human systems, Miller said, but to try to "look closely at these organisms and think of it from the way they think about themselves."

This means trying to recognize, and minimize, the extent to which we're limited by our own biases, which include our tendency to privilege the visual over the olfactory or aural, the diurnal over the nocturnal, the big over the little, and animals with relatable faces over those without. The scientist Robert May, who helped pioneer the field of theoretical ecology, has characterized our ignorance of species without features and lives "akin to our own" as "a remarkable testament to humanity's narcissism." In *Naming Nature*, a book about the history of taxonomy, the science journalist Carol Kaesuk Yoon takes a more generous view: "There is nothing harder to see," she writes, "than one's own frame of reference."

Even as they argued with each other, the taxonomists I spoke to each described their work as an exercise in humility, of trying their best before a daunting unknown, and learning, over and over, how much they don't know. It can be a painful job, as a group of them wrote, "documenting this monumental historical loss of biodiversity and, in some cases, grimly identifying and naming new species already extinct or destined thusly." Even the fiercest arguments about methods and goals boil down to this: We live in a world of diversity that exceeds the grasp of our knowledge, but not our ability to destroy it.

Before I left Colorado, Sharkey opened a new box of vials that had recently arrived via the barcoding lab in Canada: more braconid wasps, this time from a large, and largely unknown, subfamily called *Doryctinae*. They had also been collected in Costa Rica and were now waiting to be named, in a new paper that would use a minimalist method similar to the one that had caused so much furor.

Sharkey poured the first one out of its vial, and it splashed onto a sheet of paper, tiny and anonymous. And then he put the wasp under the microscope.

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Nov 8, 2022 6:00 AM

Inside Meta's Oversight Board: 2 Years of Pushing Limits

Mark Zuckerberg set up the panel to investigate how his company handles controversial posts. Now its members want to transform how social platforms work.

Illustration: Deena So’Oteh

On the morning of Thursday, June 30, 2022, two large luxury buses pulled up to a grand hotel in Menlo Park, California. Milling on the driveway were the members, staffers, and trustees of the Oversight Board. Set up two years ago by Facebook, now [Meta](#), this august gaggle exists to second-guess the company’s most controversial actions. The board members, who’d already logged countless hours on video calls and email, were spending their first week together in person. The buses rumbled off, whisking the 23 Zoom buddies to Meta’s headquarters 4 miles away.

The group made its way across the mammoth Gehry–designed complex to a verdant outdoor amphitheater known as the Bowl. Sheryl Sandberg, Meta’s [outgoing](#) chief operating officer, greeted the crowd in the midday heat. Next up was Nick Clegg, the company’s president for global affairs. Clegg was almost startling in his effusive praise of the board. He was taking questions from the members when, suddenly, the large screens in the Bowl lit up with a familiar face.

This article appears in the December 2022/January 2023 issue. [Subscribe to WIRED](#). Illustration: Boldtron

[Mark Zuckerberg](#)'s expressionless visage peered down at the sweaty visitors. Though Zuckerberg had personally willed into being this body of overseers—overseeing *him*—he had never met with all its current members. Meta's founder and CEO didn't share his location, but a fair guess would have been that he was at his Hawaiian island retreat, where he had spent much of the previous year. Staring into his webcam, Zuckerberg congratulated the board on its work so far. Free expression, he said, has always been part of his company's mission—but sometimes people use their voices to put others in danger. Meta shouldn't be making so many decisions on speech by itself. Zuckerberg finished his talk with a wholehearted endorsement. "This has been important to me from the beginning," he said, "and I'm committed to the board for the long term."

Indeed, a few weeks later, Meta announced it would give the board \$150 million—more than double its original commitment—to keep the project going through 2025. So far, the board has received nearly 2 million appeals on content and ruled on 28 of them. It has made 119 recommendations to Meta. Its judgments have involved wampum belts, blackface, and the removal of a former US president from Facebook.

Some critics see the Oversight Board as an exercise in corporate ass-covering by a bunch of Meta's puppets. If the company doesn't want to make a controversial call, it can push the board to take a position on the issue and, conveniently, take the heat. Emi Palmor, a board member who once served as the director general of Israel's Justice Ministry, says she's frequently approached in the supermarket by people seeking tech support for Meta apps. "I want to murder the person who chose the name Oversight Board," she says. "It is an unexplainable term."

But since it started hearing cases in the fall of 2020, the board has won grudging respect from the human rights organizations and content moderation wonks who pay attention to its work. "People thought it would be a total fiasco," says [Evelyn Douek](#), a Stanford law professor who follows the board closely. "But in some real ways, it has brought some accountability to Facebook." Meta, meanwhile, is declaring victory. "I'm absolutely delighted—thrilled, thrilled, thrilled with the progress," Clegg

says. The board's approach to cases "is exactly what you should expect between a social media platform and an independent oversight entity."

The truth is more complicated, and Clegg's ebullient praise and Zuckerberg's encouraging mahalo make board members nervous. If one of the world's most transgressive companies thinks that the oversight is going fantastically, how great can the board be? Suzanne Nossel, a member who is also the CEO of the literature and human rights nonprofit PEN America, thinks it's too early to make a call. "We've only just begun to figure out how to do this work," she says.

The board has figured out one big thing: It has an opportunity, with caveats, to alter how the internet's Goliaths treat the speech of billions of people.

Even after more than two decades of social media, the way platforms patrol their corridors [can seem arbitrary and self-serving](#). Imperfect algorithms and armies of undertrained, overworked moderators make life-altering decisions. People scramble to contest them, filing millions of appeals every month. They dig through help pages, argue with bots, and most often give up in frustration. The policies that supposedly balance free expression and safety were drawn up by companies whose priorities are growth and profit. "The platform was not designed with integrity in mind," says Jamal Greene, a Columbia law professor who is one of the board's cochairs. "It was designed with reach in mind."

No one wants the government to step in and bash out rulings on edgy posts. But online speech is still speech, and people expect some rights around it. The Oversight Board is a first stab at securing those liberties and, in its most ambitious form, a chance to stem some chaos. But the deeper the board's members get into the issues, the more they find themselves bumping up against the edges of what Meta will let them do.

Illustration: Deena So'oteh

The great experiment of the Oversight Board started on a bike ride. In January 2018, Noah Feldman, a professor at Harvard Law School, was visiting the Bay Area and crashing at his friend Sheryl Sandberg's house. One day, he was pedaling around the local foothills when his mind turned to

Facebook. The problem with his host's social media employer, he thought, was that no matter what it decided on a given piece of content, someone would be mad at the company. Perhaps it could benefit from a separation of powers. By the end of his ride he had a suggestion for Sandberg: Facebook should create [its own version of the Supreme Court](#), an independent body that would examine the biggest complaints about the company's decisions.

Sandberg brought the idea to Zuckerberg, who had been pummeled for months about speech on his platform and was now thinking about "governance" as a way to signal that he wasn't the dictator of the world's expression. He embraced the concept. In June of that year, I met Zuckerberg at Facebook's headquarters for a walk through its 9-acre rooftop gardens. As we strolled, he shared a vision of an independent body that would make binding decisions on content. "We need to figure out the mechanism for appointment—but they don't report to me," he said. "They're not likely going to be Facebook employees." He understood then that he would need to fend off the impression that the overseers were his flunkies.

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Zuckerberg's MO for new initiatives is to rely on loyal long-time lieutenants to make them happen. In this case, Facebook used an internal team of governance nerds. It was headed by Brent Harris, an attorney with experience in climate and environmental work, and Heather Moore, who had worked in the US Attorney's Office in Newark, New Jersey. Both said they saw it as a chance to help people on the platform. (Harris now heads a governance group at Meta that includes the board's support team.)

For a company that once boasted of moving fast, Facebook set up its board with the cautious deliberation of a 19th-century government railway bureaucracy. Buy-in was not universal. "I was skeptical we would get much benefit," says Monika Bickert, who heads global content policy. (It would be her rules that the board would question.) But the team plodded forward, set up a series of workshops, and solicited suggestions from outsiders on

how the board should operate. Some participants would wind up filling its seats.

By 2020, Facebook had set up the board as an independent trust with a \$130 million grant. The company would pay up to 40 board members six-figure salaries for what was estimated to be 15 hours of work each week. A full-time staff would support the effort, like clerks for Supreme Court justices. A lengthy charter set the ground rules. The meat of the board's activities would be handling disagreements over individual posts. Perhaps Facebook or Instagram had removed someone's post for violating its terms, and the user wanted to contest that decision. The board could rule on posts, but not ads, algorithms, or groups. (That stuff might come later.) A case selection committee, made up of board members, would extract from the sea of appeals the cases the board would take on, then assign them to five-person panels. Those groups would evaluate their case and reach a decision. Facebook was bound to honor the board's rulings on individual posts.

But there was more. The board could include in its case rulings sweeping recommendations, which the company could take or leave. If it rejected the suggestions, it would have to explain itself, but that would be it. The board *could* get a crack at the company's knottiest conundrums through a "policy advisory opinion"—a request directly from Meta for the board to review an especially controversial decision. Meta could again accept or reject whatever the board advised.

To this day, Facebook and Instagram users are not guaranteed that when some robot blocks their speech, a human being will ever see their complaints.

In May 2020, the company announced it had recruited a distinguished collection of lawyers, journalists, and human rights activists to [become the board's first 20 members](#), including four cochairs. There was a former prime minister of Denmark, a Pulitzer Prize-winning former newspaper editor, and a Nobel Peace Prize laureate. All the members had one thing in common—a resolve that they be seen as independent of the company funding their paychecks.

Still, Facebook's [critics](#) were ready to call out the Oversight Board [as a sham](#). Jessica Gonzalez is the co-CEO of Free Press, a group opposed to corporate control of media, and one of a motley collection of company detractors—including full-time Meta apostate [Roger McNamee](#) and Nobel laureate [Maria Ressa](#)—who created a shadow organization called the Real Facebook Oversight Board; it is dedicated to issuing body blows to everything its namesake does. The *really* real board “is a PR stunt,” Gonzalez says, “that gives Facebook cover for not adequately investing in the integrity of its systems and not doing enough to keep people safe.”

In January 2021, the board ruled on its first cases—and set a pot of tension on simmer. The previous October, a Brazilian Instagram user touting a breast cancer awareness campaign had posted an image with several examples of post-surgery breasts. An algorithm trained to seek and destroy nipple content took down the post. Once the board accepted the case, the company decided to manually review the post. Nudity for the sake of medical awareness was within Instagram’s rules, so the policy standards team restored the post. With the issue now moot, the company told the board to drop the case.

The members declined. Their insistence was a message: While their decisions were nominally about individual pieces of content, the real work was in interrogating company policies. They were out to change Meta.

In the write-up of their decision—reaffirming that the post should stay up—the board members exposed how this seemingly trivial, fixable mistake was a window into a deeper failure. The company overly relied on algorithms, which in this case didn’t pick up the Portuguese for “breast cancer.” Removing the post, the board argued, raised “human rights concerns.” Citing the International Covenant on Civil and Political Rights, a foundational United Nations treaty, the board wrote, “Any restriction on freedom of expression must be for a legitimate aim.” It recommended that anytime a user appeals an algorithmic decision of this sort, that person should automatically be granted a human content moderator. “We basically asserted our authority even though Facebook had decided to reinstate the content,” says board member Ronaldo Lemos, a law professor from Brazil. “At the same moment we said, ‘We want to talk about algorithms.’”

A pretty reasonable request—except the company did not follow up on the board’s recommendation. To this day, Facebook and Instagram users are not guaranteed that when some robot blocks their speech, a human being will ever see their complaints. The board was imagining a world in which social media platforms would have to at least treat their users like human beings. The members would keep pressing to make that happen, because, well, human rights are their thing.

Illustration: Deena So’Oteh

The board had issued only [a handful of rulings](#) when a bombshell of a case dropped: the suspension of President Donald Trump.

In the heated hours of the insurrection on January 6, 2021, Trump blessed the violent protests in posts on Facebook and Instagram. The company swiftly removed the posts and suspended him from both platforms indefinitely. The MAGA crowd cried censorship. Anti-Trumbers were outraged that the ban wasn’t permanent. On January 21—perhaps not coincidentally, after a new US president had been inaugurated—Facebook told the board members to [figure it out](#). “It was a very, very simple decision,” Clegg says of requesting a public advisory opinion. “Just imagine if we hadn’t deferred that decision to them. People would’ve quite rightly said, ‘You’ve created an oversight board, and you won’t even share with them this dilemma of what to do with the former elected president of the most powerful democracy on the planet.’”

For the board, though, the moment was perilous. Both pro- and anti-Trump observers were ready to pounce on any misstep; a clumsy move could have sunk the whole experiment. After months of deliberation, the board backed the company’s decision to remove the former president’s incendiary words on Facebook and Instagram and to boot him from the platforms. But the board once again demanded that the company make its policies more explicit. In [its ruling that spring](#), the board excoriated Facebook for basically making decisions on the fly—and for refusing to provide a time frame for the ex-president’s restoration. By not having clear standards for suspensions, the company was failing the public. “Facebook shunned its responsibility,” said board cochair Helle Thorning-Schmidt, a former prime minister of Denmark.

The board's [commentary](#) on that high-profile case pointed to one of its obsessions: Facebook's lack of transparency about its own rules. The board returned to it frequently and became adept at choosing complaints with the most potential for broad impact. "Case selection is the whole game," says Nicolas Suzor, a board member and law professor from Australia. Suzor is at times on the selection committee that decides which issues the board wants to address and has staffers sifting through thousands of appeals to find cases that fit.

In April 2021, the committee plucked out a case that came to be known as Ocalan's Isolation. Abdullah Ocalan is a founding member of the Kurdistan Workers' Party (PKK), a group that Facebook had designated a "dangerous entity." He is currently incarcerated on a Turkish prison island in perpetual solitary confinement. A few months earlier, an Instagram user in the US had posted a picture of Ocalan with the words "y'all ready for this conversation?" and urged people to discuss the conditions of the prisoner's confinement. Facebook removed it. Company policy bans posts in support of people involved in dangerous entities. This post wasn't that.

The board was eager to tackle the issue. "You have an organization that you can't talk about," says board member Julie Owono, who is executive director of the digital rights organization Internet Sans Frontières. "Yet you have a leader whose situation has been internationally recognized as a violation of the person's human rights."

Researchers within the company started digging up background information on the case, much of it from Facebook's private databases. While going through files, they stumbled on an embarrassing detail: The issue of Ocalan's imprisonment had come up before. The company had even created a special policy that allowed posts from users who advocated for humane treatment but weren't themselves PKK supporters. But that instruction, written in 2017, was never made public. It was evidently forgotten *inside* the company too, as it routinely took down posts regarding the conditions of Ocalan's confinement. Facebook was violating its own rules. "When I found out about that disconnection, I thought, that's precisely why I came here," Owono says.

In its first year, the board steadily pushed the company to fix its imperious attitude toward complaints. Users were seldom informed why posts were taken down or why seemingly obvious violations were allowed to remain. The board views this Kafkaesque behavior as one of the company's ongoing insults to human rights. "It was something I wouldn't have thought was even a problem before I joined the board," says Greene, one of the cochairs. "But we realized it's a huge problem." In 2021 alone, six of their 20 rulings recommended that when the company removes a person's content, it should inform the user what rule they broke.

The battle proved to the board that its mission was not to rule on the fate of one post or another, but to make Meta own up to the monster it has created.

When I bring this up with Clegg, he acts as if the board's continued pounding on this topic is the greatest thing since targeted ads. "A thousand percent!" he says. "The main early, consistent drumbeat of criticism we've had from the board—and I think it's totally understandable—is that you're not explaining to users where you stand, and users feel you are applying arbitrary decisions." Citing the board's criticisms, Meta revealed this summer that it was creating a customer service group to provide explanations of its takedowns and suspensions.

It took multiple decisions, but the board had [made its point](#). Now, "Meta is more transparent with its users about what they've done wrong," Greene says.

The battle proved to the board that its mission is not to decide the fate of one post or another, but to make Meta own up to the monster it has created. On the page of the board's website where users lodge their complaints, the text does not read, "Get your post restored" or "Fix this bad decision." The call to action says, in giant letters, "Appeal to shape the future of Facebook and Instagram."

While the board racked up points with that win, it still has limited leverage. When the board makes recommendations, a Meta working group determines whether the company will implement them. "We treat the board the way we do a regulator," says Harris, the lawyer who helped set up the board and remains its closest contact within Meta. There is, of course, a

difference. While there are consequences for ignoring a regulator, Meta is free to do as it wishes. Of the board's 87 recommendations through the end of 2021, Meta claims to have fully implemented only 19, though it reports progress on another 21. The company brushed off another 13 recommendations by saying, without elaboration, it is "work Meta already does." Other recommendations are outright refused.

"We don't have a police force," Owono says. "But I don't think it prevents us from holding the company accountable, at least to its users." A board committee is studying how to make their recommendations harder to dodge.

By early 2022, two themes were emerging in the relationship between Meta and its Oversight Board. In some company quarters, the board's decisions were having a positive effect. Even Meta's content policy head, Bickert—whom one board insider cited to me as a powerful internal detractor of the effort—says that she now often asks herself, "What would the board think?" Some board members, however, were feeling increasingly frustrated with the boundaries they were forced to work within and the obstacles they felt that Meta was intentionally placing in their path.

One point of friction is how the board grows. In an early conversation I had with Meta's Harris and Moore, the idea was that the company would help choose the first tranche of members, then step aside. But in the board's charter, the company gave itself a say in selecting the full complement of 40 members. Meta employees remain deeply involved in hiring and are a factor in why the board is still far short of the total number set out in its charter. "While it's hard to find the right kind of people, I don't know that's an excuse for operating at 50 percent capacity," says Douek, the Stanford law professor who keeps an eye on the board's activities.

Meta's influence became hard to miss when the board invited [Renée DiResta](#) to interview. DiResta, the technical research manager of the Stanford Internet Observatory, was interested in becoming a member, she says, because it "would be an opportunity to shape the direction of something that I think has real potential." DiResta has degrees in political science and computer science. Beginning in April 2021, she underwent multiple interviews. On paper, her inclusion made a lot of sense. The Oversight Board lacks experts on algorithms, so her presence would fill a

void. But there was a problem: She has been a consistent critic of Meta's failure to deal with the harmful disinformation on its platforms.

In March 2022, DiResta got an email rejecting her application. "They said they were going in a different direction," she says. That direction, it turned out, was the same as before. The board proceeded to add three more members who, like the first 20, are lawyers or journalists with no technical background. One person familiar with the process says it was Meta's reservations that put the kibosh on the nomination. Harris, of Meta, says that "the company has expressed concern in some instances about who may or may not be more effective in certain lights as a board member." Meta further explains it is not unusual for multiple people to withhold their endorsement, and that the exceptions are the candidates who earn consensus and get hired. (That's a big reason why the board has trouble filling its vacancies.) If the board were truly independent, of course, it would never solicit, let alone entertain, Meta's concerns.

Around the time of DiResta's rejection, board members were also fuming over another dispute with Meta. They wanted access to a basic company-owned tool that would help them choose and contextualize their cases. Called CrowdTangle, the software is essential for analyzing the impact of Facebook and Instagram posts. It is used internally and by selected outside researchers and media organizations. Getting access seemed like a no-brainer; investigating a case without it is like assessing damage to a coal mine without a flashlight. The board spent months asking for access, yet Meta still didn't grant the request. It seemed clear that *someone* at Meta didn't want the board to have it.

Ultimately, the issue came up in a March 2022 meeting with Clegg, who seemed taken aback by the board members' frustration. He promised to break the logjam, and a few weeks later the board finally got the tool it should have had from the start. "We had to fight them to get it, which was baffling," says Michael McConnell, a Stanford law professor who is one of the board's cochairs. "But we did it."

No sooner had that skirmish been resolved than another incident roiled the waters. When Russian troops invaded Ukraine last February, Facebook and Instagram were quickly overwhelmed with questionable, even dangerous

content. Posts promoting violence, such as “death to the Russian invaders,” were in clear violation of Meta’s policies, but banning them might suggest the company was rooting for those invaders. In March, Meta announced that in this narrow instance, it would temporarily allow such violent speech. It turned to the board for backup and asked for a policy advisory opinion. The board accepted the request, eager to ponder the human rights conundrum involved. It prepared a statement and set up appointments to brief reporters on the upcoming case.

“There are plenty of people in the company for whom we’re more of an irritation,” says board member Michael McConnell. “Nobody really likes people looking over their shoulders and criticizing.”

But just before the board announced its new case, Meta abruptly withdrew the request. The stated reason was that an investigation might put some Meta employees at risk. The board formally accepted the explanation but blasted it in private meetings with the company. “We made it very clear to Meta that it was a mistake,” says Stephen Neal, the chair of the Oversight Board Trust, who noted that if safety were indeed the reason, that would have been apparent before Meta requested the policy advisory opinion.

When I asked whether Neal suspected that the board’s foes wanted to prevent its meddling in a hot-button issue, he didn’t deny it. In what seemed like an implicit return blow, the board took on a case that addressed the very issues raised by Meta’s withdrawn advisory opinion. It involved a Russian-language post from a Latvian user that showed a body, presumably dead, lying on the ground and quoted a famous Soviet poem that reads, “Kill the fascist so he will lie on the ground’s backbone … Kill him! Kill him!”

Other members also noticed the mixed feelings inside Meta. “There are plenty of people in the company for whom we’re more of an irritation,” McConnell says. “Nobody really likes people looking over their shoulders and criticizing.”

Since the board members are accomplished people who were probably chosen in part because they aren’t bomb throwers, they’re not the type to declare outright war on Meta. “I don’t approach this job thinking that Meta is evil,” says Alan Rusbridger, a board member and former editor of *The*

Guardian. “The problem that they’re trying to crack is one that nobody on earth has ever tried to do before. On the other hand, I think there has been a pattern of dragging them screaming and kicking to give us the information we’re seeking.”

There are worse things than no information. In one case, Meta gave the board the *wrong* information—which may soon lead to its most scathing decision yet.

During the Trump case, Meta researchers had mentioned to the board a program called Cross Check. It essentially gave special treatment to certain accounts belonging to politicians, celebrities, and the like. The company characterized it to the board as a limited program involving only “a small number of decisions.” Some board members saw it as inherently unfair, and in their recommendations in the Trump case, they asked Meta to compare the error rates in its Cross Check decisions with those on ordinary posts and accounts. Basically, the members wanted to make sure this odd program wasn’t a get-out-of-jail-free card for the powerful.

Meta refused, saying the task wasn’t feasible. (This excuse seems to be a go-to when the company wants to bounce the board’s suggestions.) Meta also pointed the board to one of its previous statements: “We remove content from Facebook no matter who posts it, when it violates our standards.”

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In September 2021, *The Wall Street Journal* began publishing leaked documents showing that Cross Check actually involved *millions* of accounts. The program wound up shielding so much improper content that even its own employees had condemned it as allowing the powerful to circumvent the company’s rules. (One example: Trump’s infamous Black Lives Matter-related post that said, “When the looting starts, the shooting starts.” Another was a soccer star’s nude photos of a woman who accused him of rape.) In a May 2019 internal memo, dismayed Facebook

researchers had written, “We are knowingly exposing users to misinformation that we have the processes and resources to mitigate.” Another internal paper put it bluntly: “We are not actually doing what we say we do publicly.”

Meta was busted. Its claims to the board about the Cross Check system were at best a gross understatement. “I thought it was extremely disrespectful that Facebook so openly lied to the Oversight Board,” says former employee [Frances Haugen](#), who leaked the papers and has met with the board privately to discuss the program.

The board demanded that Meta explain itself, and the company admitted, according to the board’s transparency report, that it “should have not said that Cross Check only applied to ‘a small number of decisions.’” The board stated that if it couldn’t trust Meta to provide accurate information, the entire exercise would crumble. Suzanne Nossel, the PEN CEO, says she worried that the company’s deceptions might hobble their project. “I was chagrined and concerned about the credibility of the board, our ability to carry out our work,” she says.

Meta’s next move was reminiscent of its buck-passing in the Trump decision—it asked the board for *its* views on the program. Over the next few months, the board set up a committee to study Cross Check. Most of the meetings were virtual. But in April, the committee managed to meet for several days in New York City. The six members of the board and their prodigious staff took over several meeting rooms at a law firm in Midtown. After much pleading on my part, I sat in on one of their deliberations—the first time a journalist was allowed in an official Oversight Board session. (I had to agree not to attribute quotes to members by name.) It should not be the last; the mere glimpse I got showed just how frank and determined these semi-outsiders were to change the company that had brought them together.

Can Meta claim the right to favor certain customers? Of course not, because it is so entwined with the way people express themselves around the globe. At one point, a board member cried out in frustration: “Is being on Facebook a basic human right?”

Fifteen people gathered around a set of tables arranged in a rectangle and set up with all the formality of a United Nations summit. A team of translators was on hand so every member could speak their native language, and each participant got an iPod Touch through which to listen to the translations. Once the conversation got underway, it quickly became heated. Some members abandoned their home tongues and spoke in less-polished English so the others could hear their urgency straight from their mouths.

I wound up monitoring perhaps an hour of a much longer session. From what I could perceive, the board was evaluating the program from a human rights perspective. The members seemed to have already concluded that Cross Check embodied inequality, the exact opposite of Meta's claim that "we remove content from Facebook no matter who posts it, when it violates our standards." One member referred to those in the program as the Privileged Post Club.

The board members seemed to understand Meta's argument that giving special treatment to well-known accounts could be expeditious. Employees could more quickly assess whether an improper post was excusable for its "newsworthiness." But the members zeroed in on the program's utter lack of transparency. "It's up to *them* to say why it should be private," the cochair who was moderating the session remarked.

The members discussed whether Meta should make public all the details of the program. One suggestion was that the Privileged Posters be labeled. After listening to all this back-and-forth, one member finally burst out an objection to the entire concept of the program. "The policies should be for all people!" she exclaimed.

It was becoming clear that the problems with the Cross Check program were the same seemingly intractable problems of content moderation at scale. Meta is a private service—can it claim the right to favor certain customers? Of course not, because Meta is so entwined with the way people express themselves around the globe. At one point, a member cried out in frustration: "Is being on Facebook a basic human right?"

Meta, meanwhile, was still not sharing critical facts about the program. Was Cross Check singling out people solely to clear questionable content, or was

it giving some people extra scrutiny? The board hadn't gotten an answer. After that meeting, members and staffers met with Meta officials and unloaded on them. "We were pretty blunt and tenacious in trying to get the information we wanted," Rusbridger told me later. "They were a bit bruised; they thought we had behaved discourteously." He says that the board got some of the details it sought—but not all of them.

Despite the frustrations so far, or perhaps because of them, the members are hoping to maneuver the board into a more visible, consequential spot. In October 2022, it announced that in recent months, Meta had been accepting more of its recommendations. Going forward, it might try to take on a wider range of cases, including ones on ads and groups. "I think we could double or triple the number of cases we handle without dramatically changing the nature of our operations," says Neal, the chair of the trust. "But let's assume we were doing 100 cases a year—is that alone enough to have a real impact on where platform content moderation is going? If you want to think about bigger impacts, you need to think about a much bigger organization." The board could start by filling all its open slots.

It could also start critiquing Meta's algorithms. Even though they fall outside the board's scope of influence, some of the group's recommendations have implicated the company's code. "We have our own freedom of speech," says Palmor, the lawyer from Israel. "Even if we don't talk directly about the algorithm, we do take into consideration the way content spreads." The next step would be to get more expertise on how algorithms actually operate, and to make more direct rulings. (Hiring Renée DiResta would have helped with that.)

Then there are the policy advisory opinions, the big-issue examinations that, to date, have all originated within Meta. Members wish they could also add to the list. If Tawakkol Karman, a board member and Nobel Peace Prize-winning journalist, had her way, she would demand action on Meta's notoriously high volume of bogus accounts, which she calls "a disaster." "They breed misinformation, hatred, and conflict, and at the same time, fake accounts are recruited to attack the real accounts," she says. "It's become a tool of oppressors." So does the board have plans to address the issue? "We are working on this," she says.

The board is now exploring how it might exercise its power beyond Meta. Neal says the organization is considering a role in the execution of the European Union's Digital Services Act, which will introduce a breathtaking suite of rules on digital platforms, including social media. The act includes a provision for mandatory appeals systems. Joining the effort might stretch the board thin but could also bring it closer to becoming, as some members dream, a more global force in content policy, with influence over other companies.

Never mind that Twitter, Snap, YouTube, and TikTok aren't exactly beating down the doors to get a piece of the Oversight Board. (Twitter's new CEO had, uh, tweeted to say he's setting up an advisory committee. Almost instantly, the Oversight Board responded with an offer to help, but so far he hasn't accepted.) The board's decisions don't even cover Meta-owned WhatsApp. "I think we are making a difference," Palmor says. "Do I think that the board has enough impact? My answer is no. I wish we had made more of a difference."

Yet both within Meta and on the board, people seem intoxicated by the idea of extended purview. For Meta, it would be a triumph if its competitors also had to play by its rules.

"We're not seeking to be the board for the industry," says Thomas Hughes, who handles the board's operation. "But we *are* seeking to understand how we might interrelate with other companies" to share what they've learned and "how we might interact with companies setting up different types of councils or bodies to talk about standards." It's ironic that a board convened to oversee Meta, a company whose sins spring from a mania for growth, now has its own visions of getting big fast.

This article appears in the December 2022/January 2023 issue. [Subscribe now.](#)

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By [Andy Greenberg](#)

[Backchannel](#)

Nov 8, 2022 6:00 AM

The Hunt for the Dark Web's Biggest Kingpin, Part 3: Alpha Male

As authorities discover their target's online alter ego as a boastful womanizer, their operation takes on a double life of its own—and a bold new ambition.

Cazes frequently ventured out in the evenings to pick up dates—from a 7-Eleven, from the mall, from his language class—and then posted about his exploits to a section of the Roosh V forum known as the “I-Just-Had-Sex” thread. Illustration by Hokyoung Kim

CHAPTER 6

RAWMEO

By March 2017, the always aggressive Fresno prosecutor Grant Rabenn was ready to charge Alexandre Cazes with running AlphaBay. But his more cautious colleague Paul Hemesath wanted more evidence. They were still busy filing subpoenas for not only Cazes' [cryptocurrency](#) exchange accounts but all of his online activity, from email to banking, which had begun to coalesce into a portrait of Cazes' entire digital existence. It was only in April that they found a new element of that life, one that revealed Cazes' daily thoughts to them with a level of detail they had never believed possible.

Their investigation had led them to an online forum called Roosh V. The site, the team quickly learned, was a kind of hypermasculine, alpha-male, pickup-artist community, as well as a hive of misogyny, alt-right racism, and anti-LGBTQ bigotry. Founded by the blogger Daryush “Roosh” Valizadeh in 2008, it had tens of thousands of registered users, men who coached one another on maximizing their sexual conquests and living an “alpha” lifestyle.

The Fresno team had found a curious individual on that forum. He had joined Roosh V in late 2014 and went by the name “Rawmeo.” The pseudonym appeared to be an allusion to his love of “rawdogging,” or unprotected sex. Rawmeo had written well over a thousand posts and achieved “True Player” status on the forum. He described himself as living large in Thailand, possessing a fortune in [Bitcoin](#), and owning a web-hosting and design firm—all attributes that matched Cazes’ public persona. When the prosecutor team subpoenaed Cazes’ PayPal account, they confirmed it: Cazes, the baby-faced programmer, was using his account to pay for a premium subscription to Roosh V. Rawmeo, the alpha male, was another of his many personalities.

This story is excerpted from the forthcoming book [Tracers in the Dark: The Global Hunt for the Crime Lords of Cryptocurrency](#), available November 15, 2022, from Doubleday.

Courtesy of Penguin Random House

In some respects, Rawmeo was the opposite of Alpha02. As a dark-web kingpin, Alpha02 was all business: He had restricted his communications with AlphaBay’s community to the bare minimum, issuing only the occasional colorless pronouncement about the site’s functions. Rawmeo, by contrast, was a full-color, tell-all persona, an outlet for Cazes to enjoy the rewards of his larger-than-life success, stretch out his ego, and wax lyrical about his personal philosophy. As he put it: “The person who gives the least amount of fucks will always have the upper hand.”

Cazes, it turned out, was a prolific poster to a particular Roosh V section known as the “I-Just-Had-Sex” thread, where he described how he would frequently pick up Thai women—impressing them with his Lamborghini or Porsche—and attempt to sleep with them with as few strings attached as possible. He described the women as “his harem” or else “plates,” a reference to the common Roosh V analogy of a juggler who keeps as many plates spinning as possible, never giving any of them so much attention as to become distracted and let one fall.

Every Rawmeo post ended with his lengthy signature, which summed up his lifestyle and extolled the paradoxical virtues of promiscuity for men and

virginity for women: “Living in Thailand, enjoying life, making money, not interested in Western woman, not giving a fuck about millennial problems, addicted to rawdogging. #NoHymenNoDiamond #PoppedCherryDontMarry #RealMenDontDateSingleMoms.”

Cazes, like many self-styled pickup artists, believed in a strict system of “sexual market value,” or SMV, that could be calculated to determine a man’s sexual fortunes. “The four pillars of SMV are Fame, Looks, Money, Game,” he wrote. “I’d say fame is #1.”

He described how he would explain to the Thai women he seduced that he was of a higher social class than them and they were lucky to have his attention, even briefly. “Once she started showing ‘strong personality’ I had to let her go,” he wrote of one woman. In another post, he counseled his fellow alphas to seek out single mothers for easy sex, but never a longer-term relationship. “Not interested in being a cuckold before even having started the relationship, but for the bang, it can be good,” he wrote. “Just let out a ‘fatherly’ vibe and you’re in.”

Cazes, like many Roosh V members, was obsessed with the threat of false rape allegations. He boasted of his solution, one that, for someone obsessed with privacy, was a shocking admission. “I secretly record EVERY new sex intercourse with a girl with a hidden camera in my room,” he wrote. “This is stored on an encrypted hard drive, ready to be pulled in case the shit hits the fan. If nothing bad happens, nobody will ever know that the video exists. I respect my girls’ privacy.”

In other posts, Rawmeo explained that he was married and in fact loved his wife, who was pregnant with their first child. He described her as possessing “everything a wife needs to have: virgin, well preserved body, university degree, complete family, no LGBT in social circle, cooks for me, doesn’t complain.” He said he kept tight control of her financially, storing most of his money in cryptocurrency, cashing out only what he needed, and never revealing his full net worth.

In some respects, Cazes was as privacy-minded as Rawmeo as he was as AlphaBay’s boss. He had fully compartmentalized his life, sealing off his philandering from his family almost as completely as he’d sealed off his

Alpha02 persona from his real-world identity. “I am what we call a professional cheater,” he wrote. He kept his wife ignorant of the second home he used for sex. He maintained fake IDs to prevent his “plates” from learning his real name. He even used separate phone numbers for his different personas’ communications and bragged that he spoofed the IMEI identifiers a phone carrier can use to link two numbers on the same device, even when the SIM card has been swapped.

“I have a completely different identity with my plates,” he wrote, “and there’s no way that my two lives can be linked together.”

Among the global group of agents now assigned to the AlphaBay case, no one spent more time with Rawmeo than Jen Sanchez of the Bangkok Drug Enforcement Administration office. She read and reread his every Roosh V message with morbid fascination, amazed by the lurid details of his sexual escapades and marveling at the hypocrisy of his commentary. “I strongly favor ethics rather than money,” wrote the drug kingpin and obsessive womanizer, explaining his decision not to do web design work for “social justice warrior” customers or rent his real estate properties to LGBTQ couples for weddings. “It is important to follow our principles even if it implies a loss.”

Sanchez’s central task in the AlphaBay case wasn’t to catalog Cazes’ affairs, of course, but to trace his financial assets. She mapped out his four homes in Bangkok—his bachelor pad, his primary residence, another for his in-laws, and his mansion under renovation—as well as his \$6 million, five-bedroom seaside villa in Phuket, his two sports cars and motorcycle, and even the Mini Cooper he’d bought for his wife. Despite years tracking corrupt politicians and organized criminals, she was amazed by Cazes’ casual extravagance. In one email, a complaint he’d sent to his favorite rooftop restaurant, Sirocco, about disappointing service, he mentioned in passing that he’d spent roughly \$120,000 at the restaurant in just the previous two months.

At another point in their daily surveillance, Sanchez’s supervisor, Wilfredo Guzman, and the Thai police watched Cazes enter a Mail Boxes Etc. store to ship a package of documents. The police intercepted it after he left and found inside an application for economic citizenship in Cyprus, one of

several countries where he sought to cache his wealth and perhaps find a safe haven, should the Thai authorities get on his trail. The documents provided a detailed accounting of Cazes' finances, helping Sanchez track down bank and cryptocurrency exchange accounts in not only Thailand but Lichtenstein and Switzerland, as well as millions of dollars in real estate investments in Cyprus. Later, she found yet another property in the Caribbean island nation of Antigua and Barbuda.

But as she carried out that financial tracing, Sanchez found herself becoming more and more obsessed with Cazes' Roosh V persona and the view into his personal life it offered. She discovered, just as tellingly, that his posts as Rawmeo revealed exactly *when* Cazes was online. A small gray figurine on Roosh V users' profiles, next to their usernames, would turn green if they were active on the site. When she saw that figure light up next to Rawmeo's name, she knew she was watching Cazes in real time, practically looking over his shoulder, into a part of his life he still believed to be secret.

In some cases, Sanchez's online surveillance and the work of agents physically watching Cazes could now match up his real-world behavior with his online confessional. Guzman and the Thai police, following Cazes and tracking his cell phone location, would see Cazes pick up a young woman from a 7-Eleven, take her to his bachelor pad, and disappear inside. The next day, almost without fail, Sanchez would see Cazes describe in detail on Roosh V the sex he'd had with the woman. It was as if they now had eyes not only on Cazes' movements but into the private recesses of his mind.

Into one recess of his mind at least. Cazes was careful never to give any hint on Roosh V of his other secret life as AlphaBay's creator. But his writing on the forum nonetheless displayed, Sanchez came to believe, a deep psychological portrait. He wrote in one post, for instance, of his childhood and how his parents' separation had affected him. "My father was pretty alpha, but he was absent," Cazes wrote. "He tried hiring the best lawyers to fight for custody, but because of equality, i was able to see him 4 days per month. He got dumped by my mother when I was around 19

months old, because she found someone more exciting—who dumped her 1 year after.”

Cazes complained that because he never had a chance to live with his father as a child, he'd been denied masculine experiences until the age of 18. He listed these essential male activities with bullet points. “Using a chainsaw, driving a motorcycle, go-kart racing, approaching girls, changing a tire. All this stuff had to be learned from scratch,” he lamented.

To Sanchez, this was Alpha02's origin story. She read it, perhaps a bit reductively, as the self-portrait of a man overcompensating, blaming his mother for what he perceived as his lack of masculinity, seeking in his adult life to become the ultimate “alpha” male.

Another autobiographical document the investigators dug up seemed to capture Cazes' lifelong feeling of being an outsider, smarter than most everyone around him but struggling to find his place in society. Cazes had filed an official form with the government of Grenada, another country where he was seeking economic citizenship, in which he described his work history. It offered in abbreviated, blunt terms his life story, from skipping the second grade at his elementary school in Trois-Rivières—“due to being too ‘advanced’ in regards to the rest of the class”—to dropping out of college and his attempts to find a normal job.

He wrote that he had worked, for instance, at McDonald's part-time for a few months during his first year of college but was fired “for not fitting in the gang.” He was fired from another Quebecois chain restaurant the next year for, he noted, “excessively eating on the job.” Cazes found another job at an insurance company for a few months but left “because the pay was too low and the work hours too long.” He wrote that he was fired from yet another job at a Canadian telecom firm for, again, “not fitting in the gang.” And yet another summer job between college semesters lasted only a month because “one of the shareholders hated me for having got the job without a diploma,” he wrote, “and I got fired when they found out that I was seeing his wife.”

What if, instead of merely arresting the admins, the agents commandeered the market? With one of the most active sites on the dark web under their

control, there was no telling what powers they might gain.

Sorting through the detritus of Cazes' private life could seem almost voyeuristic at times, Sanchez admits. But it wasn't merely a distraction. Occasionally, amid all his prurient and sordid posts, the investigators would find a gem of precious information for their case.

One such morsel appeared in a Roosh V thread in which members of the forum were debating Windows versus Mac operating systems. Cazes, a talented programmer and IT administrator who would never miss an opportunity to one-up his fellow alphas, chimed in to describe his personal computer setup: He ran Linux, the "Cadillac" of operating systems, he said. What's more, he described how he used LUKS encryption, or Linux Unified Key Setup, a free encryption tool specific to Linux that would securely scramble his laptop's entire hard disk whenever he so much as closed the lid of his machine. Without his pass phrase, not even the world's most powerful supercomputers could crack that encryption within many lifetimes.

For the team of investigators now close on Cazes' heels, this had enormous implications. They knew from cases like the takedown of [Silk Road](#) that there were three central components to a truly successful dark-web bust. To have dead-to-rights evidence of their target's guilt, they would need to seize AlphaBay's servers, arrest its administrator, and access his laptop.

Now, when they came for that laptop's secrets, they knew exactly what to expect. Just as the FBI had snatched Ross Ulbricht's laptop from across the table where he was working in a public library, they understood they'd need to seize Cazes' computer while he was using it if they wanted to capture it in an unencrypted state.

This presented a daunting challenge: Based on their physical surveillance of Cazes, he never seemed to log in to AlphaBay from anywhere other than his home. He had learned, it seemed, some lessons from his dark-web predecessor.

The team was six months into the AlphaBay investigation, and they had Alpha02 in their sights, practically within their grasp. But if they couldn't

also lay hands on his laptop in a live, open state, his most incriminating secrets would remain eternally locked inside it.

In May 2017, a core team of AlphaBay investigators—including Rabenn, Hemesath, Miller, and the prosecutor Louisa Marion from the Department of Justice's computer crimes unit—convened at the US attorney's office in Sacramento to review the mountain of evidence they'd accumulated. The question of the day: Were they ready to indict Alexandre Cazes?

For about an hour, as the agents and prosecutors talked over piles of bank documents, crypto exchange records, and social media clues, Hemesath remained bent over his laptop, silently typing. Some around the conference table wondered whether the Sacramento prosecutor, who had a reputation for professorial eccentricity, was rudely doing other work or answering emails in the midst of their meeting.

Then Hemesath suddenly broke in to show what he'd assembled: He connected his laptop to a large monitor on the wall and displayed a graphic to the room. It showed a flowchart, a tangle of nodes and lines that he'd illustrated. Each node represented a piece of evidence, with the lines between them indicating [blockchain](#) connections from Chainalysis' Reactor software, traditional payments they'd tracked, and usernames and email addresses they'd linked to their target. On the left was the name Alexandre Cazes, the real-world person. On the right was Alpha02. Some lines meandered through multiple nodes, but every line began with Cazes, branched out into the mess of his online life, and then converged on his dark-web persona.

It was no smoking gun. For that, they'd still need to catch Cazes with his hands on the keyboard. But looking at the chart, summing up the totality of Cazes' opsec failures and the indelible tracks he'd left across the blockchain, the group agreed. He was no patsy; these were no coincidences.

They had found Alpha02, and they were ready to charge him; the scrappy team from a dusty city in the Central Valley was now on track to bring down a kingpin. They had no idea, however, that the scope of their operation was about to expand dramatically yet again, thanks to another small group of police in a tiny country 5,000 miles to the east.

CHAPTER 7

HANSA

Around the same time that spring, in a long, black, four-story office building flanked by forest and highway in the leafy central Netherlands town of Driebergen, a secret began to spread among the Dutch National Police: The Americans were close to executing the biggest dark-web takedown in history.

Not long after the US team had been tipped off to AlphaBay's Netherlands IP address, the FBI had discreetly alerted the Dutch that the bureau might soon need their cooperation to surveil and eventually seize an AlphaBay server hosted in their country.

The news that the United States was seeking to bust the world's largest dark-web market soon reached one group of Dutch agents for whom this represented an intriguing coincidence. They were already deep in pursuit of a site that was quickly growing into the world's *second*-largest dark-web market. And they began to wonder whether there might be an opportunity to make this confluence of events work in their favor.

Since the fall of 2016, a newly formed team of investigators at the Dutch National Police's Driebergen office had been circling a dark-web drug market called Hansa. While far smaller than AlphaBay, Hansa had thousands of vendors and tens of thousands of listings for every narcotic imaginable. The Dutch investigation into Hansa had started with a tip from a security firm called Bitdefender, sent to the European police cooperation agency Europol. The company had found what appeared to be a Hansa server, also in a Dutch data center. Though the main server actively running Hansa's market was protected by Tor and hadn't been found, this one appeared to be an older machine that the administrators had left vulnerable. (Bitdefender has never revealed how it spotted the server's unprotected IP address.)

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When the Dutch set up a wiretap on that computer, they found that the administrators had connected to it from yet another Dutch server, along with four others in Germany, adding up to six servers in total. They quickly made a plan with the help of the German federal police to seize all six machines. When the Dutch police got their hands on the servers, they found an utter bonanza of Hansa's sensitive data. It included the source code of the market, a collection of usernames and passwords, the database of all the market's transactions, and messages between users, mostly encrypted—even the two administrators' PGP private keys, allowing the team to both decrypt messages the admins received and verify their identities on messages they sent.

The seized Hansa database listed only the pseudonyms of the site's users, and each of those users' connections to the site had been obscured by Tor. Hansa buyers' and sellers' identities were still beyond the reach of the investigators. But the data included another prize: a massive chat log between Hansa's two administrators, who went by the names HL and RonSwanson. This was a treasure trove of 17,000 messages. In some of those conversations, they'd even referenced each other's full legal names. One had revealed his home address. Some quick social media searches shed more light on their lives: One was a 30-year-old based in the German city of Siegen, the other a 31-year-old in Cologne.

On a fall day in 2016, not long after the servers were seized, two Dutch investigators pored over that bounty of data at a desk on the second floor of the Driebergen police building. One investigator, Nils Andersen-Roed, was an agent on the Dutch National Police's newly formed dark-web team; the other—who asked to go unnamed—was a technical adviser to the Dutch prosecutor. Both sat entranced by the highly sensitive information unspooling on the screen before them. They wondered aloud how they could capitalize on this rare windfall.

Andersen-Roed, thinking of the two administrators' PGP keys, made a comment that he intended as a joke: With those two keys, he pointed out,

they could go onto dark-web forums and impersonate the two German admins, writing messages and “signing” them as the founders of the Hansa market. They could essentially *become* the administrators.

As the two men batted around that impersonation idea, their conversation turned more serious. They'd both seen dark-web markets rise and fall over the past half decade, ad nauseam: When law enforcement busted one—or when its administrators ran off with their users' money—a new one would simply emerge to replace it. It was an endless game of whack-a-mole.

“We should be able to do something more with this than just take the marketplace down and go on to the next one,” one man said to the other. “We're in a unique situation; we should do something different.”

Soon, the notion of becoming Hansa's bosses was no longer a joke. What if, instead of merely arresting the admins and seizing their site, the investigators secretly commandeered the market? With one of the most active sites on the dark web under their control, there was no telling what powers they might gain to identify Hansa's users, including its most high-volume drug dealers.

If and when they did ultimately reveal their sting operation, the two Dutchmen daydreamed aloud, the psychological blow to the community would be insidious: No one would ever again be able to fully trust that a dark-web administrator wasn't actually an undercover agent.

Sharing their idea with the rest of their team at the Dutch National Police, and then the German federal police who had helped seize the servers, the two Dutch investigators learned of another lucky break. The Germans were already on the trail of the two suspected Hansa admins—not for the massive drug market they had created, but for a book piracy site they were running on the side.

Rather than seeing a conflict, the Dutch police realized they could play this to their advantage. When the Germans arrested the men for their book piracy site, the Dutch would have the perfect opportunity to stealthily slip into their places, running Hansa with minimal publicity or disruption. “We could use that arrest,” says Gert Ras, the head of the Dutch National High

Tech Crime Unit that was soon brought in to take charge of the operation. “We had to get rid of the real administrators to become the administrators ourselves.”

Just as this bold plan began to come together, however, it faced a fundamental problem. The cops' initial seizure of Hansa's German servers had shown their hand. On one of the computers, they had found a text file that appeared to show the IP addresses for the market's central, still-active servers in Germany. But by then, the spooked admins appeared to have relocated them to an unknown data center, shuffling them back into Tor's vast deck of anonymized machines around the globe. “That was a setback,” Ras said with grim understatement.

At that point, the Dutch cops might have simply cut their losses and given the Germans the go-ahead to arrest Hansa's administrators—after all, they knew their names and locations—then charge them with running a massive drug market, for which they had ample evidence. Instead, remarkably, they decided to double down on their stealthy takeover plan. That meant they had to find not only the admins but the servers that had just disappeared from their radar.

They spent the next few months patiently hunting for those machines, looking for any clue that could help them reestablish the trail. It was only in April 2017, more than six months after they seized those first six servers, that they got another lead. This time, it came from the blockchain.

Among the two administrators' thousands of messages to each other were a handful in which they'd mentioned bitcoin payments. When the Dutch police fed those addresses into Chainalysis' Reactor software, they could see that the transactions led to an account on BitPay, a payment processor designed to let users spend [cryptocurrency](#) on traditional goods and services. In this case, unlike for most dark-web payments, there was a middleman to go after. The Dutch subpoenaed BitPay's Netherlands office and discovered that the admins had funneled bitcoins into the service in order to rent servers at a Lithuanian hosting provider.

So a team of Dutch investigators flew to the Lithuanian capital of Vilnius and explained their first-of-its-kind takeover plan to the local police. “They

were literally flabbergasted,” says Petra Haandrikman, a chief inspector for the Dutch police who had become team leader for their Hansa operation.

“You want to do *what*?” she remembers them responding. But they agreed to cooperate. The Dutch detectives now had Hansa’s infrastructure back in their sights.

It was around that time, just as their Hansa-hijacking scheme became a real possibility again, that the Dutch learned of the US investigation into AlphaBay. They discussed what it might mean for their own operation, now the better part of a year in the making.

Their takeover idea was already the most daring undercover operation to ever target the dark-web drug world. But maybe, they thought, they could push their luck just a little further.

On an early May morning, a delegation from the US AlphaBay investigation team arrived at the airport in the Hague, a city on the Netherlands’ North Sea coast, 40 miles west of Driebergen. Jet-lagged and hungry after their red-eye flight, they stopped for breakfast at a Dutch-style pancake restaurant in an underground cellar.

Paul Hemesath, who could never sleep on airplanes, had used the time to assemble a list of potential names for their AlphaBay takedown operation. He recited his list to the group, which included Operation Blockbuster, Operation Block Party, Operation Chain of Fools—all references to their blockchain tracing evidence—Operation Siamese Dream, Operation Not-So-Darknet, and Operation Rawdogger. (“In retrospect,” Hemesath admits, “some of these were just kind of unfortunate.”) The sleep-deprived group rejected all of Hemesath’s submissions and began brainstorming other ideas. Finally, they settled on a pun that combined an element of the name AlphaBay with the notion of the net they were tightening around it, along with an allusion to piercing the dark web’s veil: Operation Bayonet.

A few hours later, the group arrived at Europol headquarters, a fortresslike building of blue-gray brick complete with a moat in front of its entrance. They were set to present their progress to an international group of law enforcement agencies. The team sat down in a vast conference room, with

tables for each delegation arranged with placards and microphones—a kind of UN General Assembly of dark-web snoops.

The meeting was a routine event, mostly designed to prevent the agencies from stepping on one another's toes. The Americans went first, presenting the latest developments on AlphaBay: They believed they had both AlphaBay's server and its administrator, Alexandre Cazes, within reach. They planned to indict Cazes under seal in a matter of days and were working with the Thai police to arrest him soon thereafter.

After a short coffee break, it was the Dutch delegation's turn to speak. The technical adviser to the Dutch prosecutor's office made a proposal, one he had received approval for just minutes earlier, after hurriedly telling prosecutors about the Americans' presentation. The Dutch police were ready, he said, to arrest the administrators of Hansa with the help of the German federal police, take control of the market, and run it in secret.

They now could see just how close the Americans were to taking down AlphaBay. What if, the Dutch technical adviser suggested, they combined their operations?

All the Americans would need to do, he explained, was wait for the Dutch takeover of Hansa before green-lighting their takedown of AlphaBay. Then, after they'd arrested Alpha02 and seized his servers, they would simply delay any official announcement of their victory. If all went according to plan, a massive throng of the dark web's users would flood from the dead market to the next-best option—a market under Dutch police control.

Then, only after the Dutch had a chance to spy on the internal workings of the dark-web economy like never before—from the privileged position of its newly crowned kingpins—would they publicly announce their Hansa and AlphaBay operations simultaneously. Together, their sting operation would be what the Dutch technical adviser described as a “one-two” punch.

At the American table, eyes widened. Ali, the FBI analyst, remembers her exhilaration at the epic ambition of the plan. The prosecutor Louisa Marion's mind excitedly raced through the risks and rewards. Was this even legal? Was it ethical?

Paul Hemesath, still deeply jet-lagged, remembers being both impressed and wary of the complexity the Dutch were adding to their AlphaBay operation. There had been prior investigations in which law enforcement had secretly taken control of a dark-web site. In 2014, for instance, the Australian Federal Police had run a site trafficking in child sexual abuse materials called the Love Zone for six months. Cases like the Love Zone were operational successes, but controversial. Journalists and legal scholars would [later point out](#) that in order to more deeply infiltrate the underground community they were targeting, law enforcement had essentially engaged in the same crime they were investigating.

Now the Dutch were suggesting doing something similar, but for the second-biggest online narcotics market in the world. There was no precedent for it.

“In terms of dark-web drug market impersonation,” Hemesath says, “this was the first monkey being shot into space.”

Aside from the legal or ethical implications, he wondered whether it wasn’t a little “pie in the sky,” as he put it. Coordinating among the agents across the United States was difficult enough. Now they were going to coordinate among the Dutch, the Germans, half a dozen US agencies, and the Thais, too?

Still, the serendipity of these two investigations unfolding in tandem was uncanny. When would they have another opportunity to try something like this again?

“To time this and to count on it happening, who knows?” Hemesath thought. “But let’s give it a shot.”

Continued in part 4: [The team finds a crucial vulnerability in Cazes’ personal opsec—and deploys a secret technique to locate AlphaBay’s main server. But just as Operation Bayonet heats up, the investigators have an unexpected encounter with their target.](#)

This story is excerpted from the forthcoming book [Tracers in the Dark: The Global Hunt for the Crime Lords of Cryptocurrency](#), available November 15, 2022, from Doubleday.

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Nov 3, 2022 9:00 AM

Dear Artists: Do Not Fear AI Image Generators

True, new systems devalue craft, shift power, and wreck cultures and scenes. But didn't the piano do that to the harpsichord?

ILLUSTRATION: ELENA LACEY

In 1992, the poet Anne Carson published a little book called [*Short Talks*](#). It's a series of micro-essays, ranging in length from a sentence to a paragraph, on seemingly disconnected subjects—orchids, rain, the mythic Andean vicuña. Her “Short Talk on the Sensation of Airplane Takeoff” is what it sounds like. Her “Short Talk on Trout” is mostly about the types of trout that appear in haiku. In what passes for the book’s introduction, Carson writes, with dry Canadian relatability, “I will do anything to avoid boredom. It is the task of a lifetime.” Right about when she published that, the internet started to take off.

Fast-forward 30 years and one of the latest ways to avoid boredom, at least for me, is to stay up late and goof around with [AI image generation](#). Tools such as DALL-E 2, Midjourney, and Stable Diffusion can be instructed, with textual prompts, to produce ersatz oil paintings of dogs in hats in the style of Titian, or simulated photos of plasticine models of astronauts riding horses. When I first started playing with Stable Diffusion—which is open source and very fun—I was reminded of Carson’s talks. I went back to them to figure out why. Pretty quickly I realized that the resemblance had something to do with *form*.

Everyone says content is king, but the secret monarch of the content economy is form—constraints, rules, minima and maxima. You grow up learning form. A high school essay is five paragraphs. Sitcoms leave eight minutes in the half hour for ads. Novels are long. Tweets are capped at 280 characters.

What differentiates my tweet or essay or studio film from yours? The choices each of us makes within the form. In a word, our *style*. Carson's book takes a familiar form, the little lecture, and subverts it, manipulates it, until as the reader you start to feel like you're inside her wonderful brain, scrolling through her mental browser history, joining her in hyperlinked fancies and half-abandoned rabbit holes. Image generation is kind of like that—but instead of communing with a single brilliant Canadian brain, you're communing with a giant idiot world-brain. (A less neurological way to put it: vast numbers of data objects grouped in layers, connected together to an incomprehensible degree, like string-and-nail wall art of a many-masted clipper ship but on fire with the flow of data.)

The people who can use the new tools will have new power. The people who were great at the old tools (paintbrushes, cameras, Adobe Illustrator) will be thanked for their service and rendered into Soylent.

In general, humans like using machine learning to assist pathologists, sharpen a phone photo, or make a better map. But the AI generators bug a lot of people. These tools work by spidering images from across the internet, absorbing the visual culture contained within them by scanning their captions, then adding fizzy visual noise to them until they look like static. To make a new image, the AI starts with a caption and some static, then runs the process backward, removing noise until an image appears that lines up with the caption, more or less. (It's bad at drawing hands, but so am I.)

This feels gross. It feels gross to see artists databased into oblivion. It feels gross that someone could say to a computer, “I want a portrait of Alex Jones in the style of Frida Kahlo,” and the computer would do it without moral judgment. These systems roll scenes, territories, cultures—things people thought of as “theirs,” “their living,” and “their craft”—into a 4-gigabyte, open source tarball that you can download onto a Mac in order to make a

baseball-playing penguin in the style of Hayao Miyazaki. The people who can use the new tools will have new power. The people who were great at the old tools (paintbrushes, cameras, Adobe Illustrator) will be thanked for their service and rendered into Soylent. It's as if a guy wearing Allbirds has stumbled into a residential neighborhood where everyone is just barely holding on and says, "I love this place, it's so quirky! Siri, play my Quirky playlist. And open a Blue Bottle on the corner!"

So naturally, people are upset. Art websites are banning AI-generated work, at least for now; stock image services are refusing it too. Prominent bloggers who experimented with having an AI illustrate their writing have been chastened on [Twitter](#) and have promised not to do it again. AI companies are talking a lot about ethics, which always makes me suspicious, and certain words are banned from the image generator's interface, which is sad because I wanted to ask the bot to paint a "busty" cottage in the style of Thomas Kinkade. (One must confront one's deepest fears.)

Don't cancel the messenger, but come on: Image generators are going to be baked in everywhere, used for an enormous range of good, evil, or horny purposes. In a decade, or 10 minutes (time is blurry around this stuff), we'll be saying things like, "Computer, make a version of *Die Hard* where all the characters are corgis." Then we'll post it to YouTube, which will use machine learning to make sure the film studio gets its pre-negotiated cut for the audio track. Then other systems will download the video and decide that there is a connection between the voice of arch-terrorist Hans Gruber (portrayed by Alan Rickman) and corgis, which will result in a rogue AI-enhanced compression algorithm replacing all instances of Snape in *Harry Potter* with a corgi, leading to the Great Corgi Cinematic Snowball Virus of 2024, after which all filmed entertainment will feature only corgis and the occasional crossbreed like corgipoos and borgles. This will ruin *Game of Thrones* but will make *The Purge* adorable.

Remember: In the days of powdered wigs, musicians who liked the pluckiness of the harpsichord complained that the piano sounded soft and dull. Much later musicians (and their unions) fought the synthesizer, fearing it would bleep-bloop careers into oblivion. New systems always seem, at

first, to devalue craft, shift power, and wreck cultures and scenes. This is because they do all of that. And we, downstream in time, invariably fall prey to the historical fallacy and go, *Oh, those worrywarts! How stubbornly they clung to their harpsichords.* We know that, without the piano, there'd be no Shostakovich or Satie or Margaret Leng Tan; without synths, no Wendy Carlos, Kraftwerk, or Pet Shop Boys.

I asked [GPT-3](#), an AI text generator, to write me “a Short Talk on trout in the style of Anne Carson.” It replied: “Trout are most active in the early morning and late evening, so those are the best times to go fishing.” I went back to the original. Of the trout found in haiku, Carson writes: “Worn out, completely exhausted, they are going down to the sea.” I think we can agree that the Canadian brain wins this one. But we do not have to choose between, on the one hand, an unthinking digital pseudobrain and, on the other, the artifacts of a single human mind. The miracle of the age is that we can learn from both, whenever we like. Anything to avoid boredom.

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By [Andy Greenberg](#)

[Backchannel](#)

Nov 1, 2022 6:00 AM

The Hunt for the Dark Web's Biggest Kingpin, Part 2: **Pimp_alex_91**

On the trail of AlphaBay's mastermind, a tip leads detectives to a suspect in Bangkok—and to the daunting task of tracing his millions in cryptocurrency.

Cazes had piles of bills accumulating around his home, even hidden in the walls. “There was money everywhere,” Desjardins remembers. Illustration: Hokyoung Kim

CHAPTER 3

CAZES

Around the beginning of 2015, a Canadian tech entrepreneur from the small city of Trois-Rivières in Quebec—I'll call him Paul Desjardins—was planning a trip to Thailand. A friend recommended that during his stay he meet up with a contact from their hometown who now lived in Bangkok. The man's name was Alexandre Cazes. Desjardins decided to pay him a visit.

Cazes, he found, lived in an unremarkable, midsize house in a gated community in the Thai capital, but the baby-faced Canadian in his early twenties seemed to be doing well for himself. He had invested early in [Bitcoin](#), he told Desjardins, and it had paid off.

His biggest financial problem seemed to be that he now had more cash than he could deal with. He alluded to having sold bitcoins to Russian mafia contacts in Bangkok. A foreigner depositing the resulting voluminous bundles of Thai baht at a bank would raise red flags with local regulators, he worried. So instead he had piles of bills accumulating around his home, even hidden in recesses in the walls.

“There was money everywhere,” Desjardins remembers. “You open a drawer, and you find money.”

This story is excerpted from the forthcoming book [Tracers in the Dark: The Global Hunt for the Crime Lords of Cryptocurrency](#), available November 15, 2022, from Doubleday.

Courtesy of Penguin Random House

Despite Cazes' liquidity issues and his somewhat alarming mention of the Russian mob, Desjardins couldn't see any evidence that his strange new acquaintance was involved in anything overtly criminal. He didn't use any drugs; he seemed to barely drink beer. Cazes was friendly and intelligent, if socially strange and emotionally “very cold,” like someone going through the motions of human interaction rather than doing so naturally. “It was all logic,” Desjardins says, “ones and zeros.” He did note that his new friend, while otherwise generous and good-natured, had ideas about women and sex that struck him as very conservative, bordering on misogynistic.

During that first visit, the two men discussed Desjardins' idea for a new ecommerce website. Cazes appeared interested, and Desjardins suggested they work on it together.

Back in Quebec around Christmas of that year, Cazes met with Desjardins again, this time to hear a full business pitch. After no more than 15 minutes of discussion, Cazes was in. He impressed Desjardins by spending \$150,000 without hesitation on a web domain for their business, not even bothering to haggle with the seller.

In another pleasant surprise, Cazes also paid a six-figure legal bill that Desjardins had racked up in a dispute with another business. He turned out to be a coding savant too; Desjardins had planned to hire a team of coders, but Cazes quickly did most of the initial programming for their fledgling site single-handedly.

As they worked to get their business off the ground, Desjardins could see that Cazes was richer than he had first estimated. Desjardins learned that his partner was in the process of buying a villa in Cyprus and making some sort

of real estate investment in Antigua. When Desjardins next visited Bangkok, Cazes picked him up at the airport in a dark gray Lamborghini Aventador.

Desjardins pointed out that there was nowhere in the supercar to fit his large suitcase. Cazes told him to get in anyway and gamely struggled with the luggage until it fit onto his guest's lap. Desjardins remembers seeing the suitcase scratch parts of the Lamborghini's interior, but Cazes didn't seem to care. In fact, he didn't seem to have much emotional connection to the car at all; he didn't even know how to use its radio. Desjardins thought Cazes appeared to own it out of a sense that it was the socially correct way to display his wealth.

As they left the airport, Cazes asked Desjardins whether he'd ever been in a Lamborghini before. He responded that he had not. Within seconds, Desjardins was flattened against the Aventador's passenger seat as his eccentric friend rocketed them down the Bangkok highway at more than 150 miles per hour.

In late November 2016, just before Thanksgiving, Grant Rabenn was wrapping up his caseload in his office and preparing for the holiday when he got a call from Miller. "Hey, Grant," Miller said. "I think I've got something big that we should talk about."

They met at the Starbucks a block from Fresno's courthouse. Miller explained what his tipster had told him: In AlphaBay's earliest days online, long before it gained its hundreds of thousands of users or came under the microscope of law enforcement, the market's creator had made a critical, almost laughable [security](#) mistake. Everyone who registered on the site's forums at the time had received a welcome email, sent via the site's Tor-protected server. But due to a misconfiguration in the server's setup, the message's metadata plainly revealed the email address of the person who sent it—Pimp_alex_91@hotmail.com—along with the IP address of the server, which placed it in the Netherlands.

The error had quickly been fixed, but only after the tipster had registered and received the welcome email. The source had kept it archived for two years as AlphaBay grew into the biggest dark-web market in history.

And now they had given it to Miller. It seemed that even the figure Rabenn once thought of as “the Michael Jordan of the dark web” was capable of elementary security errors—with permanent consequences.

Rabenn received Miller's revelation coolly. He'd heard before from overexcited agents whose incredible leads led to dead ends or hoaxes. Surely, he thought, if his little team in Fresno had these clues, someone else in the US government must be miles ahead of them. But they nonetheless decided to drop everything and follow the tip.

There was, in fact, more to the source's lead, all of which could be corroborated with a few Google searches. The Pimp_alex_91@hotmail.com address also appeared on a French-language social media site, Skyrock.com. There, someone named “Alex” had posted photos of himself from 2008 and 2009, dressed in baggy shirts covered in images of dollar bills and jewels and wearing crisp new baseball caps with a silver pendant hanging from his neck. In one picture he'd written his hip hop handle, “RAG MIND,” at the top of the image in the style of a debut rap album. The words on his shirt read “HUSTLE KING.”

A dating profile the man had posted to the site identified his hometown, Trois-Rivières in the French-Canadian province of Quebec, and his age at the time, 17. So the “91” in his email address was his birth year. If this was indeed AlphaBay's founder, he would have been 23 at the time of the market's creation.

Nothing about this young French-Canadian hip hop wannabe matched Rabenn and Miller's sense of the kingpin known as Alpha02. Had all of the allusions to Russia and Russian-language snippets been a ruse? Based on the IP address included in the tipster's email, the site's forums, at least, seemed to be based in Western Europe.

To Miller and Rabenn, the theory that “Alex” was Alpha02 seemed outlandish at first. But the deeper they looked, the more plausible it became. The young Quebecer had used his Pimp_alex_91 email address years earlier on a French-language technology forum called Comment Ça Marche —“How It Works.” He had signed his messages with his full name: Alexandre Cazes.

Searching for that name, the investigators came upon a more recent LinkedIn profile for a decidedly more adult Alex, sans hip hop outfit, advertising himself as a web programmer and the founder of a Quebec-based hosting and web design company called EBX Technologies. His photo showed an unremarkable-looking businessman in a gray suit and white shirt with no tie. He had a round face with a cleft chin, slightly thinning hair in the front, and an innocent openness to his expression.

Cazes listed his location as Quebec, Canada, but they could see from his social media connections that he seemed to actually be based in Thailand. Further digging on social media revealed Facebook accounts for Cazes' fiancée, a pretty Thai woman named Sunisa Thapsuwan. A telling photo on a relative's profile showed Cazes in a suit and sunglasses, standing next to a dark gray Lamborghini Aventador.

Digging deeper still, they found the most telling clues of all. On Comment Ça Marche and another programming forum called Dream in Code were older profiles for Cazes that had been deleted, but they were preserved on the Internet Archive. Years earlier, it seemed, he had written on those forums under another username: Alpha02.

Within days, Rabenn and Miller knew their lead was solid. They also knew the case was too big for them to take on alone. They decided to bring their findings to the FBI field office in Sacramento, a much larger outpost just a few hours' drive north with significantly more cybercrime expertise and resources than their small Fresno office. It turned out that the agents in Sacramento had been tracking AlphaBay from its inception. Nonetheless, Miller's tip was new information to them.

Rabenn brought on the office's assistant US attorney, Paul Hemesath, as an investigative partner. The two had been friendly for years; Hemesath, an older and more deliberate prosecutor, had the air of a college professor, and he balanced out Rabenn's aggressive run-and-gun approach. Hemesath in turn asked for help from the Computer Crime and Intellectual Property Section at Justice Department headquarters—the office in Washington, DC, where a small army of cybercrime-focused agents and computer forensics analysts was based.

As they assembled their team, Miller and Rabenn began the delicate process of “deconfliction,” figuring out whether other agencies and task forces around the country had their own open cases on Alpha02. Again and again, Rabenn heard that another team in another city was investigating AlphaBay but had made no real headway. None appeared to recognize the name Alexandre Cazes.

Against all odds, Rabenn began to realize, his little office in the Central Valley was perhaps closer than anyone in the world to cracking the dark web's deepest mystery. Soon they would find themselves at the vanguard of its biggest global manhunt.

CHAPTER 4

THAILAND

If cazes had moved halfway around the world to Bangkok to run AlphaBay beyond the reach of Western law enforcement, he'd chosen, by some measures, exactly the wrong destination.

For more than half a century, the US government has had an enormous presence in Thailand. Even before the DEA was founded in 1973, a US agency called the Bureau of Narcotics and Dangerous Drugs had stationed a field office in Bangkok. American agents had long been sent there to disrupt the flow of so-called China White heroin from the opium-growing Golden Triangle region that covers parts of Thailand, Laos, and Myanmar. In the late 1950s that triangle produced half of the world's heroin supply and fed an epidemic of addicted US soldiers in Vietnam in the '60s and '70s —a problem that made quashing the Thai drug trade one of the DEA's earliest and highest priorities. Fifty years later, Bangkok remains one of the largest and most active DEA offices in the world, the regional headquarters for the entire East Asia operations of the US law enforcement agency that has more overseas agents than any other.

For Jen Sanchez, it was also a plum assignment: beautiful weather, low cost of living, incredible food, and not particularly dangerous—relative to other DEA hot spots, anyway.

Sanchez, a 26-year veteran of the DEA in her mid-fifties with white hair cut to her shoulders and a zero-bullshit, profanity-laden approach to conversation, felt she'd earned her coveted Bangkok job. She'd spent years in Mexico City investigating money laundering followed by a stint in Texas, where her work led to the arrest of three Mexican governors for taking bribes from the Zetas drug cartel and embezzling from their own state governments. In that case, dubbed Operation Politico Junction, she'd tracked the governors' dirty money into the businesses they'd bought to launder it, along with mansions, luxury cars, and private aircraft. In total, Sanchez had signed affidavits for seized assets worth more than \$90 million. She'd come to relish the righteous thrill of bankrupting criminals who had spent their lives amassing ill-gotten wealth. And since much of that money ended up in DEA coffers, it hadn't exactly hurt her career, either. As she modestly put it, "I paid for myself."

By December 2016, Sanchez had been in Thailand for nine months, mostly helping to track the financing for violent Islamic movements in the country's south. Then one day, at the Bangkok DEA office—situated in the US embassy, a white stone building with a canal surrounding its foundation and a grass lawn where 6-foot-long monitor lizards emerged from the foliage in the evening—her boss told her they had a visitor: a DEA official who was set to give them a presentation on [virtual currency](#).

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Sanchez didn't know anything about virtual currency. Nor, with just a few years left until retirement, did she particularly care to learn about it. But she listened politely throughout the presentation. Only at the end of the session did the visiting agent truly get her attention: He mentioned, almost in passing, that the DEA had recently found a lead on the administrator of the world's biggest dark-web market and that he seemed to be right there in Thailand.

Sanchez had heard of Silk Road. She asked whether this site was as big as that legendary black market. The agent responded that it was at least three or four times the size of Silk Road, and growing. “Holy shit,” Sanchez thought to herself. The biggest dark-web kingpin in history was in her backyard? The scale of the money laundering alone would be enormous.

“He’s going to have *stuff*,” she remembers thinking. And she wanted to be the one to track down those assets and seize them.

Another group of agents in Bangkok had been assigned to handle the AlphaBay case. Sanchez’s own supervisor, to her constant frustration, seemed more interested in busting small-time dealers on the tourist beaches of Pattaya than in big-game, long-term investigations. But Sanchez was not about to be left out of what she suspected might be one of the largest seizures of cash and property—virtual or otherwise—in the history of the DEA in Thailand. As soon as the presentation was over and the visiting agent left, Sanchez walked into her boss’s office, pointed a finger at him, and told him she wanted AlphaBay.

Sanchez got her wish. She soon found herself on a series of sometimes bewildering conference calls among all the different agencies now hunting Cazes across a dozen time zones. Those calls included Rabenn, Miller, Hemesath, and the Sacramento FBI team, who laid out AlphaBay’s basic mechanics and use of cryptocurrency.

As Sanchez began to get a sense of the full extent of the massive commerce in hard drugs that AlphaBay now facilitated on a daily basis, she became incensed. The US opioid crisis was, by that time, in full swing; 42,000 Americans had died of opiate overdoses in 2016, more than in any year on record. That surge was due in part to an influx of fentanyl, the opium derivative as much as 100 times stronger than morphine. And here this 25-year-old French-Canadian was running a massive open-air heroin and fentanyl bazaar in public view? She was haunted by the thought that every day AlphaBay was left online, anyone, even children, could order fentanyl from the site, receive it in the mail, and die of an overdose in a matter of hours.

In one call with Miller in Fresno, she swore they would have AlphaBay offline and Cazes behind bars in less than six months. “I’m going to take his shit, and he is going to go to jail, and we’re going to get him in Florence supermax,” she remembers telling Miller, referencing the prison where Ross Ulbricht was then serving his life sentence. “I want this kid gone.”

Now that Sanchez had joined the AlphaBay investigation, she was working under a new boss in Bangkok: a 47-year-old, Puerto Rico–born DEA agent named Wilfredo Guzman. Guzman had started his career hunting drug-laden speedboats off the coast of Puerto Rico and had risen through the agency’s ranks following a series of massive Caribbean and South American cases. Now, as a supervisor in the Bangkok office, he prioritized, above all else, maintaining a hand-in-glove relationship with the Thai police’s DEA equivalent, known as the Narcotics Suppression Bureau (NSB). Doing so required near-constant late-night business dinners of painfully spicy food, drunken banquets, and karaoke outings, belting out John Denver lyrics onstage with high-ranking Bangkok cops.

The Royal Thai Police have a far-from-sterling record when it comes to drug trafficking and corruption. For some in the agency, shakedowns of petty drug dealers are understood to be a perk of the job. One RTP official named Thitisan Utthanaphon had earned the nickname Joe Ferrari for his collection of sports cars of mysterious provenance. He would later be caught in a leaked video suffocating a suspected meth dealer to death alongside six fellow cops.

So when Robert Miller asked Guzman in the agency’s Bangkok office for help in hunting Cazes, Guzman brought it to his most trusted contact at the NSB, Colonel Pisal Erb-Arb, who led the agency’s Bangkok Intelligence Center. Pisal was a spry, fatherly officer in his mid-fifties who frequently used his unassuming look as a balding middle-aged dad to take on undercover assignments. He had assembled a small team known for its squeaky-clean, by-the-book investigative work, as well as for Pisal’s rare practice of advancing female agents.

Almost immediately, Guzman, Pisal, and the NSB team got to work tracking down their new target. Starting with just Cazes’ name and a telephone number, they began to map out his properties: one home in a

quiet gated community that he visited intermittently—what they came to call his “bachelor pad” or “safe house”—and another in his wife's name in a gated neighborhood on the other side of town, where he seemed to work and sleep. He had bought and was remodeling a third home, a \$3 million mansion, farther on the outskirts of Bangkok.

Soon the investigators were shadowing Cazes' every move around the city. The Thais were particularly fascinated to discover his Lamborghini, a supercar that cost nearly \$1 million, as well as his Porsche Panamera and BMW motorcycle, all of which he drove at speeds well above 100 miles an hour whenever Bangkok traffic allowed.

Following Cazes proved to be a moderate challenge: He frequently zoomed away from the agents tailing his sports cars on stretches of unbroken highway or lost them while snaking between trucks and tuk-tuks on his motorcycle. Pisal used a bit of personal tradecraft to plant a GPS tracker on Cazes' Porsche, posing as a drunk and collapsing next to the car in a parking garage, then affixing the device to its undercarriage. The police tried attaching a similar tracking beacon to the Lamborghini but found that the car's chassis rode so low to the ground that their gadget wouldn't fit. They resorted to tracking Cazes' iPhone instead, triangulating its position from cellular towers.

As Pisal's team began to assemble a detailed picture of Cazes' daily life, they were struck by how aboveboard it all seemed. He was a “homebody,” as one agent put it, spending entire days without stepping outside. When he did leave his home during the day, he would go to the bank or his Thai language classes downtown, or take his wife out to restaurants or the mall. He lived, as Pisal put it using an English phrase commonly adopted by Thais, a “chill-chill” life of leisure.

Could their too-good-to-be-true tip have been some sort of elaborate misdirection? Was someone just trying to frame Cazes, to use him as a patsy?

It soon became apparent to Guzman and the Thai police that Cazes did have one very significant secret in his nondigital life: He was a womanizer. He frequently ventured out in the evenings to pick up dates—from a 7-Eleven,

from the mall, from his language class—and take them to his bachelor pad, or else to love motels. These encounters were businesslike and brief. By the end of the night, Cazes would be back at home with his wife.

So-called sexpats—foreigners using their wealth to live out polyamorous fantasies—were common in Thailand. And as scandalous as Cazes' affairs might have been, there was no law against philandering. Still, the Thais needed little convincing that Cazes must be some form of crime boss. At one point the surveillance team trailed him to a restaurant called Sirocco on the roof of Bangkok's Lebua hotel; 63 floors up, it claimed to offer the highest alfresco dining in the world, with two Michelin stars and \$2,400 bottles of wine on the menu.

When Cazes and a group of friends left the restaurant, the cops entered and spoke to Sirocco's management, demanding the entire day's receipts to obscure whose bill they were hunting for. Including wine and lavish tips, they found that Cazes had spent no less than 1.3 million baht—nearly \$40,000—in a single meal for his entourage, an amount that flabbergasted even the agents accustomed to tracking high-rolling drug kingpins.

Drug lords who never touched narcotics themselves or directly carried out crimes were nothing new to the NSB agents. They were used to the notion that the cleaner a suspect's hands were, the more senior the position they likely held in a drug trafficking syndicate. But those high-ranking bosses often met with associates who were connected to hands-on crimes or were at least a step or two removed from them.

Cazes' criminality, by contrast, seemed to be channeled entirely through the opaque aperture of the dark web, safely behind the veil of Bitcoin's [blockchain](#). In the physical world, his hands were cleaner than those of any kingpin they'd ever encountered.

At times, this perfect veneer led even the US investigators to doubt themselves. Sure, Cazes seemed to have slipped up once, years ago, when he left that Pimp_alex hotmail address in the metadata of a welcome email. But as their burgeoning investigative team followed up on that initial lead, Rabenn and Hemesath periodically asked each other whether they truly had the right guy. Could their too-good-to-be-true tip have been some sort of

elaborate misdirection? Could someone have purposefully leaked the address—and even chosen the handle Alpha02—as a way to frame this Cazes, to use him as a patsy? “The nightmare scenario would be that the source was setting us up,” Rabenn remembers thinking.

The only way to know for sure, they would soon find, lay in a different approach—one that only a few years earlier would have seemed impossible. By early 2017, there was a new, growing class of investigators who saw Bitcoin’s blockchain as something other than an impenetrable veil. They had come to realize that, far from a mysterious, anonymous currency, Bitcoin was, in fact, an almost entirely *traceable* financial system. And it was those tracers who would offer the next breakthrough in the race to take down Alpha02.

CHAPTER 5

TUNAFISH

By late 2016, a pair of FBI analysts, both based in Washington, DC, had gained a reputation as perhaps the very best team of cryptocurrency tracers in the US government. (Per their request, they are referred to here by only their first names, Ali and Erin.) The two shared a focus on digital money laundering, a fascination with cryptocurrency, and a yearslong friendship. Despite working for different investigative groups in different offices, they had come to form a two-person team of their own, practically mind-melding into two lobes of a single Bitcoin-obsessed brain. And they operated almost entirely under the radar, only ever producing leads that they quietly handed off to other investigators, clues that appeared in no criminal affidavits or courtroom evidence.

As it happened, on a winter morning just weeks after Robert Miller had received his Alpha02 tip—and before almost anyone else in the US government knew about it—Ali had come to Erin with an idea. She’d left the FBI satellite office where she worked, in a grim Beltway office park in Chantilly, Virginia, and driven for half an hour through DC traffic to ambush Erin at her desk at FBI headquarters. Ali, the more ebullient and ambitious of the two, wanted Erin to push aside all their other work so they

could try something no one had ever pulled off before: tracking down a dark-web administrator—perhaps even the admin of AlphaBay—through the techniques of blockchain analysis alone.

Before Erin had time to protest, Ali squeezed a chair into Erin's tiny cubicle and impatiently grabbed her mouse to start clicking through Bitcoin addresses on her computer screen.

Ali's ambition to expose a dark-web kingpin's finances had come to seem attainable only after years of advances in crypto-tracing techniques—the latest of which had AlphaBay specifically in their crosshairs. Ali and Erin were both fluent users by that point of Reactor, a piece of software made by a New York startup called [Chainalysis](#). Together with a handful of other companies like it, Chainalysis had, since 2014, pioneered and automated a set of powerful new methods for tracing cryptocurrency. Those efforts had quietly flipped the criminal promise of Bitcoin on its head, rendering the blockchain into a branching series of breadcrumb trails that allowed cybercrime investigators to follow the money as never before.

Some of these techniques were relatively straightforward. For instance, a crypto tracer using Reactor could sometimes follow bitcoins as they moved from address to address until they reached one that could be tied to an account at an exchange, where they were cashed out for traditional currency. Then Chainalysis' customers in law enforcement could simply subpoena the exchange for the account holder's identity, since US law required exchanges to collect this information on American users.

Chainalysis' more powerful contribution to bitcoin tracing had been a collection of “clustering” methods that allowed it to show when different Bitcoin addresses—dozens to millions of them—belonged to a single person or organization. If Reactor showed that coins from two or more addresses were spent in a single “multi-input” transaction, for example, that meant one entity must have control of all those addresses. This trick had made [Silk Road](#) users' money relatively easy to track: Just send a few test transactions to any Silk Road account, and the market's wallet system would soon bundle up your coins with others in multi-input transactions, leading to a cluster of other Silk Road addresses—like a briefcase full of bills with a homing device inside, brought back to a criminal's hideout.

But Chainalysis had found that the same method didn't work on AlphaBay, which seemed to carefully avoid pooling users' payments, and kept them instead in many small, disconnected addresses. Indeed, by April 2016, AlphaBay had begun advertising to users that it functioned as a bitcoin tumbler: Put money into an AlphaBay account, and it purportedly severed any link that could be used to follow it from where it entered the market to where it left. "No level of blockchain analysis can prove your coins come from AlphaBay because we use our own obfuscation technology," read one 2016 post from AlphaBay's staff to users on the site. "You now have ironclad plausible deniability with your bitcoins."

Those claims, Chainalysis found, turned out to be largely true. Because AlphaBay never gathered coins into large, easily identifiable purses, it was nearly impossible to look at any given transaction on the Bitcoin blockchain and tell whether it involved a trade on AlphaBay.

That layer of obfuscation represented a serious problem for Chainalysis' many customers in law enforcement. And so for much of 2016, mapping all the addresses on the blockchain that were associated with AlphaBay users—the dark market's "wallet"—had become the most difficult and pressing challenge Chainalysis had ever taken on. Month after month, Chainalysis' staff performed hundreds of test transactions with AlphaBay—never actually buying anything from the market, only moving money into and out of accounts—and watched the patterns those transactions formed on the blockchain, in hopes of finding clues that they could use to spot patterns elsewhere in the vast expanse of Bitcoin's accounting ledger.

Gradually, the company's researchers found distinct tells in the way AlphaBay moved its users' money. These clues came from the highly specific choices made by Alpha02 and whoever else was writing the code of AlphaBay's wallet. Chainalysis refused to divulge most of them, but cofounder Jonathan Levin offered an example. According to the system of incentives devised by the currency's creator, Satoshi Nakamoto, a Bitcoin wallet has to pay a fee for each transaction; the greater the fee, the more likely the thousands of servers known as Bitcoin nodes—the backbone of the Bitcoin network—are to quickly rebroadcast the transaction so that the entire network agrees that the transaction occurred. Most wallets allow

users to set their own fees along a sliding scale of speed versus cost. Dark-web markets, however, typically set their own fees. On AlphaBay, Chainalysis discovered, larger transactions required larger fees according to a distinct sliding scale. This represented a small tell—one of many, Levin says—that would allow them to spot transactions likely happening on AlphaBay and so produce a new set of addresses that would then, in turn, lead to others.

It was painstaking work. Every time AlphaBay rewrote the software for its wallet, the telltale patterns changed. Yet by the end of 2016, Chainalysis had labeled more than 2.5 million addresses as part of AlphaBay's wallet.

For Chainalysis' law enforcement customers, however, that breakthrough was just a starting point. The task that still lay ahead would be to follow the money from somewhere in that vast pile of numbers out to the bank account of a real human being. And from a cubicle in Washington, DC, that's exactly what Ali and Erin set out to do.

On that winter day in 2016 when Ali decided to conscript Erin into her unprecedented scheme, she hurriedly explained to Erin a realization she'd had. Dark-web markets, everyone knew by then, were notoriously vulnerable to "[exit scams](#)": schemes in which an administrator suddenly shuts down a market and then absconds with all its users' money. Every time this happened, dark-web forums were flooded with laments and reminders that no one should store any more cryptocurrency on a market than they planned to spend immediately.

But there was one person, Ali figured, who would never have to worry about an exit scam when considering where to keep their crypto savings: the dark-web site's administrator himself. "Who would have the most faith to leave their money on the market?" Ali asked Erin. "Of course it would be the guy in charge."

So what if they simply searched for the black market addresses that had held the largest sums of bitcoins for the longest time? The biggest, most stationary piles of money might just belong to the bosses.

Erin admitted it was a good idea. But after identifying a few addresses to look at, she shooed Ali out of her office to get on with her other work. After all, no one had asked them to track down Alpha02; they had intelligence reports to write and more realistic targets to hunt.

The next day, however, Ali began calling Erin every few minutes with breathless updates. She had started with the address of the biggest sum of bitcoins that had sat unmoved for the longest time among all the wallet addresses tied to the AlphaBay cluster. And, spotting the point where that money had finally changed addresses, she'd been able to track its movements from one hop to another, following its path in Reactor through the branching tendrils forking off from the market.

“It's still going!” she'd tell Erin excitedly on the phone as she followed it from one address to the next.

Soon Erin, infected by Ali's enthusiasm, was digging through other unmoved piles of bitcoins that she now suspected might be an administrator's commissions. Talking constantly on the phone across the DC–Virginia border, they began to devote hours to their Alpha02 hunt, scanning through hundreds of AlphaBay addresses in Reactor.

Whoever owned these piles of presumably criminal money had, at least in some cases, taken pains to hide their footprints on the blockchain. The funds would sometimes flow into clusters of addresses created by services known as mixers, advertised on dark-web sites with names like Helix and Bitcoin Fog. These bitcoin-laundering services offered to take in coins, pool them with other users' funds, and then return all the coins in the pool to their senders at new addresses. In theory this would cut the forensic link for any tracer, like a bank robber who slips into a movie theater, takes off his ski mask, and walks out with the crowd, evading the police on his tail.

Ali and Erin did sometimes hit dead ends in their work to trace Alpha02's profits. But in other cases, they were able to defeat his efforts at obfuscation. Neither of the two FBI analysts would reveal how they overcame Alpha02's use of mixers, but crypto tracers like those at Chainalysis offered hints.

A mixer, Jonathan Levin explained, is only as good as its “anonymity set”—the crowd of users mixing their coins to render them untraceable. Despite whatever claims mixers made to their customers, examining their work on the blockchain revealed that many didn't actually offer an anonymity set large enough to truly flummox an investigator. The more money someone tried to launder, the harder it became to avoid those coins remaining recognizable when they reappeared on the mixer's other end.

Any decent mixer splits large sums of coins into smaller, less conspicuous payments when returning the money to its owner. But with transaction fees for every payment, there's a limit to how much big sums of money will be broken up, Levin says.

In truth, Chainalysis didn't need to offer its users proof of the path that money took on the blockchain, so much as probability. Grant Rabenn candidly explained that the bar for sending a subpoena to a cryptocurrency exchange for a user's identifying information was low enough that they could simply try multiple educated guesses.

All of this meant that, in spite of a criminal's best efforts, investigators were often left with suspicious outputs from mixers, ones that they could follow with enough likelihood—if not certainty—of staying on their target's trail. Even the crowded-movie-theater trick, it turns out, breaks down when the robber is carrying a large enough sack of loot and the cops are watching every exit.

As Ali and Erin followed what they increasingly believed to be Alpha02's personal transactions, they gave nicknames to the most significant Bitcoin addresses they were scrutinizing, turning the strings of meaningless characters into pronounceable words. An address that started 1Lcyn4t would become, in their private language, “Lye sin fort.” One that began with the characters 3MboAt would be pronounced “Em boat.” The two analysts spent so much time examining and discussing these names that the addresses began to take on “personalities” in their minds. (“It's not exactly healthy,” Erin said.)

Of all of their named addresses, one loomed largest in the two analysts' conversations. They refused to reveal even its nickname for fear that

someone might reverse engineer the actual address and learn their tricks. For the purposes of this story, let's call it "Tunafish."

Tunafish lay at the end of a long string of hops Ali and Erin had followed out from one of the initial addresses that they'd hypothesized might be Alpha02's. It held special significance, however: It connected directly to an exchange. For the first time, they realized with excitement, they had managed to trace what they suspected might be a collection of the AlphaBay admin's bitcoins all the way to a transaction in which Alpha02 had traded them for traditional currency. They knew it was at those cash-out points—the blockchain's connections to the brick-and-mortar world of finance—that they might be able to match the transactions to a real person.

Just as they were on the verge of ferreting out a name behind all of Alpha02's transactions, Ali got wind of some news quietly floating among law enforcement agents across the country. As a longtime dark-web analyst, she'd kept in close contact for years with the Sacramento FBI agent who had first opened a file on AlphaBay. So when the Sacramento office joined forces with Grant Rabenn's Fresno team, Ali was among the first people the agent called. He told her that they had finally matched a real person to Alpha02's online persona. He gave her the name of a certain French-Canadian living in Bangkok.

Investigators started to recognize Cazes' identifying tells. In some cases, his attempts to obscure his ownership of bitcoins became, themselves, a kind of fingerprint.

The Sacramento agent knew Ali was already busy tracing AlphaBay's blockchain tentacles. He asked her to join their growing investigative team. Ali returned to Erin's office at FBI headquarters, cornered her in the hallway, and insisted she join the team, too. "This is going to be a massive case," Ali told her. "We need to do this together." Erin said yes.

Now they were hunting Alpha02 no longer as an obsessive hobby, but as part of an official investigation. Ali and Erin explained their Tunafish discovery to an assistant US attorney based in DC who had also joined the team, a seasoned cybercrime prosecutor named Louisa Marion. She,

Rabenn, and Hemesath immediately filed a subpoena for the identifying records on the exchange where the Tunafish address had been cashed out.

That legal request took weeks to bear fruit. Finally, one evening in the early weeks of January 2017, Ali was in the middle of a law school night class when she got a call from the Sacramento-based FBI agent with the news: The subpoena results had come back.

The agent told her the name on the exchange account tied to the Tunafish address. It was Alexandre Cazes.

Over the next months, Ali and Erin continued to trace more high-value addresses out of the AlphaBay cluster into one cryptocurrency exchange after another. They came to recognize what seemed to be Cazes' identifying tells, even in his bitcoin-laundering habits; in some cases, his attempts to obscure his ownership of the bitcoins became, themselves, a kind of fingerprint.

In total, the two analysts traced Cazes' commissions to a dozen cryptocurrency exchanges. The prosecutors then subpoenaed these one by one, finding accounts registered in both Cazes' and his wife's names. And as those results came in, a yearslong pattern emerged: Cazes would open an account with an exchange and attempt to use it to cash out a chunk of AlphaBay's profits. At some point—often within months of his cash-out transactions—the exchange would grow suspicious about the origin of these massive cryptocurrency trades and ask for more know-your-customer information from him.

Cazes would send a note explaining that he was merely an early investor in Bitcoin. In some cases the AlphaBay founder claimed to have bought thousands of coins from the defunct exchange Mt. Gox in 2011 or 2012—knowing it would be difficult to check the records, given that Mt. Gox had declared bankruptcy in 2014. In others, Cazes claimed to have bought them from a private seller at the exchange rate of a dollar each. “Since then, I’ve been pretty much juggling the coins like stocks, buying and selling, but never cashing out,” he wrote in one emailed explanation to an exchange.

By 2017, however, legitimate Bitcoin businesses had learned to be wary of these unverifiable stories. In most cases they closed or froze Cazes' account, forcing him to move onto another exchange. Ali and Erin, meanwhile, could see the true source of Cazes' wealth traced out in strand after strand of the blockchain's connections.

For years to come, the investigators involved in the AlphaBay case would debate whether their cryptocurrency tracing alone would have cracked the case even if they had never gotten the Pimp_alex_91 tip. Would the appearance of Cazes' name on those exchange accounts have been enough to put them onto his trail, or would they have treated it as just another vague lead that they were too busy to chase down?

Coming as it did, however, in the immediate wake of the tip sent to Miller about Alpha02, the two FBI analysts' blockchain work nailed to the wall a theory that would have otherwise hung by only a few threads. Every exchange subpoena and its results drew another line between Cazes and AlphaBay's fortune.

“When we saw millions of dollars in crypto flowing to him from what appeared to be AlphaBay-associated wallets, I was fairly confident that we had the right person,” Rabenn says. “When you hit that point, you start gearing up to indict.”

Continued in part 3: [When investigators find Cazes' online alter ego on a pickup artist forum, they also discover a new challenge to catching him red-handed—and hatch a plan for the most ambitious sting in dark-web history.](#)

This story is excerpted from the forthcoming book [Tracers in the Dark: The Global Hunt for the Crime Lords of Cryptocurrency](#), available November 15, 2022, from Doubleday.

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Oct 27, 2022 9:00 AM

Is Listening to Audiobooks Really Reading?

WIRED's spiritual advice columnist on bardic traditions for a modern age—and why book snobs worry about the wrong things.

Illustration: Franziska Barczyk

“I listen to a lot of books on audio. It works for me. But certain more literary friends of mine say it doesn’t quite count as reading. Part of me wants to *read* more, but I find it much easier to listen. What do you think? Should I care?”

—Easy Listening

Dear Easy,

I wouldn’t put too much stock in what your “literary” friends say; they sound like bores. When it comes down to it, people who think about reading in terms of what “counts”—those who piously log their daily reading metrics and tally up the titles they’ve consumed on Goodreads—don’t seem to actually enjoy books all that much. Their moralistic gloom is evident in the extent to which reading has come to resemble exercise, with readers tracking their word-count metrics, trying to improve their speed, and joining clubs to keep them accountable.

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Spiritual Troubleshooting for the Digital Age

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While some disciples of this culture are quick to dismiss audiobooks as a shortcut, they cannot seem to agree on why, exactly, listening is an inferior form of engagement. Some cite studies that have shown people who listen to books retain less than those who read them, which is bound up with how tempting it is to do other things while listening. (As easy as it is to multitask with audiobooks, the form does make it harder to return, after a spell of distraction, to the passage where your mind started to wander.) Others insist that audiobooks eliminate the reader's responsibility to interpret things like irony, tone, and inflection, given that the person recording does the work of conveying emotion. According to this rather tenuous logic, listening to audiobooks is inferior precisely because it is easier—because it lacks the element of suffering that is incontrovertible evidence of accomplishment, the same way soreness is proof of a real workout.

The larger problem, however, is in viewing books as a means to some other end. Many people who aspire to read more are motivated by the promise that doing so will prevent cognitive decline, improve brain connectivity, or increase emotional intelligence. Even the obsession with retention assumes that the purpose of reading is to absorb knowledge or nuggets of trivia that one can use to demonstrate cultural literacy or being “well read.” What all of this obscures is the possibility that books might be a source of intrinsic pleasure, an end in themselves. I’d be willing to bet, Easy Listening, that your earliest experiences with the joy of literature were aural. Most of us were read to by adults before we learned to read ourselves, and listening to audiobooks recalls the distinctive delight of being told a story: the rhythms of the prose made incarnate in a human voice; the dialog animated through the performance of a skillful reader; the ease with which our eyes, liberated from the page, are free to roam around the bedroom (or the aerobics room, or the landscape beyond the car windshield) so as to better imagine the actions of the narrative playing out.

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Oral storytelling predates writing by millennia, and many of the oldest stories in our literary canon existed for centuries as bardic tales before they were put down in print. The Homeric epics likely originated with bards who told them around fires and improvised their central plot points, which were passed down and adapted from one generation to the next. Evolutionary biologists have all sorts of conjectures about the utilitarian function of these rituals—storytelling may have emerged to deepen community bonds or model unfamiliar situations in ways that might have increased chances of survival—but I doubt that members of these cultures were consciously thinking, as so many readers are today, about how narrative exposure might boost their short-term memory or sharpen their capacity for empathy. Rather, they listened to stories because they were, quite simply, transfixed by their power.

These early stories were largely composed in verse, at a time when poetry, music, and storytelling were often so intertwined as to be indistinguishable. And I suspect that audiobook fans are at least partly drawn to listening because it's easier to discern the melodic qualities of prose, which often get lost when we quickly scan a page of text without actually hearing the words in our heads. There is some evidence that listening, as opposed to reading, engages the right hemisphere of the brain, which is more closely associated with music, poetry, and spirituality. This might explain why some religious texts are designed to be read aloud. The scholar Karen Armstrong recently pointed out that the term *qur'ān* means “recitation” and that the scripture’s many repetitions and variations take on their full effect only when they are voiced by a gifted reciter who can, as she put it, “help people to slow down their mental processes and enter a different mode of consciousness.”

If you’re like most people I know, you probably find it difficult to recall the last time a book—regardless of how you consumed it—succeeded in altering your consciousness. Even your desire to “read more” contains a whiff of compulsion, suggesting that many books you’ve encountered have failed to live up to their transcendent potential. Anxieties about post-literacy tend to focus obsessively on the question of medium, and audiobooks are often hailed as one of the four horsemen of the apocalypse, alongside social media, visual entertainment, and the decline in attention spans. But it seems to me that there exists a more obvious explanation for why reading often

feels so dull: Most books are very bad. The vast majority of them are uninspired, unconvincing, and poorly written. This has always been the case (surely there were some flops even among those bardic epics of yore), though it's a truth that grows more elusive when we are led to believe that reading is not supposed to be enjoyable. When a culture falls prey to an obsession with "reading challenges" and daily word count goals, it is all too easy to become inured to the shoddiness of the texts we've chosen and more difficult to object to the offensive quality of many of the books on offer.

My advice, Easy, is to be less discriminating about the medium and more choosy about the books you pick up. If you find that your mind is wandering or that you're not able to fully enter into the reality of the narrative, consider that this might be a problem with the content, not the mechanism through which you are experiencing it. Audiobooks have some distinct advantages when it comes to this kind of discernment. It's easier to identify a tin-eared writer when the book is read aloud. And the liberation from the physical discomforts of reading—neck pain, eye strain—makes it harder to blame one's growing annoyance with a text on environmental factors, an excuse that leads so many readers to stick with bad books longer than they should. Most of all, though, I would urge you to trust your instincts—to "listen," as it were, to the critic within who instinctively knows what is worth your time and who will rarely lead you astray.

Faithfully,

Cloud

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