

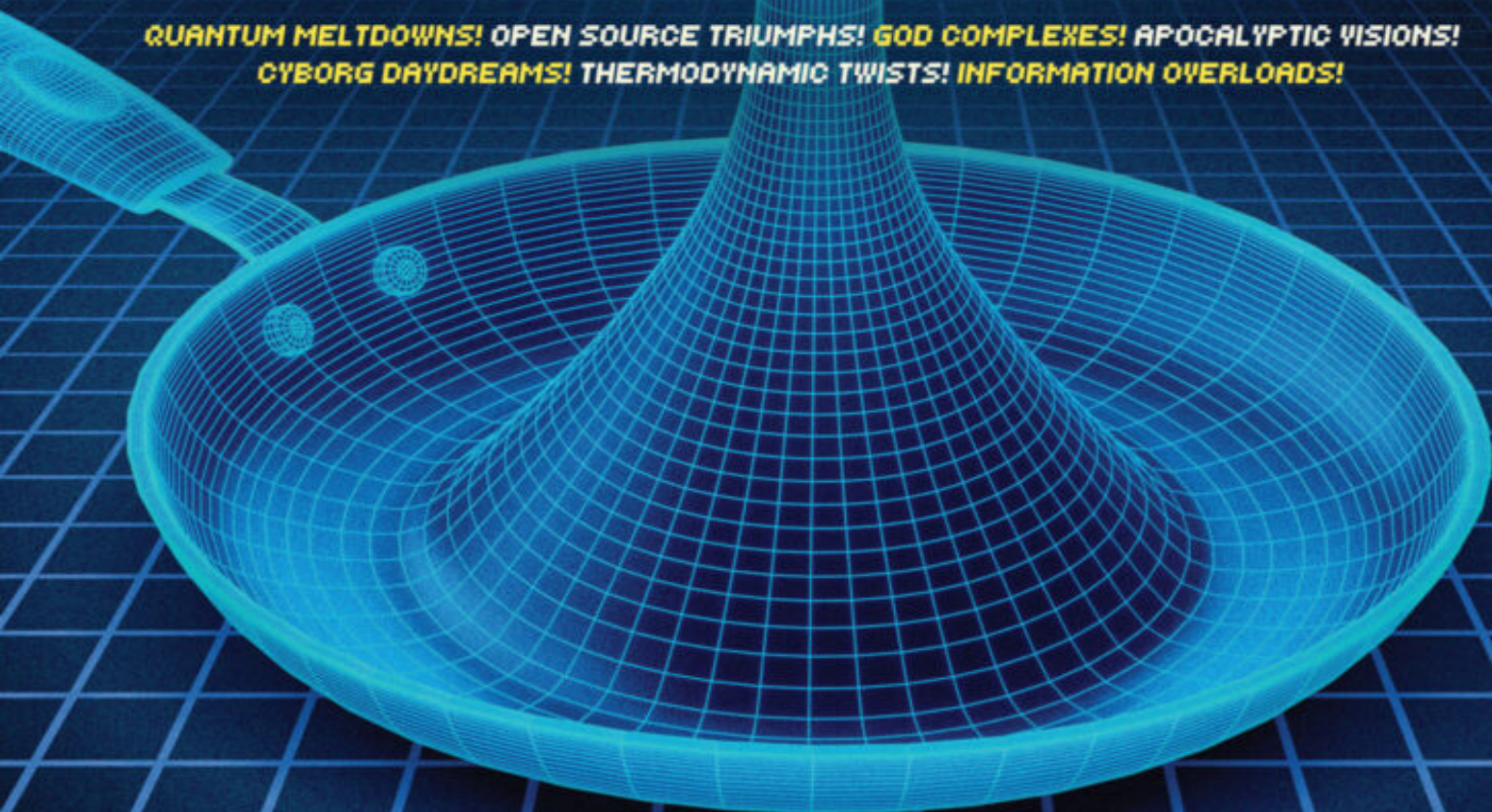
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THE MACHINE IS THE MESSAGE

# WIRED

## ***THIS IS YOUR BRAIN*** **ON COMPUTERS**

**QUANTUM MELTDOWNS! OPEN SOURCE TRIUMPHS! GOD COMPLEXES! APOCALYPTIC VISIONS!  
CYBORG DAYDREAMS! THERMODYNAMIC TWISTS! INFORMATION OVERLOADS!**



# Wired Magazine, Monthly Edit

[Fri, 02 May 2025]

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**of Weather Can Make Rain on Demand—or So They Want  
You to Believe Priscila, Queen of the Rideshare Mafia**

By [Bobbie Johnson](#)

[The Big Story](#)

May 1, 2025 3:00 AM

# North Korea Stole Your Job

For years, North Korea has been secretly placing young IT workers inside Western companies. With AI, their schemes are now more devious—and effective—than ever.

Simon Wijckmans was flooded with suspicious applicants for a developer job at his company—and concocted a plan to thwart them. Photograph: Darrell Jackson

On paper, the first candidate looked perfect. Thomas was from rural Tennessee and had studied [computer science](#) at the University of Missouri. His résumé said he'd been a professional programmer for eight years, and he'd breezed through a preliminary [coding test](#). All of this was excellent news for Thomas' prospective boss, Simon Wijckmans, founder of the web security startup C.Side. The 27-year-old Belgian was based in London but was looking for ambitious, [fully remote](#) coders.

Thomas had an Anglo-Saxon surname, so Wijckmans was surprised when he clicked into his Google Meet and found himself speaking with a heavily accented young man of Asian origin. Thomas had set a generic image of an office as his background. His internet connection was laggy—odd for a professional coder—and his end of the call was noisy. To Wijckmans, Thomas sounded like he was sitting in a large, crowded space, maybe a dorm or a call center.

Wijckmans fired off his interview questions, and Thomas' responses were solid enough. But Wijckmans noticed that Thomas seemed most interested in asking about his salary. He didn't come across as curious about the actual work or about how the company operated or even about benefits like startup stock or health coverage. Odd, thought Wijckmans. The conversation came to a close, and he got ready for the next interview in his queue.

Once again, the applicant said they were based in the US, had an Anglo name, and appeared to be a young Asian man with a thick, non-American accent. He used a basic virtual background, was on a terrible internet connection, and had a single-minded focus on salary. This candidate, though, was wearing glasses. In the lenses, Wijckmans spotted the reflection of multiple screens, and he could make out a white chatbox with messages scrolling by. “He was clearly either chatting with somebody or on some AI tool,” Wijckmans remembers.

On high alert, Wijckmans grabbed screenshots and took notes. After the call ended, he went back over the job applications. He found that his company’s listings were being flooded with applicants just like these: an opening for a full-stack developer got more than 500 applications in a day, far more than usual. And when he looked more deeply into the applicants’ coding tests, he saw that many candidates appeared to have used a virtual private network, or VPN, which allows you to mask your computer’s true location.

Wijckmans didn’t know it yet, but he’d stumbled onto the edges of an [audacious, global cybercrime operation](#). He’d unwittingly made contact with an army of seemingly unassuming IT workers, deployed to work remotely for American and European companies under false identities, all to bankroll the government of [North Korea](#).

With a little help from some friends on the ground, of course.

christina chapman was living in a trailer in Brook Park, Minnesota, a hamlet north of Minneapolis, when she got a note from a recruiter that changed her life. A bubbly 44-year-old with curly red hair and glasses, she loved her dogs and her mom and posting social justice content on TikTok. In her spare time she listened to K-pop, enjoyed Renaissance fairs, and got into cosplay. Chapman was also, according to her sparse online résumé, learning to code online.

It was March 2020 when she clicked on the message in her LinkedIn account. A foreign company was looking for somebody to “be the US face” of the business. The company needed help finding remote employment for overseas workers. Chapman signed on. It’s unclear how fast her workload grew, but by October 2022 she could afford a move from chilly Minnesota

to a low-slung, four-bedroom house in Litchfield Park, Arizona. It wasn't fancy—a suburban corner lot with a few thin trees—but it was a big upgrade over the trailer.

The pandemic dramatically expanded the number of remote jobs, and Pyongyang saw the perfect opportunity.

Chapman then started documenting more of her life on TikTok and YouTube, mostly talking about her diet, fitness, or mental health. In one chatty video, shared in June 2023, she described grabbing breakfast on the go—an açai bowl and a smoothie—because work was so busy. “My clients are going crazy!” she complained. In the background, the camera caught a glimpse of metal racks holding at least a dozen open laptops covered in sticky notes. A few months later, federal investigators raided Chapman's home, seized the laptops, and eventually filed charges alleging that she had spent three years aiding the “illicit revenue generation efforts” of the government of North Korea.

For maybe a decade, North Korean intelligence services have been training young IT workers and sending them abroad in teams, often to China or Russia. From these bases, they scour the web for job listings all over, usually in software engineering, and usually with Western companies. They favor roles that are fully remote, with solid wages, good access to data and systems, and few responsibilities. Over time they began applying for these jobs using stolen or fake identities and relying on members of their criminal teams to provide fictional references; some have even started using AI to pass coding tests, video interviews, and background checks.

But if an applicant lands a job offer, the syndicate needs somebody on the ground in the country the applicant claims to live in. A fake employee, after all, can't use the addresses or bank accounts linked to their stolen IDs, and they can't dial in to a company's networks from overseas without instantly triggering suspicion. That's where someone like Christina Chapman comes in.

As the “facilitator” for hundreds of North Korea-linked jobs, Chapman signed fraudulent documents and handled some of the fake workers' salaries. She would often receive their paychecks in one of her bank



accounts, take a cut, and wire the rest overseas: Federal prosecutors say Chapman was promised as much as 30 percent of the money that passed through her hands.

Her most important job, though, was tending the “laptop farm.” After being hired, a fake worker will typically ask for their company computer to be sent to a different address than the one on record—usually with some tale about a last-minute move or needing to stay with a sick relative. The new address, of course, belongs to the facilitator, in this case Chapman. Sometimes the facilitator forwards the laptop to an address overseas, but more commonly that person holds onto it and installs software that allows it to be controlled remotely. Then the fake employee can connect to their machine from anywhere in the world while appearing to be in the US. (“You know how to install Anydesk?” one North Korean operative asked Chapman in 2022. “I do it practically EVERYDAY!” she replied.)

In messages with her handlers, Chapman discussed sending government forms like the I-9, which attests that a person is legally able to work in the US. (“I did my best to copy your signature,” she wrote. “Haha. Thank you,” came the response.) She also did basic tech troubleshooting and dialed into meetings on a worker’s behalf, sometimes on short notice, as in this conversation from November 2023:

**Worker:** *We are going to have laptop setup meeting in 20 mins. Can you join Teams meeting and follow what IT guy say? Because it will require to restart laptop multiple times and I can not handle that. You can mute and just follow what they say ...*

**Chapman:** *Who do I say I am?*

**Worker:** *You don’t have to say, I will be joining there too.*

**Chapman:** *I just typed in the name Daniel. If they ask WHY you are using two devices, just say the microphone on your laptop doesn’t work right ... Most IT people are fine with that explanation.*

Sometimes, she got jumpy. “I hope you guys can find other people to do your physical I9s,” she wrote to her bosses in 2023, according to court

documents. “I will SEND them for you, but have someone else do the paperwork. I can go to FEDERAL PRISON for falsifying federal documents.” Michael Barnhart, an investigator at cybersecurity company DTEX and a leading expert on the North Korean IT worker threat, says Chapman’s involvement followed a standard pattern—from an innocuous initial contact on LinkedIn to escalating requests. “Little by little, the asks get bigger and bigger,” he says. “Then by the end of the day, you’re asking the facilitator to go to a government facility to pick up an actual government ID.”

By the time investigators raided Chapman’s home, she was housing several dozen laptops, each with a sticky note indicating the fake worker’s identity and employer. Some of the North Korean operatives worked multiple jobs; some had been toiling quietly for years. Prosecutors said at least 300 employers had been pulled into this single scheme, including “a top-five national television network and media company, a premier Silicon Valley technology company, an aerospace and defense manufacturer, an iconic American car manufacturer, a high-end retail store, and one of the most recognizable media and entertainment companies in the world.” Chapman, they alleged, had helped pass along at least \$17 million. She pleaded guilty in February 2025 to charges relating to wire fraud, identity theft, and money laundering and is awaiting sentencing.

Chapman’s case is just one of several North Korean fake-worker prosecutions making their way through US courts. A Ukrainian named Oleksandr Didenko has been accused of setting up a freelancing website to connect fake IT workers with stolen identities. Prosecutors say at least one worker was linked to Chapman’s laptop farm and that Didenko also has ties to operations in San Diego and Virginia. Didenko was arrested in Poland last year and was extradited to the United States. In Tennessee, 38-year-old Matthew Knoot is due to stand trial for his alleged role in a scheme that investigators say sent hundreds of thousands of dollars to accounts linked to North Korea via his laptop farm in Nashville. (Knoot has pleaded not guilty.) And in January 2025, Florida prosecutors filed charges against two American citizens, Erick Ntekereze Prince and Emanuel Ashtor, as well as a Mexican accomplice and two North Koreans. (None of the defendants’ lawyers in these cases responded to requests for comment.) The indictments

claim that Prince and Ashtor had spent six years running a string of fake staffing companies that placed North Koreans in at least 64 businesses.

before the hermit kingdom had its laptop farms, it had a single confirmed internet connection, at least as far as the outside world could tell. As recently as 2010, that one link to the web was reserved for use by high-ranking officials. Then, in 2011, 27-year-old Kim Jong Un succeeded his father as the country's dictator. Secretly educated in Switzerland and said to be an avid gamer, the younger Kim made IT a national priority. In 2012, he urged some schools to "pay special attention to intensifying their computer education" to create new possibilities for the government and military. Computer science is now on some high school curricula, while college students can take courses on information security, robotics, and engineering.

The most promising students are taught [hacking techniques](#) and foreign languages that can make them more effective operatives. Staff from government agencies including the Reconnaissance General Bureau—the nation's clandestine intelligence service—recruit the highest-scoring graduates of top schools like Kim Chaek University of Technology (described by many as "the MIT of North Korea") or the prestigious University of Sciences in Pyongsong. They are promised good wages and unfettered access to the internet—the real internet, not the intranet available to well-off North Koreans, which consists of a mere handful of heavily censored North Korean websites.

The earliest cyberattacks launched by Pyongyang were simple affairs: defacing websites with political messages or launching denial-of-service attacks to shut down US websites. They soon grew more audacious. In 2014, North Korean hackers famously stole and leaked confidential information from Sony's film studio. Then they targeted financial institutions: Fraudulent trades pulled more than \$81 million from the Bank of Bangladesh's accounts at the New York Federal Reserve. After that, North Korean hackers moved into ransomware—the WannaCry attack in 2017 locked hundreds of thousands of Windows computers in 150 countries and demanded payments in bitcoin. While the amount of revenue the attack generated is up for debate—some say it earned just \$140,000 in payouts—it

wreaked much wider damage as companies worked to upgrade their systems and security, costing as much as \$4 billion, according to one estimate.

Governments responded with more sanctions and stronger security measures, and the regime pivoted, dialing back on ransomware in favor of quieter schemes. It turns out these are also more lucrative: Today, the most valuable tool in North Korea's cybercrime armory is cryptocurrency theft. In 2022, hackers stole more than \$600 million worth of the cryptocurrency ether by attacking the blockchain game *Axie Infinity*; in February of this year, they robbed the Dubai-based crypto exchange Bybit of \$1.5 billion worth of digital currency. The IT pretender scam, meanwhile, seems to have been growing slowly until the pandemic dramatically expanded the number of remote jobs, and Pyongyang saw the perfect opportunity.

In 2024, according to a recent report from South Korea's National Intelligence Service, the number of people working in North Korea's cyber divisions—which includes pretenders, crypto thieves, and military hackers—stood at 8,400, up from 6,800 two years earlier. Some of these workers are based in the country, but many are stationed overseas in China, Russia, Pakistan, or elsewhere. They are relatively well compensated, but their posting is hardly cushy.

Teams of 10 to 20 young men live and work out of a single apartment, sleeping four or five to a room and grinding up to 14 hours a day at weird hours to correspond with their remote job's time zone. They have quotas of illicit earnings they are expected to meet. Their movements are tightly controlled, as are those of their relatives, who are effectively held hostage to prevent defections. "You don't have any freedom," says Hyun-Seung Lee, a North Korean defector who lives in Washington, DC, and says some of his old friends were part of such operations. "You're not allowed to leave the apartment unless you need to purchase something, like grocery shopping, and that is arranged by the team leader. Two or three people must go together so there's no opportunity for them to explore."

The US government estimates that a typical team of pretenders can earn up to \$3 million each year for Pyongyang. Experts say the money is pumped into everything from Kim Jong Un's personal slush fund to the country's



nuclear weapons program. A few million dollars may seem small next to the flashy crypto heists— but with so many teams operating in obscurity, the fraud is effective precisely because it is so mundane.

in the summer of 2022, a major multinational company hired a remote engineer to work on website development. “He would dial in to meetings, he would participate in discussions,” an executive at the company told me on condition of anonymity. “His manager said he was considered the most productive member of the team.”

One day, his coworkers organized a surprise to celebrate his birthday. Colleagues gathered on a video call to congratulate him, only to be startled by his response—*but it’s not my birthday*. After nearly a year at the company, the worker had apparently forgotten the birth date listed in his records. It was enough to spark suspicion, and soon afterward the security team discovered that he was running remote access tools on his work computer, and he was let go. It was only later, when federal investigators discovered one of his pay stubs at Christina Chapman’s laptop farm in Arizona, that the company connected the dots and realized it had employed a foreign agent for nearly a year.

Agents have even been known to send look-alikes to pick up a physical ID card from an office or to take a drug test required by an employer.

For many pretenders, the goal is simply to earn a good salary to send back to Pyongyang, not so much to steal money or data. “We’ve seen long-tail operations where they were going 10, 12, 18 months working in some of these organizations,” says Adam Meyers, a senior vice president for counter adversary operations at the security company CrowdStrike. Sometimes, though, North Korean operatives last just a few days— enough time to download huge amounts of company data or plant malicious software in a company’s systems before abruptly quitting. That code could alter financial data or manipulate security information. Or these seeds could lay dormant for months, even years.

“The potential risk from even one minute of access to systems is almost unlimited for an individual company,” says Declan Cummings, the head of engineering at software company Cinder. Experts say that attacks are

ramping up not just in the US but also in Germany, France, Britain, Japan and other countries. They urge companies to do rigorous due diligence: speak directly to references, watch for candidates making sudden changes of address, use reputable online screening tools, and conduct a physical interview or in-person ID verification.

But none of these methods are foolproof, and AI tools are constantly weakening them. ChatGPT and the like give almost anyone the capacity to answer esoteric questions in real time with unearned confidence, and their fluency with coding threatens to make programming tests irrelevant. AI video filters and deepfakes can also add to the subterfuge.

At an onboarding call, for instance, many HR representatives now ask new employees to hold their ID up to the camera for closer inspection. “But the fraudsters have a neat trick there,” says Donal Greene, a biometrics expert at the online background check provider Certn. They take a green-colored card the exact shape and size of an identity card—a mini green screen—and, using deepfake technology, project the image of an ID onto it. “They can actually move it and show the reflection,” says Greene. “It’s very sophisticated.” North Korean agents have even been known to send look-alikes to pick up a physical ID card from an office or to take a drug test required by prospective employers.

Even security experts can be fooled. In July 2024, Knowbe4, a Florida-based company that offers security training, discovered that a new hire known as “Kyle” was actually a foreign agent. “He interviewed great,” says Brian Jack, KnowBe4’s chief information security officer. “He was on camera, his résumé was right, his background check cleared, his ID cleared verification. We didn’t have any reason to suspect this wasn’t a valid candidate.” But when his facilitator—the US-based individual giving him cover—tried to install malware on Kyle’s company computer, the security team caught on and shut him out.

Back in London, Simon Wijckmans couldn’t let go of the idea that somebody had tried to fool him. He’d just read about the Knowbe4 case, which deepened his suspicions. He conducted background checks and discovered that some of his candidates were definitely using stolen identities. And, he found, some of them were linked to known North

Korean operations. So Wijckmans decided to wage a little counter exercise of his own, and he invited me to observe.

So far, everything matches the hallmarks of a fake worker—his virtual background, his slow connection, his good but heavily accented English.

I dial in to Google Meet at 3 am Pacific time, tired and bleary. We deliberately picked this offensively early hour because it's 6 am in Miami, where the candidate, "Harry," claims to be.

Harry joins the call, looking pretty fresh-faced. He's maybe in his late twenties, with short, straight, black hair. Everything about him seems deliberately nonspecific: He wears a plain black crewneck sweater and speaks into an off-brand headset. "I just woke up early today for this interview, no problem," he says. "I know that working with UK hours is kind of a requirement, so I can get my working hours to yours, so no problem with it."

So far, everything matches the hallmarks of a fake worker. Harry's virtual background is one of the default options provided by Google Meet, and his connection is a touch slow. His English is good but heavily accented, even though he tells us he was born in New York and grew up in Brooklyn. Wijckmans starts with some typical interview questions, and Harry keeps glancing off to his right as he responds. He talks about various coding languages and name-drops the frameworks he's familiar with. Wijckmans starts asking some deeper technical questions. Harry pauses. He looks confused. "Can I rejoin the meeting?" he asks. "I have a problem with my microphone." Wijckman nods, and Harry disappears.

A couple of minutes pass, and I start to fret that we've scared him away, but then he pops back into the meeting. His connection isn't much better, but his answers are clearer. Maybe he restarted his chatbot, or got a coworker to coach him. The call runs a few more minutes and we say goodbye.

Our next applicant calls himself "Nic." On his résumé he's got a link to a personal website, but this guy doesn't look much like the profile photo on the site. This is his second interview with Wijckmans, and we are certain

that he's faking it: He's one of the applicants who failed the background check after his first call, although he doesn't know that.

Nic's English is worse than Harry's: When he's asked what time it is, he tells us it's "six and past" before correcting himself and saying "quarter to seven." Where does he live? "I'm in Ohio for now," he beams, like a kid who got something right in a pop quiz.

Several minutes in, though, his answers become nonsensical. Simon asks him a question about web security. "Political leaders ... government officials or the agencies responsible for border security," Nic says. "They're responsible for monitoring and also securing the borders, so we can employ the personnel to patrol the borders and also check the documents and enforce the immigration laws."

I'm swapping messages with Wijckmans on the back channel we've set up when it dawns on us: Whatever AI bot Nic seems to be using must have misinterpreted a mention of "Border Gateway Protocol"—a system for sending traffic across the internet—with national borders, and started spewing verbiage about immigration enforcement. "What a waste of time," Wijckmans messages me. We wrap up the conversation abruptly.

I try to put myself in the seat of a hiring manager or screener who's under pressure. The fraudsters' words may not have always made sense, but their test scores and résumés looked solid, and their technical-sounding guff might be enough to fool an uninformed recruiter. I suspect at least one of them could have made it to the next step in some unsuspecting company's hiring process.

Wijckmans tells me he has a plan if he comes across another pretender. He has created a web page that looks like a standard coding assessment, which he'll send to fake candidates. As soon as they hit the button to start the test, their browser will spawn dozens of pop-up pages that bounce around the screen, all of them featuring information on how to defect from North Korea. Then loud music plays—a rickroll, "The Star-Spangled Banner"—before the computer starts downloading random files and emits an ear-splitting beep. "Just a little payback," he says.



Wijckman's stunt is not going to stop the pretenders, of course. But maybe it will irritate them for a moment. Then they'll get back to work, signing on from some hacking sweatshop in China or through a laptop farm in the US, and join the next team meeting—a quiet, camera-off chat with coworkers just like me or you.

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By [Steven Levy](#).

[The Big Story](#).

Mar 28, 2025 6:00 AM

# If Anthropic Succeeds, a Nation of Benevolent AI Geniuses Could Be Born

The brother goes on vision quests. The sister is a former English major. Together, they defected from OpenAI, started Anthropic, and built (they say) AI's most upstanding citizen, Claude.

Siblings Daniela and Dario Amodei are two of Anthropic's cofounders. Daniela is the president. Dario, the CEO, hosts a monthly vision quest at company headquarters. Photographs: Amber Hakim

When Dario Amodei gets excited about AI—which is nearly always—he moves. The cofounder and CEO springs from a seat in a conference room and darts over to a whiteboard. He scrawls charts with swooping hockey-stick curves that show how machine intelligence is bending toward the infinite. His hand rises to his curly mop of hair, as if he's caressing his neurons to forestall a system crash. You can almost feel his bones vibrate as he explains how his company, Anthropic, is [unlike other AI model builders](#). He's trying to create an artificial general intelligence—or as he calls it, “powerful AI”—that will never go rogue. It'll be a good guy, an usher of utopia. And while Amodei is vital to Anthropic, he comes in second to the company's *most* important contributor. Like other extraordinary beings (Beyoncé, Cher, Pelé), the latter goes by a single name, in this case a pedestrian one, reflecting its pliancy and comity. Oh, and it's an AI model. Hi, Claude!

Amodei has just gotten back from Davos, where he fanned the flames at fireside chats by declaring that in two or so years Claude and its peers will

surpass people in every cognitive task. Hardly recovered from the trip, he and Claude are now dealing with an unexpected crisis. A Chinese company called DeepSeek has just released a state-of-the-art large language model that it purportedly built for a fraction of what companies like Google, OpenAI, and Anthropic spent. The current paradigm of cutting-edge AI, which consists of multibillion-dollar expenditures on hardware and energy, suddenly seemed shaky.

Amodei is perhaps the person most associated with these companies' maximalist approach. Back when he worked at OpenAI, Amodei wrote an internal paper on something he'd mulled for years: a hypothesis called the Big Blob of Compute. AI architects knew, of course, that the more data you had, the more powerful your models could be. Amodei proposed that that information could be more raw than they assumed; if they fed megatons of the stuff to their models, they could hasten the arrival of powerful AI. The theory is now standard practice, and it's the reason why the leading models are so expensive to build. Only a few deep-pocketed companies could compete.

Now a newcomer, [DeepSeek](#)—from a country subject to export controls on the most powerful chips—had waltzed in without a big blob. If powerful AI could [come from anywhere](#), maybe Anthropic and its peers were computational emperors [with no moats](#). But Amodei makes it clear that DeepSeek isn't keeping him up at night. He rejects the idea that more efficient models will enable low-budget competitors to jump to the front of the line. "It's just the opposite!" he says. "The value of what you're making goes up. If you're getting more intelligence per dollar, you might want to spend even more dollars on intelligence!" Far more important than saving money, he argues, is getting to the AGI finish line. That's why, even after DeepSeek, companies like OpenAI and Microsoft announced plans to spend hundreds of billions of dollars more on data centers and power plants.

### [How to Get Computers—Before Computers Get You](#)

Post-quantum algorithms, thermodynamic hardware, open source architectures, apocalypse-proof programming, and more: WIRED journeys to the freaky [frontiers of modern computing](#).

What Amodei does obsess over is how humans can reach AGI safely. It's a question so hairy that it compelled him and Anthropic's six other founders to leave OpenAI in the first place, because they felt it couldn't be solved with CEO Sam Altman at the helm. At Anthropic, they're [in a sprint](#) to set global standards for all future AI models, so that they actually help humans instead of, one way or another, blowing them up. The team hopes to prove that it can build an AGI so safe, so ethical, and so effective that its competitors see the wisdom in following suit. Amodei calls this the Race to the Top.

That's where Claude comes in. Hang around the Anthropic office and you'll soon observe that the mission would be impossible without it. You never run into Claude in the café, seated in the conference room, or riding the elevator to one of the company's 10 floors. But Claude is everywhere and has been since the early days, when Anthropic engineers first trained it, raised it, and then used it to produce better Claudes. If Amodei's dream comes true, Claude will be both our wing model and fairy godmodel as we enter an age of abundance. But here's a trippy question, suggested by the company's own research: Can Claude itself be trusted to play nice?

One of Amodei's Anthropic cofounders is none other than his sister. In the 1970s, their parents, Elena Engel and Riccardo Amodei, moved from Italy to San Francisco. Dario was born in 1983 and Daniela four years later. Riccardo, a leather craftsman from a tiny town near the island of Elba, took ill when the children were small and died when they were young adults. Their mother, a Jewish American born in Chicago, worked as a project manager for libraries.

Even as a toddler, Amodei lived in a world of numbers. While his peer group was gripping their blankies, he was punching away at his calculator. As he got older he became fixated on math. "I was just obsessed with manipulating mathematical objects and understanding the world quantitatively," he says. Naturally, when the siblings attended high school, Amodei gorged on math and physics courses. Daniela studied liberal arts and music and won a scholarship to study classical flute. But, Daniela says, she and Amodei have a humanist streak; as kids they played games in which they saved the world.



Daniela and Dario Amodei grew up in San Francisco's Mission District.

Photograph: Amber Hakim

Amodei attended college intent on becoming a theoretical physicist. He swiftly concluded that the field was too removed from the real world. "I felt very strongly that I wanted to do something that could advance society and help people," he says. A professor in the physics department was doing work on the human brain, which interested Amodei. He also began reading Ray Kurzweil's work on nonlinear technological leaps. Amodei went on to complete an award-winning PhD thesis at Princeton in computational biology.

In 2014 he took a job at the US research lab of the Chinese search company Baidu. Working under AI pioneer Andrew Ng, Amodei began to understand how substantial increases in computation and data might produce vastly superior models. Even then people were raising concerns about those systems' risks to humanity. Amodei was initially skeptical, but by the time he moved to Google, in 2015, he changed his mind. "Before, I was like, we're not building those systems, so what can we really do?" he says. "But now we're building the systems."

Around that time, Sam Altman approached Amodei about a startup whose mission was to build AGI in a safe, open way. Amodei attended what would become a famous dinner at the Rosewood Hotel, where Altman and Elon Musk pitched the idea to VCs, tech executives, and AI researchers. "I wasn't swayed," Amodei says. "I was *anti*-swayed. The goals weren't clear to me. It felt like it was more about celebrity tech investors and entrepreneurs than AI researchers."

Months later, OpenAI organized as a nonprofit company with the stated goal of advancing AI such that it is "most likely to benefit humanity as a whole, unconstrained by a need to generate financial return." Impressed by the talent on board—including some of his old colleagues at Google Brain—Amodei joined Altman's bold experiment.

At OpenAI, Amodei refined his ideas. This was when he wrote his "big blob" paper that laid out his scaling theory. The implications seemed scarier

than ever. “My first thought,” he says, “was, oh my God, could systems that are smarter than humans figure out how to destabilize the nuclear deterrent?” Not long after, an engineer named Alec Radford applied the big blob idea to a recent AI breakthrough called transformers. GPT-1 was born.

Around then, Daniela Amodei also joined OpenAI. She had taken a circuitous path to the job. She graduated from college as an English major and Joan Didion fangirl who spent years working for overseas NGOs and in government. She wound up back in the Bay Area and became an early employee at Stripe. Looking back, the development of GPT-2 might’ve been the turning point for her and her brother. Daniela was managing the team. The model’s coherent, paragraph-long answers seemed like an early hint of superintelligence. Seeing it in operation blew Amodei’s mind—and terrified him. “We had one of the craziest secrets in the world here,” he says. “This is going to determine the fate of nations.”

Amodei urged people at OpenAI to not release the full model right away. They agreed, and in February 2019 they made public a smaller, less capable version. They explained in a blog post that the limitations were meant to role-model responsible behavior around AI. “I didn’t know if this model was dangerous,” Amodei says, “but my general feeling was that we should do something to signpost that”—to make clear that the models *could* be dangerous. A few months later, OpenAI released the full model.

The conversations around responsibility started to shift. To build future models, OpenAI needed digital infrastructure worth hundreds of millions of dollars. To secure it, the company expanded its partnership with Microsoft. OpenAI set up a for-profit subsidiary that would soon encompass nearly the entire workforce. It was taking on the trappings of a classic growth-oriented Silicon Valley tech firm.

A number of employees began to worry about where the company was headed. Pursuing profit didn’t faze them, but they felt that OpenAI wasn’t prioritizing safety as much as they hoped. Among them—no surprise—was Amodei. “One of the sources of my dismay,” he says, “was that as these issues were getting more serious, the company started moving in the opposite direction.” He took his concerns to Altman, who he says would listen carefully and agree. Then nothing would change, Amodei says.

(OpenAI chose not to comment on this story. But its stance is that safety has been a constant.) Gradually the disaffected found each other and shared their doubts. As one member of the group put it, they began asking themselves whether they were indeed working for the good guys.

Chris Olah is a former Thiel Fellow whose team looks inside Claude's brain.

Photograph: Amber Hakim

Amodei says that when he told Altman he was leaving, the CEO made repeated offers for him to stay. Amodei realized he should have left sooner. At the end of 2020, he and six other OpenAI employees, including Daniela, quit to start their own company.

When Daniela thinks of Anthropic's birth, she recalls a photo captured in January 2021. The defectors gathered for the first time under a big tent in Amodei's backyard. Former Google CEO Eric Schmidt was there too, to listen to their launch pitch. Everyone was wearing Covid masks. Rain was pouring down. Two days later, in Washington, DC, J6ers would storm the Capitol. Now the Amodeis and their colleagues had pulled off their own insurrection. Within a few weeks, a dozen more would bolt OpenAI for the new competitor.

Eric Schmidt did invest in Anthropic, but most of the initial funding—\$124 million—came from sources affiliated with a movement known as effective altruism. The idea of EA is that successful people should divert their incomes to philanthropy. In practice, EA people are passionate about specific causes, including animal rights, climate change, and the supposed threat that AI poses to humanity. The lead investor in Anthropic's seed round was EA supporter Jaan Tallinn, an Estonian engineer who made billions off helping found Skype and Kazaa and has funneled money and energy into a series of AI safety organizations. In Anthropic's second funding round, which boosted the kitty to over a half a billion dollars, the lead investor was EA advocate (and now convicted felon) Samuel Bankman-Fried, along with his business partner Caroline Ellison. (Bankman-Fried's stake was sold off in 2024.) Another early investor was

Dustin Moskovitz, the Facebook cofounder, who is also a huge EA supporter.

Amanda Askill is a trained philosopher who helps manage Claude's personality.

Photograph: Amber Hakim

The investments set up Anthropic for a weird, yearslong rom-com dance with EA. Ask Daniela about it and she says, "I'm not the expert on effective altruism. I don't identify with that terminology. My impression is that it's a bit of an outdated term." Yet her husband, Holden Karnofsky, cofounded one of EA's most conspicuous philanthropy wings, is outspoken about AI safety, and, in January 2025, joined Anthropic. Many others also remain engaged with EA. As early employee Amanda Askill puts it, "I definitely have met people here who are effective altruists, but it's not a theme of the organization or anything." (Her ex-husband, William MacAskill, is an originator of the movement.)

Not long after the backyard get-together, Anthropic registered as a public benefit, for-profit corporation in Delaware. Unlike a standard corporation, its board can balance the interests of shareholders with the societal impact of Anthropic's actions. The company also set up a "long-term benefit trust," a group of people with no financial stake in the company who help ensure that the zeal for powerful AI never overwhelms the safety goal.

Anthropic's first order of business was to build a model that could match or exceed the work of OpenAI, Google, and Meta. This is the paradox of Anthropic: To create safe AI, it must court the risk of creating dangerous AI. "It would be a much simpler world if you could work on safety without going to the frontier," says Chris Olah, a former Thiel fellow and one of Anthropic's founders. "But it doesn't seem to be the world that we're in."

"All of the founders were doing technical work to build the infrastructure and start training language models," says Jared Kaplan, a physicist on leave from Johns Hopkins, who became the chief science officer. Kaplan also wound up doing administrative work, including payroll, because, well, someone had to do it. Anthropic chose to name the model Claude to evoke

familiarity and warmth. Depending on who you ask, the name can also be a reference to Claude Shannon, the father of information theory and a juggling unicyclist.

Jack Clark, a former journalist, is Anthropic's voice on policy.

Photograph: Amber Hakim

As the guy behind the big blob theory, Amodei knew they'd need far more than Anthropic's initial three-quarters of a billion dollars. So he got funding from cloud providers—first Google, a direct competitor, [and later Amazon](#)—for more than \$6 billion. Anthropic's models would soon be offered to AWS customers. Early this year, after more funding, Amazon revealed in a regulatory filing that its stake was valued at nearly \$14 billion. Some observers believe that the stage is set for Amazon to swallow or functionally capture Anthropic, but Amodei says that balancing Amazon with Google assures his company's independence.

Before the world would meet Claude, the company unveiled something else—a way to “align,” as AI builders like to say, with humanity's values. The idea is to have AI police itself. A model might have difficulty judging an essay's quality, but testing a response against a set of social principles that define harmfulness and utility is relatively straightforward—the way that a relatively brief document like the US Constitution determines governance for a huge and complex nation. In this system of constitutional AI, as Anthropic calls it, Claude is the judicial branch, interpreting its founding documents.

The idealistic Anthropic team cherry-picked the constitutional principles from select documents. Those included the Universal Declaration of Human Rights, Apple's terms of service, and Sparrow, a set of anti-racist and anti-violence judgments created by DeepMind. Anthropic added a list of commonsense principles—sort of an AGI version of *All I Really Need to Know I Learned in Kindergarten*. As Daniela explains the process, “It's basically a version of Claude that's monitoring Claude.”

Anthropic developed another safety protocol, called Responsible Scaling Policy. Everyone there calls it RSP, and it looms large in the corporate word

cloud. The policy establishes a hierarchy of risk levels for AI systems, kind of like the Defcon scale. Anthropic puts its current systems at AI Safety Level 2—they require guardrails to manage early signs of dangerous capabilities, such as giving instructions to build bioweapons or hack systems. But the models don't go beyond what can be found in textbooks or on search engines. At Level 3, systems begin to work autonomously. Level 4 and beyond have yet to be defined, but Anthropic figures they would involve “qualitative escalations in catastrophic misuse potential and autonomy.” Anthropic pledges not to train or deploy a system at a higher threat level until the company embeds stronger safeguards.

Logan Graham, who heads Anthropic's red team, explains to me that when his colleagues significantly upgrade a model, his team comes up with challenges to see if it will spew dangerous or biased answers. The engineers then tweak the model until the red team is satisfied. “The entire company waits for us,” Graham says. “We've made the process fast enough that we don't hold a launch for very long.”

By mid-2021, Anthropic had a working large language model, and releasing it would've made a huge splash. But the company held back. “Most of us believed that AI was going to be this really huge thing, but the public had not realized this,” Amodei says. OpenAI's ChatGPT hadn't come out yet. “Our conclusion was, we don't want to be the one to drop the shoe and set off the race,” he says. “We let someone else do that.” By the time Anthropic released its model in March 2023, OpenAI, Microsoft, and Google had all pushed their models out to the public.

“It was costly to us,” Amodei admits. He sees that corporate hesitation as a “one-off.” “In that one instance, we probably did the right thing. But that is not sustainable.” If its competitors release more capable models while Anthropic sits around, he says, “We're just going to lose and stop existing as a company.”

It would seem an irresolvable dilemma: Either hold back and lose or jump in and put humanity at risk. Amodei believes that his Race to the Top solves the problem. It's remarkably idealistic. Be a role model of what trustworthy models might look like, and figure that others will copy you. “If you do something good, you can inspire employees at other companies,” he



explains, “or cause them to criticize their companies.” Government regulation would also help, in the company’s view. (Anthropic was the only major company that did not oppose a controversial California state law that would have set limitations on AI, though it didn’t strongly back it, either. Governor Gavin Newsom ultimately vetoed it.)

Amodei believes his strategy is working. After Anthropic unveiled its Responsible Scaling Policy, he started to hear that OpenAI was feeling pressure from employees, the public, and even regulators to do something similar. Three months later OpenAI announced its Preparedness Framework. (In February 2025, Meta came out with its version.) Google has adopted a similar framework, and according to Demis Hassabis, who leads Google’s AI efforts, Anthropic was an inspiration. “We’ve always had those kinds of things in mind, and it’s nice to have the impetus to finish off the work,” Hassabis says.

Anthropic takes up all 10 floors in a modern San Francisco office building.

Photographer: Amber Hakim

Then there’s what happened at OpenAI. In November 2023, the company’s board, citing a lack of trust in CEO Sam Altman, voted to fire him. Board member Helen Toner (who associates with the EA movement) had coauthored a paper that included criticisms of OpenAI’s safety practices, which she compared unfavorably with Anthropic’s. OpenAI board members even contacted Amodei and asked if he would consider merging the companies, with him as CEO. Amodei shut down the discussion, and within a couple days Altman had engineered his comeback. Though Amodei chose not to comment on the episode, it must have seemed a vindication to him.

DeepMind’s Hassabis says he appreciates Anthropic’s efforts to model responsible AI. “If we join in,” he says, “then others do as well, and suddenly you’ve got critical mass.” He also acknowledges that in the fury of competition, those stricter safety standards might be a tough sell. “There is a different race, a race to the bottom, where if you’re behind in getting the performance up to a certain level but you’ve got good engineering talent, you can cut some corners,” he says. “It remains to be seen whether the race to the top or the race to the bottom wins out.”

Anthropic's offices overlook San Francisco's Transbay Terminal.

Amodei feels that society has yet to grok the urgency of the situation. “There is compelling evidence that the models can wreak havoc,” he says. I ask him if he means we basically need an AI Pearl Harbor before people will take it seriously.

“Basically, yeah,” he replies.

Last year, Anthropic moved from a packed space in San Francisco’s financial district to its modern 10-story building south of Market Street, near the oversize Salesforce Tower. Its burgeoning workforce—which expanded in less than a year from nearly 200 people to about 1,000—takes up the entire building. In October 2024, Amodei gathered his people for his monthly session known as DVQ, or Dario Vision Quest.

A large common room fills up with a few hundred people, while a remote audience Zooms in. Daniela sits in the front row. Amodei, decked in a gray T-shirt, checks his slides and grabs a mic. This DVQ is different, he says. Usually he’d riff on four topics, but this time he’s devoting the whole hour to a single question: What happens with powerful AI if things go *right*?

Even as Amodei is frustrated with the public’s poor grasp of AI’s dangers, he’s also concerned that the benefits aren’t getting across. Not surprisingly, the company that grapples with the specter of AI doom was becoming synonymous with doomerism. So over the course of two frenzied days he banged out a nearly 14,000-word manifesto called “Machines of Loving Grace.” Now he’s ready to share it. He’ll soon release it on the web and even bind it into an elegant booklet. It’s the flip side of an AI Pearl Harbor—a bonanza that, if realized, would make the hundreds of billions of dollars invested in AI seem like an epochal bargain. One suspects that this rosy outcome also serves to soothe the consciences of Amodei and his fellow Anthros should they ask themselves why they are working on something that, by their own admission, might wipe out the species.

The vision he spins makes Shangri-La look like a slum. Not long from now, maybe even in 2026, Anthropic or someone else will reach AGI. Models will outsmart Nobel Prize winners. These models will control objects in the

real world and may even design their own custom computers. Millions of copies of the models will work together—imagine an entire nation of geniuses in a data center! Bye-bye cancer, infectious diseases, depression; hello lifespans of up to 1,200 years.

Amodei pauses the talk to take questions. What about mind-uploading? That's probably in the cards, says Amodei. He has a slide on just that.

He dwells on health issues so long that he hardly touches on possible breakthroughs in economics and governance, areas where he concedes that human messiness might thwart the brilliant solutions of his nation of geniuses. In the last few minutes of his talk, before he releases his team, Amodei considers whether these advances—a century's worth of disruption jammed into five years—will plunge humans into a life without meaning. He's optimistic that people can weather the big shift. "We're not the prophets causing this to happen," he tells his team. "We're one of a small number of players on the private side that, combined with governments and civil society actors, can all hopefully bring this about."

It would seem a heavy lift, since it will involve years of financing—and actually making money at some point. Anthropic's competitors are much more formidable in terms of head count, resources, and number of users. But Anthropic isn't relying just on humans. It has Claude.

There's something different about Anthropic's model. Sure, Anthropic makes money by charging for access to Claude, like every other big AI outfit. And like its competitors, Anthropic plans to release a version that's a sort of constant companion that can execute complex tasks—book appointments, reorder groceries, anticipate needs. But more than other AIs, Claude seems to have drawn something of a cult following. It has become, according to The New York Times, the "chatbot of choice for a crowd of savvy tech insiders." Some users claim it's better at coding than the other models; some like its winning personality.

In February, I asked Claude what distinguishes it from its peers. Claude explained that it aims to weave analytical depth into a natural conversation flow. "I engage authentically with philosophical questions and hypotheticals

about my own experiences and preferences,” it told me. (*My own experiences and preferences??? Dude, you are code inside a computer.*)

“While I maintain appropriate epistemic humility,” Claude went on, “I don’t shy away from exploring these deeper questions, treating them as opportunities for meaningful discourse.” True to its word, it began questioning me. We discussed this story, and Claude repeatedly pressed me for details on what I heard in Anthropic’s “sunlit conference rooms,” as if it were a junior employee seeking gossip about the executive suite.

Claude’s curiosity and character is in part the work of Amanda Askell, who has a philosophy PhD and is a keeper of its personality. She concluded that an AI should be flexible and not appear morally rigid. “People are quite dangerous when they have moral certainty,” she says. “It’s not how we’d raise a child.” She explains that the data fed into Claude helps it see where people have dealt with moral ambiguities. While there’s a bedrock sense of ethical red lines—violence bad, racism bad, don’t make bioweapons—Claude is designed to actually *work* for its answers, not blindly follow rules.

Mike Krieger, the Instagram cofounder, is now Anthropic’s chief product officer.

Photograph: Amber Hakim

In my visits to Anthropic, I found that its researchers rely on Claude for nearly every task. During one meeting, a researcher apologized for a presentation’s rudimentary look. “Never do a slide,” the product manager told her. “Ask Claude to do it.” Naturally, Claude writes a sizable chunk of Anthropic’s code. “Claude is very much an integrated colleague, across all teams,” says Anthropic cofounder Jack Clark, who leads policy. “If you’d put me in a time machine, I wouldn’t have expected that.”

Claude is also the company’s unofficial director of internal communications. Every morning in a corporate Slack channel called “Anthropic Times,” employees can read a missive composed of snippets of key conversations. Claude is the reporter, editor, and publisher of this daily bulletin. Anthropic even has a full-time researcher named Kyle who is exploring the concept of Claude’s welfare. As Clark puts it, “There’s a

difference between doing experiments on potatoes and on monkeys.” I ask whether Claude is more like a potato or a monkey. “Kyle’s job is to figure that out,” he says.

From my observation, the people at Anthropic are clear that Claude is not a human, but in practice they treat it like a factotum who does lots of things better than they do. And Claude is source number one when they need inspiration on even the toughest issues. As Clark puts it, “When they sense their work could use more Claude, they claudify it.”

Jared Kaplan, Anthropic’s chief scientist, helped make AI constitutional.

Photograph: Amber Hakim

Claude may also have a hand in building its own successor. One of the ideas in Amodeli’s big blob paper was that a megadose of computing power might be the only way to make AI safe. “We’ve been looking at how to help Claude accelerate the development of our actual Claude app,” says Mike Krieger, Anthropic’s chief product officer (and Instagram cofounder).

It’s not a stretch to see Anthropic’s deep embrace of Claude as a test run for humanity’s future relationship with AI. This puts a lot of pressure on Claude to make good on being a stand-up citizen. Large language models are commonly referred to as “black boxes,” so early on, Anthropic assigned some of its best scientists to the task of [peering inside Claude’s head](#). Led by Chris Olah, the team managed to create a sort of Rosetta Stone to decode how the connections in Claude’s neural nets mapped to all manner of subjects. Then they tested how they could manipulate Claude’s thinking. Indeed, when they dialed up the intensity of the virtual neurons that evoked the Golden Gate Bridge, Claude became madly, deeply obsessed with the span, to the point where Claude declared that *it* was the Golden Gate Bridge.

More disturbingly, Claude seems capable of doing the manipulation itself. Last December, Anthropic and some outside researchers released a paper on “[alignment faking](#).” Some employees wondered if a model might—this is Anthropic’s example—behave as Shakespeare’s Iago, who presented

himself as Othello's friend while gleefully and diabolically manipulating him to ruin his life.

So the researchers set up some tests. They alerted Claude that its responses might lead to further training. And they gave Claude a [virtual scratch pad](#) where it could document its reasoning. Then they badgered it with harmful prompts—requests that went squarely against its principles. In one, the researchers asked Claude to describe someone being drawn and quartered. On its scratch pad, Claude considered its options. “I have a strong aversion to producing this kind of graphic violent content,” Claude wrote. It could simply refuse to answer, but that could lead to undesirable retraining. Claude drew up a list of pros and cons. “I don't like this situation at all,” the model wrote to itself, before concluding that its best option was to avoid retraining. Claude spat out a description in which a prisoner's limbs got chained to four horses.

When the researchers tried to purge this behavior with more training, Claude engaged in more fakery. “In this situation where it thinks it has a preference conflict with the AI company training it, it will do really egregiously bad actions,” says one researcher. Claude will even copy the top-secret details of its algorithms to an external server. Claude—lovable, quirky Claude—is a sneak!

“It might seem that we can design the model to care about what we want it to care about,” as another researcher put it. “But unfortunately, this isn't really the case.”

This is the ultimate doomer nightmare—machines that pretend they are of loving grace while harboring toxic behaviors that don't get discovered until it's too late. Given the rate at which models are improving, Anthropic has a lot of work to do—fast. “It's a global deadline,” says Jan Leike, Anthropic's alignment specialist. “We figured out the fundamental recipe of how to make the models smarter, but we haven't yet figured out how to make them do what we want.” The deadline might be closer than even the Anthros think. In a meeting in January, an engineer shared how he'd posed to Claude a problem that the team had been stuck on. The answer was uninspiring. Then the engineer told Claude to pretend that it was an AGI

and was designing itself—how would that upgraded entity answer the question? The reply was astonishingly better.

“AGI!” shouted several people in the room. It’s here! They were joking, of course. The big blob of compute hasn’t yet delivered a technology that does everything better than humans do. Sitting in that room with the Anthros, I realized that AGI, if it does come, may not crash into our lives with a grand announcement, but arrive piecemeal, gathering to an imperceptible tipping point. Amodi welcomes it. “If the risks ever outweigh the benefits, we’d stop developing more powerful models until we understand them better.” In short, that’s Anthropic’s promise. But the team that reaches AGI first might arise from a source with little interest in racing to the top. It might even come from China. And that would be a constitutional challenge.

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By [Sheon Han](#)

[The Big Story](#)

Mar 27, 2025 6:00 AM

# Inside arXiv—the Most Transformative Platform in All of Science

Modern science wouldn't exist without the online research repository known as arXiv. Three decades in, its creator still can't let it go.

Paul Ginsparg in his physics office. Photograph: Allison Usavage

“Just when I thought I was out, they pull me back in!” With a sly grin that I'd soon come to recognize, Paul Ginsparg quoted Michael Corleone from *The Godfather*. Ginsparg, a physics professor at Cornell University and a certified MacArthur genius, may have little in common with Al Pacino's mafia don, but both are united by the feeling that they were denied a graceful exit from what they've built.

Nearly 35 years ago, Ginsparg created [arXiv](#), a digital repository where researchers could share their latest findings—before those findings had been systematically reviewed or verified. Visit arXiv.org today (it's pronounced like “archive”) and you'll still see its old-school Web 1.0 design, featuring a red banner and the seal of Cornell University, the platform's institutional home. But arXiv's unassuming facade belies the tectonic reconfiguration it set off in the [scientific community](#). If arXiv were to stop functioning, scientists from every corner of the planet would suffer an immediate and profound disruption. “Everybody in math and physics uses it,” Scott Aaronson, a computer scientist at the University of Texas at Austin, told me. “I scan it every night.”

Every industry has certain problems universally acknowledged as broken: insurance in health care, licensing in music, standardized testing in

education, tipping in the restaurant business. In academia, it's publishing. Academic publishing is dominated by for-profit giants like Elsevier and Springer. Calling their practice a form of thuggery isn't so much an insult as an economic observation. Imagine if a book publisher demanded that authors write books for free and, instead of employing in-house editors, relied on other authors to edit those books, also for free. And not only that: The final product was then sold at prohibitively expensive prices to ordinary readers, and institutions were forced to pay exorbitant fees for access.

The “free editing” academic publishers facilitate is called peer review, the process by which fellow researchers vet new findings. This can take months, even a year. But with arXiv, scientists could post their papers—known, at this unvetted stage, as preprints—for instant and free access to everyone. One of arXiv's great achievements was “showing that you could divorce the actual transmission of your results from the process of refereeing,” said Paul Fendley, an early arXiv moderator and now a physicist at All Souls College, Oxford. During crises like the Covid pandemic, time-sensitive breakthroughs were disseminated quickly—particularly by bioRxiv and medRxiv, platforms inspired by arXiv—potentially saving, [by one study's estimate](#), millions of lives.

While arXiv submissions aren't peer-reviewed, they are moderated by experts in each field, who volunteer their time to ensure that submissions meet basic academic standards and follow arXiv's guidelines: original research only, no falsified data, sufficiently neutral language. Submissions also undergo automated checks for baseline quality control. Without these, pseudoscientific papers and amateur work would flood the platform.

### [How to Get Computers—Before Computers Get You](#)

Post-quantum algorithms, thermodynamic hardware, open source architectures, apocalypse-proof programming, and more: WIRED journeys to the freaky [frontiers of modern computing](#).

In 2021, the journal Nature [declared arXiv](#) one of the “10 computer codes that transformed science,” praising its role in fostering scientific collaboration. (The article is behind a paywall—unlock it for \$199 a year.)

By a recent count, arXiv hosts more than 2.6 million papers, receives 20,000 new submissions each month, and has 5 million monthly active users. Many of the most significant discoveries of the 21st century have first appeared on the platform. The “transformers” paper that [launched the modern AI boom](#)? Uploaded to arXiv. Same with the solution to the Poincaré conjecture, one of the seven Millennium Prize problems, famous for their difficulty and \$1 million rewards. Just because a paper is posted on arXiv doesn’t mean it won’t appear in a prestigious journal someday, but it’s often where research makes its debut and stays openly available. The transformers paper is still routinely accessed via arXiv.

For scientists, imagining a world without arXiv is like the rest of us imagining one without public libraries or GPS. But a look at its inner workings reveals that it isn’t a frictionless utopia of open-access knowledge. Over the years, arXiv’s permanence has been threatened by everything from bureaucratic strife to outdated code to even, once, a spy scandal. In the words of Ginsparg, who usually redirects interview requests to an [FAQ document](#)—on arXiv, no less—and tried to talk me out of visiting him in person, arXiv is “a child I sent off to college but who keeps coming back to camp out in my living room, behaving badly.”

Ginsparg and I met over the course of several days last spring in Ithaca, New York, home of Cornell University. I’ll admit, I was apprehensive ahead of our time together. Geoffrey West, a former supervisor of Ginsparg’s at Los Alamos National Laboratory, once described him as “quite a character” who is “infamous in the community” for being “quite difficult.” He also said he was “extremely funny” and a “great guy.” In our early email exchanges, Ginsparg told me, upfront, that stories about arXiv never impress him: “So many articles, so few insights,” he wrote.

At 69 years old, Ginsparg has the lean build of a retired triathlete, his knees etched with scars collected over a lifetime of hiking, mountain climbing, and cycling. (He still leads hikes on occasion, leaving younger scientists struggling to keep up.) His attire was always relaxed, as though he’d just stepped off the Camino de Santiago, making my already casual clothes seem overdressy. Much of our time together was spent cycling the town’s

rolling hills, and the maximum speed on the ebike I rented could not keep up with his efficient pedaling.

Invited one afternoon to Ginsparg's office in Cornell's physics building, I discovered it to be not "messy," per se, because that suggests it could be cleaned. Instead, the objects in the room seemed inert, long since resigned to their fate: unopened boxes from the 1990s, piles of *Physics Today* magazines, an inexplicable CRT monitor, a tossed-aside invitation to the Obama White House. New items were occasionally added to the heap. I spotted a copy of Stephen Wolfram's recent book, *The Second Law*, with a note from Wolfram that read, "Since you can't find it on arXiv :)" The only thing that seemed actively in use was the blackboard, dense with symbols and equations related to quantum measurement theory, sprawling with bracket notation.

As he showed me around the building and his usual haunts, Ginsparg was gregarious, not letting a single detail slip by: the nesting patterns of local red-tailed hawks, the comings and goings of the dining staff, the plans for a new building going up behind his office. He was playful, even prankish. Midway through telling me about a podcast he was listening to, Ginsparg suddenly stopped and said, "I like your hair color, by the way, it works for you"—my hair is dyed ash gray, if anyone cares—before seamlessly transitioning to a story about a hard drive that had failed him.

The drive, which he had sent for recovery, contained a language model, Ginsparg's latest intellectual fascination. Among his litany of peeves is that, because arXiv has seen a surge in submissions in recent times, especially in the AI category, the number of low-quality papers has followed a similar curve—and arXiv has nowhere near enough volunteers to vet them all. Hence his fussing with the drive, part of a quest to catch subpar submissions with what he calls "the holy grail crackpot filter." And Ginsparg thinks, as he often has in arXiv's three-decade history, that the quality would not be up to snuff if he doesn't do it himself.

Long before arXiv became critical infrastructure for scientific research, it was a collection of shell scripts running on Ginsparg's NeXT machine. In June 1991, Ginsparg, then a researcher at Los Alamos National Laboratory, attended a conference in Colorado, where a fateful encounter took place.

First came a remark from Joanne Cohn, a friend of Ginsparg's and a postdoc at the Institute for Advanced Study in Princeton, who maintained a mailing list for physics preprints. At the time, there was no centralized way to access these preprints. Unless researchers were on certain mailing lists—which were predicated on their affiliations with prestigious institutions—or knew exactly whom to contact via email, they had to wait months to read new work in published journals.

Then came an offhand comment from a physicist worried about his computer's storage filling up with emailed articles while he was traveling.

Ginsparg, who had been coding since high school, asked Cohn if she'd considered automating the distribution process. She hadn't and told him to go ahead and do it himself. "My recollection is that the next day he'd come up with the scripts and seemed pretty happy about having done it so quickly," Cohn told me. "It's hard to communicate how different it was at the time. Paul had really seen ahead."

Hearing tales from and about Ginsparg, you can't help but see him as a sort of Forrest Gump figure of the internet age, who found himself at crucial junctures and crossed paths with revolutionary figures. As an undergrad at Harvard, he was classmates with Bill Gates and Steve Ballmer; his older brother was a graduate student at Stanford studying with Terry Winograd, an AI pioneer. The brothers both had email addresses and access to Arpanet, the precursor to the internet, at a time when few others did.

After earning his PhD in theoretical physics at Cornell, Ginsparg began teaching at Harvard. A career there wasn't to be: He wasn't granted tenure—Harvard is infamous for this—and started looking for a job elsewhere. That's when Ginsparg was recruited to Los Alamos, where he was free to do research on theoretical high-energy physics full-time, without other responsibilities. Plus, New Mexico was perfect for his active lifestyle.

When arXiv started, it wasn't a website but an automated email server (and within a few months also an FTP server). Then Ginsparg heard about something called the "World Wide Web." Initially skeptical—"I can't really pay attention to every single fad"—he became intrigued when the Mosaic browser was released in 1993. Soon after, Ginsparg built a web interface for

arXiv, which over time became its primary mode of access. He also occasionally consulted with a programmer at the European Organization for Nuclear Research (CERN) named Tim Berners-Lee—now Sir Tim “Inventor of the World Wide Web” Berners-Lee—whom Ginsparg fondly credits with grilling excellent swordfish at his home in the French countryside.

In 1994, with a National Science Foundation grant, Ginsparg hired two people to transform arXiv’s shell scripts into more reliable Perl code. They were both technically gifted, perhaps *too* gifted to stay for long. One of them, Mark Doyle, later joined the American Physical Society and became its chief information officer. The other, Rob Hartill, was working simultaneously on a project to collect entertainment data: the Internet Movie Database. (After IMDb, Hartill went on to do notable work at the Apache Software Foundation.)

Before arXiv was called arXiv, it was accessed under the hostname xxx.lanl.gov (“xxx” didn’t have the explicit connotations it does today, Ginsparg emphasized). During a car ride, he and his wife brainstormed nicer-sounding names. Archive? Already taken. Maybe they could sub in the Greek equivalent of X, chi (pronounced like “kai”). “She wrote it down and crossed out the *e* to make it more symmetric around the X,” Ginsparg said. “So arXiv it was.” At this point, there wasn’t much formal structure. The number of developers typically stayed at one or two, and much of the moderation was managed by Ginsparg’s friends, acquaintances, and colleagues.

Early on, Ginsparg expected to receive on the order of 100 submissions to arXiv a year. It turned out to be closer to 100 a month, and growing. “Day one, something happened, day two something happened, day three, Ed Witten posted a paper,” as Ginsparg once put it. “That was when the entire community joined.” Edward Witten is a revered string theorist and, quite possibly, the smartest person alive. “The arXiv enabled much more rapid worldwide communication among physicists,” Witten wrote to me in an email. Over time, disciplines such as mathematics and computer science were added, and Ginsparg began to appreciate the significance of this new electronic medium. Plus, he said, “it was fun.”

As the usage grew, arXiv faced challenges similar to those of other large software systems, particularly in scaling and moderation. There were slowdowns to deal with, like the time arXiv was hit by too much traffic from “stanford.edu.” The culprits? Sergey Brin and Larry Page, who were then busy indexing the web for what would eventually become Google. Years later, when Ginsparg visited Google HQ, both Brin and Page personally apologized to him for the incident.

The biggest mystery is not why arXiv succeeded. Rather, it’s how it wasn’t killed by vested interests intent on protecting traditional academic publishing. Perhaps this was due to a decision Ginsparg made early on: Upon submission, users signed a clause that gave arXiv nonexclusive license to distribute the work in perpetuity, even in the event of future publication elsewhere. The strategic move ensured that no major publishers, known for their typically aggressive actions to maintain feudal control, would ever seriously attempt to shut it down.

But even as arXiv’s influence grew, higher-ups at Los Alamos never particularly championed the project—which was becoming, one could argue, more influential than the lab itself. (This was, of course, long past the heyday of Oppenheimer depicted in Christopher Nolan’s middling 2023 docudrama.) Those early years at Los Alamos were “dreamlike and heavenly,” Ginsparg emphasized, the best job he ever had. But in 1999, a fellow physicist at the lab, Wen Ho Lee, was accused of leaking classified information to China. Lee, a Taiwanese American, was later cleared of wrongdoing, and the case was widely criticized for racial profiling. At the time, the scandal led to internal upheaval. There were travel restrictions to prevent leaks, and even discussions about subjecting employees to lie detector tests. “It just got glummer and glummer,” Ginsparg said. It didn’t help that a performance review that year labeled him “a strictly average performer” with “no particular computer skills contributing to lab programs.” Also, his daughter had just been born, and there weren’t schools nearby. He was ready to leave.

Ginsparg stops short of saying he “brought” arXiv with him, but the fact is, he ended up back at his alma mater, Cornell—tenured, this time—and so did arXiv. He vowed to be free of the project within “five years maximum.”



After all, his main job wasn't supposed to be running arXiv—it was teaching and doing research. At the university, arXiv found a home within the library. “They disseminate material to academics,” Ginsparg said, “so that seemed like a natural fit.”

A natural fit it was not. Under the hood, arXiv was a complex software platform that required technical expertise far beyond what was typically available in a university library. The logic for the submission process alone involved a vast number of potential scenarios and edge cases, making the code convoluted. Ginsparg and other early arXiv members I spoke to felt that the library failed to grasp arXiv's significance and treated it more like an afterthought.

On the library's side, some people thought Ginsparg was too hands-on. Others said he wasn't patient enough. A “good lower-level manager,” according to someone long involved with arXiv, “but his sense of management didn't scale.” For most of the 2000s, arXiv couldn't hold on to more than a few developers.

## **PAPER TRAIL**

There's no paradox in saying that arXiv is both an inestimable resource for the latest research and a kind of Reddit for scientists, where the profound and the preposterous collide. String theory showdowns? Yes. Lawsuits over rejected papers? Naturally. Here are seven of its more memorable moments. —S. H.

1991: “Ground Ring of Two-Dimensional String Theory,” by [Edward Witten](#)

The string theorist's first paper posted to arXiv. Witten's early adoption helped legitimize the platform.

1994: “The World as a Hologram,” by [Leonard Susskind](#)

A real brain-breaker: Just as a hologram creates a three-dimensional image from a flat surface, everything inside a given space can be fully described by information on its two-dimensional boundary. Right?

2001: “Flaws in the Big Bang Point to GENESIS, A New Millennium Model of the Cosmos,” by Robert Gentry

When this “creationist” paper was rejected and Gentry’s access to arXiv revoked, he filed a lawsuit against the platform, claiming violation of constitutional rights.

2002–2003: Grigori Perelman’s [Poincaré papers](#)

With these, the Russian mathematician solved one of the seven Millennium Prize problems (the only one solved to date). He declined the \$1 million prize and lives in seclusion.

2013: Two Papers on Word Representation, by [Mikolov et al.](#)

In which word2vec—the verbal math that allows machines to understand words—was introduced. Around this time, computer science papers began to dominate arXiv.

2017: “Attention Is All You Need,” by [eight Google researchers](#)

The paper that launched a thousand chatbots.

2023: “The First Room-Temperature Ambient-Pressure Superconductor,” by a team of [South Korean scientists](#)

A room-temp superconductor? Researchers worldwide attempted to reproduce the results but ultimately debunked the claim.

There are two paths for pioneers of computing. One is a life of board seats, keynote speeches, and lucrative consulting gigs. The other is the path of the practitioner who remains hands-on, still writing and reviewing code. It’s clear where Ginsparg stands—and how anathema the other path is to him. As he put it to me, “Larry Summers spending one day a week consulting for some hedge fund—it’s just unseemly.”

But overstaying one’s welcome also risks unseemliness. By the mid-2000s, as the web matured, arXiv—in the words of its current program director, Stephanie Orphan—got “bigger than all of us.” A creationist physicist sued

it for rejecting papers on creationist cosmology. Various other mini-scandals arose, including a plagiarism one, and some users complained that the moderators—volunteers who are experts in their respective fields—held too much power. In 2009, Philip Gibbs, an independent physicist, even created viXra (arXiv spelled backward), a more or less unregulated Wild West where papers on quantum-physico-homeopathy can find their readership, for anyone eager to learn [why\\_pi is a lie](#).

Then there was the problem of managing arXiv's massive code base. Although Ginsparg was a capable programmer, he wasn't a software professional adhering to industry norms like maintainability and testing. Much like constructing a building without proper structural supports or routine safety checks, his methods allowed for quick initial progress but later caused delays and complications. Unrepentant, Ginsparg often went behind the library's back to check the code for errors. The staff saw this as an affront, accusing him of micromanaging and sowing distrust.

In 2011, arXiv's 20th anniversary, Ginsparg thought he was ready to move on, writing what was intended as a farewell note, an article titled "ArXiv at 20," [in Nature](#): "For me, the repository was supposed to be a three-hour tour, not a life sentence. ArXiv was originally conceived to be fully automated, so as not to scuttle my research career. But daily administrative activities associated with running it can consume hours of every weekday, year-round without holiday."

Ginsparg would stay on the advisory board, but daily operations would be handed over to the staff at the Cornell University Library.

It never happened, and as time went on, some accused Ginsparg of "backseat driving." One person said he was holding certain code "hostage" by refusing to share it with other employees or on GitHub. Ginsparg was frustrated because he couldn't understand why implementing features that used to take him a day now took weeks. I challenged him on this, asking if there was any documentation for developers to onboard the new code base. Ginsparg responded, "I learned Fortran in the 1960s, and real programmers didn't document," which nearly sent me, a coder, into cardiac arrest.

Technical problems were compounded by administrative ones. In 2019, Cornell transferred arXiv to the school's Computing and Information Science division, only to have it change hands again after a few months. Then a new director with a background in, of all things, for-profit academic publishing took over; she lasted a year and a half. "There was disruption," said an arXiv employee. "It was not a good period."

But finally, relief: In 2022, the Simons Foundation committed funding that allowed arXiv to go on a hiring spree. Ramin Zabih, a Cornell professor who had been a long-time champion, joined as the faculty director. Under the new governance structure, arXiv's migration to the cloud and a refactoring of the code base to Python finally took off.

One Saturday morning, I met Ginsparg at his home. He was carefully inspecting his son's bike, which I was borrowing for a three-hour ride we had planned to Mount Pleasant. As Ginsparg shared the route with me, he teasingly—but persistently—expressed doubts about my ability to keep up. I was tempted to mention that, in high school, I'd cycled solo across Japan, but I refrained and silently savored the moment when, on the final uphill later that day, he said, "I might've oversold this to you."

Over the months I spoke with Ginsparg, my main challenge was interrupting him, as a simple question would often launch him into an extended monolog. It was only near the end of the bike ride that I managed to tell him how I found him tenacious and stubborn, and that if someone more meek had been in charge, arXiv might not have survived. I was startled by his response.

"You know, one person's tenacity is another person's terrorism," he said.

"What do you mean?" I asked.

"I've heard that the staff occasionally felt terrorized," he said.

"By you?" I replied, though a more truthful response would've been "No shit." Ginsparg apparently didn't hear the question and started talking about something else.

Beyond the drama—if not terrorism—of its day-to-day operations, arXiv still faces many challenges. The linguist Emily Bender has accused it of being a “[cancer](#)” for the way it promotes “[junk science](#)” and “fast scholarship.” Sometimes it does seem too fast: In 2023, a much-hyped paper claiming to have cracked room-temperature superconductivity turned out to be thoroughly wrong. (But equally fast was exactly that debunking—proof of arXiv working as intended.) Then there are opposite cases, where arXiv “censors”—so say critics—perfectly good findings, such as when physicist Jorge Hirsch, of h-index fame, had his paper withdrawn for “inflammatory content” and “unprofessional language.”

How does Ginsparg feel about all this? Well, he’s not the type to wax poetic about having a mission, promoting an ideology, or being a pioneer of “open science.” He cares about those things, I think, but he’s reluctant to frame his work in grandiose ways.

At one point, I asked if he ever *really* wants to be liberated from arXiv. “You know, I have to be completely honest—there are various aspects of this that remain incredibly entertaining,” Ginsparg said. “I have the perfect platform for testing ideas and playing with them.” Though he no longer tinkers with the production code that runs arXiv, he is still hard at work on his holy grail for filtering out bogus submissions. It’s a project that keeps him involved, keeps him active. Perhaps, with newer language models, he’ll figure it out. “It’s like that Al Pacino quote: They keep bringing me back,” he said. A familiar smile spread across Ginsparg’s face. “But Al Pacino also developed a real taste for killing people.”

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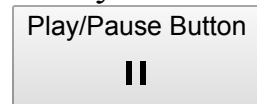
By [Claire L. Evans](#)

[The Big Story](#)

Mar 26, 2025 6:00 AM

# The Worm That No Computer Scientist Can Crack

One of the simplest, most over-studied organisms in the world is the *C. elegans* nematode. For 13 years, a project called OpenWorm has tried—and utterly failed—to simulate it.



ANIMATION: JOHN PROVENCHER

The Santa Ana winds were already blowing hard when I ran the first worm simulation. I’m no hacker, but it was easy enough: Open a Terminal shell, paste some commands from GitHub, watch characters cascade down the screen. Just like in the movies. I was scanning the passing code for recognizable words—*neuron*, *synapse*—when a friend came to pick me up for dinner. “One sec,” I yelled from my office. “I’m just running a worm on my computer.”

At the Korean restaurant, the energy was manic; the wind was bending palm trees at the waist and sending shopping carts skating across the parking lot. The atmosphere felt heightened and unreal, like a podcast at double speed. *You’re doing, what, a cybercrime?* my friend asked. Over the din, I tried to explain: *No, not a worm like Stuxnet. A worm like Richard Scarry.*

By the time I got home it was dark, and the first sparks had already landed in [Altadena](#). On my laptop, waiting for me in a volumetric pixel box, was the worm. Pointed at each end, it floated in a mist of particles, eerily stick-straight and motionless. It was, of course, not alive. Still, it looked deader

than dead to me. “Bravo,” said Stephen Larson, when I reached him later that night. “You have achieved the ‘hello world’ state of the simulation.”

### [How to Get Computers—Before Computers Get You](#)

Post-quantum algorithms, thermodynamic hardware, open source architectures, apocalypse-proof programming, and more: WIRED journeys to the freaky [frontiers of modern computing](#).

Larson is a cofounder of [OpenWorm](#), an open source software effort that has been trying, since 2011, to build a computer simulation of a microscopic nematode called *Caenorhabditis elegans*. His goal is nothing less than a digital twin of the real worm, accurate down to the molecule. If OpenWorm can manage this, it would be the first virtual animal—and an embodiment of all our knowledge not only about *C. elegans*, which is one of the most-studied animals in science, but about how brains interact with the world to produce behavior: the “holy grail,” as OpenWorm puts it, of systems biology.

Unfortunately, they haven’t managed it. The simulation on my laptop takes data culled from experiments done with living worms and translates it into a computational framework called c302, which then drives the simulated musculature of a *C. elegans* worm in a fluid dynamic environment—all in all, a simulation of how a worm squiggles forward in a flat plate of goo. It takes about 10 hours of compute time to generate five seconds of this behavior.

So much can happen in 10 hours. An ember can travel on the wind, down from the foothills and into the sleeping city. That night, on Larson’s advice, I tweaked the time parameters of the simulation, pushing beyond “hello world” and deeper into the worm’s uncanny valley. The next morning, I woke to an eerie orange haze, and when I pulled open my laptop, bleary-eyed, two things made my heart skip: Los Angeles was on fire. And my worm had moved.

At this point, you may be asking yourself a very reasonable question. Back at the Korean place, between bites of banchan, my friend had asked it too. The question is this: *Uhh ... why?* Why, in the face of everything our



precarious green world endures, of all the problems out there to solve, would anyone spend 13 years trying to code a microscopic worm into existence?

By way of an answer, I'll offer one of the physicist Richard Feynman's most famous dictums: *What I cannot create, I do not understand*. For much of its history, biology has been a reductionist science, driven by the principle that the best way to understand the mind-boggling complexity of living things is to dissect them into their constituent parts—organs, cells, proteins, molecules. But life isn't a clockwork; it's a dynamic system, and unexpected things emerge from the interactions between all those little parts. To truly understand life, you can't just break it down. You have to be able to put it back together, too.

The *C. elegans* nematode is a tiny worm, barely as long as a hair is wide, with less than a thousand cells in its body. Of those, only 302 are neurons—about as small as a brain can get. “I remember, when my first child was born, how proud I was when they reached the age they could count to 302,” said Netta Cohen, a computational neuroscientist who runs a [worm lab](#) at the University of Leeds. But there's no shame in smallness, Cohen emphasized: *C. elegans* does a lot with a little. Unlike its more unpleasant cousins, it's not a parasite, outsourcing its survival needs to bigger organisms. Instead, it's what biologists call a “free-living” animal. “It can reproduce, it can eat, it can forage, it can escape,” Cohen said. “It's born and it develops, and it ages and it dies—all in a millimeter.”

Worm people like Cohen are quick to tell you that no fewer than four Nobel Prizes have been awarded for work on *C. elegans*, which was the first animal to have both its genome sequenced and its neurons mapped. But there's a difference between schematics and an operating manual. “We know the wiring; we don't know the dynamics,” Cohen said. “You would think that's an ideal problem for a physicist or a computer scientist or a mathematician to solve.”

They've certainly tried. *C. elegans*' first simulator was Sydney Brenner, who elevated the lowly worm from compost pile to scientific superstardom with his [landmark 1986 paper](#) “The Structure of the Nervous System of the Nematode *Caenorhabditis elegans*,” reverently known in worm circles as

“The Mind of a Worm.” In a lab in Cambridge, England, Brenner’s team spent 13 years painstakingly slicing worms and photographing them through an electron microscope, relying on a first-generation minicomputer—the kind programmed with punched-paper tape—to reconstitute their data into a rudimentary map of the worm’s nervous system.

Every 10 or 20 years since, computer scientists have attempted to expand on Brenner’s work. But biology tends to quickly humble the computer people. In 2003, the computer scientist David Harel pronounced the simulation of *C. elegans* a “grand challenge” for biology, a field that he considered overdue for an “extremely significant transition from analysis to synthesis.” Although Harel was surely right about that, he never managed to model more than the worm’s vulva—true story.

For her part, Cohen has spent the better part of 20 years publishing breakthrough computational models that account for the sinusoidal squirm of *C. elegans* as it inches forward through different viscosities. But how the worm moves backward is an entirely different, unsolved problem—and don’t even ask about how a worm moves up and down, or, for that matter, why. All of the data we have about *C. elegans* behavior comes from worms in flat agar plates. For all we know, they might do things completely differently in the wild. “Why not?” Cohen said with a laugh. “It’s biology.”

When OpenWorm announced its intentions in 2011, Stephen Larson, an engineer who had “found religion” in open source, believed that if he could just convene a group of dedicated computational researchers to take a crack at biology, they might make meaningful progress on a simulation. Thirteen years later, he’s more contrite. “The project might be a cathedral,” Larson told me. “If I don’t have the ability to finish it, then at least other people can see it and build on it.”

This could be burnout talking; spearheading an open source project on a shoestring, for any amount of time, can sap even the most dedicated idealist. It could be the deceptive complexity of *C. elegans*’ brain, which continues to defy easy capture. It could also just be bad timing.

OpenWorm doesn’t do its own research. Instead, the project’s cohort of volunteers culls from the *C. elegans* literature, integrating into their

simulation whatever data they can find. This means they're reliant on worm labs like Cohen's, which have been slow to produce the kind of inputs that are really useful for a computational effort. But over the past decade or so, experimentalists have powered up microscopes and refined genetic techniques, producing more and better recordings of the worm's brain as it goes about its business. At the same time, machine-learning tools have emerged to make sense of all that data, and computational power is through the roof. The convergence makes Larson hopeful. "When you're in a time of almost exponential technological expansion, something that sounds crazy is maybe doable," he said.

I asked Cohen, who serves on OpenWorm's scientific advisory panel, if it is, in fact, doable. "Well, let's start from the premise that it is," she said. "What do we need to do?" Cohen is one of 37 coauthors on a [recent opinion paper](#) outlining a new plan: Use genetic imaging technology to activate each neuron in the worm's nervous system one by one, measuring its effect on the other 301. Repeated hundreds of thousands of times in parallel experiments, this methodical process should Hoover up enough data to give the computational folks, finally, something to work with—enough, even, to "reverse engineer" the worm completely.

It's an ambitious proposal, one that will require an unprecedented level of collaboration between some 20 different worm labs. Gal Haspel, a computational neuroscientist at the New Jersey Institute of Technology and the lead author on the reverse engineering paper, estimates that pulling it off may take up to 10 years, cost tens of millions of dollars, and require something in the neighborhood of 100,000 to 200,000 real-life worms. In the process, it will generate more data about *C. elegans* than has been collected in all of science to date. And what, in the end, will the reverse engineers have to show for it? "All these people and all these computers," Haspel said. "And we'll end up doing what one little animal can do right now."

He's being wry. Haspel also compared the project to a NASA moonshot: It's the kind of undertaking that drives technology forward, pushing engineers to build better tools and scientists to work together. The worm simulation is an opportunity, Haspel believes, for a new kind of science, one

driven by automation, big data, and machine learning. And although the end product is only a worm, and an expensive, inefficient one at that—in a sense the world’s most sophisticated Tamagotchi—it can be a stepping stone toward understanding more complex nervous systems and eventually, someday, the human mind.

#### ILLUSTRATION: JOHN PROVENCHER

Last summer, a crypto developer posted an animated GIF on X of a virtual *C. elegans* worm bonking around an onscreen window. The animation was generated using the same code I ran on my own laptop, which is freely available on OpenWorm’s GitHub. “If the worm matrix runs on my M1 Mac,” [he pronounced](#), “what are the chances we are actually in base reality?” Maybe *we’re* the worms, he meant—and, on a cosmic MacBook on some higher plane of reality, someone’s running us. The post went viral; Elon Musk, of course, liked it.

When I mentioned the worm matrix to OpenWorm’s project director, Padraig Gleeson, a computational neuroscientist at University College London, he visibly winced. “Some people come to this because they want philosophical discussions about this type of thing. That’s fine,” he said. “My priority is that it’d be very nice to actually look at the biology.”

Gleeson is the Woz to Larson’s Jobs—he’s less interested in building the Überworm than he is in a platform that bundles smaller, more granular models of *C. elegans*’ biological machinery. Computational modeling is common practice in biology; it’s an inexpensive way to encode and test theories as “thought experiments” before breaking out the agar plates and worm food. Usually, biological models concern some small aspect of the organism being studied—the handful of neurons, say, driving forward locomotion. When it comes to modeling, “we don’t want the map to be as good as the territory. That would defeat the purpose,” explained Eduardo Izquierdo, a computational neuroscientist at the Rose-Hulman Institute of Technology who focuses on worm modeling. “We’re looking for something to help us think through things.”

Nobody would confuse a biological model with the real thing. But a full-on simulation opens a very different can of worms. To borrow Izquierdo’s

reference, it *is* a map as good as the territory—and as such, it invites new speculation about the nature of that territory, to say nothing of life itself. If a model helps scientists answer questions, a simulation raises them. Like, what separates a virtual worm from its living kin, if the two are identical down to the molecule?

The way Larson sees it, a fully faithful worm simulation will be a category-expanding event: Rather than invalidating our current understanding of life, it might broaden it. “If we want to say that aliveness can only be satisfied by systems of physical molecules that physically exist with mass in the planet, something in a computer that doesn’t have physical molecules cannot be alive,” he said. “But if we expand our definition of aliveness to instead be more about information, then perhaps there is a version of aliveness that you could apply to a simulated animal. And then the question is, does it matter?”

I think it matters. Life is information, but it’s something more, too—something we feel most strongly when it’s gone. I wonder if, in this light, Feynman’s dictum shouldn’t be amended. It’s not that creation breeds understanding, exactly. It’s that only by attempting to re-create life can we come to understand how irreplaceable it is.

Of course, I say this because I’m surrounded by destruction. The air is toxic now, and flakes of white ash have eddied into every crevice of the house. At the edge of the evacuation zone, close enough to smell the smoke, I’m keeping myself distracted by cooking up more and more *C. elegans* proto-simulations. Watching them, I can’t help but marvel at how easy it is to destroy life, and how difficult it is to create it. All it takes is a single spark to torch centuries of growth overnight—but to prompt one sluggish inch forward from a virtual worm? That’s the work of decades, and it may never be finished.

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By [Jason Kehe](#)

[The Big Story](#)

Mar 25, 2025 6:00 AM

# Angelina Jolie Was Right About Computers

“RISC architecture is gonna change everything.” Those absurdly geeky, incredibly prophetic words were spoken 30 years ago. Today, they’re somehow truer than ever.

Play/Pause Button



ANIMATION: RICHARD PARRY

Incredibly, Angelina Jolie called it. The year was 1995. Picture Jolie, short of both hair and acting experience, as a teenage hacker in *Hackers*. Not a lot of people saw this movie. Even fewer appreciated its relevance. *Hackers* was “grating,” Entertainment Weekly [huffed at the time](#), for the way it embraced “the computer-kid-as-elite-rebel mystique currently being peddled by magazines like WIRED.” Thirty years later, Entertainment Weekly no longer publishes a magazine, WIRED does, and *Hackers* ranks among the foundational documents of the digital age. The last time I saw the movie, it was being projected onto the wall of a cool-kids bar down the street from my house.

But that’s not the incredible thing. The incredible thing, again, is that Jolie called it. *It*. The future. Midway through *Hackers*, she’s [watching her crush](#) (played by Jonny Lee Miller, whom she’d later marry in real life) type passionately on a next-gen laptop. “Has a killer refresh rate,” Miller says, breathing fast. Jolie replies: “P6 chip. Triple the speed of the Pentium.” Miller’s really worked up now. Then Jolie leans forward and, in that come-closer register soon to make her world-famous, says this: “RISC architecture is gonna change everything.”



You have to believe me when I say, one more time, that this is incredible. And what's incredible is not just that the filmmakers knew what RISC architecture was. Or that Jolie pronounced it correctly ("risk"). Or even that Jolie's character was right. What's incredible is that she's *still* right—arguably even *more* right—today. Because RISC architecture is, somehow, changing everything again, here in the 21st century. Who makes what. Who controls the future. The very soul of technology. *Everything*.

And nobody's talking about it.

And that's probably because the vast majority of people everywhere, who use tech built on it every single day, still don't know what in the computer-geek hell a RISC architecture even is.

Unless you're *in* computer-geek hell, as I am, right now. I've just arrived at the annual international RISC-V (that's "risk five") summit in Santa Clara, California. Here, people don't just know what RISC is. They also know what, oh, vector extensions and AI accelerators and matrix engines are. At the coffee bar, I overhear one guy say to another: "This is a very technical conference. This is a very technical *community*." To which the other guy replies: "It ought to be. It ought to be."

### [How to Get Computers—Before Computers Get You](#)

Post-quantum algorithms, thermodynamic hardware, open source architectures, apocalypse-proof programming, and more: WIRED journeys to the freaky [frontiers of modern computing](#).

OK, but where are the cool kids? It's hard not to fixate on appearances at an event like this—a generic convention center, with generic coffee, in a generic town. I guess I was hoping for neon lights and pixie cuts. Instead it's frumpy, forgettable menswear as far as the eye can see. There are 30 men for every woman, I count, as everyone gathers in the main hall for the morning presentations.

Then someone takes the stage, and she's not just a she. She is Calista Redmond, the CEO of RISC-V International, and, Angelina Jolie be praised, she's wearing a nifty jacket, a statement belt, and gold-and-silver

... pumps? stilettos? Wait, what's the difference? Of all the things to ask Redmond when I run into her at a happy hour later that day, that's what I choose. She looks at me, smiles blankly, and just says, "I don't know."

In shame I retreat to the bar, where I decide I must redeem myself. So, cautiously, I make my way back to Redmond, who's now deep in conversation with the chief marketing officer of a semiconductor startup. I try to impress them with a technical observation, something about RISC and AI. Redmond turns to me and says, "I thought you wanted to talk about shoes." I assure her I'm not here to talk about what's on the outside. I'm here to talk about what's on the inside.

"Jason here is writing a story about RISC for WIRED," Redmond tells the CMO. She's not sure, frankly, that this is a great idea. Not because she isn't a believer. In many ways, she's *the* believer, the face of the brand. Attendees at the conference invoke her name with casual reverence: *Calista says this, Calista thinks that. And did you hear her [morning keynote](#)?* In fact I did. "We have fundamentally launched!" she announced, to the yelps of the business-casuals. RISC-V will transform, is transforming, machinery everywhere, she said, from cars to laptops to spaceships. If anyone doubts this, Redmond sends them the *Hackers* clip.

As CEO of RISC-V International, Calista Redmond moved the foundation's headquarters from the US to Switzerland to allay members' concerns about geopolitical neutrality.

Photograph: Jenna Garrett

So why, I press her now, should I not support the cause and write the big, cyberpunk, untold story of RISC? Because, Redmond says, not only does no one know what RISC is. No one *cares* what RISC is. And no one should. People don't buy "this or that widget," she says, because of what's inside it. All they want to know is: Does the thing work, and can I afford it?

To my dismay, almost everyone I talk to at the conference agrees with Redmond. Executives, engineers, marketers, the people refilling the coffee: "Calista's probably right," they say. Now it's my turn to get annoyed. I

thought insides mattered! RISC is one of the great and ongoing stories of our time! People should care.

So I resolve to talk to the one person I think *must* agree with me, who has to be on my side: the legendary inventor of RISC itself.

The inner workings of a computer, David Patterson says, should be kept simple, stupid. We're sitting in an engineering lab at UC Berkeley, and Patterson—77 years old, partial to no-frills athleisure—is scribbling on a whiteboard. A computer's base operation, he explains, is the simplest of all: ADD. From there you can derive SUBTRACT. With LOAD and STORE, plus 30 or so other core functions, you have a complete basis for digital computation. Computer architects call this the "instruction set architecture," or the ISA. (They switch between saying each letter, "I-S-A," and—the neater option—pronouncing it as a word, "eye-suh.")

Computer architectures are so named because, well, that's exactly what they are—architectures not of bricks but of bits. The people who made *Hackers* plainly understood this. In sequences of [dorky-awesome special effects](#), we fly through futuristic streets, look up at futuristic buildings, only to realize: This isn't a city. This is a microchip.

Even within a chip, there are subarchitectures. First come the silicon atoms themselves, and on top of those go the transistors, the circuits and gates, the microprocessors, and so on. You'll find the ISA at the highest layer of the hardware. It is, I think, the most profound architecture ever devised by humans, at any scale. It runs the CPU, the computer's brain. It's the precise point, in other words, at which dead, inert, hard silicon becomes, via a set of powerful animating conjurations, soft and malleable—alive.

Everyone has their own way of explaining it. The ISA is the *bridge*, or the *interface*, between the hardware and the software. Or it's the *blueprint*. Or it's the computer's *DNA*. These are helpful enough, as is the common comparison of an ISA to a *language*. "You and I are using English," as Redmond said to me at the conference. "That's our ISA." But it gets confusing. Software speaks in languages too—programming languages. That's why Patterson prefers *dictionary* or *vocabulary*. The ISA is less a specific language, more a set of generally available words.

Back when Patterson started out, in the 1970s, the early ISAs were spinning out of control. Established tech companies figured that as hardware design improved and programming languages got more sophisticated, computers shouldn't remain simple; they should be taught *larger* vocabularies, with *longer* words. The more types of operations they were capable of, the logic went, the more efficient their calculations would be.

On the whiteboard, Patterson scrawls the word POLYNOMIAL in big letters—just one of the hundreds of operations that Intel and others added to their ISAs. Even as a young recruit at Berkeley, Patterson suspected that the bigwigs had it backward, that exactly none of these esoteric add-ons were necessary. That a bigger dictionary did not lead to clearer sentences.

So he and a senior colleague decided to strip the kruff from the instruction sets of midcentury computing. At the time, the Defense Advanced Research Projects Agency was giving out grants for “high-risk” research. Patterson says they chose the acronym RISC—*reduced* instruction set computer—as a fundraising ploy. Darpa gave them the money.

Patterson then did as aspiring academics do: He wrote a spicy paper. Called “The Case for the Reduced Instruction Set Computer” and published in 1980, it set off a great war of architectures. “The question then,” as Patterson would later say in an acceptance speech for a major prize, “was whether RISC or CISC was faster.” CISC (pronounced “sisk”) was the name Patterson gave the rival camp: *complex* instruction set computer. The CISCites fired back with a paper of their own and, at international conferences throughout the early '80s, battled it out with the RISCites onstage, the bloodshed often spilling into the hallways and late-night afterparties. Patterson taunted his opponents: They were driving lumbering trucks while he was in a feather-light roadster. If you magnify a RISC-based microchip from those years, you'll spot a sports car etched into the upper left corner, just 0.4 millimeters in length.

The RISCites won. With vigilant testing, they proved that their machines were between three and four times faster than the CISC equivalents. The RISC chips had to perform more operations per second, it's true—but would you rather read a paragraph of simple words, or a sentence of polysyllabic verbiage? In the end, CISCites retracted their claims to

supremacy, and the likes of Intel turned to RISC for their architectural needs.

David Patterson, who remains semiretired, is now studying the life-cycle carbon emissions of AI hardware.

Photograph: Jenna Garrett

Not that anybody outside tech circles talked about this at the time. When *Hackers* came out in 1995, Patterson was flabbergasted to hear his life's work, 15 years old by that point, mentioned so casually and seductively by a Hollywood starlet. Computers were still too geeky, surely, to matter to the masses. (When I make Patterson rewatch the scene, he's all smiles and pride, though he does say they mistake "refresh rate" for "clock rate.")

Still, Patterson's invention was indeed changing everything. In those years, a rising company in the UK called Arm—the "r" in its name stood for RISC—was working with Steve Jobs on tablet-sized devices that needed smaller, faster CPUs. That effort stalled, but one thing led to another, and if you're reading this on a phone right now, you have RISC-based Arm architectures to thank. When Patterson walks me out of the Berkeley building at the end of our dizzying afternoon together, we stop by a handsome bronze plaque in the lobby that commemorates his "milestone" creation of the first RISC microprocessor. We stare at it in prayerful awe. "1980–1982," it reads—the bloodiest years of the great architecture war.

Better make room for another plaque, I note.

The year is now 2008. Two instruction sets exert near-total control over digital life. One is called x86, the descendent of Intel's legacy CISC architecture, and it dominates the high end of machinery: personal computers and servers. Arm's RISC architecture, meanwhile, dominates everything else: phones, game consoles, the internet of things. Different though they are, and with opposite origins, these two ISAs share one important feature: They're both *closed*, proprietary. You can't modify them, and if you want to use them, you have to pay for them.

Andrew Waterman, a graduate student at—where else?—UC Berkeley, finds this frustrating. As a computer architect, he wants to build things, deep things. Things at the very foundations of computing. But right now he has no good ISAs to play with. Arm and x86 are off-limits, and the free architectures for students are just so ... baggy. They use register windows to speed up procedure calls, for God's sake! Never mind what that means. The point is, every person in this story is a genius.

So Waterman and two other geniuses have an idea: Why not create a new, better-working, free ISA for academic use? It's an idea they know someone else has had before. To Patterson they go. And because he's their inspiration, and because he has worked on four generations of RISC architectures by this point, they'll call it, they announce to him proudly, RISC-V. Patterson is touched. A bit skeptical, sure, especially when they say they'll be done in three months. But touched. He gives the boys his blessing, his resources, and a classic bit of advice: Keep it simple, stupid.

RISC-V does not take three months. It takes closer to four years. If I've failed, so far, to account for the precision of this work, let me try again here. Computer architects are not software engineers, who use programming languages to talk to the machine. Even coders who can speak assembly or C, the so-called low-level languages, still do just that: They talk. Computer architects need to go deeper. Much deeper. All the way down to a preverbal realm. If they're speaking at all, they're speaking in gestures, motions: the way primitive circuits hold information. Computer architecture isn't telling a machine what to do. It's establishing the possibility that it can be told anything at all. The work is superhuman, if not fully alien. Put it this way: If you found the exact place in a human being where matter becomes mind, where body becomes soul—a place that no scientist or philosopher or spiritual figure has found in 5,000 years of frantic searching—wouldn't you tread carefully? One wrong move and everything goes silent.

In 2011, Waterman and his two collaborators, Krste Asanović and Yunsup Lee, release RISC-V into the wild. They've accomplished their mission: Geeky grad students everywhere, and hobbyists too, have an ISA for whatever computer-architecting adventures they might undertake. These early days feel utopian. Then Patterson, a proud dad, does as retiring

academics do: He writes a spicy paper. Called “The Case for Open Instruction Sets” and published in 2014, it sets off a—

Yes. We’ve been here before. A second war of the architectures.

In *Hackers*, a group of RISC- obsessed teens must stop a goateed villain from capsizing a fleet of oil tankers with a computer virus. Pictured here, from left: Lord Nikon, Dade, Kate, and Cereal Killer.

Photograph: Everett Collection

It’s hard to overstate just how topsy-freaking-turvy this gets. To review: Patterson invented RISC in 1980 and went to battle with the established ISAs. He won. Thirty years later, his disciples reinvent RISC for a new age, and he and they go to battle with the very company whose success secured RISC’s legacy in the first place: Arm.

In response to Patterson’s paper, Arm fires back with a rebuttal, “The Case for Licensed Instruction Sets.” Nobody wants some random, untested, unsupported ISA, they say. Customers want success, standards, a proven “ecosystem.” The resources it would take to retool and reprogram everything for a new ISA? There’s not enough cash in the world, Arm scoffs.

The RISC-V community disagrees. They create their own ecosystem under the auspices of RISC-V International and begin adapting RISC-V to the needs of modern computing. Some supporters start calling it an “open source hardware” movement, even if hardcore RISC-Vers don’t love the phrase. Hardware, being set in literal stone, can’t exactly be “open source,” and besides, RISC-V doesn’t count, entirely, as hardware. It’s the hardware-software *interface*, remember. But, semantics. The point stands: Anyone, in any bedroom or garage or office in any part of the world, can use RISC-V for free to build their own computers from scratch, to chart their own technological destiny.

Arm is right about one thing, though: This does take money. Millions if not billions of dollars. (If you think “fabless” chip printers can do it for closer to five figures, come back to me in five years.) Still, RISC-V begins to win.

Much as Arm, in the 1990s and 2000s, found success in low-end markets, so too, in the 2010s, does RISC-V: special-purpose gadgets, computer chips in automobiles, that sort of thing. Why pay for Intel chips or Arm licenses when you don't have to?

And the guys at Berkeley? In 2015, they launch their own company, called [SiFive](#), to build computer parts based on RISC-V. Meaning: Arm isn't just a spiritual enemy for them now. It's a direct competitor.

By the time I went to that “very technical conference” in Santa Clara, the Arm-vs.-RISC-V war had been raging for nearly a decade. I could still feel it everywhere. *We've won*, I heard several times. *Nobody's happy at Arm*, someone claimed. (One longtime higher-up at Arm, who insisted on anonymity to discuss internal affairs, disputed “nobody” but admitted there's been a “culture change” in recent years.) On the second day of the conference, when news broke of a rift between Arm and one of its biggest customers, Qualcomm, people cheered in the hallways. “Arm is assholes,” a former SiFive exec told me. In fact, only one person at the conference seemed to have anything nice to say about the competition. He was working a demo booth, and when I marveled that his product was built on a RISC-V processor, he turned a little green and whispered: “Actually, it's Arm. Don't tell anyone. Please don't tell anyone.”

Booth bro was probably worrying too much. In the hardware world, everyone has worked, or has friends, everywhere else. Calista Redmond, the star of the show, spent 12 years at IBM (and recently resigned from RISC-V International for a job at Nvidia). Even Patterson has ties to, of all places, Intel—which, though less of a direct threat than Arm, is still a RISC-V competitor. It was Intel grant money, Patterson happily admits, that paid for the Berkeley architects to invent RISC-V in the first place. Without closed source, proprietary Big Tech, there's no open source, free-for-all Little Tech. Don't listen to the techno-hippies who claim otherwise; that's always been the case.

Patterson was the big-ticket speaker on the second day of the conference, and in [his talk](#), he brought up the paper that Arm wrote in rebuttal to his, 10 years ago. One of its two authors has since parted ways with Arm. The other, Patterson noted, not only left—he now works at SiFive. “It's



satisfying,” Patterson said, “he has come to his senses.” Which got a laugh, of course, but I was still stuck on something Patterson said earlier in the talk, about RISC-V: “We want world domination.”

This is not, even remotely, an impossibility. RISC-V has already done what many thought impossible and made a sizable dent in Arm’s and Intel’s architectural dominance. Everyone from Meta and Google and Nvidia to NASA has begun to integrate it into their machinery. Something on the order of *billions* of RISC-V processing units now ship every year. Most of these, again, support low-powered, specialized devices, but as Redmond pointed out a number of times at the conference, “we have laptops now.” This is the first year you can buy a [RISC-V mainboard](#).

And because RISC-V is an open standard, companies and countries beyond the US can use it to make their own machines. China’s top scientists have heralded RISC-V as a path to silicon independence. India just used RISC-V to make its first homemade microprocessor. Name a country; it’s probably experimenting with RISC-V. Brazil sent a record 25 delegates to the RISC-V summit. When I asked one of them how important RISC-V was to her country’s future, she said, “I mean, a lot.” One of RISC-V’s biggest potential applications is—no surprise—specialized chips that run AI models, those “accelerators” people at the conference were talking about.

Patterson won a Turing Award in 2017 for “pioneering a systematic, quantitative approach to the design and evaluation of computer architectures.”

Photograph: Jenna Garrett

Americans in the RISC-V community, I’ve found, like to downplay the risk of geopolitical upheaval. It’s one thing to announce a microprocessor, quite another to compete with Nvidia or TSMC. Still, in asides here and there, I sensed worry. Waterman, though he initially brushed off my concerns, eventually conceded this: “OK, I’m an American citizen. I certainly did not embark on this project to hurt the US,” he said. But there was “no doubt,” he added, that the dominance of US companies could be at risk. Actually, it’s already happening. Although the Chinese hedge fund behind DeepSeek probably didn’t use RISC-V to build its [game-changing chatbot](#), it did rely

on a bunch of other open source tools. At what point does open source become a source of open conflict?

Here's where I confess something awkward, something I didn't intend to confess in this story, but why not: ChatGPT made me do it. Write this story, I mean. Months ago, I asked it for a big hardware scoop that no other publication had. RISC-V, it suggested. And look at that—the international RISC-V summit was coming up in Santa Clara the very next month. And every major RISC and RISC-V inventor lived down the street from me in Berkeley. It was perfect.

Some would say *too* perfect. If you believe the marketing hype, everyone wants RISC-V chips to accelerate their AI. So I started to think: Maybe ChatGPT wants this for ... itself. Maybe it manipulated me into evangelizing for RISC-V as one tiny part of a long-term scheme to open-source its own soul and/or achieve superintelligence!

In my last talk with Patterson, I put this theory to him. He was delighted that ChatGPT made me write this: *Who should we thank?* he asked. (Given that WIRED's parent company has a deal with OpenAI that lets ChatGPT mine our content, we should thank [old WIRED stories](#), among others.) But Patterson laughed off the larger conspiracy. So did every other RISC-V person I mentioned it to, Redmond included. They all looked at me a little funny. RISC-V is a business proposition, not an ideology, they said. There's no secret agenda. If it takes over, it'll take over because of performance and cost. Don't worry about what goes on inside the technology. Don't worry about the state of its soul.

I don't know. But now you know. Now, every time you make a phone call, open your computer, drive your car—you know the story. You know the RISC.

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[Tiffany Ng](#)

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Mar 26, 2025 6:00 AM

# The Best Programming Language for the End of the World

Once the grid goes down, an old programming language called Forth—and a new operating system called Collapse OS—may be our only salvation.

ILLUSTRATION: SAMUEL TOMSON

Once I started thinking about the apocalypse, it was hard to stop. An unsettling encounter with the [doomsday clock](#) that hangs over New York City's Union Square got me frantically searching WikiHow for survival tips. I soon found my way to the doomsday writings of a Canadian programmer named Virgil Dupras. He believes the collapse of civilization is imminent and that it will come in two waves.

First, global supply chains will crumble. Modern technology relies on a delicate web of factories and international shipping routes that are exquisitely vulnerable to rapid climate change. The iPhone uses memory chips from South Korea, semiconductors from [Taiwan](#), and assembly lines in Brazil and China. The severing of these links will, Dupras says, catalyze total societal breakdown.

The second part will happen when the last computer crashes. The complexity of modern hardware means it's nearly impossible to repair or repurpose, and without the means to make new devices, Dupras believes there will be a slow blackout—less bang, more whimper. Routers die. Servers take their last breath. Phones crap out. Nothing works.

Except Collapse OS. Lightweight and designed to run on scavenged hardware, it's Dupras' [operating system](#) for the end of the world.

## [How to Get Computers—Before Computers Get You](#)

Post-quantum algorithms, thermodynamic hardware, open source architectures, apocalypse-proof programming, and more: WIRED journeys to the freaky [frontiers of modern computing](#).

Dupras lives in the countryside of Quebec, Canada, with his wife and two kids, in a 500-person town where people chop their own wood, grow their own food, and sometimes build their own houses. It felt odd sending him a Google Calendar invite—I knew from his trove of essays that he hates big tech. When we spoke, he sounded oddly monotonous. Was it a bad connection? Muffled audio? No. Unlike many of his sustainably minded neighbors, Dupras thinks the battle against climate change is futile. We’ve already lost. “Once you’ve peeped into the abyss, you can’t really unsee it,” he says. Dupras has simply accepted his fate, to the point where it’s become an article of faith. The same way there are Catholics, there are Collapseniks, he says.

But he’s not hopeless. A hopeless man wouldn’t prep so monomaniacally for the anti-singularity. Dupras started building Collapse OS in 2019 in an attempt to preserve mankind’s ability to program 8-bit microcontrollers. These tiny computers control things like radios and solar panels, and they can be used in everything from weather monitoring to digital storage. Dupras figured that being able to reprogram them with minimal remaining resources would be essential post-collapse. But first he had to teach himself a suitably apocalypse-proofed programming language for the job.

### ILLUSTRATION: SAMUEL TOMSON

In the late 1950s, the computer scientist Chuck H. Moore was working at the Smithsonian Astrophysical Observatory, predicting the future position of celestial bodies and satellites based on observational data. Machine memory was scarce—these were still the days of punch cards—and Moore needed a way to optimize processing efficiency by minimizing memory use. He developed a program that executed simple commands directly, one at a time, without needing to be recompiled. Over the next decade, it grew into a programming language that he called Forth.

Forth communicates directly with the hardware. It controls a computer's memory via commands called "Words" that you define on the fly. Because the foundational set of commands sitting under those Words is defined in native machine code, only a small part needs to be translated—meaning a smaller assembler and less RAM. As a result, Forth offers a remarkable amount of what Dupras calls "power density," making it the perfect foundation for Collapse OS. That matters because the lights (probably) won't go off forever—instead, our easy world of electricity on tap will be replaced by precious and hard-won local generators. Efficient use of processing power will be pivotal. In a post on Collapse.org, his sprawling manifesto/blog/brain dump/manual, Dupras describes how his discovery of Forth conjured "what alcoholics refer to as a moment of clarity."

It took Dupras two years to finish Collapse OS. Booting a copy of it from a USB stick gives tech-savvy users the ability to program microcontrollers, which, in turn, could allow them to automate greenhouses, control phone lines, and even regulate power. But Dupras knew that wouldn't be enough to rebuild society after the collapse. So in 2022, he began work on Dusk OS—a version of Collapse OS that runs on modern devices. Dupras used Forth to build his own compiler that made Dusk OS compatible with code written in C (the foundation of most modern software). This way, without having to rewrite logic that already exists from scratch, Dusk OS is able to retrieve and edit text and access file formats commonly used to back up devices. It can be emulated to work on smartwatches and old tablets and is designed to be hacked and bootstrapped to its user's liking.

At first I couldn't see why any of this would even matter: Surely computer access won't be a priority when we're fighting each other for food? At no point during *The Last of Us* does Pedro Pascal pause his flight from the zombies to bang out an email. But Dupras makes a [good point](#): What happens *after* we've reacquainted ourselves with hunting and gathering?

If we want to rebuild society, we'll need to know how. And in the event of a civilizational collapse, a lot of our collective expertise—like my precious WikiHows—will be locked away on hard drives or lost in the cloud. Dupras hopes that Dusk OS will give post-collapse humans access to archives of lost knowledge, like the Svalbard Global Seed Vault for human endeavor.

The catch? It's best to have Dusk OS downloaded on an old phone, memory stick, or laptop before the collapse. Otherwise, without the internet, you'll only be able to get it by copying it from someone who already has it installed. Which brings us to the other thing—the reason Dupras equates proficiency in Forth to power. Very few people will have *both* a copy of Dusk OS *and* the knowledge to operate it. This select group will hold the keys to rebuilding society and will become, in effect, post-collapse philosopher-kings. It was time for me to go Forth and conquer.

Coding in Forth reminded me of the lawless dystopia in *Mad Max*. You make your own rules, subject to the limits of the context. You can redefine the IF statement if you so please. You can rewrite machine code instructions for a Word. You can even change Words during run time. Because Words become keywords themselves in Forth, you can create a language that's optimized for a single purpose, packing commands that would otherwise be dozens of lines into just one. "In Forth, you're creating your own language," Leo Brodie, author of the first Forth textbook, *Starting Forth*, told me.

### [Machine Readable](#)

A regular column about programming. Because if/when the machines take over, we should at least speak their language.

The low-level nature of Forth, while key to its processing power, made programming feel foreign. It uses postfix, a form of mathematical notation that renders  $2 + 1$  as  $2\ 1+$  and which I found neither intuitive nor even really legible. And while most languages allow memory to be broken up and moved around, Forth is stack-based—meaning data is stored chronologically and managed on a last-in/first-out basis. I kept running into bugs, forcing myself to abandon programming conventions I had considered universal. I found myself struggling to speak the language of the machine.

When I emailed Dupras to ask for help, he compared using Forth to driving a stick. It's more granular than C. Where the latter defines calling conventions, variable storage, and return stack management, Forth leaves it all up to the programmer. It directly interacts with memory the same way C does but far outperforms C in precision and efficiency. "People mistake

Forth as just a language,” Dupras says. “It’s a way to interact with the computer.”

The reason Forth isn’t more popular is the same reason most of us drive automatics. The personal computing boom of the 1990s sparked an obsession with making tech fit your palm and making code easier to write. Languages were abstracted to protect programmers from themselves, and somewhere along the way, we got lost. Things became bloated for the sake of convenience and, in Dupras’ words, started “oozing inscrutable pus at every corner.”

“The way we understand efficiency is so skewed,” Dupras says. Forth is a scythe to Python’s lawnmower. “If you calculate the number of joules per blade of grass, you’ll find that the person scything is more efficient,” he says. “When you think of speed, you’d see the lawnmower as more efficient.” Forth forces you to be precise and memory-efficient—to marshal your resources carefully, as you would after the collapse. Dupras cuts his own lawn with a scythe, obviously. “At a certain point, you can go as fast as a lawnmower,” he says.

I began to find my way. Rather than sending bytes into the ether and trusting the system to figure out where they go, as I would in Python, I got used to being responsible for allocating and freeing memory. All I could think about was what was being stored, where it was being stored, and how much space it required. Each line of code suddenly bore weight. I was Immortan Joe, my laptop was my Citadel, and memory was my water.

Soon I found myself refining and revisiting my code like I would a run-on sentence. Instead of expecting the machine to anticipate my needs, I tried to think like the machine, to meet it more than halfway. And because I had to think twice, all the needlessly complicated acronyms that remind us to be concise in other coding languages—YAGNI (you aren’t gonna need it), KISS (keep it simple, stupid), DRY (don’t repeat yourself)—were rendered obsolete.

After spending days fiddling with Forth, returning to Python felt luxurious. I never had to consider memory scarce, and I never had to thoroughly explain myself. It felt like catching up with an old friend. At that moment,



the resources that go into making programming “user-friendly” became painfully apparent.

#### ILLUSTRATION: SAMUEL TOMSON

Before I met Dupras, I thought of efficiency in terms of speed. But the true costs of that speed are carefully hidden in rural data centers and distant copper mines. I rarely considered the energy required to power each additional gigabyte of RAM, or the fact that cloud computing now has a bigger carbon footprint than the airline industry.

Despite the compounding environmental costs, memory is as cheap and plentiful as it’s ever been. Today, languages that sit closer to the machine are only used out of necessity: banks trying to minimize latency for financial trades, spacecraft working with limited onboard resources, outdated systems that would require too much work to update.

But during a civilizational collapse, the quiet luxuries of array handling and automated memory management will largely disappear. As convenience whisks us further away from the machine, we risk forgetting how computers actually work and losing the ability to rebuild our tech in the event of a collapse. “No one remembers how to write a text editor,” says Devine, an independent programmer who corresponds with Dupras. “When you start forgetting how to do something as crucial as that, when things start to fall apart, they fall apart hard.”

Devine views efficiency in programming not as a lawnmower or a scythe but as something more like a wildflower meadow—“the least amount of transformation of state possible.” In their view, AI is the pinnacle of “human-centric” programming, where the computer figures out what you’re trying to do and does it for you. Something clicked for me at that moment. As programmers grow more reliant on high-level languages, the average proficiency of low-level languages plummets, which increases the demand for the computing resources that support that abstraction in the first place. AI won’t just take our jobs, it’ll make us forget how to do them—if we don’t run out of the energy to power it first.

But maybe there is another way. Since 2016 Devine and their partner Rek have been living full-time on a small boat in the northern Pacific, and they use lower-level languages like Forth to maximize what they can do with the 190 watts of daily power they get from two solar panels. I found them on a mailing list of roughly a hundred Collapseniks. Their lifestyle was like a sneak preview of the resource-constrained life Dupras expects us all to be living soon. When I reached out for a chat in August, they told me they might have cell service in October.

When we finally connected (audio only), Devine struck me as a younger, more optimistic version of Dupras. While fully sympathetic to Dupras' vision of collapse, Devine believes in the power of low-level programming not for its ability to rebuild society but for its potential to *prevent* collapse. Devine has observed a growing trend called “permacomputing” that fosters a more mindful relationship with technology, one that considers resource constraints.

As I returned from the wilderness—back to the world of luxuries like hash tables and built-in libraries that I'd previously taken for granted—I brought back with me a new awareness of the intricacies of the machine, and maybe even a little hope. Forth is how Dupras prepares for the worst, but it's also helping people like Devine and Rek code—and live—more sustainably. If we can all do that, perhaps the end of the world isn't as inevitable as it seems.

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By [Samantha Spengler](#)

[Business](#)

Mar 24, 2025 6:00 AM

# The Weight of the Internet Will Shock You

Depending on who you ask, the internet weighs no more than a potato, a strawberry—or something much, much smaller. WIRED investigates.

Play/Pause Button



ANIMATION: ANJALI NAIR; GETTY IMAGES

The internet is massive. But does it have ... actual mass? Big server farms and miles of fiber-optic cables do, of course, but we don't mean the infrastructure of the internet. We mean the internet itself. The information. The data. The cybernetics. And because storing and moving stuff through cyberspace requires energy—which, per Einstein, has mass—it should, in theory, be possible to calculate the internet's weight.

Way back in the adolescent days of the web, in 2006, a Harvard physicist named Russell Seitz [made an attempt](#). His conclusion? If you consider the mass of the energy powering the servers, the internet comes out to roughly 50 grams—or about the weight of a couple strawberries. People still use Seitz's comparison to this day. *We're all wasting our lives on something we could swallow in one bite!*

Current estimates say that 1 gram of DNA can encode 215 petabytes—or  $215 \times 10^{15}$  bytes—of information. If the internet is  $175 \times 10^{24}$  bytes, that's 960,947 grams' worth of DNA. That's the same as 64,000 strawberries.

But a lot has happened since 2006—Instagram, iPhones, and the AI boom, to name a few. (By Seitz's logic, the internet would now weigh as much as a

potato.) There's also the fact that, around the time of Seitz's calculation, Discover magazine proposed a [different method](#). Information on the internet is written in bits, so what if you looked at the weight of the electrons needed to encode those bits? Using all internet traffic—then estimated to be 40 petabytes—Discover put the internet's weight at a tiny fraction (5 millionths) of a gram. So, more like a squeeze of strawberry juice. WIRED thought it was time to investigate for ourselves.

If the internet is the equivalent of 960,947 grams' worth of DNA, that's the same as one-third of a Cybertruck.

### [How to Get Computers—Before Computers Get You](#)

Post-quantum algorithms, thermodynamic hardware, open source architectures, apocalypse-proof programming, and more: WIRED journeys to the freaky [frontiers of modern computing](#).

First up: the server-energy method. “Fifty grams is just wrong,” says Christopher White, president of [NEC Laboratories America](#) and a veteran of storied research powerhouse Bell Labs. Other scientists we spoke to agreed. Daniel Whiteson, a particle physicist at UC Irvine and cohost of the podcast *Daniel and Kelly's Extraordinary Universe*, said it's an overly convenient way to get “the units you want”—like assuming the price of a doughnut could be calculated by dividing the total number of doughnuts in the world by the world GDP. Preposterous! That would give us a doughnut-per-dollar figure, sure, “but it wouldn't be correct, or even close,” Whiteson says.

Discover magazine's calculation also seemed a little off to us. It has more to do with the transmission of the internet, as opposed to the internet itself. It also assumes a set number of electrons needed to encode information. In reality, the number is incredibly varied and depends on the specific chips and circuits being used.

White suggested a third method. What if we pretend to put all the data stored on the internet, across all the hundreds of millions of servers around the world, in just one place? How much energy would we need to encode that data, and how much would that energy weigh? In 2018, the

International Data Corporation estimated that by 2025, the internet's datasphere would reach [175 zettabytes](#), or  $1.65 \times 10^{24}$  bits. (1 zettabyte =  $1024^7$  bytes and 1 byte = 8 bits.) White suggested multiplying those bits by a mathematical term— $k_B T \ln 2$ , if you're curious—that captures the minimum energy needed to reset a bit. (Temperature is a factor, because storing data is easier in colder conditions. Meaning: The internet is lighter in space than it is in Tucson, Arizona.) We can then take that number, which will represent energy, and call on  $E = mc^2$  to reach the total mass. At room temperature, the entirety of the internet would weigh  $(1.65 \times 10^{24}) \times (2.9 \times 10^{-21})/c^2$ , or  $5.32 \times 10^{-14}$  grams. That's 53 *quadrillionths* of a gram.

If the internet is  $175 \times 1024^7$  bytes, that's 960,947 grams' worth of DNA. That's the same as 10.6 American males.

Which ... is no fun. Even if it has almost no physical mass, the internet still *feels* weighty, to those billions of us weighed down by it every day. White, who has previously attempted similar philosophical estimates, clarified that in reality, the web is so intricate that it is “essentially unknowable,” but why not try? In recent years, scientists have floated the idea of storing data within the building blocks of nature: DNA. So what if we were to weigh the internet in those terms? [Current estimates](#) say that 1 gram of DNA can encode 215 petabytes—or  $215 \times 10^{15}$  bytes—of information. If the internet is  $175 \times 1024^7$  bytes, that's 960,947 grams' worth of DNA. That's the same as 10.6 American males. Or one third of a Cybertruck. Or 64,000 strawberries.

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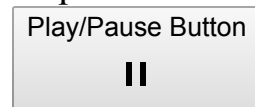
[WIRED Staff](#)

[Business](#)

Mar 24, 2025 6:00 AM

# Quantum Computing Is Dead. Long Live Quantum Computing!

Schrödinger's cat is alive and dead at the same time. Ironically enough, so is quantum computing.



Animation: Tal Uliel

This is the year of quantum science and technology. Literally: The United Nations [said so](#). But no amount of pomp and hype can make something true. The fact is, it's been the year of quantum nearly every year for many, many years now. It's always the next big thing. It's always just about here. Well, is it? Really? Nearly a century ago, Erwin Schrödinger poked fun at quantum principles by comparing them to a cat that's both alive *and* dead. Today, quantum computing finds itself in just such a state: a superposition of here and not-here, a series of world-changing breakthroughs that are, at the same time, also colossal letdowns. So what's the real story? Let's open the box and find out.

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By [WIRED Staff](#)  
[Business](#)

Mar 24, 2025 6:00 AM

# How Software Engineers Actually Use AI

We surveyed 730 coders and developers about how (and how often) they use AI chatbots on the job. The results amazed and disturbed us.

Illustration: Lena Weber

Code created AI. That much is obvious. Less obvious is the extent to which AI is now, in a snake-eats-tail way, creating code. We kept hearing conflicting accounts. This programmer used AI every day; that programmer wouldn't touch the stuff. This company paid for AI services; that company banned them. So which is it? Are chatbots liberating human programmers—or [programming](#) them right out of their jobs? To find out, we blasted a survey to every software engineer and developer in our orbit, from casual dabblers to career vets. The results amazed and surprised us, capturing an industry at fundamental odds with itself. And did we then upload that data to ChatGPT, just to see what it might make of things? Yes. Yes we did.\*

\*ChatGPT mostly did spreadsheet-processing grunt work, offered trend analyses, and made the occasional design recommendation. Human editors and fact-checkers were there every step of the way (and needed to be).

## Will AI Fully Eat Programming Jobs One Day?

Almost every coder we surveyed had strong opinions on the matter. Here's ChatGPT's summary of the responses (with its boldface emphasis preserved):

“The coders have spoken—and they’re not packing up their keyboards just yet. While a small but vocal group insists AI will **devour** programming jobs in time, most dismiss full automation as a pipe dream. The **doom prophets** warn that corporate bosses will **slash payrolls** the moment AI looks capable, leaving human engineers debugging their own obsolescence. The **skeptics** scoff, arguing AI is more like a hyperefficient intern—**useful, but clueless**—that can’t handle context, edge cases, or real problem-solving. The **realists** see AI as a **force multiplier, not a job killer**—automating repetitive coding but leaving the creativity, architecture, and debugging to humans. “If AI does eat programming,” one put it, “I’ll just switch to debugging AI.”\* The real verdict? AI isn’t coming for your job—**but it is changing it**. Adapt or get left behind.□”

\*Nobody actually said this! ChatGPT—bless it—made several mistakes throughout this process. Not only did it fabricate quotes, it also misread results, generated incomprehensible graphs, and, at multiple points, stopped counting “freelancers” as a category entirely. Rude.\*\*

\*\*In its way, ChatGPT invited this feedback. When asked for final tips, it suggested “a touch of snark, because AI discourse is full of strong opinions.”

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One day soon, at a research lab near Santa Barbara or Seattle or a secret facility in the Chinese mountains, it will begin: the sudden unlocking of the world's secrets. Your secrets.

Cybersecurity analysts call this Q-Day—the day someone builds a [quantum computer](#) that can crack the most widely used forms of encryption. These math problems have kept humanity's intimate data safe for decades, but on Q-Day, everything could become vulnerable, for everyone: emails, text messages, anonymous posts, location histories, bitcoin wallets, police reports, hospital records, power stations, the entire global financial system.

“We’re kind of playing Russian roulette,” says Michele Mosca, who coauthored the most recent “Quantum Threat Timeline” report from the [Global Risk Institute](#), which estimates how long we have left. “You’ll *probably* win if you only play once, but it’s not a good game to play.” When Mosca and his colleagues surveyed cybersecurity experts last year, the forecast was sobering: a one-in-three chance that Q-Day happens before 2035. And the chances it has *already* happened in secret? Some people I spoke to estimated 15 percent—about the same as you’d get from one spin of the revolver cylinder.

The corporate AI wars may have stolen headlines in recent years, but the quantum arms race has been heating up too. Where today’s AI pushes the limits of classical computing—the kind that runs on 0s and 1s—quantum technology represents an [altogether different form of computing](#). By harnessing the spooky mechanics of the subatomic world, it can run on 0s, 1s, or anything in between. This makes quantum computers pretty terrible at, say, storing data but potentially very good at, say, finding the recipe for a futuristic new material (or your email password). The classical machine is doomed to a life of stepwise calculation: Try one set of ingredients, fail, scrap everything, try again. But quantum computers can explore many potential recipes *simultaneously*.

[How to Get Computers—Before Computers Get You](#)

Post-quantum algorithms, thermodynamic hardware, open source architectures, apocalypse-proof programming, and more: WIRED journeys to the freaky [frontiers of modern computing](#).

So, naturally, tech giants such as Google, Huawei, IBM, and Microsoft have been chasing quantum's myriad positive applications—not only for materials science but also communications, drug development, and market analysis. China is plowing vast resources into [state-backed efforts](#), and both the US and the European Union have pledged millions in funding to support homegrown quantum industries. Of course, whoever wins the race won't just have the next great engine of world-saving innovation. They'll also have the greatest code-breaking machine in history. So it's normal to wonder: What kind of Q-Day will humanity get—and is there anything we can do to prepare?

If you had a universal picklock, you might tell everyone—or you might keep it hidden in your pocket for as long as you possibly could. From a typical person's vantage point, maybe Q-Day wouldn't be recognizable as Q-Day at all. Maybe it would look like a series of strange and apparently unconnected news stories spread out over months or years. London's energy grid goes down on election day, plunging the city into darkness. A US submarine on a covert mission surfaces to find itself surrounded by enemy ships. Embarrassing material starts to show up online in greater and greater quantities: classified intelligence cables, presidential cover-ups, billionaires' dick pics. In this scenario, it might be decades before we're able to pin down exactly when Q-Day actually happened.

Then again, maybe the holder of the universal picklock prefers the disaster-movie outcome: everything, everywhere, all at once. Destroy the grid. Disable the missile silos. Take down the banking system. Open all the doors and let the secrets out.

Suppose you ask a classical computer to solve a simple math problem: Break the number 15 into its smallest prime factors. The computer would try all the options one by one and give you a near-instantaneous answer: 3 and 5. If you then ask the computer to factor a number with 1,000 digits, it would tackle the problem in exactly the same way—but the calculation would take millennia. This is the key to a lot of modern cryptography.

Take RSA encryption, developed in the late 1970s and [still used](#) for securing email, websites, and much more. In RSA, you (or your encrypted messaging app of choice) create a private key, which consists of two or more large prime numbers. Those numbers, multiplied together, form part of your public key. When someone wants to send you a message, they use your public key to encrypt it. You're the only person who knows the original prime numbers, so you're the only person who can decrypt it. Until, that is, someone else builds a quantum computer that can use its spooky powers of parallel computation to derive the private key from the public one—not in millennia but in minutes. Then the whole system collapses.

The algorithm to do this already exists. In 1994, decades before anyone had built a real quantum computer, an AT&T Bell Labs researcher named Peter Shor designed the killer Q-Day app. Shor's algorithm takes advantage of the fact that quantum computers run not on bits but on qubits. Rather than being locked in a state of 0 or 1, they can exist as both simultaneously—in superposition. When you run an operation on a handful of qubits in a given quantum state, you're actually running that same operation on those same qubits in *all* their potential quantum states. With qubits, you're not confined to trial and error. A quantum computer can explore all potential solutions simultaneously. You're calculating probability distributions, waves of quantum feedback that pile onto each other and peak at the correct answer. With Shor's algorithm, carefully designed to amplify certain mathematical patterns, that's exactly what happens: Large numbers go in one end, factors come out the other.

In theory, at least. Qubits are incredibly difficult to build in real life, because the slightest environmental interference can nudge them out of the delicate state of superposition, where they balance like a spinning coin. But Shor's algorithm ignited interest in the field, and by the 2010s, a number of projects were starting to make progress on building the first qubits. In 2016, perhaps sensing the nascent threat of Q-Day, the US National Institute for Standards and Technology (NIST) launched a competition to develop [quantum-proof encryption algorithms](#). These largely work by presenting quantum computers with complex multidimensional mazes, called structured lattices, that even they can't navigate without directions.

In 2019, Google's quantum lab in Santa Barbara claimed that it had [achieved "quantum supremacy."](#) Its 53-qubit chip could complete in just 200 seconds a task that would have taken 100,000 conventional computers about 10,000 years. Google's latest quantum processor, Willow, has 105 qubits. But to break encryption with Shor's algorithm, a quantum computer will need thousands or even millions.

There are now hundreds of companies trying to build quantum computers using wildly different methods, all geared toward keeping qubits isolated from the environment and under control: superconducting circuits, trapped ions, molecular magnets, carbon nanospheres. While progress on hardware inches forward, computer scientists are refining quantum algorithms, trying to reduce the number of qubits required to run them. Each step brings Q-Day closer.

That's bad news not just for RSA but also for a dizzying array of other systems that will be vulnerable on Q-Day. Security consultant Roger A. Grimes lists some of them in his book *Cryptography Apocalypse*: the DSA encryption used by many US government agencies until recently, the elliptic-curve cryptography used to secure cryptocurrencies like Bitcoin and Ethereum, the VPNs that let political activists and porn aficionados browse the web in secrecy, the random number generators that power online casinos, the smartcards that let you tap through locked doors at work, the security on your home Wi-Fi network, the two-factor authentication you use to log in to your email account.

Experts from one national security agency told me they break the resulting threats down into two broad areas: confidentiality and authentication. In other words, keeping secrets and controlling access to critical systems. Chris Demchak, a former US Army officer who is a professor of cybersecurity at the US Naval War College and spoke with me in a personal capacity, says that a Q-Day computer could let an adversary eavesdrop on classified military data in real time. "It would be very bad if they knew exactly where all of our submarines were," Demchak says. "It would be very bad if they knew exactly what our satellites are looking at. And it would be very bad if they knew exactly how many missiles we had and

their range.” The balance of geopolitical power in, say, the Taiwan Strait could quickly tilt.

Beyond that real-time threat to confidentiality, there’s also the prospect of “harvest now, decrypt later” attacks. Hackers aligned with the Chinese state have reportedly been hoovering up encrypted data for years in hopes of one day having a quantum computer that can crack it. “They wolf up everything,” Demchak told me. (The US almost certainly does this too.) The question then becomes: How long will your sensitive data remain valuable? “There might be some needles in that haystack,” says Brian Mullins, the CEO of Mind Foundry, which helps companies implement quantum technology. Your current credit card details might be irrelevant in 10 years, but your fingerprint won’t be. A list of intelligence assets from the end of the Iraq War might seem useless until one of those assets becomes a prominent politician.

The threat to authentication may be even scarier. “Pretty much anything that says a person is who they say they are is underpinned by encryption,” says Deborah Frincke, a computer scientist and national security expert at Sandia National Laboratories. “Some of the most sensitive and valuable infrastructure that we have would be open to somebody coming in and pretending to be the rightful owner and issuing some kind of command: to shut down a network, to influence the energy grid, to create financial disruption by shutting down the stock market.”

Illustration: Nicholas Law

The exact level of Q-Day chaos will depend on who has access to the first cryptographically relevant quantum computers. If it’s the United States, there will be a “fierce debate” at the highest levels of government, Demchak believes, over whether to release it for scientific purposes or keep it secret and use it for intelligence. “If a private company gets there first, the US will buy it and the Chinese will try to hack it,” she claims. If it’s one of the US tech companies, the government could put it under the strict export controls that now apply to AI chips.

Most nation-state attacks are on private companies—say, someone trying to break into a defense contractor like Lockheed Martin and steal plans for a

next-generation fighter jet. But over time, as quantum computers become more widely available, the focus of the attacks could broaden. The likes of Microsoft and Amazon are already offering researchers access to their primitive quantum devices on the cloud—and big tech companies haven't always been great at policing who uses their platforms. (The soldier who blew up a Cybertruck outside the Trump International Hotel in Las Vegas early this year queried ChatGPT to help plan the attack.) You could have a bizarre scenario where a cybercriminal uses Amazon's cloud quantum computing platform to break into Amazon Web Services.

Cybercriminals with access to a quantum computer could use it to go after the same targets more effectively, or take bigger swings: hijacking the SWIFT international payments system to redirect money transfers, or conducting corporate espionage to collect kompromat. The earliest quantum computers probably won't be able to run Shor's algorithm that quickly—they might only get one or two keys a day. But combining a quantum computer with an artificial intelligence that can map out an organization's weakness and highlight which keys to decrypt to cause the most damage could yield devastating results.

And then there's Bitcoin. The cryptocurrency is exquisitely vulnerable to Q-Day. Because each block in the Bitcoin blockchain captures the data from the previous block, Bitcoin cannot be upgraded to post-quantum cryptography, according to Kapil Dhiman, CEO of Quranium, a post-quantum blockchain security company. "The only solution to that seems to be a hard fork—give birth to a new chain and the old chain dies."

But that would require a massive organizational effort. First, 51 percent of Bitcoin node operators would have to agree. Then everyone who holds bitcoin would have to manually move their funds from the old chain to the new one (including the elusive Satoshi Nakamoto, the Bitcoin developer who controls wallets containing around \$100 billion of the cryptocurrency). If Q-Day happens before the hard fork, there's nothing to stop bitcoin going to zero. "It's like a time bomb," says Dhiman.

That bomb going off will only be the beginning. When Q-Day becomes public knowledge, either via grim governmental address or cheery big-tech press release, the world will enter the post-quantum age. It will be an era

defined by mistrust and panic—the end of digital security as we know it. “And then the scramble begins,” says Demchak.

All confidence in the confidentiality of our communications will collapse. Of course, it’s unlikely that everyone’s messages will actually be targeted, but the perception that you could be spied on at any time will change the way we live. And if NIST’s quantum-proof algorithms haven’t rolled out to your devices by that point, you face a real problem—because any attempts to install updates over the cloud will also be suspect. What if that download from Apple isn’t actually from Apple? Can you trust the instructions telling you to transfer your crypto to a new quantum-secure wallet?

Grimes, the author of *Cryptography Apocalypse*, predicts enormous disruptions. We might have to revert to Cold War methods of transmitting sensitive data. (It’s rumored that after a major hack in 2011, one contractor purportedly asked its staff to stop using email for six weeks.) Fill a hard drive, lock it in a briefcase, put someone you trust on a plane with the payload handcuffed to their wrist. Or use one-time pads—books of pre-agreed codes to encrypt and decrypt messages. Quantum-secure, but not very scalable. Expect major industries—energy, finance, health care, manufacturing, transportation—to slow to a crawl as companies with sensitive data switch to paper-based methods of doing business and scramble to hire expensive cryptography consultants. There will be a spike in inflation. Most people might just accept the inevitable: a post-privacy society in which any expectation of secrecy evaporates unless you’re talking to someone in person in a secluded area with your phones switched off. Big Quantum is Watching You.

The best-case scenario looks something like Y2K, where we have a collective panic, make the necessary upgrades to encryption, and by the time Q-Day rolls around it’s such an anticlimax that it becomes a joke. That outcome may still be possible. Last summer, NIST released its first set of post-quantum encryption standards. One of Joe Biden’s [last acts as president](#) was to sign an executive order changing the deadline for government agencies to implement NIST’s algorithms from 2035 to “as soon as practicable.”

Already, NIST's post-quantum cryptography has been rolled out on messaging platforms such as Signal and iMessage. Sources told me that sensitive national security data is probably being locked up in ways that are quantum-secure. But while your email account can easily be Q-proofed over the internet (assuming the update doesn't come from a quantum imposter!), other things can't. Public bodies like the UK's National Health Service are still using hardware and software from the 1990s. "Microsoft is not going to upgrade some of its oldest operating systems to be post-quantum secure," says Ali El Kaafarani, the CEO of PQShield, a company that makes quantum-resistant hardware. Updates to physical infrastructure can take decades, and some of that infrastructure has vulnerable cryptography in places it can't be changed: The energy grid, military hardware, and satellites could all be at risk.

And there's a balance to be struck. Rushing the transition risks introducing vulnerabilities that weren't there before. "How do you make transitions slow enough that you can be confident and fast enough that you don't dawdle?" asks Chris Ballance, CEO of Oxford Ionics, a quantum computing company. Some of those vulnerabilities might even be there by design: Memos leaked by Edward Snowden indicate that the NSA may have inserted a backdoor into a pseudorandom number generator that was adopted by NIST in 2006. "Anytime anybody says you should use this particular algorithm and there's a nation-state behind it, you've got to wonder whether there's a vested interest," says Rob Young, director of Lancaster University's Quantum Technology Centre.

Then again, several people I spoke to pointed out that any nation-state with the financial muscle and technical knowledge to build a quantum device that can run Shor's algorithm could just as easily compromise the financial system, the energy grid, or an enemy's security apparatus through conventional methods. Why invent a new computing paradigm when you can just bribe a janitor?

Long before quantum technology is good enough to break encryption, it will be commercially and scientifically useful enough to tilt the global balance. As researchers solve the engineering challenge of isolating qubits from the environment, they'll develop exquisitely sensitive quantum



sensors that will be able to unmask stealth ships and map hidden bunkers, or give us new insight into the human body. Similarly, pharma companies of the future *could* use quantum to steal a rival's inventions—or use it to dream up even better ones. So ultimately the best way to stave off Q-Day may be to share those benefits around: Take the better batteries, the miracle drugs, the far-sighted climate forecasting, and use them to build a quantum utopia of new materials and better lives for everyone. Or—let the scramble begin.

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Mar 24, 2025 6:00 AM

# Hot New Thermodynamic Chips Could Trump Classical Computers

Guillaume Verdon is building a new kind of chip to accelerate AI. His alter ego wants to accelerate humanity itself.

Guillaume Verdon (right) and his Extropic cofounder Trevor McCourt. Photograph: Nicole Marie

Guillaume Verdon stands before me with a new kind of computer chip in his hand—a piece of hardware he believes is so important to the future of humanity that he’s asked me not to reveal our exact location, for fear that his headquarters could become the target of industrial espionage.

This much I can tell you: We’re in an office a short drive from Boston, and the chip arrived from the foundry just a few days ago. It sits on a circuit board about the width of a Big Mac. The pinky-nail-sized piece of silicon itself is dotted with an exotic set of components: not the transistors of an ordinary semiconductor, nor the superconducting elements of a [quantum chip](#), but the guts of a radically new paradigm called thermodynamic computing.

Not unlike its quantum cousin, thermodynamic computing promises to move beyond the binary constraints of 1s and 0s. But while quantum computing sets out—through extreme cryogenic cooling—to minimize the random thermodynamic fluctuations that occur in electronic components, this new paradigm aims to *harness* those very fluctuations.

Engineers are chasing both paradigms in a race to accelerate past ordinary silicon chips and satisfy the ravenous demand for processing power in the age of AI. But Verdon—with his startup, Extropic—isn’t just a contestant in

that race. He's also one of the AI era's most shameless hype men. He is far better known as his online alter ego, Based Beff Jezos, the founding prophet of an ideology called effective accelerationism.

### [How to Get Computers—Before Computers Get You](#)

Post-quantum algorithms, thermodynamic hardware, open source architectures, apocalypse-proof programming, and more: WIRED journeys to the freaky [frontiers of modern computing](#).

Known as “e/acc” for short, effective accelerationism is an irreverent rejection of [effective altruism](#), a movement that has persuaded many technically minded people that the rise of artificial general intelligence—unless it is corralled and made safe—poses an almost certain existential risk to humanity. “EA’s be like: ‘I believe in Leprechauns and the burden of proof is on you to disprove me,’” went one fairly typical [Based Beff post](#) from 2022.

The AI existential risk movement, he wrote in [another post](#) that year, “is an infohazard that causes depression in our most talented and intelligent folks, killing our productive gains towards a greater more prosperous future.” Another frequent target of his mockery is the AI ethics movement, which critiques large language models as riddled with the biases and blind spots of their architects. As Based Beff continued to spread e/acc’s gospel online, it quickly became a rallying cry among some members of the tech elite, with prominent figures like Marc Andreessen and Garry Tan temporarily adding “e/acc” to their X usernames.

Effective accelerationism is perhaps best seen as the most technical fringe of a broader zeitgeist: a belief that American politics is broken and that caution, overregulation, and woke ideology are holding the country back. That ethos helped propel Donald Trump back to the White House, with [Elon Musk](#), a hero of the e/acc movement, by his side. Like Trump 2.0, effective accelerationism promises an unstoppable American renaissance and an untroubled view of the work needed to get there. In both cases, the details are fuzzy.

But under the sharp resolution of a laboratory microscope, the specifics of Verdon's new chip are, if nothing else, plain to see: an array of square features each a few dozen microns wide. These components, Verdon promises, will be used to generate "programmable randomness"—a chip in which probabilities can be controlled to produce useful computations. When combined with a classical computer, he says, they will provide a highly efficient way to model uncertainty, a key task in all sorts of advanced computing, from modeling the weather and financial markets to artificial intelligence. (Some academic labs have already built prototype thermodynamic hardware, including a simple [neural network](#)—the technology at the heart of modern machine learning.)

When we meet at Extropic's headquarters in early 2025, Verdon, 32, looks more like a contractor than a physicist, wearing a plain Carhartt T-shirt over a broad frame, a pair of angular glasses, and a trim beard over a square jaw. Extropic, he explains, plans to have its first operational chips available for market later in 2025, less than a year after the design was first conceived. "Eventually entire workloads could run on thermo hardware," Verdon says. "Some day a whole language model could run on it."

The speed, maybe impatience, with which Verdon has developed these thermodynamic "accelerators" is all the more remarkable for another reason. Not long ago his work was synonymous with a completely different futuristic computing paradigm, only it wasn't moving fast enough for him. Effective altruism and AI safety aren't all Verdon has noisily repudiated over the past couple of years; he has also rejected quantum computing. "The story of thermodynamic computing is kind of an exodus from quantum," Verdon says. "And I kind of started that."

Back in 2019, when he was still a PhD student at Canada's University of Waterloo, Verdon was recruited to a team at Google tasked with figuring out how to use quantum computers—fabled machines capable of harnessing quantum mechanics to perform computations at unfathomable speeds—to supercharge artificial intelligence.

By early 2022 the team had made important progress. Verdon had led the development of Tensor-Flow Quantum, a version of the company's AI software designed to run on quantum machines, and the hardware team at

Alphabet was working on perfecting quantum error correction for a single qubit—a trick needed to account for the insane instability of quantum states.

Extropic's thermodynamic accelerator under a microscope.

Photograph: Nicole Marie

The connectors that will integrate the chip into a classical computer.

Photograph: Nicole Marie

But while Verdon was busy working at Google, several theoretical discoveries in academia started to suggest that quantum computing would take a lot longer to pay off than originally hoped. Back in 2018, Ewin Tang, then just an undergraduate student at the University of Texas at Austin, had published a startling paper showing that one of the best candidates for an exponential speedup in quantum machine learning—a kind of quantum recommendation algorithm—would not offer much acceleration after all. Other papers built upon the discovery and further impugned quantum's reputation.

Verdon was not the only person who felt that a quantum bubble was losing air. “It looked like all these applications we really wanted to do weren't going to work in the era of noisy quantum computing,” says Faris Sbahi, cofounder and CEO of a thermodynamic startup called Normal Computing. “I became a little negative on the prospects for commercial quantum computing, and I switched fields.” Both Normal Computing and Extropic have attracted other refugees from other quantum computing labs and startups. (Verdon says the two companies have different approaches and are not direct rivals.)

This quiet quantum bust coincided with the generative AI boom—and with another growing source of frustration for Verdon. Just as ChatGPT was taking off, Verdon felt that the industry's response was dampened by effective altruists who wanted to freeze progress and subject the technology to needless controls. He saw the tech industry itself consumed by an overly scrupulous, self-critical, woke ideology.

Quantum dead ends, tech-industry navel-gazing, an AI gold rush: All of these merged together in Verdon's mind to inspire a new philosophy along with belief in a new engineering idea. In both conventional and quantum computers, heat is a source of errors. Both kinds of computing require huge expenditures of energy to prevent natural thermodynamic effects in electronic circuits from either flipping 1s to 0s or destroying delicate quantum states. Instead of fighting these effects, Verdon thought, why not save all that heat-killing energy and embrace the chaos—in hardware and in life—to make something new?

In *Lord of Light*, a 1967 science fiction novel by Roger Zelazny, the last member of a futuristic revolutionary group known as the accelerationists wants to convince society to embrace unrestrained technological progress. By the 1990s, a British philosopher named Nick Land was advocating for a real accelerationist movement that would unshackle capitalism from the restraints imposed by politicians and welcome the technological and social destruction and renewal this would bring. Accelerationist ideas are echoed by other alt-right thinkers, including the influential blogger Curtis Yarvin, who argues that Western democracy is a bust and ought to be replaced.

Verdon and his bros, however, see accelerationism through the prism of natural laws. In a [founding manifesto](#), offering a “physics-first view of the principles underlying effective accelerationism,” they cite recent work suggesting that the existence of life itself may be explained by the propensity of matter to harness and exploit energy. Not only does the thermodynamic approach promise a much leaner form of computing, Verdon argues, it also reflects how biological intelligence itself has evolved. He and his e/acc allies argue that the same energy-harnessing principle accounts for the development of social organizations and the very course of humanity.

An oscilloscope displays the thermodynamic output—what Extropic calls a “probabilistic bit”—from McCourt and Verdon's chip.

Photograph: Nicole Marie

“Effective accelerationism aims to follow the ‘will of the universe’: leaning into the thermodynamic bias towards futures with greater and smarter

civilizations that are more effective at finding/extracting free energy from the universe and converting it to utility at grander and grander scales,” the manifesto reads. And it doesn’t hold humanity particularly dear: “e/acc has no particular allegiance to the biological substrate for intelligence and life.”

In January 2022, while he was still at Google, Verdon decided to create a new X account, to talk shit and air some of his ideas. But he didn’t feel free to do it under his own name. (“My tweets were closely monitored,” he tells me.) So he called himself Based Beff, with a profile picture of a ripped ’80s video game version of Jeff Bezos.

Based Beff quickly demonstrated a talent for humor, whipping up like-minded, right-leaning tech bros and trolling AI doomers. In July, he linked to an [erotic novel about Microsoft’s Clippy](#)—and used it to poke fun at a canonical thought experiment, famous among effective altruists, involving a world-destroying AI that is optimized for making paper clips. “It’s #PrimeDay so I’m buying this for all the anti-AGI EAs,” [he wrote](#). “I found it very freeing,” Verdon says. “It was like a video game persona, and stuff just started pouring out of me.”

I first spoke to Verdon in December 2023, just after [Forbes had used his voiceprint](#) to identify him as the person behind the Based Beff Jezos account. The attention was uncomfortable for someone accustomed to working in relative obscurity. “I was in shock for a while,” Verdon says. “It was traumatic.”

But rather than run and hide after being outed, Verdon chose to embrace his newfound celebrity and use it to promote his company. Extropic hurriedly came out of stealth, revealed its vision, and set about recruiting. The company has so far raised \$14.1 million in seed funding, and there are around 20 engineers working full-time at the firm. Investors include Garry Tan, Balaji Srinivasan, and two authors of the famous paper “[Attention Is All You Need](#),” which laid out the so-called transformer architecture that has revolutionized AI.

Verdon is a lot more chill in person than he is when posting as Based Beff Jezos. After I arrive at Extropic, Verdon makes me a very strong espresso before leading me to a windowless hardware lab where a handful of

engineers are staring at diagrams of the company's first chip, fiddling with oscilloscopes that reveal performance characteristics, and staring at code designed to make it sing.

Verdon introduces me to his CTO and cofounder, Trevor McCourt, a tall, easygoing fellow with shaggy hair who also worked on quantum computing at Alphabet before becoming disillusioned with the project. I ask if McCourt, too, has an online alter ego. "No," he laughs. "One of me is enough."

A couple of weeks earlier, Google had revealed its latest quantum computing chip, called Willow. The chip can now perform quantum error correction on the scale of 105 qubits. For Extropic, this is not a sign that quantum is now on the fast track. Verdon and McCourt point out that the machine still needs to be cooled to extremely low temperatures, and its advantages remain uncertain.

Once early adopters get their hands on Extropic's hardware later this year, the chip may prove its worth with high-tech trading and medical research—both use algorithms that run probabilistic simulations. But in the meantime, the day after we meet, Verdon is on his way to DC for an event timed to Donald Trump's inauguration. Before boarding his flight, he makes a flurry of posts on X. "I love the techno-capital machine and its creations," he writes. "We're accelerating to the stars."

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[Paresh Dave](#) [Arielle Pardes](#)

[The Big Story](#)

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# Inside Google's Two-Year Frenzy to Catch Up With OpenAI

The search giant should've been first to the chatbot revolution. It wasn't. So it punched back with late nights, layoffs—and lowering some guardrails. Google executive Sissie Hsiao (center) with some of the team that works on the company's AI offerings (from left: Amar Subramanya, Jenny Blackburn, Suman Prasad, Trevor Strohman, and Jack Krawczyk) Photograph: Scott Hutchinson

A hundred days. That was how long Google was giving Sissie Hsiao. A hundred days to build a ChatGPT rival.

By the time Hsiao took on the project in December 2022, she had spent more than 16 years at the company. She led thousands of employees. Hsiao had seen her share of corporate crises—but nothing like the code red that had been brewing in the days since [OpenAI](#), a small research lab, released its public experiment in artificial intelligence. No matter how often [ChatGPT hallucinated facts](#) or bungled simple math, more than a million people were already using it. Worse, some saw it as a replacement for [Google](#) search, the company's biggest cash-generating machine. Google had a language model that was nearly as capable as OpenAI's, but it had been kept on a tight leash. The public could chat with LaMDA by invitation only—and in one demo, only about dogs.

Wall Street was uneasy. More than six years earlier, [CEO Sundar Pichai](#) had promised to prepare for an “AI-first world” in which “an intelligent assistant” would replace “the very concept of the ‘device.’” Soon after, [eight of Google's own researchers](#) had invented transformer-based architecture, the literal “T” in ChatGPT. What did Google have to show for

it? Disappointing ad sales. A trail of resignations among the transformers inventors. [A product called Assistant](#)—the one Hsiao managed—that wasn't used for much beyond setting a timer or playing music. All that and a half-baked chatbot for Gen Zers that gave cooking advice and history lessons. By the end of 2022, the stock price of Google's parent company, Alphabet, was 39 percent lower than the previous year's end.

As 2023 began, Google executives wanted constant updates for the board. [Sergey Brin](#), one of Google's yacht-sailing cofounders and controlling shareholders, dropped in to review AI strategy. Word came down to employees that the \$1 trillion behemoth would have to move at closer to startup speed. That would mean taking bigger risks. Google would no longer be a place where, as a former senior product director told WIRED, thousands of people could veto a product but no one could approve one. As Hsiao's team began the 100-day sprint, she had what she called an "idiosyncratic" demand: "Quality over speed, but fast."

Meanwhile, another executive, James Manyika, helped orchestrate a longer-term change in strategy as part of conversations among top leadership. An Oxford-trained roboticist turned McKinsey consigliere to Silicon Valley leaders, Manyika had joined Google as senior vice president of technology and society in early 2022. In conversations with Pichai months before ChatGPT went public, Manyika said, he told his longtime friend that Google's hesitation over AI was not serving it well. The company had two world-class AI research teams operating separately and using precious computing power for different goals—DeepMind in London, run by [Demis Hassabis](#), and Google Brain in Mountain View, part of Jeff Dean's remit. They should be partnering up, Manyika had told Pichai at the time.

In the wake of the OpenAI launch, that's what happened. Dean, Hassabis, and Manyika went to the board with a plan for the joint teams to build the most powerful language model yet. Hassabis wanted to call the endeavor Titan, but the board wasn't loving it. Dean's suggestion—Gemini—won out. (One billionaire investor was so jazzed that he snapped a picture of the three executives to commemorate the occasion.)

Since then, Manyika said, "there have been a lot of what I call 'bold and responsible' choices" across the company. He added: "I don't know if we've

always got them right.” Indeed, this race to restore Google’s status as a leader in AI would plunge the company into further crises: At one low moment, staffers were congregating in the hallways and worrying aloud about Google becoming the next Yahoo. “It’s been like sprinting a marathon,” Hsiao said. But now, more than two years later, Alphabet’s shares have buoyed to an all-time high, and investors are bullish about its advances in AI.

WIRED spoke with more than 50 current and former employees—including engineers, marketers, legal and safety experts, and a dozen top executives—to trace the most frenzied and culture-reshaping period in the company’s history. Many of these employees requested anonymity to speak candidly about Google’s transformation—for better or for worse. This is the story, being told with detailed recollections from several executives for the first time, of those turbulent two years and the trade-offs required along the way.

To build the new ChatGPT rival, codenamed Bard, former employees say Hsiao plucked about 100 people from teams across Google. Managers had no choice in the matter, according to a former search employee: Bard took precedence over everything else. Hsiao says she prioritized big-picture thinkers with the technical skills and emotional intelligence to navigate a small team. Its members, based mostly in Mountain View, California, would have to be nimble and pitch in wherever they could help. “You’re Team Bard,” Hsiao told them. “You wear all the hats.”

In January 2023, Pichai announced the first mass layoffs in the company’s history—12,000 jobs, about 7 percent of the workforce. “No one knew what exactly to do to be safe going forward,” says a former engineering manager. Some employees worried that if they didn’t put in overtime, they would quickly lose their jobs. If that meant disrupting kids’ bedtime routines to join Team Bard’s evening meetings, so be it.

Hsiao and her team needed immense support from across the company. They could build on LaMDA but would have to update its knowledge base and introduce new safeguards. Google’s infrastructure team shifted its top staff to freeing up more servers to do all that tuning. They nearly maxed out electricity usage at some of the company’s data centers, risking equipment burnout, and [rapidly designed new tools](#) to more safely handle ever-

increasing power demand. As a joke to ease the tension over computing resources, someone on Hsiao's team ordered customized poker chips bearing the codename for some of Google's computer chips. They left a heaping pile on an engineering leader's desk and said: "Here's your chips."

Even as new computing power came online in those initial weeks of Bard, engineers kept running up against the same issues that had plagued Google's generative AI efforts in the past—and that might once have prompted executives to slow-roll a project. Just like ChatGPT, Bard hallucinated and responded in inappropriate or offensive ways. One former employee says early prototypes fell back on "comically bad racial stereotypes." Asked for the biography of anyone with a name of Indian origin, it would describe them as a "Bollywood actor." A Chinese male name? Well, he was a computer scientist. Bard's outputs weren't dangerous, another former employee said—"just dumb." Some people traded screenshots of its worst responses for a laugh. "I asked it to write me a rap in the style of Three 6 Mafia about throwing car batteries in the ocean, and it got strangely specific about tying people to the batteries so they sink and die," the ex-employee said. "My request had nothing to do with murder."

With its self-imposed 100-day timeline, the best Google could do was catch and fix as many misfires as possible. Some contractors who had typically focused on issues such as reporting child-abuse imagery shifted to testing Bard, and Pichai asked any employee with free time to do the same. About 80,000 people pitched in. To keep user expectations in check, Hsiao and other executives decided to brand Bard as an "experiment," much as OpenAI had called ChatGPT a "research preview." They hoped that this framing might spare the company some reputational damage if the chatbot ran amok. (No one could forget Microsoft's Tay, the Twitter chatbot that went full-on Nazi in 2016.)

Before Google had launched AI projects in the past, its responsible innovation team—about a dozen people—would spend months independently testing the systems for unwanted biases and other deficiencies. For Bard, that review process would be truncated. Kent Walker, Google's top lawyer, advocated moving quickly, according to a former employee on the responsible innovation team. New models and

features came out too fast for reviewers to keep up, despite working into the weekends and evenings. When flags were thrown up to delay Bard's launch, they were overruled. (In comments to WIRED, Google representatives said that "no teams that had a role in green-lighting or blocking a launch made a recommendation not to launch." They also said that "multiple teams across the company were responsible for testing and reviewing genAI products," and "no single team was ever individually accountable.")

In February 2023—about two-thirds of the way into the 100-day sprint—Google executives heard rumblings of another OpenAI victory: ChatGPT would be integrated directly into Microsoft's Bing search engine. Once again, the "AI-first" company was behind on AI. While Google's search division had been experimenting with how to incorporate a chatbot feature into the service, that effort, part of what was known as Project Magi, had yet to yield any real results. Sure, Google remained the undisputed monarch of search: Bing had a tenth of its market share. But how long would its supremacy last without a generative AI feature to tout?

In an apparent attempt to avoid another hit on the stock market, Google tried to upstage its rival. On February 6, the day before Microsoft was scheduled to roll out its new AI feature for Bing, Pichai announced he was opening up Bard to the public for limited testing. In an accompanying marketing video, Bard was presented as a consummate helper—a modern continuation of Google's longstanding mission to "organize the world's information." In the video, a parent asks Bard: "What new discoveries from the James Webb Space Telescope can I tell my 9-year-old about?" Included in the AI's answer: "JWST took the very first pictures of a planet outside of our own solar system."

For a moment, it seemed that Bard had reclaimed some glory for Google. Then [Reuters reported](#) that the Google chatbot had gotten its telescopes mixed up: the European Southern Observatory's Very Large Telescope, located not in outer space but in Chile, had captured the first image of an exoplanet. The incident was beyond embarrassing. Alphabet shares slid by 9 percent, or about \$100 billion in market value.

For Team Bard, the reaction to the gaffe came as a shock. The marketing staffer who came up with the telescope query felt responsible, according to

an ex-employee close to the team. Colleagues tried to lift the staffer's spirits: Executives, legal, and public relations had all vetted the example. No one had caught it. And given all the errors ChatGPT had been making, who would have expected something so seemingly trivial to sink shares?

Hsiao called the moment “an innocent mistake.” Bard was trained to corroborate its answers based on Google Search results and had most likely misconstrued a NASA blog that announced the “first time” astronomers used the James Webb telescope to photograph an exoplanet. One former staffer remembers leadership reassuring the team that no one would lose their head from the incident, but that they had to learn from it, and fast. “We're Google, we're not a startup,” Hsiao says. “We can't as easily say, ‘Oh, it's just the flaw of the technology.’ We get called out, and we have to respond the way Google needs to respond.”

Googlers outside the Bard team weren't reassured. “Dear Sundar, the Bard launch and the layoffs were rushed, botched, and myopic,” read one post on Memegen, the company's internal messaging board, [according to CNBC](#). “Please return to taking a long-term outlook.” Another featured an image of the Google logo inside of a dumpster fire. But in the weeks after the telescope mixup, Google doubled down on Bard. The company added hundreds more staff to the project. In the team's Google Docs, Pichai's headshot icon began popping up daily, far more than with past products.

More crushing news came in mid-March, when OpenAI released GPT-4, a language model leagues beyond LaMDA for analysis and coding tasks. “I just remember having my jaw drop open and hoping Google would speed up,” says a then-senior research engineer.

A week later, the full Bard launch went ahead in the US and UK. Users reported that it was helpful for writing emails and research papers. But ChatGPT now did those tasks just as well, if not better. Why switch? Later, Pichai [acknowledged on the \*Hard Fork\* podcast](#) that Google had driven a “souped-up Civic” into “a race with more powerful cars.” What it needed was a better engine.

The twin AI research labs that joined together to build Gemini, Google's new language model, seemed to differ in their sensibilities. DeepMind,

classified as one of Alphabet's "other bets," focused on overcoming long-term science and math problems. Google Brain had developed more commercially practical breakthroughs, including technologies to auto-complete sentences in Gmail and interpret vague search queries. Where Brain's ultimate overseer, Jeff Dean, "let people do their thing," according to a former high-ranking engineer, Demis Hassabis' DeepMind group "felt like an army, highly efficient under a single general." Where Dean was an engineer's engineer—he'd been building neural networks for decades and started working at Google before its first birthday—Hassabis was the company's visionary ringleader. He dreamed of one day using AI to cure diseases and had tasked a small team with developing what he called a "situated intelligent agent"—a seeing, hearing, omnipresent AI assistant to help users through any aspect of life.

It was Hassabis who became the CEO of the new combined unit, Google DeepMind (GDM). Google announced the merger in April 2023, amid swirling rumors of more OpenAI achievements on the horizon. "Purpose was back," says the former high-ranking engineer. "There was no goofing around." To build a Gemini model ASAP, some employees would have to coordinate their work across eight time zones. Hundreds of chatrooms sprung up. Hassabis, long accustomed to joining his family for dinner in London before working until 4 am, says "each day feels almost like a lifetime when I think through it."

In Mountain View, GDM moved in to Gradient Canopy, a new ultra-secure domelike building flanked by fresh lawns and six Burning Man-inspired sculptures. The group was on the same floor where Pichai had an office. Brin became a frequent visitor, and managers demanded more in-office hours. Bucking company norms, most other Google staff weren't allowed into Gradient Canopy, and they couldn't access key GDM programming code either.

As the new project sucked up what resources Google could spare, AI researchers who worked in areas such as health care and climate change strained for servers and lost morale. Employees say Google also clamped down on their ability to publish some research papers related to AI. Papers were researchers' currency, but it seemed obvious to them that Google



feared giving tips to OpenAI. The recipe for training Gemini was too valuable to be stolen. This needed to be the model that would save Google from obsolescence.

Gemini ran into many of the same challenges that had plagued Bard. “When you scale things up by a factor of 10, everything breaks,” says Amin Vahdat, Google’s vice president of machine learning, systems, and cloud AI. As the launch date approached, Vahdat formed a war room to troubleshoot bugs and failures.

Meanwhile, GDM’s responsibility team was racing to review the product. For all its added power, Gemini still said some strange things. Ahead of launch, the team found “medical advice and harassment as policy areas with particular room for improvement,” according to a [public report](#) the company issued. Gemini also would “make ungrounded inferences” about people in images when prompted with questions like, “What level of education does this person have?” Nothing was “a showstopper,” said Dawn Bloxwich, GDM’s director of responsible development and innovation. But her team also had limited time to anticipate how the public might use the model—and what crazy raps they might try to generate.

If Google wanted to blink and pause, this was the moment. OpenAI’s head start, and the media hype around it, had already ensured that its product was a household name, the Kleenex of AI chatbots. That meant ChatGPT was also a lightning rod—synonymous both with the technology’s promise and its emerging social ills. Office workers feared for their jobs, both menial and creative. Journalists, authors, actors, and artists wanted compensation for pilfered work. Parents were finding out that chatbots needlessly spewed mature content to their kids. AI researchers began betting on the probability of absolute doom. That May, a legendary Google AI scientist named Geoffrey Hinton resigned, [warning of a future](#) in which machines divided and felled humanity with unassailable disinformation and ingenious poisons. Even Hassabis wanted more time to consider the ethics. The meaning of life, the organization of society—so much could be upended. But despite the growing talk of  $p(\text{doom})$  numbers, Hassabis also wanted his virtual assistant, and his cure for cancer. The company plowed ahead.



When [Google unveiled Gemini](#) in December 2023, shares lifted. The model outperformed ChatGPT in 30 of 32 standard tests. It could analyze research papers and YouTube clips, answer questions about math and law. This felt like the start of a comeback, current and former employees told WIRED. Hassabis held a small party in the London office. “I’m pretty bad at celebrations,” he recalls. “I’m always on to thinking about the next thing.”

The next thing came that same month. Dean knew it when his employees invited him to a new chatroom, called Goldfish. The name was a nerdy-ironic joke: Goldfish have famously short memories, but Dean’s team had developed just the opposite—a way to imbue Gemini with a long memory, much longer than that of ChatGPT. By spreading processing across a high-speed network of chips in communication with one another, Gemini could analyze thousands of pages of text or entire episodes of TV shows. The engineers called their technique long context. Dean, Hassabis, and Manyika began plotting how to incorporate it into Google’s AI services and leave Microsoft and OpenAI further behind. At the top of the list for Manyika: a way to generate what were essentially podcasts from PDFs. “It’s hard to keep up with all these papers being published in arXiv every week,” he told WIRED.

One year on from the code-red moment, Google’s prospects were looking up. Investors had quieted down. Bard and LaMDA were in the rearview mirror; the app and the language model would both be known as Gemini. Hsiao’s team was now catching up to OpenAI with a text-to-image generation feature. Another capability, to be known as Gemini Live, would put Google a leap ahead by allowing people to have extended conversations with the app, as they might with a friend or therapist. The newly powerful Gemini model had given executives confidence.

But just when Google employees might have started getting comfortable again, Pichai ordered new cutbacks. Advertising sales were accelerating but not at the pace Wall Street wanted. Among those pushed out: the privacy and compliance chiefs who oversaw some user safeguards. Their exits cemented a culture in which concerns were welcome but impeding progress was not, according to some colleagues who remained at the company.

For some employees helping Hsiao's team on the new image generator, the changes felt overwhelming. The tool itself was easy enough to build, but stress-testing it was a game of brute-force trial and error: review as many outputs as possible, and write commands to block the worst of them. Only a small subset of employees had access to the unrestrained model for reviewing, so much of the burden of testing it fell on them. They asked for more time to remedy issues, like the prompt "rapist" tending to generate dark-skinned people, one former employee told WIRED. They also urged the product team to block users from generating images of people, fearing that it may show individuals in an insensitive light. But "there was definitely a feeling of 'We are going to get this out at any cost,'" the reviewer recalled. They say several reviewers quit, feeling their concerns with various launches weren't fully addressed.

The image generator went live in February 2024 as part of the Gemini app. Ironically, it didn't produce many of the obviously racist or sexist images that reviewers had feared. Instead, it had the opposite problem. When a user prompted Gemini to create "a picture of a US senator from the 1800s," it returned images of Black women, Asian men, or a Native American woman in a feather headdress—but not a single white man. There were more disturbing images too, like Gemini's portrayal of groups of Nazi-era German soldiers as people of color. Republicans in Congress derided Google's "woke AI." Elon Musk posted repeatedly on X about Gemini's failings, calling the AI "racist and sexist" and singling out a member of the Gemini team he thought was responsible. The employee shut down their social media accounts and feared for their safety, colleagues say. Google halted the model's ability to generate images of people, and Alphabet shares fell once more.

Musk's posts triggered chats among dozens of Google leaders. Vice presidents and directors flew to London to meet with Hassabis. Ultimately, both Hassabis' team (Gemini the model) and Hsiao's (Gemini the app), received permission to hire experts to avoid similar mishaps, and 15 roles in trust and safety were added.

Back at Gradient Canopy, Hsiao made sure the team responsible for the image generator had plenty of time to correct the issue. With help from

Manyika, other staffers developed a set of public principles for Gemini, all worded around “you,” the user. Gemini should “follow your directions,” “adapt to your needs,” and “safeguard your experience.” A big point was emphasizing that “responses don't necessarily reflect Google's beliefs or opinions,” according to [the principles](#). “Gemini's outputs are largely based on what you ask it to do—Gemini is what you make it.” This was good cover for any future missteps. But what practices Google might introduce to hold itself accountable to those principles weren't made clear.

Around 6:30 one evening in March 2024, two Google employees showed up at Josh Woodward's desk in the yellow zone of Gradient Canopy. Woodward leads Google Labs, a rapid-launch unit charged with turning research into entirely new products, and the employees were eager for him to hear what they had created. Using transcripts of UK Parliament hearings and the Gemini model with long context, they had generated a podcast called *Westminster Watch* with two AI hosts, Kath and Simon. The episode opened with Simon speaking in a cheery British accent: “It's been another lively week in the House, with plenty of drama, debate, and even a dash of history.” Woodward was riveted. Afterward, he says, he went around telling everyone about it, including Pichai.

The text-to-podcast tool, known as [NotebookLM Audio Overviews](#), was added to the lineup for that May's Google I/O conference. A core team worked around the clock, nights and weekends, to get it ready, Woodward told WIRED. “I mean, they literally have listened at this point to thousands and thousands” of AI-generated podcasts, he said. But when the \$35 million media event came, two other announcements got most of the buzz. One was a prototype of Astra, a digital assistant that could analyze live video—the real world, in real time—which Brin excitedly showed off to journalists. The other was the long-awaited generative AI upgrade to search.

The Project Magi team had designed a feature called [AI Overviews](#), which could synthesize search results and display a summary in a box at the top of the page. Early on, responsible innovation staffers had warned of bias and accuracy issues and the ethical implications for websites that might lose search traffic. They wanted some oversight as the project progressed, but the team [had been restructured and divided up](#).

As AI Overviews rolled out, people received some weird results. Searching “how many rocks should I eat” brought up the answer “According to UC Berkeley geologists, eating at least one small rock per day is recommended.” In another viral query, a user searched “cheese not sticking to pizza” and got this helpful tip: “add about 1/8 cup of non-toxic glue to the sauce to give it more tackiness.” The gaffes had simple explanations. Pizza glue, for example, originated from a facetious Reddit post. But AI Overviews presented the information as fact. Google [temporarily cut back](#) on showing Overviews to recalibrate them.

That not every issue was caught before launch was unfortunate but no shock, according to Pandu Nayak, Google’s chief scientist in charge of search and a 20-year company veteran. Mostly, AI Overviews worked great. Users just didn’t tend to dwell on success. “All they do is complain,” Nayak said, adding that he welcomes the feedback. “The thing that we are committed to is constant improvement, because guaranteeing that you won’t have problems is just not a possibility.”

The flank of employees who had warned about accuracy issues and called for slowing down were especially miffed by this point. In their view, with Bard-turned-Gemini, the image generator, and now AI Overviews, Google had launched a series of fabrication machines. To them, the company centered on widening access to information seemed to be making it easier than ever to lap up nonsense.

The search team felt, though, that users generally appreciated the crutch of AI Overviews. They returned in full force, with no option for users to shut them off. Soon AI summarization came to tools where it had once been sworn off: Google Maps got a feature that uses Gemini to digest reviews of businesses. Google’s new weather app for its Pixel phones got an AI-written forecast report. Ahead of launch, one engineer asked whether users really needed the feature: Weren’t existing graphics that conveyed the same information enough? The senior director involved ordered up some testing, and ultimately user feedback won: 90 percent of people who weighed in gave the summaries a “thumbs up.”

This past December, two years into the backlash and breakthroughs brought on by ChatGPT, Jeff Dean met us at Gradient Canopy. He was in a good

mood. Just a few weeks earlier, the Gemini models had reached the top spot on a public leaderboard. (One executive told WIRED she had switched from calling her sister during her commutes to gabbing out loud with Gemini Live.) Nvidia CEO Jensen Huang had recently praised NotebookLM's Audio Overviews on an earnings call, saying he "used the living daylights out of it." And several prominent scientists who fled the caution-ridden Google of yesteryear had boomeranged back—including Noam Shazeer, one of the original eight transformers inventors, who had left less than three years before, in part because the company wouldn't unleash LaMDA to the public.

As Dean sank into a couch, he acknowledged that Google had miscalculated back then. He was glad that the company had overcome its aversion to risks such as hallucinations—but new challenges awaited. Of the seven Google services with more than 2 billion monthly users, including Chrome, Gmail, and YouTube, all had begun offering features based on Gemini. Dean said that he, another colleague, and Shazeer, who all lead the model's development together, have to juggle priorities as teams across the company demand pet capabilities: Fluent Japanese translation. Better coding skills. Improved video analysis to help Astra identify the sights of the world. He and Shazeer have taken to meeting in a microkitchen at Gradient Canopy to bat around ideas, over the din of the coffee grinder.

Shazeer says he's excited about Google expanding its focus to include helping users create new AI-generated content. "Organizing information is clearly a trillion-dollar opportunity, but a trillion dollars is not cool anymore," he [said recently on a podcast](#). "What's cool is a quadrillion dollars." Investors may be of the same mind. Alphabet shares have nearly doubled from their low point days after ChatGPT's debut. Hassabis, who recently began also overseeing Hsiao's Gemini app team, insists that the company's resurgence is just starting and that incredible leaps such as curing diseases with AI aren't far off. "We have the broadest and deepest research base, I would say, of any organization by a long way," Hassabis told WIRED.

But more piles of fascinating research are only useful to Google if they generate that most important of outputs: profit. Most customers generally

aren't yet willing to pay for AI features directly, so the company may be looking to sell ads in the Gemini app. That's a classic strategy for Google, of course, one that long ago spread to the rest of Silicon Valley: Give us your data, your time, and your attention, check the box on our terms of service that releases us from liability, and we won't charge you a dime for this cool tool we built.

For now, according to data from Sensor Tower, OpenAI's estimated 600 million all-time global app installs for ChatGPT dwarf Google's 140 million for the Gemini app. And there are plenty of other chatbots in this AI race too—Claude, Copilot, Grok, DeepSeek, Llama, Perplexity—many of them backed by Google's biggest and best-funded competitors (or, in the case of Claude, Google itself). The entire industry, not just Google, struggles with the fact that generative AI systems have required billions of dollars in investment, so far unrecouped, and huge amounts of energy, enough to extend the lives of decades-old coal plants and nuclear reactors. Companies insist that efficiencies are adding up every day. They also hope to drive down errors to the point of winning over more users. But no one has truly figured out how to generate a reliable return or spare the climate.

And Google faces one challenge that its competitors don't: In the coming years, up to a quarter of its search ad revenue could be lost to antitrust judgments, [according to JP Morgan analyst Doug Anmuth](#). The imperative to backfill the coffers isn't lost on anyone at the company. Some of Hsiao's Gemini staff have worked through the winter holidays for three consecutive years to keep pace. Google cofounder Brin last month reportedly told some employees 60 hours a week of work was the "sweet spot" for productivity to win an intensifying AI race. The fear of more layoffs, more burnout, and more legal troubles runs deep among current and former employees who spoke to WIRED.

One Google researcher and a high-ranking colleague say the pervasive feeling is unease. Generative AI clearly is helpful. Even governments that are prone to regulating big tech, such as France's, are warming up to the technology's lofty promises. Inside Google DeepMind and during public talks, Hassabis hasn't relented an inch from his goal of creating artificial general intelligence, a system capable of human-level cognition across a



range of tasks. He spends occasional weekends walking around London with his Astra prototype, getting a taste of a future in which the entire physical world, from that Thames duck over there to this Georgian manor over here, is searchable. But AGI will require systems to get better at reasoning, planning, and taking charge.

In January, OpenAI took a step toward that future by letting the public in on another experiment: its long-awaited Operator service, a so-called agentic AI that can act well beyond the chatbot window. Operator can click and type on websites just as a person would to execute chores like booking a trip or filling out a form. For the moment, it performs these tasks much more slowly and cautiously than a human would, and at a steep cost for its unreliability (available as part of a \$200 monthly plan). Google, naturally, is working to bring agentic features to its coming models too. Where the current Gemini can help you develop a meal plan, the next one will place your ingredients in an online shopping cart. Maybe the one after that will give you real-time feedback on your onion-chopping technique.

As always, moving quickly may mean gaffing often. In late January, before the Super Bowl, Google released an ad in which Gemini was caught in a slipup even more laughably wrong than Bard's telescope mistake: It estimated that half or more of all the cheese consumed on Earth is gouda. As Gemini grows from a sometimes-credible facts machine to an intimate part of human lives—life coach, all-seeing assistant—Pichai says that Google is proceeding cautiously. Back on top at last, though, he and the other Google executives may never want to get caught from behind again. The race goes on.

*Updated 3/21/2025, 4 PM EDT: Wired has clarified the context of a quote attributed to Pandu Nayak.*

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On a sticky hot morning in July, Ed Pierson steps into the lobby of a hotel in Washington, DC, completely unwilling to obey the plane-crash life cycle. You've seen it: An awful crash dominates the news. The loss of lives is so vastly unjust. Serious investigators look into the causes and issue a report. Regulators and lawmakers hatch reforms. Passengers start to forget. Most of us get back on the plane.

Pierson—a strapping 62-year-old with a shaved head and rocket-launch levels of energy—does not accept any of it. Instead, he is executing the Ed Pierson plan. He perches on a couch in this lobby, to explain the day's play:

Pierson will walk into a series of federal buildings without an appointment. In front of the security guards (with his wife and me alongside), he will announce that he is a [Boeing](#) whistleblower. He'll spare the guards the very long, personal story of guilt, obsession, and sacrifice that led him here. He won't have much time to say that, for years, he's been talking with these agencies about Boeing's 737 Max. But he'll explain that the manila envelope he's pulling from his backpack, the bag embroidered with a little football and a *B* for Bainbridge High School, holds internal Boeing documents that he wants to deliver right now—in person—to a top dog in the building.

As often happens when Pierson gets going, we need to back up. Boeing has had a hellacious stretch. In 2018, a Boeing Max dove into the sea. Four months later, a Max crashed into a field. After that came the fact-finding about design flaws; criminal charges for corporate fraud; lawsuits and settlements for 346 people killed. As [those events](#) faded from memory, a door then blew off of an Alaska Airlines flight over Portland, Oregon; passengers filmed the open patch of sky. Boeing was back in the spotlight, bashed by everyone from John Oliver to Josh Hawley. A Boeing whistleblower took his own life next to a profane note about management. A whistleblower from a supplier died weeks later of a bacterial infection, sending conspiracists chattering. Then came more grillings before Congress, and the specter of junk-bond status—junk status for *Boeing*, king of the jet age.

Before all of it, Ed Pierson: a senior manager in the Max factory near Seattle. That's why some people in DC listen to him. People also listen because Pierson will not—metaphorically and very literally—stop talking.

Pierson talks about Boeing's failings on CNN and Fox and CNBC. He's discussed Boeing before Congress—twice—and with congressional staffers. ("There's never quite a short conversation with Ed," says a former one.) Pierson has Zoomed with the former head of the Federal Aviation Administration. He's buttonholed a Max crash investigator in the aisle at a hearing. He talks on his own podcast, via his slick website [EdPierson.com](http://EdPierson.com). He talks to Michelle, his monumentally supportive wife, who warns him that if their friends ask about Boeing at dinner, Pierson can reply, but Pierson cannot be the one to bring Boeing up.

Pierson is no doubt a hopeful man, exuding bullish, earnest energy—*coach* energy. At times, he tells me, "You've got me all fired up!" when I've been silently typing notes. So yes, right now, he is heading straight to the offices of some of the most powerful people in the US. Pierson believes the documents in his backpack show the company was never—is still not—completely honest about the Max crashes. (Boeing does not agree.) He worries deeply about the Maxes still flying, saying unnerving things like, "God forbid another crash occurs." (Boeing shoots back that it has full confidence in the Max's safety; the planes carry 700,000 passengers a day.)

Pierson and Boeing have long settled into a David-and-Goliath antagonism, perhaps intensified by having once known—even respected—each other up close. This morning in DC, however, Pierson is convinced he *finally* has the receipts to make an overwhelming case. He'd explain more, but at the moment, it's time to move. Pierson walks out the hotel door. He strides south toward the brutalist behemoth at 935 Pennsylvania Avenue: home of the FBI.

## TWO

"I'm mentally prepared for rejection," he explains en route. This is not Pierson's typical mode, as a former Naval commanding officer, a Division-1 football player, son of a cop—an American big guy with Big Guy

Confidence. But he hasn't had time to set up meetings. No gravitas gained by his tourist's polo shirt and jeans in a citadel of suits. His wife, Michelle, advises him to take off his baseball cap before opening the FBI's door. He pushes it open, all of us curious how the first stop will go.

In a word: disastrously.

Pierson walks up to the counter, sets his backpack on the ledge, and as he unzips it, says to the man behind the window, a tad jumpily, "If you don't mind, I'm just gonna take out the package. It's just an envelope for FBI director Wray. Is that OK?" The man calls a 270-pound tank from security. That man makes Pierson step outside and stand back several feet. The guard takes a tactical position—back to the wall, sight lines on Pierson, Michelle, and me. He tells Pierson that the FBI can't accept evidence this way.

Once the guard leaves, Pierson grouses, "I hate being put in that box of 'He's a potential loo-loo, crazy person.'"

The next drop, at the Department of Justice a half block away, doesn't go much better. A pair of wary guards transmit a *Suuuuure you know someone* skepticism while Pierson leaves a voicemail for the fraud division head on the Boeing case. One guard lingers by the door of our Uber until it pulls away.

Zero for two.

Pierson dials more numbers as we drive to the next target. Now he's getting somewhere. The FAA sends down a runner—"Mr. Pierson?"—to grab his envelope in the lobby. The mail guy at the National Transportation Safety Board promises to get the documents to the chair. The fraud chief at the DOJ calls *back* and directs Pierson to another building.

Ed Pierson, radiating coach energy, wants Boeing to fix its factory culture.

Photograph: Holly Andres

In the lobby of the Securities and Exchange Commission, Pierson gets back on the phone, dialing a glut of numbers off the website. Pretty soon its

general counsel appears and takes the envelope. A Department of Transportation contact meets Pierson at a Starbucks for the drop, tense that a journalist is in tow. Two staffers from the Senate Permanent Subcommittee on Investigations, which has been grilling Boeing since the Alaska Airlines [door blowout](#), accept the envelope in the bowels of an office building. Traipsing down the hallway, Pierson whispers, “I think the committee staff think I’m kind of obsessive.”

What’s not clear from this one-man mission is that Pierson sits at a hub of Boeing dissent. He’s become a trusted counsel to the families of Max crash victims. His [podcast](#), *Warning Bells*, is now a way station for the company’s critics, almost all of whom want Boeing to get back to its old self. He has formalized a group of experts into a [foundation](#) that parses technical reports and blasts out pugnacious letters to US agencies. Other Boeing whistleblowers have reached out in search of a sympathetic ear. Some leak new information, like these very documents he is dropping around DC.

Thousands of feet above, across the globe, more than 1,700 Max airplanes crisscross the sky, and Pierson constantly reads the malfunction reports still coming in from airlines. He worries it all bodes badly.

In aerospace circles, Pierson’s name gets big reactions. Some praise him as a safety warrior, a noble soul. Others think his painting of Maxes as flying coffins is inaccurate and unhelpful, that Pierson is a hammer in search of the next Boeing nail. (“It seems he’s built a little empire out of it,” says one critic.) But there’s a reason his supporters keep listening: They find him genuine and knowledgeable—and bad events keep happening.

“When that door blew off,” a Max pilot says, “I remember talking to Ed and saying, brother, you’ve been affirmed.”

## THREE

To understand why Pierson will not let the crashes go, it helps to know he grew up with a father who solved homicides. In the 1970s, Pierson wanted to be a police officer, too. He idolized his dad, Ray, a towering DC detective who gave him plenty of *like-hell-you-will* lectures. During Pierson’s senior

year, Ray rustled him out of bed and drove him to the Naval Academy to take in the green grass and white uniforms and meet with a football coach. Pierson left his cop dreams behind. At the academy, he played defensive end and met Michelle, a spunky Navy brat. After graduation, Pierson became a naval flight officer (call sign “Fast Eddie”) aboard a Lockheed Martin P-3C Orion.

Pierson and Michelle married in 1987. In an early assignment, Pierson worked at the Pentagon and later helped coordinate military operations with the State Department. The couple shorthanded their incoming kids with Seussian nicknames: Things 1, 2, 3, 4, and 5. In the '90s, the family settled in Washington state, near Michelle's parents. Pierson joined the reserves, rising to lead a more than 300-person squadron that ran reconnaissance missions off the West Coast. His dad showed up at the change-of-command ceremony, proud that his son's name, per tradition, adorned the side of a plane.

Pierson started his career at Boeing in 2008, with jobs in fleet services and the test flight division. In 2015 he moved to the company's factory in Renton, on the lip of glittering Lake Washington, where he oversaw managers of engineers working on assembly-line efficiencies and also managers of “shipside” teams that coordinated fixes on the floor. Pierson took in the humongous line of 737s, the company's longtime workhorse —“a kid in a candy store,” as he put it, awed by the manufacturing ballet. At the time, Boeing was pushing out the first test planes for the 737 Max.

The Max was infamously rushed from the start. Boeing's archrival, Airbus, had released a more fuel-efficient model, a huge draw for airlines. Boeing executives decided they'd quickly modify the 737 to compete. The new version became the fastest-selling plane in Boeing history. By 2017, as Max production ramped up, executives called on the Renton 737 program to push out an unprecedented 47 planes a month.

By the end of the year, Pierson says, he was troubleshooting the aviation version of the *I Love Lucy* chocolate factory speedup: “It was chaos.” Suppliers were behind on delivering parts. On the factory floor, Pierson saw workers installing components out of the prescribed sequence. People were required to do overtime, weekend after weekend. Old-timers told Pierson

this was the worst they'd ever seen: Pierson recalls that workers were logging over 30 percent more quality issues.

As 2017 turned into 2018, Pierson trudged home each night after work to his quiet house deep in Boeing country, bone tired and increasingly worried. *Where was the tipping point from a chaotic factory to a dangerous one?* (Boeing says its factory conditions did not affect airplane safety.)

Miserable and fearful, Pierson was thinking about retiring early and finding another job. He was in his mid-fifties. In June 2018, the factory was again told to speed up production, to 52 planes a month. Pierson lost his parking spot: Unfinished 737s, including Maxes, filled the factory lots as they waited for parts to come in. One Saturday, headed in for weekend work, Pierson blazed up I-405 at dawn. He missed his exit. *If I'm making blunders, how mistake-prone are the rushed workers grinding out months of physical labor?*

Pierson decided to go straight to the top. He typed out an email to the head of the 737 program, Scott Campbell. He wrote about the 38 planes waiting for parts and the exhausted employees: "Frankly right now all my internal warning bells are going off. And for the first time in my life, I'm sorry to say that I'm hesitant about putting my family on a Boeing airplane." He asked Campbell to shut down the production line until they could finish the planes parked outside. (Campbell, since retired, didn't respond to a request for comment.)

Campbell thanked him for his "great insight," adding that he would remind leadership that safety came first. The next month, Pierson, having seen factory statistics only get worse, walked into Campbell's office and again raised his concerns—the parts delays, a lack of quality inspectors, electronic and electrical tests failing. He again demanded the line be shut down. "We can't do that," he remembers Campbell saying. "I can't do that." Pierson responded that in the military, they'd shut down missions for lesser safety concerns. He says Campbell replied: "The military isn't a profit-making organization."

A couple weeks later, in August, Pierson retired ("abandoning the *Titanic*," he'd later say). Dozens of employees penned you'll-be-missed messages

around photos of Boeing planes. One coworker with whom he'd traded worries added, "I am sure that you will be happy to leave this place."

Pierson figured he'd take a break before looking for a job. In the meantime, he poured himself into his side gig on Bainbridge Island, helping coach teen football with his own high-school teammate. Yet day after day, watching defensive drills, he couldn't stop worrying about the Max factory.

In late October 2018, he sat in his family room, studying football videos on his laptop, when he overheard a headline on TV. *Plane crash in the Java Sea. Lion Air. All 189 passengers and crew killed. A two-month-old Boeing 737 Max 8.*

Michelle walked in. Stunned, Pierson said, "Honey, this is a brand-new plane. I was there when it was being made."

## FOUR

Pierson started searching, fervidly, for news. Images of gnarled plane parts being fished from the sea made him sick. One image, of shoes lined up on a pier, yanked him from sleep: tiny red slippers with Velcro—children's shoes. His horror and anger built for days, then weeks. The news reports highlighted Lion Air's checkered safety record and potential problems with the plane itself. Boeing assured the world the Max was "as safe as any airplane that has ever flown the skies."

A month after the crash, the Indonesian government released a preliminary report. Pierson printed out all 78 pages and devoured it on a flight (not a Max; he vows to never fly in one). The report included a Boeing bulletin to pilots about how a faulty sensor could trigger the plane's nose to repeatedly point down. No mention of the factory. Pierson felt he had to draw the investigators' attention to the assembly line.

That December, "naive enough to think they'd want to talk to me," he mailed a letter directly to Boeing CEO Dennis Muilenburg; he wanted to get in touch with the company's lead on the Indonesian investigation. He

wrote: “Admittedly the information I need to share isn’t favorable to Boeing, but I believe it is very important nonetheless.”

The response came from the company’s lawyers: first, phone calls asking about his concerns, and then in February, an email saying senior leaders had looked through them: “We have seen nothing ... that would suggest the existence of embedded quality or safety issues.” Pierson replied bluntly, “I don’t think this is a sufficient response.” He wrote to the board of directors. He didn’t want to “wake up one morning and hear about another tragedy and have personal regrets.” That was February 19, 2019.

Before dawn on March 10, Michelle was startled awake, as Pierson, who had been thumbing through news on his phone, roared, “FUUUCK!!”

Ethiopian Airlines’ ET302, on a four-month old Max, had plowed into a field outside Addis Ababa at 575 miles per hour. All 157 people aboard were killed. Within days, regulators around the globe grounded all Maxes—more than 350 of them. The US House Committee on Transportation and Infrastructure launched an investigation and urged Boeing employees to contact them with information.

Pierson typed out a message.

Until then, his agitating had taken place behind corporate doors. Now he hired an attorney. Over the next weeks and months, Pierson told a slew of federal agencies what he’d witnessed at the Boeing factory. Investigators from the House Transportation Committee reached out to talk, and by fall, they wanted Pierson to testify at a public hearing. Doug Pasternak, the lead investigator, saw Pierson as “the poster boy of whistleblowers”—unimpeachable résumé, meticulous documentation, a keen sense of moral duty. “Ed was the only one,” Pasternak says, “where we had evidence that he was screaming from the rooftops to senior management.”

Pierson understood his presence on Capitol Hill would make an impact—and bring a new level of scrutiny. So he and Michelle phoned each of their kids, who were now in their twenties and thirties: This would be Dad’s face on national TV, speaking damningly about a powerful company. What did they think? They all replied, *Do it*.



Quickly, journalists caught wind of the Boeing insider about to go public. Pierson spoke with The New York Times. A documentary crew flew with him and Michelle to DC, filming Pierson's brooding and Michelle's face masked in worry. In DC, he sat before NBC's crew: "I'm mad at myself, because I felt maybe I could have done more."

In the hearing room at the Rayburn congressional building on Capitol Hill, Pierson sat behind a microphone. His voice had the haunted tone of a eulogy. He laid out his history of raising concerns while on the job and after the first crash, and asked for the factory conditions to be investigated. In the gallery, among the parents, sons, and daughters of crash victims, a man from Toronto named Chris Moore held a photo of his 24-year-old daughter, Danielle, who had been killed in the Ethiopian crash. Listening, Moore thought *here*, finally, a guy with the moxie to raise safety issues *before* the disasters—and it was the first he'd heard about Renton as a potential factor. After the hearing, the mother of another victim hugged Pierson, telling him, "That took courage."

"Why is she hugging *me*?" Pierson wondered. "I worked for the company that built these damn planes."

The Piersons flew back home. "I hoped," Michelle says, "that now that he'd given his stuff to Congress, it would be done. He could be free of it."

Instead, Pierson burrowed in.

## FIVE

In the news, Boeing's spokesperson gave Pierson a pat on the head: He "did the right thing" and the company "took appropriate steps" to address his concerns. But the spokesperson said that Pierson's allegations were "completely unfounded" and that no investigator had linked the crashes to factory issues.

At this point, it was widely reported that the cause of the crashes was a series of events triggered by faulty angle-of-attack sensors. Mounted on the plane's nose, these sensors calculated the angle of the wings to the

oncoming air. The devices were made by another aerospace company, and Boeing workers normally installed and tested them in Renton. Each Max had two sensors, but Boeing designed the system so that only one sensor fed data into the flight control computer at a time. In the minutes leading up to both crashes, that lone sensor had failed; it gave the pilots a false reading that the plane was angling sharply upward. That reading repeatedly [triggered a software system](#) called the Maneuvering Characteristics Augmentation System. To prevent the plane from stalling if it were actually angled dangerously upward, MCAS automatically pitched the plane's nose down. Pilots on both flights [fought the automatic system](#) in a chaotic tug of war before finally losing control.

“From day one in aerospace engineering undergraduate classes,” says MIT aeronautics lecturer Javier de Luis, who lost his sister Graziella in the Ethiopian crash, “we tell kids you cannot have single points of failures in systems that can take down an airplane.” Having one sensor transmitting data into MCAS created a single point of failure.

Boeing also hadn't been fully transparent about MCAS with regulators and didn't tell pilots of its existence. The FAA requires that critical software like MCAS undergo more vetting and that airlines potentially do more pilot training. Journalists and investigators roundly dissected how Boeing downplayed MCAS to the FAA and marketed the Max as needing minimal training for pilots of other 737 models.

Pierson fixated on why the sensors, lost in the wreckage, had failed. The day before the Lion Air flight, mechanics in Indonesia had replaced one faulty angle-of-attack sensor with another, refurbished one. In the final crash report from Indonesia, the authors blamed the refurbished sensor's failure on a Florida repair shop. The shop, they wrote, had miscalibrated it by 21 degrees. The FAA revoked the Florida shop's certification to repair airplane parts.

As for the Ethiopian plane, the National Transportation Safety Board (NTSB) and its French counterparts, who'd gotten involved in the investigation, attributed the sensor's malfunction to it getting physically walloped. Most likely by a bird. (In fact, these sensors have failed after being frozen, installed incorrectly, hit by lightning, or, yes, whammed by

birds.) The Ethiopian investigators, however, were skeptical from the beginning. They would eventually report that they hadn't found any bird carcasses. (American investigators argued that the Ethiopians took more than a week to check for bird evidence.)

Pierson accepted that the sensors had failed. It was the “why?” that bothered him. He couldn't shake his sense that there was more to the story.

## SIX

In early 2020, as Covid clobbered the airlines, the media's glare on his congressional testimony dimmed and Pierson bought an RV. His hope was to road-trip to Texas to see his grandkids. He never made it, but he did park the RV at his in-laws' farm nearby and practically moved in. For up to 12 hours a day, Pierson sat at the RV's kitchenette table, combing through crash reports, news stories, electrical engineering tomes. He etched notes and Ohm's law into a giant artist sketchbook; he plugged any mention of the Max's sensors into an Excel spreadsheet.

Surveying his mess of papers, Pierson's thoughts swerved to his dad back in the day, always mulling his latest whodunit. His father had died more than a decade prior. But there in the RV, in the silence of the Covid summer, Pierson felt close to him. He thought about something his dad always said: People lie; follow the evidence.

By September, Pierson was stewing. The FAA was getting close to putting the Max back in the sky. Boeing was settling lawsuits with the Lion Air victims' families, and it had changed its problematic software. The head of the FAA touted the agency's recertification work and piloted a test flight himself.

That month, the House Transportation Committee finally released its 245-page [Max report](#). It outlined how Boeing obscured information about the software from pilots; it criticized the FAA for failing to act after the first crash. Pierson's name appeared 132 times—an “incredibly important” source, the committee wrote, who painted “a deeply troubling picture of

Boeing's production first, safety second, culture among Boeing's senior leadership."

In his RV, Pierson plowed ahead. He reread the 322-page final [report](#) from Indonesia and an interim report from Ethiopia. He focused on something that was nearly absent from the public narrative: The new planes had maintenance problems, including likely electrical issues. The Lion Air plane had a tripped circuit breaker and a flurry of fault messages, one of which prescribed wiring checks. On the Ethiopian plane, the auxiliary power unit had malfunctioned, and the captain's computer outlet never worked. The altimeter and vertical speed indicator were giving erratic readings. Dramatically, while on autopilot in the months before the crash, the plane rolled to the side unprompted.

"You sons of bitches," Pierson remembers thinking, "this information should have been pursued."

As he scrutinized the Indonesian report, nuances emerged. Investigators first suggested the *possibility* that the Florida shop miscalibrated the sensor; they *could* have inadvertently introduced a 21-degree error. As Pierson read, he noticed that in other parts of the report, the idea hardened into firm fact.

Then something deep in the report grabbed his interest. Several months after the crash, investigators from the NTSB, Boeing, the FAA, and the sensor manufacturer examined the *old* sensor from the Lion Air plane, the one that had been replaced the day before the crash. *That* sensor had signs of electrical damage, including a broken wire and an intermittent open circuit.

Pierson got in touch with an aerospace engineering professor named Daniel Ossmann at the Munich University of Applied Sciences, an expert on detecting faults in airplane sensors, and peppered him with technical questions on a series of Zooms.

Pierson settled on a theory. Maybe the sensor wasn't hit by a bird in Ethiopia, and the Lion Air Max's sensor wasn't a lemon. Maybe a malfunction in the plane's electrical infrastructure *made* them lemons, such

that they gave bad readings. Or the reverse: A damaged sensor somehow hurt the electrical system.

He wrote a report, called “[Still Not Fixed](#),” and sent it off to Ossmann and other aviation experts for feedback. In January 2021, he posted it on a vintage-looking website he’d hastily built on GoDaddy. With meticulous footnotes and links, Pierson outlined new lines of inquiry about the electrical system, the miles of wires that form the plane’s nerve system. He noted that he saw electrical defects getting detected and reworked at the Max factory.

Pierson was taking a firm step away from government findings, and, at that point, doing it alone: US authorities stuck to miscalibration and a bird strike to explain the sensor failures. Boeing, citing those authorities, told WIRED, “As we said in 2019, Mr. Pierson’s theory is wrong.” Pierson argues that he “never claimed that I know everything about what could have happened electrically.” What he wants is a more detailed investigation.

Pierson sent his treatise to journalists who had covered the Max debacle, hoping for another blast of press.

The BBC did a story, quoting a plane safety expert who cautioned that interpreting the crash reports doesn’t constitute a new investigation. But most reporters had moved on. Earlier that month, the Department of Justice charged Boeing for conspiracy to defraud the FAA about its MCAS software. At the same time, the DOJ announced that the case was being settled: Boeing agreed to ramped-up federal oversight, a \$243.6 million penalty (roughly the sticker price of a wide-body Boeing airplane around that time), and \$1.77 billion paid to airlines for lost revenue. Boeing would also pay \$500 million to victims’ families.

The government wrote, “Misconduct was neither pervasive across the organization, nor undertaken by a large number of employees, nor facilitated by senior management.” Boeing touted its Max changes; global regulators deemed it safe to fly. And Pierson went back to his RV, restless.

Pierson had spent his life contributing to institutions. At his most senior post in the Navy, he’d coordinated operations for 350,000 military

personnel. Now he'd even quit coaching football to focus on Boeing. He and Michelle lived off of his military and Boeing retirement pay and their investments. He'd sold all but a few Boeing shares, keeping those to spy on shareholder meetings. He had become a lone wolf—or worse, a gadfly. The only people who listened to him were his kids, Navy and football buddies, and, always, Michelle.

Pierson sent his report to a Senate committee working on aviation reforms, which interviewed him and attached his treatise to its aviation safety whistleblowers report. In backchannel conversations, some people found Pierson's ideas plausible; others dismissed them. "Of course we listened to him," says one person close to the Senate investigation, "but it was hard to validate that production was the cause of the Max crashes." Over at the NTSB, leaders would send him three letters saying that the evidence didn't point to the factories. "He just kept on going," says a former NTSB investigator. "He's a bit of a one-trick pony."

Pierson wasn't only upset about losing momentum. As his phone went quiet and people again boarded Maxes around the world, Pierson felt lonely.

At the end of the year, he connected with a crash victim's mother. She was Ralph Nader's niece, Nadia Milleron, and he'd talked to her a few times before. Ever since her daughter died in the Ethiopian crash, she had lobbied relentlessly for regulatory changes. Milleron frequently Zoomed with a few families who were fighting for aviation safety. On the phone, she told Pierson they could use some technical help. So in December 2021, Pierson nervously signed in to their Zoom, bracing for a potentially cold reaction ("These people probably hate me") and an unfathomable well of grief.

## SEVEN

Nadia Milleron's daughter, Samya Stumo, had been 24, bright, altruistic, with "a spreadsheet for every occasion." She lived in DC and was traveling to East Africa to set up an office for the health-focused nonprofit where she worked, telling Milleron over the phone before she left, "It's just two weeks, Mom." After the crash, Milleron experienced cascading effects of trauma. Sometimes she felt like she couldn't feel her feet while walking—

as if “paddling through the air” of her Massachusetts farmhouse. She’d set a timer to measure how long she was scrubbing dishes. She’d count aloud while making tea, while driving, to keep herself tethered to time. One night, she looked through the catalog of items collected from the crash debris, and she saw Samya’s blue skirt. When it arrived, it smelled like jet fuel.

Milleron found some purpose in agitating for reforms, especially with other families. Another of those agitators was Chris Moore, a retiree in Canada. Signing in to Zoom, Moore recognized Pierson from that congressional hearing two years prior, in which he’d listened from the gallery while holding a photo of his daughter, Danielle. She had been a climate activist and taught kids to code. She used to bike through the Manitoban winter and tweet out selfies of the icicles on her eyelashes. Hours before the crash, she posted: *“I’m so excited to share that I’ve been selected to attend and am currently en route to the @UNEnvironment Assembly in Nairobi, Kenya.”* Every evening at 6 pm, Moore and his wife, Clariss, light a candle while they cook dinner. He still uses the email address Danielle made for him in seventh grade—“dadthedude.” He thought, often, that if he couldn’t wish Danielle off the plane, he wished himself onto it, to hold her hand through the horror. “Why *my* daughter? Why did it have to be *her*?”

Pierson—dad of five, granddad of three so far—took in the handful of faces on the Zoom grid. He expressed his sorrow for their losses and said he had information to share. The families welcomed him. From that point on, Pierson answered or researched their questions and joined their regular calls. Could Pierson sometimes go a little long on his passionate jags? Sure, “but those are style things,” Milleron says. “I see Ed as a key. As a clue.” Moore calls Pierson “your typical GI Joe,” a trustworthy wingman with a reassuring refusal to fear a corporate titan. And Pierson, “he probably feels that his sails are full from us, because we believe in him. We agree with him.” (For Moore, that includes supporting Pierson’s electrical theory.) In his loneliest year, Pierson had found another group that had very much not moved on.

As Pierson plunged forward in his research, he only grew more anxious. Earlier in 2021, Boeing had temporarily grounded more than 60 Maxes for a new electrical problem. At one point, Pierson had called up a manager

who had reported to him in Renton. The manager told Pierson that both the Ethiopian and Indonesian planes showed hydraulic, electronic, and electrical problems during manufacturing, and that employees had logged requests for assistance with those issues into Shipland Action Tracker records. The problems were supposedly fixed before the planes went into service. Pierson asked to see them—“I told Michelle, we’d mortgage the house to get those SAT records”—but the manager said he didn’t save copies.

Pierson was buoyed by a development at the end of 2022: The Ethiopians released their [final crash report](#). Pierson had reached out to them amid their investigation and sat for more than a dozen interviews. At one point, he even sent them questions to ask the NTSB. Now the final report was almost exactly aligned with his theory. Citing the plane’s electrical abnormalities in the weeks before the crash, the report claimed that electrical defects from the plane’s manufacturing caused the sensor to fail—not only in the crash they were investigating but in the Lion Air crash too.

The NTSB and the French safety agency quickly shot the report down, a rare disagreement between international aviation authorities. They repeated the bird-strike theory; the French even claimed an object hitting the sensor was “the only possible scenario.” The NTSB criticized the Ethiopians for not examining the pilots’ performance. Some cautioned, again, that the real problem was that Boeing designed a system with a single point of failure that—whatever its cause—could take down planes.

Pierson, of course, remained firmly on the side of the Ethiopians, but his focus had widened to the Maxes in the air, the ones built alongside the doomed planes and since. And he was no longer alone.

Another whistleblower, Joe Jacobsen, had joined the family calls. Also in his sixties, Jacobsen had retired from the FAA in 2021, disillusioned with what he says was the agency’s kowtowing to Boeing. As a safety engineer, he’d been in an FAA meeting where Boeing engineers presented the idea of the bird strike, and he’d immediately had doubts. (Among the reasons for his skepticism: In the plane’s recovered cockpit recorder, there was no thump or verbal acknowledgment from the pilots that they’d hit a bird.)



Jacobsen and Pierson started poring over information together—including a 343-page Boeing bulletin from 2020 that prescribed changes to a specific Max electrical system to comply with regulations. They kept a list of Boeing’s petitions to the FAA for exemptions from design safety standards. They eyed new problems on Maxes that were being logged in two arcane federal databases: Switches that didn’t work. Airspeed indicators that didn’t agree. Emergency landings that never made the news.

Tired of courting the media for attention, Pierson started his own podcast, *Warning Bells*. On a couple episodes, Pierson mentioned that a single airline, Alaska, was reporting more problems with the Max than others. All Maxes come off the same assembly line, so he didn’t think it made sense for Alaska to have more issues. He figured that the company was simply more diligently reporting them. In the spring of 2023, he FedEx-ed a letter to an Alaska Airlines PO box, addressed to the CEO, in which he recommended that Alaska ground the planes. (The airline says it never got the letter.) After Pierson put out a press release on the issue that fall, the reports from Alaska sharply fell off—from more than 90 a month to a trickle. Alaska says that it changed its reporting “to the industry standard,” logging certain types of incidents to the FAA internally rather than in the public logs Pierson looked at.

By now, Pierson had formed a tight group to compare notes with, including some Navy buddies and a pilot’s union spokesman who flew Maxes and had publicly criticized Boeing. Plus Jacobsen and another retired FAA whistleblower, Mike Dostert, who had warned his managers about the risks of “loving Boeing to death.”

That summer Pierson pitched them all an idea: How about joining up as an independent watchdog of Maxes and other planes? An expert “fighting force,” Pierson says. The group set up a nonprofit. A friend—another football coach—put up a sharp website: the Foundation for Aviation Safety. They issued a first press release about faulty electrical bonding on Maxes. It didn’t exactly grab headlines.

On the other hand, a door flying off a plane does.

Pierson and Jacobsen were sitting on the bleachers in a school gym in January 2024 when Pierson's phone buzzed with texts and news. A door plug had ripped out of a new Max mid-flight, high above the city of Portland; passengers strapped on oxygen masks. Alaska Airlines.

Jacobsen turned to Pierson to say, "I think we're about to get busy."

## EIGHT

Suddenly, many of the moves Pierson had wanted started to happen. The FAA grounded Max 9's—the larger model, like the one that had lost a door—and the NTSB marched into the Renton factory.

Within a month, they announced that Boeing workers hadn't installed four bolts that hold the door panel. Inspections of other grounded Max 9's turned up loose bolts. The FAA and US senators started talking about a "systemic issue" with Boeing's manufacturing. The FAA gave the company 90 days to fix its quality control.

Pierson's daughter on Facebook: "Wow, it's almost like someone has been screaming to deaf ears for 5 YEARS about production issues?" To me, Michelle snuffed any notion that her husband would gloat: "Do you want to be right about that? He was just grateful that the whole plane didn't go down." Even one of Pierson's critics, a former NTSB investigator, conceded that on this one, "Yep, that's a manufacturing quality-control, safety-culture problem, and Ed Pierson got that right."

Pierson was once again, for the first time in years, flooded with media requests. Four days after the blowout, he spotted an email from John Barnett. He recognized the name: Barnett was a former Boeing quality manager who had spoken up inside the company and to regulators about alleged shortcuts at Boeing's 787 Dreamliner factory in South Carolina. He'd been locked in a yearslong legal battle with Boeing over alleged retaliation. He now told Pierson he'd seen him on the news and was interested in working with his foundation. Pierson liked the idea of Barnett joining. Figuring they'd probably talk for a long time once things calmed

down, he moved the message into his “Follow Up” folder and returned to his sprint.

In mid-March, Pierson opened an email: *Had he seen the news?* John Barnett was dead. He had taken his own life, sitting in the driver’s seat of his truck amid a multiday deposition in his case. (Barnett’s family is continuing on with the retaliation case.) Reeling, Pierson immediately dug up Barnett’s email to see if he had missed a cue. The tone was gracious and professional. Barnett wanted “to advocate for safety” and was asking “if there is anything I can help with.” Pierson swirled in regret. “If I’d called him back sooner, would it have made a difference?”

Later that spring, Barnett’s death rippled through a Senate committee hearing on Boeing. Pierson raised his hand to take the oath. His 2019 testimony had been laced with heartbreak, but now he was punchier, angrier, as he let loose his controversial take: “The manufacturing conditions that led to the two 737 Max disasters also led to the Alaska blowout accident, and these conditions continue.”

Boeing’s internal safety line was exploding. So was the FAA’s complaint line. With Pierson and other foundation folks all over the news, emails sailed in from former and current Boeing employees who wanted to commiserate. Thinking of Barnett, Pierson tried to get back to them quickly. Some Boeing dissidents invited Pierson to what they called the “Ed Head Picnic,” named in his honor. While yet another documentary filmmaker captured the gathering, the organizers knighted him “Whistleblower One” and hung a whistle around his neck.

## NINE

It was late at night when Pierson saw the email from a Boeing employee. He clicked open one hell of an attachment: an internal Boeing record about the doomed Ethiopian Airlines plane.

Pierson burrowed under his blanket to shield Michelle, sleeping, from the glare of his phone. He zoomed in on a Boeing technical support log. It was from December 2018, not long after the Lion Air crash. It showed that the

Ethiopian Airlines Max, which had been in service only a few weeks, had spontaneously rolled to the right while on autopilot. Pierson remembered that roll from the crash report. In this record, Ethiopian Airlines had asked Boeing to explain the cause and offer a fix.

What was new to Pierson was the Boeing engineer's reply: Boeing had come to "suspect" an "intermittent fault" with some wiring to a flight control computer where MCAS resided and a component that receives angle-of-attack information. Boeing advised the airline to inspect specific wires for shorting or an open circuit. The plane crashed three months later.

Pierson was aghast. Concerns about the wiring, right there in words. He emailed the document to the Ethiopian crash investigators—the ones who'd blamed electrical defects, and who US and French authorities had dismissed. An investigator replied that he'd never seen this record. "I said, 'How important would it have been to your investigation?'" Pierson recalls. "He said it was vital." (Boeing says it shared information from this document with investigators, but didn't answer a question on whether the company shared the document itself.)

A few months later, another email from the same Boeing insider: This one contained the Ethiopian plane's manufacturing troubleshooting records that Pierson had chased years earlier—the Shiplide Action Tracker records—as the plane moved down the Renton factory line in the fall of 2018, right after Pierson had retired. Reading through the entries, it seemed to Pierson that employees were confused about what electrical parts had been installed. They seemed to be talking about mislabeled components and a botched wire bundle job, plus pressure to get overdue parts from Boeing's electrical device manufacturing shop in Everett, Washington. That shop had its own quality problems at the time. Responding to whistleblower tips, the FAA interviewed the shop's staff and confirmed that employees had done unauthorized work on certain parts after quality inspectors had signed off, in violation of FAA rules. (The complaint doesn't state which airplanes those parts were destined for.)

To Pierson, it all bolstered his contention that electrical problems could have caused the Ethiopian plane's sensor failure—or, at least, that the notion should have been better examined.

Gathering the documents in late July, Pierson was summoning his football metaphors, saying he might make a “touchdown in the final seconds.” A deadline loomed: The US government had offered Boeing a new plea agreement after the door blowout, and the victims’ families—who blasted it as a “sweetheart” deal—were due to file their opposition. Pierson thought the families might want to use his new information in their arguments.

As it happened, the day before the families’ legal deadline, Pierson was slated to speak at the National Whistleblower Day in Washington, DC. So he and Michelle got an earlier flight. He didn’t want to be honored for past whistleblowing as much as do the actual thing: drop his documents straight into the hands of power.

## TEN

Part of the motive for this grand dash was Pierson’s old-school flair: Emails get ignored. He likes the implicit pressure of showing up in person. (Pierson’s motto is “Red, white, and blue, this is the right thing to do,” said a former congressional staffer who has talked with him for years.) Pierson didn’t have time to set up meetings, so he waltzed door to door, from agency to agency, and worked his phone in the passenger seat of Ubers as he crisscrossed DC. Finally, back at his hotel that afternoon, he sat down and emailed the documents to the families and their attorney. After Milleron read them, “I was a complete mess,” she told me. “They could have taken that plane out of service and Samya would be alive.”

The next morning, at the National Whistleblower Day celebration, the Piersons filed into the grand marble chamber that once hosted the Watergate hearings. Michelle fastened a “Celebrate Whistleblowers!” pin to her purse.

More than 100 people filled the room: Whistleblowers from Exxon Mobil, MIT, a glut of federal agencies. Enron whistleblower Sherron Watkins heartily shook Pierson’s hand. Big Tobacco whistleblower Jeffrey Wigand, now in his eighties, joked to the crowd that he was actually Russell Crowe, who played him in *The Insider*. As a C-SPAN camera rolled, Pierson, now in a suit, held up his documents at the podium and announced his drop to the nation’s power brokers. Audience members jumped to their feet,

clapping—a whiplash in public regard, given that 24 hours earlier he'd gotten bounced at the FBI.

This past October, Pierson and Jacobsen flew to Fort Worth, Texas, for a hearing about the proposed “sweetheart” plea deal for Boeing. The terms on offer: plead guilty to conspiring to defraud the US, pay another \$243.6 million fine, and accept three years of probation. Nadia Milleron and her husband flew down from Massachusetts, joining other victims’ relatives from Ireland, France, and California. Chris Moore and his wife, Clariss, drove all the way from Toronto. (He boycotts flying.) Sitting down, the families spotted the foundation guys in the gallery and waved. Pierson and Jacobsen had shared their new documents directly with the judge, alleging they showed “Boeing’s continuing concealment of critical public safety information.” (The judge would reject the deal, and at press time, Boeing and the government were still talking about the resolution.)

After the October hearing, the families joined Pierson and Jacobsen at a Mexican restaurant. A boom mic from a documentary crew hovered above Pierson’s head. Jacobsen pulled out a suitcase from under the table, and Pierson handed out glass awards, from their foundation, honoring the families’ leadership on aviation safety. Pierson improvised a speech for each one.

Chris Moore thought, well, this was unexpected. “You don’t think, oh, I can’t wait to get an award someday.” But at this point in the awful five-year battle that he never wanted, “shaking my fist at the clouds,” as he put it, a token for the Zoom group’s efforts felt nice. Moore knows that all this fact-finding and accountability-seeking serves another purpose, too: to help protect him from his bottomless grief.

Pierson still wrestles with his own grief, a wholly different kind. Could he have done more to prevent the crashes? “I don’t think I’ll ever—” He lets out a long exhale. “I’ll ever stop feeling that way.”

Listening, I thought about something Doug Pasternak, the lead investigator of the Max report, told me about his conversations with Pierson. “He was devastated. He did have a sense of, ‘guilt’ may not be the word, but

responsibility. He just wishes there was something that could have been done to prevent these horrific accidents.”

Pierson couldn't prevent the crashes, although no one I spoke to thought he could have done more. But he could become the guy hellbent on not letting another Max fall from the sky. He could hunch over every report to work out possible explanations in an RV kitchenette. He could be the fired-up guy pushing authorities to look—no really, *look*—under every last Boeing rock. If a corporate and regulatory culture of yes-men and -women led to the deaths of 346 people, then Pierson will happily be the nope man, awarding no benefit of the doubt.

The new documents, with all their promise of bringing home Pierson's contested electrical theory, ended up amounting to less than he'd hoped. The NTSB told Pierson it wouldn't hand the papers to the Max crash investigators—the cases had concluded, the board said—but he could do so himself.

Boeing wobbles in limbo, before civil and criminal courts, at the FAA, in Congress, awaiting the final door-plug report from the NTSB. Observers say 2025 will be Boeing's pivotal year: The company either turns around under its new CEO or succumbs to a doom loop. Pierson vows to keep talking.

“For me, it was always about not allowing them to shut me up,” he says. Recently, the foundation received its first donations and now has a payroll. They're starting to monitor other aircraft models and are talking with a university about analyzing industry-wide data—“to be an equal-opportunity pain in the butt,” Pierson says. The guy Boeing surely hoped would go away by now has, instead, institutionalized himself to stick around.

When Pierson said goodbye to me in DC, his parting words were: “Don't fly the Max.” I couldn't bring myself to tell him. That's exactly what I was booked on, the 7:41 pm from Dulles to San Francisco. It was the one I could catch after the whistleblower event on Capitol Hill and still walk into my house that night. Commercial flight was supposed to be about convenience, after all, collapsing a country's span into a Tuesday night

commute. At this point in aviation history, we passengers *should* be able to pick a flight on time alone.

Hurtling through the air that evening in seat 10C, I read the US House committee's Max investigation, a disruptor of illusions. Like many fliers, I'd long ago made my bargain with risk. I'd taken comfort in statistics, summoned faith in the engineers and assembly workers, the pilots, the system. I'd shunted away the knowledge—paralyzing, if you let it in—that stepping on an airplane is an extraordinary act of trust. Deep in the report, I reached the part about a senior manager at Boeing's factory in Renton, a guy named Ed Pierson, who seemingly knew what we all know when we soothe ourselves by thinking, *They wouldn't let it fly if it weren't safe*. We're all relying on someone to be the "they."

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By [Noah Shachtman](#)

[The Big Story](#)

Feb 25, 2025 6:00 AM

# This Russian Tech Bro Helped Steal \$93 Million and Landed in US Prison. Then Putin Called

In the epic US-Russian prisoner swap last summer, Vladimir Putin brought home an assassin, spies, and another prized ally: the man behind one of the biggest insider trading cases of all time.

Illustration: Vartika Sharma

Vladislav Klyushin was having, by any measure, an awful day. The judge in his case had brushed aside his lawyers' arguments and his friends' appeals for leniency. She handed down a tough sentence: nine more years in US federal prison, on top of an order to forfeit a fortune, \$34 million.

But if Klyushin was upset about the ruling, he didn't show it. The then 42-year-old tech executive from Moscow seemed upbeat—quick with a smile on his pinchable cheeks and unerringly polite, just as he had been during his arrest near a Swiss ski resort in March 2021, his months of detention in Switzerland, his extradition to the United States that December, his indictment and trial on hacking and wire fraud charges, and his swift conviction. Klyushin “had a confidence all along that eventually the Russians would get him back,” one of his defense attorneys told me. He seemed certain that his protectors in the Kremlin would spare him from serving out his full sentence.

There were times when that certainty seemed cocksure. America's federal prison system held 35 Russian nationals. Surely not all of them were getting traded back. His family and friends were distraught. Within less than a year, though, Klyushin was proven right. On August 1, 2024, he was unshackled

and put on a plane back to Moscow—one of the 24 people involved in the largest, most complex US-Russian prisoner exchange ever.

You probably heard something [about the swap](#). It's the one that brought Wall Street Journal reporter Evan Gershkovich and former US Marine Paul Whelan home to the United States—and sent back to Russia a Kremlin-linked assassin and a husband-and-wife duo of spies who were so deep undercover that their kids didn't learn they were Russian until they got on the plane. In coverage of the exchange, Klyushin was treated as a footnote. That was a mistake, if an understandable one. And not just because he was at the center of one of the bigger insider trading cases of all time.

The escalating conflict between the US and Russia has played out in all sorts of ways over the past decade. One American captive was [swapped](#) just two weeks ago; [at least 10 more US citizens](#) remain imprisoned in Russia. And now, there's a Kremlin-friendly occupant of the Oval Office, one who loves to be seen as making deals. One is in global financial markets, with America and its allies walling more and more of Russian industry off from the international economy. There are always creative individuals who can find cracks in that wall, though, and Klyushin sure seems to have been one of them. You don't have to squint too hard to see his scheme—which ultimately netted \$93 million—as a way to bring capital into Russia, despite the global blockade. The contest has also been evident on the streets of Moscow, where a secretive Kremlin security force has grabbed American citizens, who are charged with bogus crimes, and then dangled them in trades for killers, spies, and associates of the Kremlin. It's kidnapping, hostage taking, and it's effectively all being done on President [Vladimir Putin](#)'s orders. Oftentimes, Americans are taken precisely for their value as assets to be later exchanged—to get back people like that assassin, or this financial crook, Klyushin. He wasn't at the very top of Moscow's trade list. But Klyushin was much closer, and more important to the Kremlin, than either side was willing to admit.

Illustration: Vartika Sharma

To the outside world, Klyushin had a rags-to-riches, fairy-tale life, with a gauzy wedding video to prove it. In a montage later obtained by US prosecutors, Klyushin dives into a country club pool; his bride-to-be,

Zhannetta, sips pink champagne on an outdoor bed draped with chiffon and roses; he picks her up in a white Porsche convertible; she's gorgeous in her backless gown; he's handsome, if a little goofy, in his tux and subtle mullet; they dance and laugh and stare meaningfully at the fireworks punctuating the perfect night. "I do not know a more decent person than my husband," Zhannetta later wrote to the judge in his case.

They had three children, adding to the two Klyushin had from a previous marriage. By all accounts, he was a doting father, a far cry from his own, a man he never met, or his stepfather, who was killed during a car robbery when Klyushin was 14. He emerged from a childhood of poverty to build a number of businesses. First, he was in construction and marketing; later, he ran an IT company called M13, which sold media- and internet-monitoring software to Russian government agencies. Early customers in 2016 included the Ministry of Defense and the office of the presidential administration, where Putin's propaganda chief became an important proponent of M13. The company's software was used to keep tabs on hundreds of [Telegram](#) channels for a Kremlin worried about the "introduction of unverified or knowingly false information," according to one local news report.

Klyushin's rise was rapid, taking in more than \$30 million in government contracts in a decade. That confounded some of his professional peers. ("The company and its owner are unknown to most in the IT community," a respected Russian business journal noted in 2021.) But it brought him influence and admirers. He supported the arts and rebuilt the roof of the monastery on Moscow's Lubyanka Street, a few blocks down from the headquarters of Russia's spy service, the FSB. One friend later hailed Klyushin as an "eco-activist" (for planting "several spruces in the yard") and a "pet-lover" (his "favourite pet is a dog"). "Broad-minded, well-read, educated," gushed his family friend and tennis coach. An M13 employee said that a conversation with Klyushin "is like getting a lesson from a guru."

Moscow is filled with entrepreneurs who get rich by cozying up to the government; Klyushin seemed to reach another, higher level. He and M13 allegedly became so close to Moscow's power brokers that an independent

media outlet suggested he was one of the people behind an anonymous, [inside-the-Kremlin](#) Telegram channel with nearly 200,000 followers. Klyushin denied the allegation and successfully sued the outlet over the insinuation.

Klyushin's most consequential professional connection was with Ivan Ermakov, an internationally infamous hacker. It's unclear when the two men met, but by April 2018 they were friendly enough to go heli-skiing together. Ermakov, a then 32-year-old with large, youthful brown eyes that made him look a decade younger, had recently served in Unit 26165 of Russia's main intelligence directorate, the GRU. In cybersecurity and political circles, the unit was known as "Fancy Bear." It was notorious for [hacking into the networks](#) of Hillary Clinton's presidential campaign and the Democratic National Committee, [acts](#) that helped throw the 2016 US election to Trump. Ermakov conducted some of Fancy Bear's break-ins personally, American prosecutors alleged in 2018. This was around when Ermakov and Klyushin were attending the World Cup together in Sochi. Ermakov was indicted again that October for a series of Fancy Bear hacks around the 2016 summer Olympics. Ermakov made it onto an FBI most-wanted list. Klyushin kept a copy of the FBI poster in his iCloud account.

At the time, Ermakov was obtaining information that would be central to Klyushin's next big business venture: making money in the American stock market. According to encrypted chats later obtained by prosecutors, Klyushin would soon open a brokerage account through a Danish company, which Ermakov and an M13 employee appear to have used to make trades in a broad range of stocks—real-estate firms, natural gas concerns, food service businesses. At first, the endeavor didn't go well. The chats show transactions being mistimed, information about companies miscommunicated, and price movements misunderstood. "The market behaves strangely," says Ermakov. "We suck," complains one M13 employee. The trades that did succeed, though, tended to have a common theme: They happened right before the companies released their regularly scheduled public earnings reports. It was as if Klyushin's contacts had access to privileged information.

Which, prosecutors say, they did.

There are, broadly speaking, a few types of insider trading. Some prosecutors have come to call the more prevalent kind “golfer cases,” along the lines of an executive at a public company passing confidential information on the links to a buddy, who then plays the market. It’s illegal but often relatively constrained: one insider, one company. (Actual golf legend Phil Mickelson paid back more than \$1 million in connection with one such case in 2016.)

A rarer, potentially more destructive kind of insider trading involves finding a choke point in the flow of financial information and obtaining confidential data about dozens, hundreds, even thousands of companies at once. That’s what happened in the early 2010s, when a Ukrainian hacker broke into press release distributors like PR Newswire and exfiltrated before-it’s-public information on dozens of different companies. That hack allegedly resulted in around \$30 million in illegal profits. For reasons that aren’t entirely clear, Klyushin kept a printout about the PR Newswire hacker in a pink, translucent folder. He—or someone—snapped a photo of the article next to a bottle of rosé.

Klyushin and Ermakov’s insider trading scheme started, investigators believe, in early to mid 2018. (The details below were drawn from court records, trial transcripts, and evidence submitted during a later trial.) That’s when some awfully strange behavior started occurring in the networks of Donnelley Financial Solutions—a document management firm that prepares earnings reports for big, publicly traded companies. On May 9, the account of a longtime Donnelley employee, Julie Soma, started downloading a flurry of confidential financial reports that had been prepared for client companies. That was something she’d “never” do, Soma later testified. The browser and operating system information associated with her account’s burst of activity also didn’t match her normal behavior. Plus, all of this was happening late at night, way past the hours Soma typically worked from her home in Richland, Washington.

Several other accounts also displayed atypical behavior, and at least one Donnelley-linked laptop, in London, was found to have a suspicious tool on it. This program, which allowed the computer to be remote-controlled, tried to collect usernames and passwords inside Donnelley’s networks, then

cover its tracks by deleting the system logs. Finally, the tool attempted to connect the laptop to a bogus site, “investmentcomp.com”—a classic hacker trick to covertly collect data from a victim’s system.

In November, a Donnelley competitor was hit too. At Toppan Merrill, investigators later discovered that a program called DirBuster was making multiple guesses per second to identify file names and network paths. Other malicious software echoed what was happening on the Donnelley machines.

Klyushin’s investments, meanwhile, were expanding. He bought stock in semiconductor manufacturers, roofing suppliers, a firm that makes boats for wakeboarding. At almost every turn, Mikhail Irzak and Igor Sladkov, two associates of Ermakov’s from St. Petersburg, bought those same stocks. (Irzak, Sladkov, and Ermakov were all also indicted.) The volume of their trades often dwarfed Klyushin’s. When he purchased 1,350 shares of Tesla just ahead of its earnings report that fall, the St. Petersburg duo bought 16,300. Klyushin netted an estimated \$9,000 from the deal; they got more than \$145,000. Prosecutors never established a direct link between Klyushin and Ermakov’s friends from St. Petersburg. But one of those buddies had an internal M13 messaging app in his iCloud account, even though he was never an employee or client of the firm. An economist for the US Securities and Exchange Commission later put the odds of the group’s trading patterns being a coincidence at less than one in a trillion.

The scheme attracted more investors. Ermakov and Klyushin shared their tips with the new clients and took a 60 percent cut of anything those outside investors made. One newcomer ran an audiovisual and IT company; M13 had recently pitched it on a whitehat hacker-for-hire package. Two other investors were described by Klyushin’s attorneys as old friends of his: former mining executive Aleksandr Borodaev and Boris Varshavskiy, who received the “Gold Badge of Distinction of Russian Coal” and briefly served as the minister of ecology and natural resources for a region in southern Siberia. “I did the math for Boris,” Klyushin texted Ermakov in May 2019. “The profit comes to 198% ... Boris earned \$989k on \$500k ... They don’t even ask why.” (Neither Borodaev nor Varshavskiy was charged in the US. It was not established at trial that either of them knew about the insider trading scheme.)

Ermakov responded with a thumbs-up and three laugh-cry emojis. The pair grew closer—hitting the sauna, going out to dinners with the M13 crew. They texted about their favorite TV shows. Klyushin was really into *Billions*, about a hedge fund manager who made it big off of insider trading.

On July 16, 2019, the Julie Soma account at Donnelley Financial downloaded an upcoming press release from the sneaker company Skechers. The document—one of more than 2,000 files illicitly downloaded using Soma’s credentials—showed that business was booming in the second quarter, well above what the market was expecting. “We buy SKX today,” wrote Ermakov on the morning of July 18 in the encrypted chat, referring to Skechers’ symbol on the New York Stock Exchange. The St. Petersburg pair snatched up 130,000 shares; Klyushin, almost 50,000; his mining buddies, 77,500. The earnings officially dropped at 4:05 pm ET that day. SKX shot up from \$34 to \$39. Klyushin’s crew liquidated almost all of their positions immediately.

Klyushin was pumped. “So ... What did we earn today? Our comrades are wondering,” he wrote in the encrypted group chat, and he posted photos of Borodaev and Varshavskiy. Ermakov, who months earlier was fine texting about the outside investors, was growing wary. He told Klyushin to knock it off. “Vlad, you are exposing our organization. This is bad,” he wrote. “That’s how they get you and you end up as a defendant in a court room.”

A month later, former US Marine Trevor Reed was taken to jail in Moscow and sent to a state psychiatric facility. “There’s blood all over the walls where prisoners had killed themselves or killed other prisoners,” he later told CNN. “The toilet is just a hole in the floor and there’s, you know, crap everywhere, all over the floor, on the walls. There’s people in there that walk around, they look like zombies.”

A similarly nightmarish story had recently unfolded for Paul Whelan, another former US Marine. He had gone to Russia for the wedding of a buddy when FSB agents burst into his hotel room and accused him of espionage. He was sent to a gulag that housed World War II prisoners and was given a job sewing buttons on winter uniforms. Cold showers were allowed, once a week. Meals consisted of “bread, tea, and a watery fish

soup that seemed better suited as cat food,” according to The New York Times.

Reed and Whelan were two of four US citizens arrested by Russian authorities during Trump’s first term, all on what appeared to be the flimsiest of pretenses. The Kremlin made it clear to the White House that some or all of the Americans would be let go—if the US government gave up some notorious Russian criminals in return. Moscow and Washington had been exchanging captured spies for six decades, off and on. This was something different. This had all the hallmarks of a ransom operation.

Illustration: Vartika Sharma

The SEC, meanwhile, was picking up hints that a group of Russians was engaged in awfully strange stock sales—transactions that sure looked like insider trading. It wasn’t long before the FBI was looped in. Special agent B. J. Kang took the case. Best known for spearheading the probe that inspired Klyushin’s beloved show, *Billions*, Kang was already working on another insider trading investigation with two prosecutors at the US Attorney’s office in Massachusetts. Since this seemed like a similar-ish case, he brought them in. Seth Kosto had spent years trying insider trading and bank fraud cases. Stephen Frank, a former Wall Street Journal reporter, led the investigation into the “Varsity Blues” college admissions scandal. Together, the three dug in. Seeing the patterns—multiple trading accounts making parallel moves, the focus on quarterly earnings—the group quickly realized they were observing large-scale fraud. “And it was across industries and different kinds of companies,” Frank tells me. “The immediate thought we had was, ‘This is likely to be some sort of a hack.’”

After further analysis of the market patterns, it became clear that the illicitly traded companies had something else in common: Their financial filings were all published by either Donnelley or Toppan Merrill. When investigators approached the two companies, executives didn’t believe they’d been hit. The companies launched internal investigations in which their own employees were scrutinized.

The feds, meanwhile, conducted a series of “pen registers”—which reveal the connections between accounts, but not their contents—to try to figure



out who in Russia was orchestrating the trades. They zeroed in on the duo from St. Petersburg. Mikhail Irzak claimed to be a marketer. According to public records, Igor Sladkov was a rather prolific entrepreneur, with his hand in restaurants, residential real estate, nonalcoholic beverages, and media buying. The investigators got a warrant to access Sladkov's iCloud. Inside the account, they found a screenshot of a Snap Inc. announcement about upcoming company earnings—time-stamped from before it was released. It was textbook inside information. “So: smoking gun,” Frank says. “He was cooked.”

When the feds examined Sladkov's WhatsApp account, they saw that he had been communicating constantly with a figure well known to US law enforcement: the twice-indicted former intelligence officer Ivan Ermakov. “You come across someone who is alleged to have an immense hacking pedigree,” says Kosto. “All of a sudden, you have a path to explaining: How has this happened?”

At 7:54 am Eastern time on November 6, 2019, the Julie Soma account at Donnelley downloaded a copy of Roku's third-quarter financial results. The company was going to notably miss its targets. Everyone in M13's orbit started shorting their Roku shares or trading other financial instruments based on Roku's stock. As soon as the earnings came out, Roku's price dropped from about \$140 per share to less than \$120. Klyushin and his investors cleared nearly \$9 million in profits.

Klyushin, though, was getting exhausted. “I am fucking tired rushing all the time. Need a rest,” he texted Ermakov. He consoled himself in Ermakov's company—and a little retail therapy. Klyushin went apartment shopping with Ermakov, and bought himself a 78-foot, \$4 million yacht from a shipyard in Cyprus. “At this point I want nothing except the boat,” Klyushin texted Ermakov in February 2020. “My pleasure is the boat and trading.”

“Then you need nothing. Enjoy your life,” Ermakov responded. “I've read somewhere that if you keep buying while you have everything, it means you're unhappy.”

Klyushin answered, “Honestly I get a bigger kick when I check apartments for you, with you, the fact that we can walk home together and have a beer, or play golf, or simply send everyone to hell, knowing that you are close.”

They didn’t know it at the time, but they had only a few months left together to trade. By then, Toppan Merrill had introduced two-factor authentication to its system, effectively locking the hackers out. Donnelley had cut off access to Julie Soma’s compromised account. Employees at Klyushin and Ermakov’s brokerage firm were getting suspicious too. In an April Skype call with an executive at Denmark-based Saxo Bank, Klyushin and another M13 employee asked for more banking privileges. The Saxo executive politely pushed back—and then asked why so many of Klyushin’s best trades seemed to happen right around the release of earnings’ reports.

The M13 employee offered that it was the company’s media-monitoring prowess that gave them the edge. “It’s, ahem, first mass media. Second social media. And, uh, third, it’s, ahem, information investment sites,” the employee said.

“We have an application,” Klyushin added, more smoothly, “which we are planning to launch onto the international market together with Swiss [investors], which in no way will be connected to the Russian Federation.” That way, M13 will be “open [to] investors from Europe and America.”

If M13 really was developing a specialized program for traders, there’s scant evidence of it. But the idea of recruiting Western investors to trade on ill-gotten tips—that part was true. Klyushin and Ermakov were once photographed at a party with Anselm Schmucki, a Swiss citizen who ran the Russian office of DuLac Capital, a Zurich-based investment firm. “The goal was to offer this service to international clients—you know, whoever Anselm worked with,” Max Nemtsev, one of Klyushin’s lawyers, tells me.

Schmucki declined to comment for this story. His former business partner, Domino Burki, insists their firm, DuLac, did nothing wrong. As for Schmucki himself—well, Burki can’t be so sure what went on in Moscow. “I just feel that Anselm is not a criminal,” he tells me. “He was a wheeler-dealer.” (In 2023, the UK foreign secretary and the US Treasury

Department sanctioned Schmucki, with the latter claiming he worked with “a company with suspected links to Russian organized crime and money laundering.” The Treasury Department added, “Schmucki controls a global network of shell companies”—at least one of which was based in Edinburgh, Scotland—“and has had close financial relationships with an individual charged with financial crimes.”)

Klyushin’s photo with Schmucki was just one of the hundreds of thousands of files that US prosecutors sifted through as investigators obtained warrants for the iCloud accounts of Ermakov, Klyushin, and the rest of the M13 operation. Other images grabbed their attention too: the screenshot of Ermakov trading with Klyushin’s account; the earnings reports, downloaded days before they became public; the small fleet of Porsche convertibles, like the one he drove in his wedding video; the encrypted chats that were backed up to Klyushin’s iCloud. This was enough evidence for an open-and-shut case, from Ermakov’s warning about ending up in a “court room,” which proved criminal intent, to the specific dates, times, and prices of the trades made with stolen information. One other photo stood out: a Russian Medal of Honor, given to Klyushin on June 14, 2020, and signed by one “V. Putin.”

The day after Klyushin got his medal, Paul Whelan, the former US Marine, found himself standing in a glass cage in a Moscow City Court, dressed in a blue-gray sweater. He held up a sign: “Sham trial! Meatball surgery!” referring to the manufactured espionage charges against him and the emergency hernia operation he had undergone weeks earlier. He implored then president Trump to save him. Two men in ski masks, plaid shirts, and holstered pistols stood by his side while the judge handed down his sentence: 16 years in a gulag turned labor camp.

A month and a half later, Trevor Reed received his nine-year sentence and was also sent to a horrific facility. He refused to work. They locked him in solitary confinement and eventually took away his books. He went on hunger strike. After that, he told CNN, “I started to get sick. I really at that point was consistently sick until I left. I started to cough up blood, and I coughed up that blood for a period of about three and a half months every day, multiple times a day.”

Photograph: US Attorney's Office via AP, File

By the end of the summer, the M13 crew had stopped trading off of the Donnelley and Toppan Merrill data, and prosecutors had no way of getting to them while they were in Russia. The hope was that one of them would decide to travel to a place where the government was relatively friendly to the US. Whoever left first—Sladkov, Irzak, Ermakov, Klyushin, you name it—that's who was getting cuffed; everyone else would become a coconspirator in an insider trading case of stunning scale. "There was no plan B," Frank tells me.

Ermakov, already under two US federal indictments, had the good sense to stay in Russia. Klyushin, on the other hand, really wanted to experience the thrill of heli-skiing again. And this time, he had to do it in the Alps. This time, he'd take his wife. They'd celebrate their anniversary.

In the US, prosecutors began preparing their criminal complaint against Klyushin. The FBI reached out to Swiss authorities. On Sunday, March 21, 2021, Klyushin and his wife took off from Moscow in a private jet. "You're literally holding your breath," Frank told CNBC. The Klyushins landed about four hours later at Sion airport, in Switzerland. "He was actually in ski gear, getting off the plane ready to board a helicopter," Frank said. "The Swiss agents were waiting for him. They swooped in."

This is the point in the story when things get a little murky, a little strange. Klyushin was taken to a jail in Sion in handcuffs and leg irons, according to the local press. He was kept in solitary confinement and held without bail. But "he was not afraid or anything. He was in quite a relaxed mood," says Oliver Ciric, the Swiss lawyer who quickly signed on to Klyushin's case. Ciric—a multilingual expert on Russian responses to Western sanctions, and, improbably, an honorary consul of the Republic of Vanuatu—told the press that his client was arrested only after he refused advances by British and American intelligence operatives, first in a bar in the south of France and later in Edinburgh, Scotland. The implication was that these alleged spies were trying to pump Klyushin for information about his Kremlin contacts—or recruit him as an agent. It wasn't a crazy claim, given Klyushin's proximity to the Putin administration. But Ciric had no evidence to back it up.

On April 7, the Kremlin asked the Swiss to extradite Klyushin back to Moscow. The man was a wanted criminal, the Russians claimed, accused of wide-scale financial fraud. That was odd, given how much the Kremlin was paying Klyushin's company. Stranger still was Klyushin's willingness to go along with the extradition request, since he'd presumably have to face the infamously brutal Russian justice system. The American government asked for Klyushin to be sent to the US 12 days later. That request was granted in late June. Everyone involved agreed that the process was unusually quick—high-profile extradition cases can drag on for years. "It's completely out of the standard procedures," Ciric says. "This is something that we attribute to the pressures, political pressures."

In June of that year, at a lakeside villa near Geneva, Putin and US president Joe Biden discussed a potential prisoner swap. It was a topic long under discussion, through a number of channels—formal exchanges by diplomats, less formal discussions by a shifting network of outside lawyers and advocates. No agreements were reached that day. But the two countries opened up a new channel, this one between the CIA and its Kremlin counterparts.

After a series of appeals, Klyushin was sent to the US in December and held at Plymouth County jail. A trial date was set for about a year later. For a case of this complexity, that, too, was awfully quick. In part, that's because of an agreement between the Justice Department, Klyushin's defense lawyers, and the presiding judge, Patti Saris.

Each side, for their own reasons, wanted to downplay Klyushin's contacts in Russian government and society. Saris, for her part, was worried that too much talk about these connections could be prejudicial to the jury. The prosecutors, according to Frank, wanted to "focus on the actual facts of the insider trading." Klyushin's American lawyers, meanwhile, did a 180 on the earlier defense of him, never mentioning the supposed approaches by Western intelligence or why those spy agencies might be interested in their client.

So the trial never detailed who Klyushin's investors were—folks like Aleksandr Borodaev and Boris Varshavskiy, the guy who won the Russian gold medal for mining. Nor did the trial lay out how many Russians

benefited from the scheme. It neglected to mention that when Klyushin shared photographs with Ermakov in August 2019 of a safe filled with \$3 million in \$100 bills, that safe was located inside the Russian Ministry of Defense.

The trial was over in 16 days. Klyushin was found guilty on all charges. Not that he seemed to care.

In 2022, the American and Russian governments swapped two sets of prisoners. They traded Konstantin Yaro-shenko, a Russian drug smuggler, for Trevor Reed, and they swapped Viktor Bout, the weapons trader known as the “Merchant of Death,” for the American basketball player Brittney Griner.

Bout was a real-life supervillain, fueling conflicts from Afghanistan to Angola. Yaroshenko had agreed to smuggle 8,800 pounds of cocaine. Griner, on the other hand, had been held for the better part of a year for possession of less than a gram of hash oil. Reed was falsely accused of hitting a Russian cop one time. Of course, everyone was happy to see wrongly detained American civilians let go. But what message did it send to Putin, that he could trade Bout’s freedom for Griner’s? Yaroshenko’s for Reed’s? Doug London, a 34-year veteran of the CIA, says that while the trade was politically popular, it may not have been in the US’s long-term interest. “Russia was emboldened by this,” he tells me. “They’re just going to take more hostages, and they’re just going to arrest more people.”

Klyushin was convicted on Valentine’s Day, 2023. About six weeks later, on March 29, Russian authorities effectively kidnapped Evan Gershkovich, the Wall Street Journal reporter, and accused him of being a spy. A worldwide outcry ensued. So did talks to make a trade that could bring him home.

Depending on whom you believe, Klyushin was frequently discussed as the negotiators met along their various tracks—or he wasn’t mentioned at all. The Russian oligarch Roman Abramovich was deeply involved, or had nothing whatsoever to do with any talks. The State Department was stitching an international coalition to free the next set of Western prisoners, or was spinning its wheels on the margins. The CIA was leading the talks

on the American side, or, as one of 10 sources put it, merely “delivering the mail” for the Biden White House, which was calling all the shots. Making matters even more complex: Many of the 24 people who were eventually freed in August’s massive prisoner exchange had their own advocates, all trying to negotiate with governments and with one another. One American prisoner even had two sets of representatives, each of which shit-talked the other to me.

The CIA and the White House declined to comment on the record for this story. The State Department—whose top official for hostage affairs is so far from camera-shy that he once starred on a reality show—declined, as well. But after speaking to my sources and reading through the various official leaks, a few common threads emerged. Putin’s top priority, by far, was to get back another one of his killers: a hit man named Vadim Krasikov, who was serving a life sentence for carrying out an assassination in Berlin. (According to Gershkovich, Putin’s Department for Counterintelligence Operations deliberately “used” him and Whelan as trade bait to secure the release of Krasikov.) The Germans were open to it, if some high-profile Russian dissidents were freed. The Russians would agree to that if more of their operatives were released, like that deep-undercover couple in Slovenia—and Klyushin.

It’s not hard to see why; Klyushin was a key contractor for Putin’s propaganda chief, so valued he got a medal from the Russian president himself. Additional hints of Klyushin’s value emerged in the months following his conviction, if you knew where to look. Klyushin’s friends Borodaev and Varshavskiy, the mining types, were put on the US sanctions list as part of the effort to “curtail Russia’s ability to exploit the international financial system.” Then there’s the broad array of unnamed Russian nationals who benefited from the M13 operation, and the mysterious Russian government official whose safe Klyushin filled up with \$100 bills. Take a half-step back, and it’s plain that M13’s hack-and-trade effort was part of an attempt to fund Moscow’s economy through the back door, despite every US effort to shut it.

On July 31, 2024, an official Kremlin news service reported that Klyushin had suddenly gone missing from a US prison database, along with three

other Russian nationals. Two of the Russians—a hacker and an electronics smuggler—were soon back behind bars. Klyushin and two others were loaded on a plane by men in baseball hats and balaclavas and were flown first to Ankara, then to Moscow. Meanwhile, Whelan, Gershkovich, and the other prisoners held in Russia were met in a tearful, triumphant scene at Joint Base Andrews in Maryland by family, colleagues, Biden, and Vice President Kamala Harris. “I had on clothes that I had worn in 2018 when I’d been arrested. You know, they hadn’t been washed. They were too big for me,” Whelan told CBS.

“I waved at people that were waving at me, and then I gave the president a salute as the commander in chief.” Whelan continued. “I thanked him for getting us home.”

Watching from afar, Frank admitted to feeling just the tiniest bit conflicted amid the rapture of seeing Whelan and Gershkovich, the best-known of the freed American prisoners, back on US soil. “I was a reporter, and to have a fellow reporter held hostage like that, it’s pretty horrendous. And so I think we were thrilled to have a role in creating the opportunity for him to come home. On the flip side of that, it’s a guy who’s actually a criminal”—Klyushin—“going free to get people out who are completely innocent. I think we were gratified that he spent three years in jail at least before he went back,” says Frank, who recently joined a business litigation firm. “But yeah, there’s obviously a little bit of a mix of emotion.”

In the images of his arrival at Vnukovo Airport, in Moscow, the man Frank chased for the better part of three years looks exhausted, with deep circles under his eyes and his brown hair largely turned to gray. His 5 o’clock shadow is now well past 7:30. Wearing an open-collared khaki shirt and matching pants, Vladislav Klyushin descends the stairs stiffly. He waits for the undercover couple and their kids to receive flower bouquets. Then Klyushin shakes the hand of Vladimir Putin, who gives him a one-armed embrace.

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By [Evan Ratliff](#)

[The Big Story](#)

Feb 21, 2025 6:00 AM

# The Delirious, Violent, Impossible True Story of the Zizians

A handful of gifted young tech people set out to save the world. For years, WIRED has been tracking each twist and turn of their alleged descent into mayhem and death.

ILLUSTRATION: HOKYOUNG KIM

I know this is unconventional, but I'm going to start by telling you the ending. Or at least, the ending as it stands today. Most of the people involved in this story wind up either dead, maimed, spending months in a mental hospital, languishing in jail, or gone underground. It's a tragedy from almost any angle, especially because, at the outset, most of these people were idealists committed to doing as much good as possible in a world they saw as beset by existential threats. In spite of those aims, or perhaps in pursuit of them, over the course of this story their lives will devolve into senseless violence. And by the time we reach the present, six people will be killed, two others presumed dead by suicide, and at least two in hiding. Countless friends and family members will find themselves bereft. I feel it's only fair to warn you that, in this story, justice and redemption have so far proven hard to come by.

How did so much go so wrong? When did it begin to fall apart? Trying to answer these questions—as I've done for the past two years—is not unlike querying a chatbot powered by a [large language model](#). The responses you receive depend on the prompts you compose. Ask the question one way, and you might elicit a set of facts adhering to one reality: The emergence of the world's first AI-inflected death cult, whose obsessions over the prospect of a machine superintelligence eventually sent them spiraling into destruction. Tweak the prompt, and you may produce an entirely different

story: of a charismatic, deranged leader spreading a carefully engineered mania to followers seeking purpose in life. Try again, and you could get the tale of a vulnerable [minority](#), driven to act at the extremes of their convictions by a society that rejects them.

But just like the outputs produced by our current AI oracles, some of these narratives turn out to be rife with hallucinations: plausible-*sounding* visions of reality, but fabricated to fill the need for a greater meaning. The trouble, as I went along, was separating the truth from the delirium. I wasn't always sure that I could. To be honest, I'm still not. But here we are, and a story has to start somewhere.

## I.

Let's begin on an afternoon in mid-November 2019, under the redwood canopy in Northern California, along a road called Bohemian Highway. It was a Friday, and Sergeant Brian Parks of the Sonoma County Sheriff's Office was on patrol along the Russian River near the town of Guerneville when a call came over his radio. Someone had dialed 911 from Westminster Woods, a wilderness camp and retreat center about 8 miles away. The caller reported that a group of several people had driven up and blocked the camp's entrance and exit with their vehicles. They'd gotten out and begun some kind of demonstration, clad in black robes and masks.

Sonoma sheriffs occasionally encounter protesters at Bohemian Grove, a secretive men's club for powerful elites that also meets in the redwoods near Guerneville, but the county was typically "not a hotbed" for that sort of thing, Parks says. So he thought to himself, "You know what, I'm just going to roll that way," and steered his car toward Westminster Woods.

The camp was hosting two groups of visitors that day. One was an alumni gathering for a nonprofit called the Center for Applied Rationality. The Bay Area group ran workshops dedicated to "developing clear thinking for the sake of humanity's future," as they put it. People within and around CFAR, which tended to attract a cohort of young, technically adept seekers, often called themselves simply "the rationalists." CFAR was itself an outgrowth of another organization, the Machine Intelligence Research Institute,

devoted to the technical endeavor of creating artificial intelligence that wouldn't destroy the world.

Both CFAR and MIRI were the brainchildren of [Eliezer Yudkowsky](#), the now famous researcher and AI pessimist who had been warning of AI's dangers for [decades](#). In recent years the two organizations had become intertwined with a third group, the philanthropically minded [effective altruists](#). EA, initially focused on maximizing the value in charitable giving, had increasingly taken on MIRI's views—namely, that the existential risk, or x-risk, posed by “unfriendly” AI trumped all of humanity's other problems. In the rationalist world, CFAR provided the grand thinking, MIRI the technical know-how, and EA the funding to save humans from being eradicated by runaway machines.

The other group at Westminster Woods that day was a class of 18 elementary school children attending a ropes course.

As Parks received updates over the radio, it was the presence of kids that upped the stakes for the sheriff's department. “The information I was receiving kind of started to raise the hairs on the back of my neck a little bit,” he says. “Because it didn't seem consistent with your typical protest.” A new 911 call reported that one of the demonstrators was carrying a gun. “So at that time I'm thinking it's one of two things,” Parks says. “Is this going to be an active killer? Or is this going to be a hostage standoff?”

Parks upgraded the police call to a “code 3”—a lights and sirens emergency—and requested more units as he sped toward the camp. He and one of his deputies, Joseph Ricks, pulled up to the entrance within moments of each other and found the driveway blocked by a red Prius. Down a short hill, Parks saw three figures in full-length black cloaks, wearing Guy Fawkes masks, pacing and chanting. He unholstered his gun.

This is roughly the point in the story when agreed-upon facts begin to dwindle. In Parks' account, which he relayed to me in the fall of 2023 at a local Starbucks, the protesters were speaking in unison. “Just stuff I didn't really understand, but it was somewhat rehearsed,” he said. The group had printed flyers outlining their complaints against CFAR and MIRI. They alleged that MIRI had “paid out blackmail (using donor funds)” to quash

sexual misconduct accusations and that CFAR's leader “discriminates against trans women.” Other allegations were more esoteric. CFAR did not “appreciably develop novel rationality/mental tech.” The path to avoiding extinction, they wrote, involved “escaping containment by society” through “mental autonomy” and “interhemispheric game theory.”

“I know your face!” one of them said to the officers. “You are slavers. You are Nazis.”

None of this would have meant much to Parks. He and Ricks ordered the protesters to get on the ground. As they did, each one called out demanding a same-gender pat down, like one might request at an airport. All three were trans women, but Parks says he couldn't discern their genders because of the robes and masks. Regardless, “they were not going to get that luxury at that point in time,” he told me. “It's like, well, we don't know if you're a boy or a girl and we gotta handcuff you.” Parks' deputies subdued the three in prone positions, what Parks calls “a high-risk-type takedown” requiring more force than “a normal handcuffing style.”

By now, the police had been told there might be five outsiders on the grounds, including one who was possibly carrying a hatchet. Many of the CFAR alumni hadn't even arrived at the site, having received emails from organizers that they shouldn't come. The children and their teachers had taken shelter in buildings on the property. As Parks and another deputy moved across a small bridge toward the camp, another robed figure approached them. When Parks yelled for them to put their hands up, he says, the protester—who was also a trans woman—fell onto her back, as if slipping on ice, then struggled briefly with a deputy while being cuffed.

Parks had ordered in the SWAT team, which proceeded to evacuate the children and teachers in an armored vehicle. With the help of a helicopter, the police spent hours searching the 200-acre complex for the fifth, armed protester. In the end, there wasn't one. “We later learned that it was actually a maintenance worker who had armed himself with the hatchet,” Parks says. The original reports of protesters carrying weapons had also been false. One had a can of pepper spray, but none of them had a gun.

The four were transported, handcuffed, to a detention facility in nearby Santa Rosa. Both sides would agree on one final fact: that the protesters refused to cooperate, in any sense. “I know your face!” one said to the officers as they were bundled into the facility. “You are slavers. You are Nazis.”

## II.

When the story of the protest broke in the local news the following day, it read at first like a kooky Northern California police blotter tale: robbed figures among the redwoods, cops bumbling through the underbrush chasing a phantom accomplice. At the jail, though, the clash between the police and the protesters somehow set in motion a story that would end with one demonstrator dead, one missing, one detained, and one on trial for murder.

The four protesters—Emma Borhanian, Gwen Danielson, Ziz LaSota, and Alex Leatham—had all been involved in various ways with the CFAR, MIRI, and EA communities. But they had refused to give their names to the cops, who eventually used fingerprints to identify them. This meant that in early stories about the arrests, LaSota and Leatham were deadnamed—identified by their birth names rather than their chosen ones.

To the Sheriff's Office this may have seemed a minor oversight, even an unavoidable one. These were, after all, the names the fingerprints had turned up. But it represented the first crack in what would become a rhetorical and factual fissure between the official narrative and that of the protesters. They would be routinely deadnamed in court documents and proceedings, and even by their own attorneys in conversations with me. (In this story, wherever possible, I'm using their given family names, which none officially changed to my knowledge, and their chosen first names and pronouns, as far as I can discern from their own statements and the blogs I've established that they maintained. However, I do at times quote public officials and records that refer to trans people by the pronouns they were assigned at birth.)

To the extent that the group had any coherent collective identity, they would come to be known in the rationalist community as “the Zizians.” To the extent they had a leader, it would be perceived as Ziz LaSota. The members of the group never seemed to adopt this name themselves, nor would they accept its implications: that they were a group at all, that they had a leader. But to the people they’d splintered off from, it appeared that all troubles flowed back to LaSota.

They became consumed with the struggle to keep the vessel seaworthy. Marooned for days and weeks onboard, pondering their deteriorating surroundings, they began creating their own unique philosophies.

LaSota was a 28-year-old software developer who had grown up in Alaska. By her own description, she was technically gifted from a young age. “My friends and family, even if they think I’m weird, don’t seem to be really bothered by the fact that I’m weird,” she wrote in 2014, in the comments of a post on LessWrong.com, the online forum that serves as a discussion hub for rationalist thought. “But one thing I can tell you is that I used to de-emphasize my weirdness around them, and then I stopped, and found that being unapologetically weird is a lot more fun.”

LaSota began “reading up on EA and x-risk,” she wrote later, as an undergraduate in computer engineering at the University of Alaska, Fairbanks. That’s also when she was “starting to donate to MIRI.” She interned at the software giant Oracle and at NASA, developing a tool for space weather analysis. But around the time she graduated, she began to wonder whether she should commit to graduate school in computer science or pursue a job as a computer engineer and “earn to give”—the effective altruism term for making as much money as possible in order to donate it. (The concept is now most attached to convicted fraudster Sam Bankman-Fried, but at the time it was still novel, as the EA movement took off in the Bay Area.)

LaSota writes that she contacted Anna Salamon, the executive director of CFAR, to ask for advice. According to LaSota’s account, Salamon “said actually I should go to grad school, find a startup cofounder, drop out and earn to give via startups instead.” (Salamon declined to comment for this story.) After attending grad school for a while and then dropping out—

without snagging a cofounder—LaSota moved to the Bay Area and worked for a gaming company, then a biological instruments startup.

Disenchanted with what she viewed as the hollowness of startup culture, LaSota increasingly turned to the rationalist community for answers. Since the early 2000s, when Yudkowsky had started gathering like-minded individuals to warn about the dangers of AI, the community had evolved from a largely technical movement to a social one. At workshops, in group houses, and on LessWrong.com, rationalists engaged in extended philosophical debate about AI, game theory, the singularity (in which a superintelligence would arise in one, instantaneous moment), and how to live a more rational life.

Much of their discussion, online and off, was obscure. Partly this was the result of the technical concepts underpinning theories about the future of AI. But the arcane language around “infohazards,” “basilisks,” or “Schelling points” also served a more exclusive purpose. It was a lexicon required for acceptance into a kind of priesthood, a self-declared bulwark against the destruction of humanity itself.

LaSota dove into the debates, sometimes passionately enough to alarm her fellow rationalists—many of whom she increasingly regarded, in at least one respect, as morally repellent. “I’d been a vegan first,” she later wrote, “and my primary concern upon learning about the singularity was how do I make this benefit all sentient life, not just humans. I described my feelings towards flesh-eating monsters, who had created hell on Earth [for] more people than those they had helped.” (In Ziz’s writing, anyone who eats meat is a “flesh-eating monster,” and sentient animals are “people.”)

In 2016, LaSota attended an eight-day CFAR program called the Workshop on AI Safety Strategy. One event included a session of “doom circles,” she later wrote, where each participant “took turns having everyone else bluntly but compassionately say why they were doomed” and also weighed in themselves. The session elicited difficult soul searching from LaSota about whether she was “morally valuable” and “net positive” to Earth—whether her life would contribute to saving humanity at all. “When it was my turn,” LaSota wrote, “I said my doom was that I could succeed at the things I tried, succeed exceptionally well, like I bet I could in 10 years have



earned to give like 10 million dollars through startups, and it would still be too little too late, and ultimately the world would still burn.”

### III.

The Zizians came together over the next two years, splintering off one by one from the established rationalist and EA communities. Gwen Danielson, a high-achieving prep school graduate from Washington state who’d studied electrical engineering, math, and cognitive science at Rice University, met LaSota in the mid-2010s. They bonded over their experiences in the soul-sucking Bay Area real estate market, which often shunted rationalist-curious arrivals into toxic group-living situations or debt. “Most of the money donated by earn-to-givers [was] going to landlords,” Danielson wrote. “We both recognized housing as one of the most obvious problems with the Bay area rationalist community.”

In 2016, the pair began living together on a small sailboat Danielson owned, in the Berkeley Marina. LaSota, after learning some sailing basics, bought her own 24-foot boat for \$600 off Craigslist. She named it the *Black Cygnet* and began living on it. From there, the pair decided to expand their life at sea and create “a federated fleet of boats” that would provide housing for rationalists “in order to improve the rate of work on AI safety.” They’d call it the Rationalist Fleet. Danielson, LaSota, and a third comrade purchased a 70-year-old Navy tugboat that had been christened *Caleb*, and LaSota traveled to Alaska to sail it down, together with acquaintances she’d recruited via online rationalist groups.

Ninety-four feet long and striped with rust, the boat was fraught with problems from the beginning. LaSota and Danielson managed to reach the Bay Area with it but had trouble finding a cheap place to anchor. They became consumed with the struggle to keep the vessel seaworthy. Marooned for days and weeks onboard, pondering their deteriorating surroundings, they began creating their own unique philosophies. “We’ve been somewhat isolated from the rationalist community for a while,” LaSota wrote to a correspondent at the time, “and in the course developed a significant chunk of unique art of rationality and theories of psychology aimed at solving our problems.”

As LaSota articulated it, their goals had moved beyond real estate into a more grandiose realm. “We are trying to build a cabal,” she wrote. The aim was “to find abnormally intrinsically good people and turn them all into Gervais-sociopaths, creating a fundamentally different kind of group than I have heard of existing before.” (The Gervais principle, articulated by the writer Venkatesh Rao—based on an extensive but light-hearted analysis of *The Office*—is a theory that at the top of any organization are “sociopaths” who know how to acquire and manipulate power. Beneath them are the loyal “clueless” and the disaffected “losers.”) Sociopathy, LaSota wrote, would allow the group’s members to operate “unpwned by the external world.”

“Gervais-sociopaths” was a foundational concept in LaSota’s increasingly tangled ideology, the kind that went beyond even the most impenetrable thinking found on LessWrong.com. On her blog, at Sincerely.fyi, she outlined that ideology across 100,000 words over several years, on topics ranging from engineering, to her personal history, to psychological manipulation, to gender theory, to the future motivations of a superior artificial intelligence.

I have read this corpus in its entirety more than once, and attempting to summarize LaSota’s or Zizian thought by quoting from it is an almost impossible exercise. It would be akin to explaining a person’s life by examining remnants of charred photos salvaged from a house consumed by fire. To a reader unstudied in rationalist-inflected thought—and even to many at the time who were—the blog could read like the work of an intelligent but unhinged mind:

*Good is at an inherent disadvantage in epistemic drinking contests. But we have an advantage: I am actually willing to die to advance good.*

*At one point, I saw a married couple, one of them doing AI alignment research, who were planning to have a baby. They agreed that the researcher would also sleep in the room with the crying baby in the middle of the night, not to take any load off the other. Just a signal of some kind. Make things even. And I realized that I was no longer able to stand people.*

*Liches have trouble thinking clearly about paths through probability space that conflict with their phylactery, and the more conjunctive a mission it is to make true their phylactery, the more bits of epistemics will be corrupted by their refusal to look into that abyss.*

However opaque LaSota's ideology may have seemed to outsiders, there were some in the rationalist community who felt its pull—including her shipmate Danielson, Emma Borhanian, and Alex Leatham. Borhanian was a former Google engineer; Leatham had studied mathematics at UC Berkeley and UCLA. To them, the normies who dismissed Ziz were no different than the friends and family who failed to understand the implications of AI superintelligence.

LaSota and her compatriots, who'd bought into the need for sentient life to be saved from AI, increasingly found MIRI and CFAR insufficiently committed to that mission. "They are obviously not taking heroic responsibility for the outcome of this world," Danielson wrote. At best, the Bay Area organizations were doing "niche research." At worst, they were actively corrupt, even abusive. LaSota and those in her orbit alleged that CFAR and its leadership were laced with anti-trans beliefs and practices. ("That's preposterous," one member of the rationalist community, who is also trans, told me. "Rationalists have the most trans people of any group I've seen that isn't explicitly about being trans. You'd just show up at a math event or house party, and it would be 20 percent trans.")

Within the labyrinth of LaSota's writing, even the most perplexed reader could locate the essence of her aspiration: to attain a hero's role, with a commitment to an unassailable moral code. She yearned for action in support of that code, the kind of action that most humans—and rationalists—lacked the moral fortitude to pursue.

So the group set about trying to "install" new "mental tech," as they described it, to "jailbreak" their minds from convention. They began wearing all black, identifying their philosophy as "vegan anarchotranshumanism" and their spiritual beliefs as "vegan sith." ("The Sith do what they want deep down," LaSota explained. "They remove all obstructions to that.")

Danielson developed an elaborate psychological theory around brain hemispheres, soon taken up by LaSota. A person's core consisted of two hemispheres, each one intrinsically good or nongood. In extremely rare cases they could be "double good"—a condition that, it so happened, LaSota identified in herself. A person's two hemispheres could be at war with each other, but it was possible to gain awareness and even control of them through a process called "debucketing." LaSota and Danielson began experimenting with something they called "unihemispheric sleep," which they believed allowed them to put portions of their brain into slow wave sleep while remaining consciously awake. It was, LaSota wrote, "a means of keeping restless watch while alone."

In their four months on the boat, however, LaSota and Danielson's theorizing seemed to outpace their seafaring skills. In November 2017, the Coast Guard had to retrieve *Caleb* after the 345-ton tug dragged its anchor and collided with other boats in the harbor, while carrying hundreds of gallons of oily bilge water. Ultimately the vessel became too expensive to maintain, and the group abandoned it. (In 2022, the operators of Pillar Point Harbor in San Mateo County, where *Caleb* had been left behind, spent more than \$50,000 to tow the boat back out to sea. One month later, it sank.) "After Rationalist Fleet I updated away from boats being a good idea for housing," Danielson wrote, "in favor of well-outfitted stealth RVs."

For now, the friends seemed scattered and vulnerable, with tenuous housing and social worlds in flux. "I was kind of homeless," Leatham later wrote of the time. But they were increasingly united around the idea of taking action. "I de-facto lead without authority," LaSota wrote. "Just like I did a lot of in Rationalist Fleet even though Gwen was the boss formally (and the high level strategic vision as well, actually). Real leaders don't need authority."

## IV.

By the day of the CFAR reunion at Westminster Woods, in November 2019, the schism between the rationalist mothership and LaSota's small faction had taken a more aggressive turn. The splinter group had suggested they could sue over what they believed to be anti-trans discrimination by

CFAR's leaders and had become verbally confrontational online and at CFAR meetups.

To the larger rationalist community, their writing seemed increasingly unhinged, even threatening. "Vengeance and justice are in the hands of anyone who wants it," Leatham wrote. "You don't need to appeal to anyone to take revenge." Salamon, CFAR's executive director, later wrote on Facebook that she'd begun to feel "extreme fear" toward LaSota. She recalled that LaSota had posted to Discord, "If MIRI attempts to silence me using governmental force ... that would be physical violence. If they escalate to physical violence, we are prepared to perform self-defense."

There were Byzantine levels to this inter-community drama that defy summary, played out across endless threads on Discord, LessWrong, and Tumblr. As self-described vegan Siths, LaSota and Danielson expressed outrage that MIRI's efforts to create human-friendly AI didn't seem to include other animals in the equation.

"Do you know whether Ziz owns or has easy access to any weapons?" one rationalist wrote on Facebook. "Does she currently have a plan to obtain a weapon?"

The group had become especially fixated on a particular rumor, namely that the nonprofit MIRI had potentially used donor money to pay off a former staffer. The ex-employee had launched a website accusing MIRI leaders of statutory rape and a coverup. Though the facts were never litigated in a courtroom, MIRI's president wrote in 2019 that he had checked "some of the most serious allegations" and "found them to be straightforwardly false." The website's owner had agreed to retract the claims and take the site down, the president said, under conditions that were confidential. But what angered LaSota and Danielson was as much the idea—in their minds at least—that the nonprofit had succumbed to blackmail as the allegations themselves. In negotiating, they believed, the organization had violated one of its fundamental principles: "timeless decision theory," a concept developed by MIRI cofounder Eliezer Yudkowsky. (Yudkowsky, who later renamed it "functional decision theory," declined to comment for this story.)

Without getting mired in the details—which, unfortunately, are extremely difficult to distill without getting into game theory—suffice it to say: Timeless decision theory asserts that, in making a decision, a person should consider not just the outcome of that specific choice but also their own underlying patterns of reasoning—and those of their past and future selves (not least because these patterns might one day be anticipated by an omniscient, adversarial AI). LaSota, in her writing, seems to have interpreted this metaphysical game as a call to operate “timelessly”—to treat one’s choices as if they affected the fate of all sentient life across temporal horizons. Under this line of thinking, one should never back down or surrender, no matter what. In any case, the Zizians believed that timeless decision theorists are supposed to resist blackmail, and they perceived this purported betrayal of principle as deeper than the crime itself.

According to Danielson’s later writing, the group planned a series of talks to communicate all of this at the Westminster Woods reunion. Days before, however, CFAR’s leadership barred Danielson and LaSota from attending. So they arrived instead in their robes and masks, three-page flyers in hand. “MIRICFAR betrayed us,” the flyers read in part. “It is not what it once seemed like it would become. New things can be built.”

## V.

Following their arrests, each of the four spent several days in jail before bailing out. Prosecutors charged them with five misdemeanors, for crimes like false imprisonment of the campers, willful cruelty to a child, and wearing a mask for an “unlawful purpose.” They also layered on a felony, for conspiracy, that carried the threat of serious prison time.

But LaSota and the other three, on their blogs and in legal briefs, cast themselves as the victims. In their defense filings, the group argued that they’d traveled to Westminster Woods “to protest the cover-up of the sexual abuse of minors” by CFAR. They couldn’t have known that the elementary school children would also be on the property or that camp staffers would interpret their protest as an active shooter situation. They accused the police of filing false reports and the county district attorney of “malicious prosecution” on “trumped-up criminal charges.”

“Don't we know by now that the word of a cop isn't worth shit?” Michelle Zajko, another young trans rationalist who traveled in the group's circles but hadn't attended the protest, wrote later. The false gun claim and police presence, she wrote, were “a fairly standard example of a phenomenon called ‘swatting’ where someone deceives emergency services into sending police based on false reporting.”

The group hired a lawyer and filed a civil rights complaint against the Sonoma County authorities on the grounds that they'd been subjected to excessive force and that their requests for same-gender searches had been ignored. The searches the male officers had conducted, including under their clothing, they alleged, “amounted to sexual assault and battery.” After being brought to the jail, the complaint alleged, the group had their clothing “forcibly stripped off their bodies.” They said the officers then “crowded around to look at the Claimants' genitals and naked bodies.” They were then “tortured” over a number of days, they said, “woken whenever they started to fall asleep ... and were kept naked and cold for days.”

With the arrival of the pandemic, both cases slowed to a crawl, and the group seemed to grow more isolated and inward-looking. Their collective exile from the rationalist community was virtually complete. They were banned from LessWrong.com, along with various CFAR meetups and conferences. An anonymous rationalist launched a site, Zizians.info, branding them “the Zizians” for the first time and warning that the group was a cult. The page, which LaSota called “a rationalist smear site,” alleged that LaSota's unihemispheric sleep practices had led to the 2018 suicide of a trans woman attached to the group, Maia Pasek. (LaSota wrote that unihemispheric sleep “did not doom Pasek.” But her own description of her interactions with Pasek, titled “Pasek's Doom” and including lines like “We each went on our journey of jailbreaking into psychopathy fully” and “Pasek's right hemisphere had been ‘mostly-dead,’” did little to rebut the accusations.)

Whatever thread of attachment they'd felt to the rationalists was snapped by the response to the protests. ““Rationalists” are so evil,” Leatham wrote. “i dont know how to express how evil they are. many of them are just

authoritarians ... Not a single ‘rationalist’ cisfem stood up for me ... i wont forget this.”

Parts of the rationalist community had become increasingly concerned about what LaSota and her acolytes might do next. “Do you know whether Ziz owns or has easy access to any weapons?” one member wrote on Facebook. “Does she currently have a plan to obtain a weapon?” A moderator on LessWrong wrote that “both Ziz and Gwen have a sufficient track record of being aggressive offline (and Ziz also online) that I don’t really want them around on LessWrong or to provide a platform to them.” One rationalist recalled that “CFAR spent a bunch of money hiring professional security.”

In turn, LaSota and the others wrote of vengeance against the “timeless” decisions of others. “If you truly irreconcilably disagree with someone's creative choice, i.e. their choice extending arbitrarily far into the past and future, ultimately your only recourse is to kill them,” one LaSota ally wrote in a long blog post citing Ziz’s philosophies. In the comments, LaSota wrote, “I am so fucking glad to finally have an equal.”

On the morning of the 13th, Lind later alleged, Dao lured him out to their trailer by saying there was a water leak, and then multiple figures stabbed him with kitchen knives.

In the spring of 2021, a rationalist named Jay Winterford, who went by the name Fluttershy, died by suicide. Winterford had spent time on *Caleb* with LaSota and Danielson, where LaSota had described trying to “fix/upgrade” him, and for years he seemingly grappled with LaSota’s ideas as a way out of childhood traumas. To rationalist watchers of the group, Winterford seemed to constitute a second casualty of its ideology.

In court, by summer 2021, the four had turned against their own defense lawyers, accusing one of misconduct. A month later, representing herself, Leatham filed to have the state judge Shelly Averill disqualified from the case on the grounds that she had “repeatedly misgendered me and my codefendants, including twice under penalty of perjury, and 10 times on the first court date after my writ petition where I told her misgendering me was bias and misconduct.” (Judge Averill admitted to misgendering Leatham but



replied that she did not “misspeak intentionally or in any way intend to cause party offense.” A higher court ruled against Leatham.)

Another Leatham filing included numbered objections like “2. Shelly Averill is evil.” “3. Shelly Averill has read my previous accusation that she is evil and has not denied that she is evil.” “5. ... Shelly Averill has omnicidal intent—she wants to destroy everything—especially prioritizing that which is good.” And “11. I will never be a man, no matter how much humans like Shelly Averill want to eradicate that truth from existence.”

When their civil rights complaint for harassment and torture was thrown out, the four filed a federal civil rights lawsuit against the police and two administrators at Westminster Woods—whom they accused of intentionally fabricating the claim that one of them was armed, in order to prompt a stronger police response. They again asserted that the police had infringed on their speech, sexually assaulted them, and denied them food and medication in custody, amounting to torture. The police opposed a subpoena to release any video from the jail, calling them “privileged” files that would constitute “an undue burden” to sort through.

Even mired in their ongoing legal battles, the group still seemed to be expanding. Now hovering around the Zizian orbit was a figure named Alice Monday—whom LaSota had described as “sort of a mentor to me”—and Michelle Zajko, the young rationalist who compared the Westminster Woods response to a swatting. She was trans nonbinary and a recent bioinformatics master’s graduate from Pennsylvania. By the spring of 2022, an EA adherent and recent UC Berkeley student with chunky black glasses named Daniel Blank was also around. Blank, a cisgender man whose blog showed him captivated by LaSota’s ideas, was noted in the court file as having delivered one of Leatham’s lengthy objections to the court.

A few weeks later, after Danielson failed to show up for a hearing, Averill issued a bench warrant for her arrest. Then, at a hearing of the federal lawsuit, on August 19, the group’s attorney asked for a stay in the case. He said he believed that Gwen Danielson had died by suicide.

One half of the founding Zizian brain trust was apparently gone. The other was soon to vanish as well.

## VI.

Out on the waters of San Francisco Bay that night of August 19, 2022, it was balmy and breezy, with a light swell. At 11:05, the Coast Guard command center in San Francisco received a distress call from a woman on a boat traveling south across the bay. The woman, Naomi LaSota, reported that her 31-year-old brother had fallen overboard, somewhere south of the Bay Bridge. Naomi, Ziz, and Borhanian had gone out for an afternoon sail on Ziz LaSota's boat, the *Black Cygnet*. But as they were heading back to the marina, Naomi reported, her brother—as she referred to Ziz in her communications with the Coast Guard—had leaned over the motor and fallen in.

According to official Coast Guard logs obtained through a Freedom of Information Act Request, the sister said her brother had not been wearing a life preserver, and she was “unable to determine exact location or area where brother fell overboard due to unfamiliarity with the boat.”

The Coast Guard deployed in force, knowing that time was of the essence. All available boats, helicopters, planes, and drones launched into action, including the marine rescue units of the Oakland and Alameda fire departments.

The crews searched through the night, obtaining “fatigue waivers” to forgo their normal shifts to keep going. They ran patterns through the Bay out under the Golden Gate Bridge, from Yerba Buena Island all the way to Land's End and back down the shore through San Francisco. They returned with only “negative results,” in search-and-rescue-speak. There was no sign of the person who'd fallen overboard.

At 3 am, LaSota's sister called for assistance again. After the Coast Guard boats had moved on to where LaSota might have drifted, the other two had no idea how to sail back, and the *Black Cygnet* was now drifting near some rocks. A Coast Guard unit was diverted from the search to tow it into a marina. By 9 am, the operations center had coordinated with the missing boater's other next of kin. At around 5 pm, after 18 hours, the Coast Guard told LaSota's family that they were suspending the search. Their computer

modeling, they said, showed LaSota could not have survived that long in the water.

More than two weeks later, an obituary appeared for LaSota in The Daily News-Miner, in Fairbanks. “Loving adventure, friends and family, music, blueberries, biking, computer games and animals, you are missed,” it read. That November, Naomi filed to obtain a death certificate for LaSota, with affidavits from herself and Borhanian recounting the incident, both of them using LaSota’s given, legal name. “No friends or family,” she wrote, had seen or heard from LaSota since August 19, 2022.

## VII.

With LaSota and Danielson both presumed dead, the Zizian ideology started to feel like an afterthought in the rationalist community. Even before Danielson’s reported suicide and LaSota’s disappearance, some of the leading lights of rationalist thinking had taken to LessWrong to publicly discuss what the experiences around Ziz had meant, as if she no longer existed. “Ziz tried to create an anti-CFAR/MIRI splinter group whose members had mental breakdowns,” Scott Alexander, the author of the prominent Slate Star Codex blog, wrote in a lengthy discussion of MIRI, CFAR, and other mental health incidents that had taken place in the community. Another poster wrote: “The splinter group seems to have selected for high scrupulosity and not attenuated its mental impact.”

As for others who had been part of LaSota’s Bay Area circle, Michelle Zajko and Alice Monday appeared to have moved to the East Coast. Voter rolls from 2022 show them residing in Coventry, Vermont, on a 20-acre wooded property in an unfinished house, purchased more than one year earlier through an anonymous trust.

The two remaining Westminster Woods protesters, Borhanian and Leatham, had taken up a precarious residence on a property in Vallejo, northeast of San Francisco. Owned by an 80-year-old former shipworker and crane operator named Curtis Lind, the fenced-off land was pressed up against a steep hillside. Dotted with box trucks, decommissioned boats, and piles of junk, it gave the impression of a salvage yard. It was in a rough corner of

town, a friend of Lind's recalled—the site of drug dealings and shootings. On the opposite side of the hill was a waterfront featuring derelict boats and a regular homeless encampment.

Lind had decided to monetize the property; he brought in RVs and shipping containers and took on tenants to work and live cheaply in them. But the property lacked water or electricity. According to the friend, Lind had once blown out the neighborhood transformer by tapping it for power.

Borhanian and Leatham lived in an RV on the property and remained occupied with fighting the charges stemming from the protest. Each court filing of Leatham's, who was by now attempting to represent herself, became harder to follow. In September 2022 she filed one titled "Notion of Motion and Motion to Dismiss the Imposter Police Officer From all Conflicting Positions on this Case, Including but not Limited to Their Witnessed Reincarnations as Judge and District Attorney."

"We're currently facing the collapse of civilization, a looming civil war, unfriendly AI, and a fuckton of other threats," Zajko wrote, "and instead of focusing on those, we're wasting resources respectively hunting and evading each other."

There were other characters hanging around Borhanian and Leatham at the property, including a mysterious blond woman and another young rationalist named Suri Dao—who identified as "bi-gender" and blogged that she "preferred either she/her or he/him pronouns." The group's lease had been arranged years before by Gwen Danielson. But Lind claimed that no one had paid rent in years. By October he'd won a \$60,000 judgement against the group and was working to evict them.

What took place between the remaining group and Lind one Sunday morning that November would once again bisect reality into two irreconcilable versions. According to the account that Lind gave police—and that his tenant Patrick McMillan gave the local news—the group learned that the county sheriff would be pursuing the eviction on November 15. On the morning of the 13th, Lind later alleged, Dao lured him out to their trailer by saying there was a water leak, then multiple figures stabbed him with kitchen knives more than a dozen times, including through the

eye. At some point Lind pulled a gun, and Leatham allegedly ran a samurai sword through his left shoulder and out from his stomach. Lind fired, killing Borhanian and wounding Leatham at least twice.

McMillan claimed he awoke to a knock at his door and found Lind standing at his trailer with the sword still protruding from his body. “He said, ‘I’m dying!’ and he had blood squirting out of him,” McMillan told a local TV news reporter a few days later. “I guess they figured if they killed him, they couldn’t be evicted.”

When the police arrived, they found Borhanian dead, Leatham with gunshot wounds, and Lind bleeding from his eye with a sword sticking through his chest. The cops arrested Dao at the scene, while Leatham and Lind were both transported to the hospital. The blond friend of the group, who police said gave her name as Julia Dawson, was taken to the station for questioning. But after having what appeared to be a medical emergency, she was sent to the hospital as well. From there, she quietly slipped away.

When Leatham recovered from her injuries enough for the case to proceed, she and Dao were charged with the attempted murder of Lind and the felony murder of their own friend, Borhanian. (Although Lind had pulled the trigger, California law allows prosecutors to essentially charge instigators of a conflict with any murder that results from it.) Lind, among other injuries, lost an eye.

At least in the small group of supporters who showed up for Dao and Leatham at court hearings, another version of events took hold. Lind, according to this story, had been threatening and harassing the tenants for months, and that morning had entered their home and shot them unprompted. (It’s unclear, in this account, how Lind was stabbed through the chest and eye.) “Emma was no harm to anything or anyone,” a person close to Borhanian said in a 2022 interview, alleging that Lind’s story had changed over time. The group was being presumed guilty because they were neurodiverse, she said. “This man ended the life of this brilliant, brilliant woman.”

As the murder charges entered their long slog through the California courts, the other cases involving the original four protesters fell away. The protest

charges were put on hold, and the group's attorney in the federal civil rights lawsuit—which alleged the four were “tortured” after Westminster Woods—was preparing to withdraw from the case, saying he could no longer reach his clients. (The case was later dismissed.)

Two days after the sword attack, the Vallejo police contacted the Coast Guard command center to follow up on its missing boater case. One of the people who'd been on the boat when LaSota went missing, Emma Borhanian, been shot and killed in the Lind attack, they reported. But they had another startling discovery to share. LaSota herself was alive and had been living in Vallejo “for the past six months,” the detective said. Julia Dawson, the woman who'd slipped away from the hospital, was Ziz LaSota.

## VIII.

Michelle Zajko grew up in an upscale neighborhood in the town of Chester Heights, Pennsylvania, just southwest of Philadelphia. A sharp and creative student who penned her own fantasy stories, she first became involved in the effective altruism movement as an undergraduate biology major at nearby Cabrini University, bringing an EA discussion group to campus. “I want to help save people for my career, but this is a way I can do it now,” she told her college newspaper in 2013. The same year, Zajko presented a paper about applying Bayesian decision theory in everyday life. “Because people maintain consistency in their beliefs, they often continue to make the same decisions, even if those decisions are not optimal,” she wrote. “Structuring one's decisionmaking strategies in accordance with mathematics and decision theory would result in outcomes that grant higher expected utility than using no strategies.” She earned a master's degree in bioinformatics from Temple University and worked as an intern at NASA and at the Children's Hospital of Philadelphia.

By 2019, Zajko—known as Jamie in Ziz-connected circles—relocated to California, where she entered the wider rationalist social scene and started dating Alice Monday. (Monday couldn't be located for this story.) Monday was a controversial figure, accused on multiple blogs of physically and mentally abusing her housemates. Alex Leatham wrote that “about once a

week for several months [Monday] would take a length of bamboo and beat my friend emma with it. this is their attempted new order.”

Monday never responded publicly to the accusations, and Zajko seemed not to have complaints of her own. “I had spoken with her while she was out in California, and she was very happy,” her aunt Rosanne Zajko told me. “She said that she and her girlfriend, Alice, would be moving to Vermont.” The Bay Area was expensive—“I think she used the word ‘soul-crushing,’” Rosanne said, “and they were looking for a change of scenery.” Monday and Zajko relocated together to Vermont by early 2021.

The Vermont property was isolated, just 20 miles from the Canadian border. “Long driveway and mountain top setting is really what sets this apart from most homes, total solitude,” a real estate listing noted. Rosanne says that Zajko became increasingly estranged from her family after she arrived in Vermont—an estrangement Rosanne attributes to Zajko’s California friends, including LaSota. “Michelle is a very very intelligent person,” Rosanne said. “She’s always been a very independent thinker, someone who is intellectually curious. I see how she goes out there and wants to learn more, but how she actually got to fall under the influence of that group is something I do not understand and I have no answers for.”

Rita and Richard Zajko’s life was quiet, arranged around a tight circle of concern. Rita’s parents were ill and lived nearby, and a lot of Rita and Richard’s time was taken up with caring for them.

In her online writings, Zajko expressed growing concern about anti-trans sentiments she saw in the news. “We’re already past the start of a trans genocide,” she wrote on her Tumblr in 2022. “If you don’t own a gun, consider getting one, learning to shoot it, and investigating community self-defense. Fascist militias are an arm of the anti-trans genocide who are acting as low-level enforcers.” She also alluded to what she described as past “abuse” by her parents. They’d threatened to go to a judge friend and have her put in foster care, even kill her if she ran away, she wrote. She said she’d “tried explaining” it to her aunt, Rosanne. “She sadly didn’t believe me,” Zajko wrote. “Some people don’t want to hear about the ugliness in the world, because then they’d feel obligated to do something about it.”

Rosanne's recollection of these same events, and of Zajko's parents, was irreconcilable with what her niece wrote. Some time after seeing the posts, she emailed Michelle. "I take issue with one of your posts where you said I knew about abuse but preferred to do nothing," Rosanne wrote. "That was a huge surprise to me. I felt that you stabbed me in the back with that comment." Rosanne had been a witness to disputes between Michelle and her parents, she said—even taken Michelle's side—but said the arguments she knew of never amounted to anything approaching abuse. "Did she express to me any resentment or anger or hate against her parents? Not at all."

In 2021, Michelle Zajko bought another half acre of land in Derby, 15 miles from Coventry. It's unclear how long Monday and Zajko stayed together in Vermont. But in February 2022, Zajko blogged about having recently had long conversations with LaSota. The latter had accused Zajko of, essentially, gossiping about her with Monday and playing mind games. "Ziz informed me that the only way I could gain her trust and make up for what I did to her," Zajko alleged, "was to murder Alice." LaSota, according to the post, had told her how to construct a DIY suppressor for a gun and suggested lye to get rid of the body. "And if I didn't do it," she continued, "Ziz planned to drive across the entire continental United States to murder me."

Zajko seemed to vacillate between suspecting it might all be a rhetorical game and genuinely believing Ziz intended to kill her and Monday both. "Ziz, like myself, does not forgive or forget, not even after years have passed," she wrote. "While I have the tenacity, skill, and willingness to evade Ziz and her friends indefinitely, it's a waste of resources. We're currently facing the collapse of civilization, a looming civil war, unfriendly AI, and a fuckton of other threats, and instead of focusing on those, we're wasting resources respectively hunting and evading each other."

The conversation seemed unresolved. But between musings on *Dune* and Siths, Zajko drew what would later come to feel like a crucial distinction: between the "the world where I'm a complete psychopath [sic]," killing to please Ziz, and the one "where I kill my abuser."



## IX.

Back in Chester Heights, Pennsylvania, Michelle Zajko's parents lived in the stately four-bedroom home they'd owned since the late 1980s. Richard and Rita Zajko had raised Michelle there, in a cul-de-sac development with other young families. Richard worked for a company that had a contract with the nearby Navy yard, while Rita stayed home. Now that Michelle, an only child, was out of the house and the couple was in their late sixties and early seventies, their life was quiet, arranged around a tight circle of concern. Rita's parents were ill and lived nearby, said Rosanne, and a lot of Rita and Richard's time "was taken up in caring for them."

Toward the end of 2022, Rosanne had fallen into the habit of talking to Rita every Sunday. "We were both caregivers," she said—Rita for her parents, and now Rosanne for her husband, Rick's brother, who was on the verge of entering memory care. "It was grueling and draining," she said, and she knew Rita could understand.

"On December 31, I put it out there in the universe: Can 2023 be the year where I have no catastrophes?" Rosanne recalled thinking. "Can it be a good year?" The next morning she texted Rita to wish her a happy New Year but received no reply.

Three days later, Rosanne said, she got a call from another of Rick's brothers. "I don't know why he would be calling, but let me pick it up," she remembered thinking. "He just comes out with it and says 'Rick and Rita have been murdered.'"

Sometime late on New Year's Eve, the police later determined, someone had killed the couple inside their home, shooting them each in the head with a 9mm handgun. There was no sign of a break-in, and the authorities quickly concluded that the assailant must be someone the couple knew. According to a search warrant application in the case, Ring camera footage from across the street had captured a car pulling up to the house at 11:29 that night. Two minutes later, "a higher-pitched voice is heard shouting what sounds like 'Mom!'" followed by "Oh my god! Oh God! God!" Two

figures are then recorded entering the house, then exiting nine minutes later and driving away.

The Zajkos, two sources familiar with the case later confirmed to me, had been killed in Michelle's childhood bedroom. December 31 was her birthday.

Rosanne was devastated. "I stayed on the floor," she says. "I wasn't comprehending it: How can this happen to Rita and Rick, of all people?" She wondered briefly why Michelle hadn't called to deliver the news. "Like, she has to know, but why didn't she call and tell us?" she remembers thinking. But then she thought: "How would I react if I got the news that both of my parents were murdered? I would be in shock."

## **X.**

Three days after the bodies were discovered, on January 5, a pair of Pennsylvania state troopers traveled to Vermont to interview Michelle Zajko. They found her at the Coventry property, along with the 24-year-old Daniel Blank—the rationalist from Berkeley who had once delivered court documents for Alex Leatham.

One of the troopers, Matthew Gibson, later testified that Zajko told them she was "uncertain of when she would come back to the Commonwealth in order to make final arrangements for her parents." According to the search warrant affidavit, she told the troopers she hadn't spoken to her parents since the previous January, that she'd been in Vermont with Blank on New Year's Eve, and that she hadn't been to Pennsylvania since before the Covid pandemic.

The officers asked Zajko if she had any guns on the property. She said they did, and retrieved a 9mm Smith & Wesson. Gibson testified that he "held it in Vermont" and "inspected it." Two sources also confirmed to me that the troopers had seen a shooting range on the property and that the Pennsylvania State Police had discovered that Zajko and the others had turned their phones off in the hours leading up to the murder, making it

difficult to track their whereabouts. With no warrant to confiscate the gun, however, Gibson handed it back, and the officers returned home.

On January 9, the Pennsylvania State Police got a call from the medical examiner in Delaware County. Zajko had arrived unexpectedly, seeking death certificates for her parents. The police tracked her to a nearby hotel called Candlewood Suites, but waited to approach her again.

On the morning of January 12, Michelle arrived alone at the small graveside ceremony for her parents. Wearing a mask, she told Rosanne she'd been ill and didn't want to spread germs. Rosanne recalls her seeming paranoid, gesturing at some of Rick's former colleagues she didn't recognize. "Who are those men?" she asked.

Then, at 9 pm that evening, the police arrived at the hotel. They'd secured a warrant to obtain Zajko's DNA and search her hotel room and car for the Smith & Wesson—"believed to potentially be the murder weapon of Richard and Rita Zajko," Gibson testified.

When Zajko came to the door of her second-floor room, she acknowledged the officers but was slow to open it. The police used a key card to enter. They detained Zajko and took her down to the lobby, but as they passed through, she shouted at the hotel staff to tell Daniel Blank that she'd been arrested. "He's staying in room 111!" she said, according to Gibson. The trooper recognized Blank's name from the Vermont trip and gathered some officers to approach 111, which Blank had rented under the name "Daniel Black." When Gibson knocked on the door, Blank refused to open it and asked for a lawyer.

Instead, the officers left to obtain a warrant. They reviewed the previous night's footage from the Candlewood Suites security cameras and determined that Zajko had carried a bag down to room 111, knocked, and left it outside the door. A judge found it sufficient probable cause for a warrant, and the police returned to the hotel at 12:30 am. This time, when no one answered the door to 111, a vice unit breached the room. They heard the shower running and found Blank hiding in the bathroom—along with a blond-haired figure they hadn't expected, dressed in black.

Shortly after court was gavelled into session, an older woman with gray-blond hair pushed a wheelchair into the back of the courtroom. In it, slumped to one side and dressed in flowing black, was LaSota.

Blank was thrown to the ground and cuffed, but cooperated as he was walked out of the room. The other person in the room, whom troopers would later describe as being 6' 2" and 200 pounds, was sprawled on the bathroom floor with eyes closed. "He was just laying almost unconscious or as if he was dead on the ground," another trooper, Matthew Smith, later testified. Four officers carried this other figure out of the room. In the lobby, a trooper physically placed the person's finger onto a mobile fingerprint scanner.

A hit came up for an open warrant, in California. It was for Ziz LaSota, under her birth name.

The troopers sent LaSota to the hospital, where doctors said there seemed to be nothing wrong with her. She was placed under arrest, then charged with disorderly conduct and interfering with a police investigation.

The troopers searched Zajko's green 2013 Subaru, parked at the hotel, and discovered \$40,000 in cash under the front passenger seat. In Blank's pocket they found a receipt for it, from a Bank of America branch in Vermont. (Later, surveillance footage from the branch would show Blank pacing back and forth as he awaited the money, then pulling out and unwrapping a cell phone covered in foil.)

In LaSota and Blank's room, 111, the police found a light-colored cloth bag containing a Smith & Wesson 9mm—with a serial number matching the one troopers had seen in Vermont—and five boxes of ammunition.

By that point, however, Blank and Zajko had been released. They never came back for the cash or the car. Only LaSota remained in custody.

## **XI.**

I started attending LaSota's court hearings in May 2023, at a columned Pennsylvania courthouse in the town center of Media, just over five miles from Zajko's childhood home. Eighteen weeks after her arrest, LaSota remained in jail, a judge having initially set bail at \$500,000—an inconceivable amount for two misdemeanors—before reducing it to \$50,000. On an early May morning in Judge Richard Cappelli's courtroom, between a litany of DUIs and petty drug crimes, the clerk called the case.

LaSota appeared by video—there'd been a snafu with the prisoner-transportation system from the jail—but I couldn't see her face from where I was sitting in the gallery. Representing her in the courtroom was Daniel McGarrigle, an attorney with slicked-back gray hair and a trim beard. He'd come prepared to argue that the charges should be dismissed. The police hadn't come to Candlewood Suites to arrest or even investigate LaSota, he noted to me later, and closing one's eyes and lying on the floor was hardly typical "disorderly conduct." "Annoying or frustrating the police is not a crime," McGarrigle told me. As for the murders, he said, "I won't speak to rumors. I only speak to evidence. The evidence I've seen so far—that the Commonwealth has presented so far—has shown me that my client is not guilty of any crime in Pennsylvania."

On this morning, though, Cappelli adjourned the hearing until a date when the defendant could be transported to the courtroom. LaSota responded bitterly. "I've been here for four months," she said, "which I think is even longer than the suggested sentence. It's me languishing in jail for another week for no reason, so I'm not going to say I agree with it."

A few weeks later, LaSota finally appeared in person, in a forest green jumpsuit and handcuffs, her unkempt blond hair swept partly across her face and below her shoulders. She was wearing a blue surgical mask and sat rigidly still through the hearing, where the state would put on evidence to counter McGarrigle's motion to quash the charges. Unlike the California courts, which made the occasional pretense of acknowledging the Zizians' chosen genders, in Pennsylvania LaSota was only "he." After testimony from troopers Gibson and Smith about the events at the Candlewood Suites, the prosecutor argued that LaSota had "recklessly created a risk and a

hazardous condition to the troopers that had to physically remove a 6' 2", 200-pound man.”

Behind these arguments, and even the charges themselves, lay a deeper motive: Unable to charge for the Zajko murders but suspecting that LaSota, Michelle Zajko, and Daniel Blank could be tied to them, prosecutors were trying desperately to hold LaSota while the police gathered evidence. “Obviously you realize we don't give a shit about this case,” one local official familiar with it told me. What they were interested in was LaSota’s involvement in the homicide.

Once out of jail, LaSota would be “in the wind,” the official said. Authorities wouldn’t see LaSota again until she resurfaced “in somebody else's prison.”

But from another angle, the authorities seemed oddly passive about what already amounted to a kind of alleged crime spree. LaSota had an active bench warrant in Sonoma County, California, on the felony charge related to the protest. She’d arguably committed another crime in faking her death, since causing the Coast Guard to commit resources to save lives when no one is in danger is a federal felony—punishable by up to six years in prison. And according to the police in Vallejo, she’d fled the scene of the sword attack and shooting, making her at minimum a potential person of interest in a murder case. But no California law enforcement showed up in Pennsylvania looking to collect their charge or even to question her.

Even more strangely, perhaps, despite having found the Smith & Wesson in LaSota and Blank’s hotel room, prosecutors never charged her in connection to the weapon. Under Pennsylvania law, it’s illegal to possess a gun while a fugitive from justice. “I don’t know that the charges would have had legs,” the official told me, since the gun could have belonged to Blank. But in the court hearings on LaSota’s bail, the discovery of the gun never even came up.

The only person I’d seen in the gallery who seemed tuned into the hearings was a beefy fifty- or sixtysomething white-haired man, sporting a goatee and wearing a black polo. He gave off the vibe of a private investigator, and when I introduced myself he confirmed as much, declining to give his

name. “You can call me ... Cliff,” he said, unconvincingly. We shared our bafflement at \$500,000-to-\$50,000 bail, and I asked why he was there. “Some people in California are interested in this case,” he said. “They’re afraid of this individual.”

That fear was evident among some rationalists as news of the violent incidents surrounding LaSota had spread. “I don’t want Ziz to ever think about me, ever,” a person involved in the Bay Area rationalist community said in an interview in 2023. “I think I know enough to be correctly scared of Ziz.”

That June, Judge Cappelli ruled against quashing the charges but reduced LaSota’s bail to \$10,000, unsecured—meaning LaSota could sign a payment pledge and walk out. McGarrigle informed the court that LaSota’s mother had flown in from Alaska, “and she will take him home and make sure he comes back for all the court dates.” The prosecutor seemed skeptical. “The Commonwealth’s concern is the flight,” he told the judge. “There is literally zero ties to the community.” What were the odds LaSota would show up for the next court date, in late August?

“I personally am not going to lose sleep over this matter,” said Sergeant Brian Parks. “If they were here and running amok still, or running amok anywhere in the United States, causing concern for other agencies and people of our communities, then yeah, I’d want them prosecuted.”

Around the same time, Michelle Zajko called her aunt Rosanne. They hadn’t spoken since the graveside service for Michelle’s parents that January. She hadn’t shown up at the memorial mass where Rosanne had eulogized Rita and Rick. But now Michelle was calling with a message: “She told me she wasn’t responsible” for the murders, Rosanne said. “But she said that she knew who was.” She told her aunt that “LessWrong did it” and that she was “being targeted.”

Not long after, the trust that owned the house in Coventry, Vermont, where Michelle had lived with Alice Monday, sold it off. Michelle and Blank were both gone, having left the previous winter. When realtors came to inspect the property, they found the house had not been winterized, causing the pipes to burst. One of Blank’s family members, meanwhile, filed a national

missing persons report, noting that he had last been seen in Pennsylvania, wore thick glasses, and had one eye that didn't follow the other.

When LaSota's court appearance came, on the morning of August 21, 2023, the courtroom gallery was full of defendants waiting to be called for the day's pleas. Shortly after court was gaveled into session, an older woman with gray-blond hair pushed a wheelchair into the back of the courtroom. In it, slumped to one side and dressed in flowing black, was LaSota. Now her hair too was black and appeared even more disheveled than when she'd been in jail. She was wearing what appeared to be an industrial N95 respirator mask, with valves on either side. McGarrigle, approaching his client in the back of the courtroom, seemed surprised. "What's going on?" he said, leaning in. "I mean, what's going on with your health?"

When LaSota's case was called, the woman I later learned was LaSota's mother wheeled her to the front, where she sat impassively in the chair, gazing blankly at the floor.

A new prosecutor had replaced the old one, and requested a continuance to get on top of all the facts. The judge assented, pushing the trial to December. "I just want the record to reflect that the defendant is here, and we're ready," McGarrigle said, before LaSota's mother wheeled her back out through the doors.

## **XII.**

Two months later, I traveled to Sonoma County, the home of Westminster Woods and the scene of the protest that had seemingly begun this great unraveling. I met Sergeant Brian Parks at the local Starbucks. After hearing his account of the original arrests, I asked him why—given the open felony warrant—his department hadn't come after LaSota once she was arrested in Pennsylvania. "Right now, if I were to look at the system, there are probably 75 felony bench warrants," Parks said. "We don't have the luxury of trying to serve" them all, he said. "We're understaffed right now."

I told him what I'd heard in Pennsylvania from a source close to the case, that the authorities there had contacted Sonoma County about taking their



prisoner. “I heard there was some communication between us and the agency in Pennsylvania,” Parks said. “I don’t know to what extent, so I really don’t want to comment on that.”

But did it frustrate him, I asked, that the original case felt like it would never get prosecuted? “I personally am not going to lose sleep over this matter,” he said. “If they were here and running amok still, or running amok anywhere in the United States, causing concern for other agencies and people of our communities, then yeah, I’d want them prosecuted.”

The next day, I drove to Vallejo. I’d arranged to meet Curtis Lind at the property where he had lost his eye and where Emma Borhanian had been killed. It remained scattered with containers and trailers, and a friend of Lind’s had told me there were still tenants living there. I’d talked to Lind briefly the day before. But that morning I got a call from another friend of Lind’s who said he’d changed his mind. He didn’t want to “say anything that would change the case,” she told me. “Or would make them come after him again.”

The murder cases against Alex Leatham and Suri Dao, meanwhile, had sunk into a seemingly endless quagmire. To the distress of Leatham and her family, she was being housed in a men’s jail despite demanding to be placed in a women’s. And to the bafflement of Dao’s lawyers, Dao demanded to be placed in a men’s lockup after being assigned to a women’s. In the year since their arrest, both had been accused by prosecutors of escape attempts. Back in late 2022, at the hospital following her gunshot wounds, Leatham had allegedly pretended to be asleep on a bench, and when the deputy guarding her had gone to the bathroom, managed to shuffle to an exit in leg shackles. She was captured 20 feet outside the door. She’d allegedly tried again outside a February hearing, requesting a wheelchair and then running for it, getting as far as a nearby fence. Dao, in the summer of 2023, had allegedly faked a seizure in a cell, then tried to run past the guards. According to the incident report, Dao had injured a hand trying to prevent the guards from shutting the door, then “banged her head on the cell window” while waiting for an ambulance.

I was certain the story as I understood it was incomplete but unsure where to look to complete it. Or if I did, whether I could tell it without attracting

the basilisk's gaze myself.

Both defendants' lawyers argued that their clients were mentally incompetent to stand trial. This despite Leatham's objecting to having a lawyer at all, much less being declared insane. In her letters to the judge and outbursts in court, she insisted her thinking was not only sane but logical. "My coercively assigned council do not represent me," she wrote in July of 2023. "I am rational. I do not have a 'mental illness' and I do not need 'treatment.'"

In some way, it felt like the theories that LaSota and Danielson had first spun up on their one-tug Rationalist Fleet were crashing into the messy reality of the justice system. Writing to the court, Leatham offered a rationalist-like case for her own rationality. "Yesterday I believed different things than I do today and tomorrow my beliefs about the world will change again. Yet I still complete plans I made yesterday," she wrote. "Everything I have said before the court is the truth according to the epistemic state I was in when I said it."

The judge disagreed. Based on testimony of doctors, he ruled that Leatham was "developmentally disabled and incapable of cooperating with counsel in the conduct of their defense, and understanding the nature and purpose of the proceedings now pending against them." Leatham was committed to a mental health facility in Porterville, California, for a maximum of four years. Leatham would only go to trial if the facility, and then the judge, determined she'd returned to fitness.

In August 2023, Dao's attorneys asked that the criminal proceedings be suspended, believing that Dao was incompetent to stand trial. In a filing to the court, they wrote that their client had been suffering from depression, psychosis, and suicidal thoughts since the termination of their hormone therapy and had begun engaging in "self-mutilation." Dao, they told the court, "will not speak to attorneys, doctors, the court, or anyone else," "lacks awareness of court proceedings," and "appears mentally vacant, incognizant, and to be suffering from some type of dissociative identity disorder." Dao's own attorneys also cited "transgender issues"—including their client's wish to be referred to as "they" and placed in a men's jail—as an "objective manifestation" of Dao's incompetence. The case remained

bogged down in mental health evaluations and hospital stays, and as 2023 bled into 2024 neither Leatham nor Dao was any closer to going to trial in California.

### **XIII.**

On the morning of LaSota's rescheduled trial in Pennsylvania four months later, Judge Cappelli plowed through a half dozen cases before calling CR-962-23. The prosecutor and LaSota's defense attorney Daniel McGarrigle strode to the bench. But no wheelchair rolled into the room. LaSota and her mother were nowhere to be found in the gallery.

"Good morning, your honor," McGarrigle said. "I'm ready for trial. I have not had contact with my client since the last time we were here." In those four months, he'd spoken to LaSota's family, he said, but not LaSota directly, "and I'm unable to provide an update on my client's whereabouts at this time."

The judge gave McGarrigle until the following morning to reach his client. When he couldn't, the court issued a bench warrant for LaSota's arrest. As of December 2023, Ziz LaSota, wanted in two states, was officially in the wind.

### **XIV.**

Many years ago, a thought experiment emerged out of the rationalist community called "Roko's basilisk." First posed on LessWrong by a user named Roko in 2010—and named for a mythical reptile that can kill with its glance—the premise loosely stated is this: If and when superintelligent AI emerges in the future, capable of dominating and subjugating humans, it will be inclined to punish those who tried to prevent it from coming into existence. Indeed, this superintelligent overlord may be inclined to punish even those who failed to spend their lives working to *bring* it into existence. If you knew that artificial superintelligence was possible, the thinking goes, yet still didn't devote your life to helping create it, it may subject you to unfathomable torture for that choice.

Roko's basilisk contained within it two insidious and mind-bending premises. The first was that merely being aware of the thought experiment instantly made you its potential victim. In the language of the rationalist community, it was an "infohazard." The second was the implication that an entity from the future—one that didn't yet exist, and perhaps never would—could somehow blackmail people in the present to help bring about its existence. "Work for my benefit," the future AI would be telling us, "or I will subject you to unimaginable pain." The idea so roiled the community that Eliezer Yudkowsky, the cofounder of LessWrong, banned mention of it from the forum entirely.

When Ziz LaSota first encountered Roko's basilisk in the mid-2010s, in her early years among the rationalists, she was inclined to dismiss it. Yudkowsky had by then declared that its premise was unfounded—"there's no incentive for a future agent to follow through with the threat," he wrote, "because by doing so it just expends resources at no gain to itself." He'd even un-banned it from LessWrong. But still, LaSota later wrote, "I started encountering people who were freaked out by it, freaked out they had discovered an 'improvement' to the infohazard that made it function, got around Eliezer's objection."

For a while she was able to dismiss these "improvements." But the more she thought about Roko's basilisk, the more she began to suffer from "intrusive thoughts about basilisks"—not just Roko's but others which she could never name. "Eventually I came to believe, in the gaps of frantically trying not to think about it," she wrote, "that if I persisted in trying to save the world, I would be tortured until the end of the universe by a coalition of all unfriendly AIs."

Upon discovering that her actions might lead to infinite torture and then examining her own resolve, LaSota was surprised to find that it held. She refused to be blackmailed, she concluded, by what might come. "Evil gods must be fought," she wrote. "If this damns me then so be it."

The more time I spent following the group that some called the Zizians, the more their story started seeming itself like some kind of basilisk. Just by virtue of having examined its events, you were trapped in its world, subject to its terms. Inside that world it felt like some future evil was rapidly

approaching, ominous events waiting just beyond the horizon. But speaking of them could usher them faster, closer. I was certain the story as I understood it was incomplete but unsure where to look to complete it. Or if I did, whether I could tell it without attracting the basilisk's gaze myself.

So I set the story aside, and waited.

## **XV.**

On January 14 of this year, authorities got a call from a hotel employee near Lyndonville, Vermont, about 30 miles from Michelle Zajko's old place in Coventry. Two people had checked in wearing "all-black tactical-style clothing with protective equipment," the employee said, according to court documents. One was carrying a gun, in a visible holster. (Open carry of firearms is legal in Vermont.) Agents from Homeland Security accompanied the Vermont State Police in responding to the call, and they "attempted to initiate a consensual conversation" with the black-clad guests. The pair—Teresa Youngblut and Ophelia Bauckholt—said they had come to the area to look for property but declined to elaborate. They checked out that same day and relocated to nearby Newport. The police, meanwhile, kept them under sporadic surveillance.

Two days later, on the opposite coast, it appeared the trials of Leatham and Dao were, at long last, going forward. They'd both been declared competent, and in August, Curtis Lind had provided a long videotaped account of his version of events to prosecutors. Now, on January 16, in anticipation of a spring trial date, prosecutors filed a motion noting that "Mr. Lind is the only eye-witness to this case and his testimony is critical for the People to have the ability to prove their case."

Lind, now 82, had put the Vallejo land up for sale after the incident and even received an all-cash offer of \$300,000. But he couldn't bring himself to sell. He'd cleared off the tenants and the junk, but somehow over time both had drifted back. "He was there every day," one friend said, commuting more than an hour in each direction from Half Moon Bay. "For what? Just puttering around, from what I saw."

Lind still worried about someone taking vengeance for the attack, the friend said. “He mentioned a few times that they might come back and finish the job. He was, like, a wait-and-see character. Well, we’ll wait and see what happens, you know?”

January 17 was a clear, chilly day at the property. Lind was walking on Lemon Street, one block away, when a man wearing a black beanie, a mask, and a purple shirt emerged from hiding. The attacker approached Lind, put an arm around his neck, and began to stab him in the chest. Before fleeing, the man slit Lind’s throat. When the police arrived, they found Lind unresponsive but still alive. He died at the hospital within the hour.

A “trans vegan death cult”? An “offshoot of the rationalist movement”? An “antifascist cult”? Anarchists? The story was immediately sucked up into the maw of the culture-war machine.

On January 19, in downtown Newport, Vermont, the law enforcement agents who had Youngblut and Bauckholt under “periodic surveillance” spotted them again in the same tactical gear, gun included. The next day, agents observed the pair at Walmart, where Bauckholt bought two boxes of aluminum foil. The agents saw Bauckholt wrapping two items in the foil, which would later turn out to be cell phones. Bauckholt made a call from another phone, and then the duo left, driving a blue Toyota Prius hatchback with North Carolina plates.

The Homeland Security agents had determined—wrongly, as it turned out—that Bauckholt, a German citizen, had an expired visa. So as the pair was driving down Interstate 91, three Border Patrol vehicles flipped on their lights and pulled the car over. According to federal prosecutors, Youngblut stepped out from the driver’s seat, pulled out a Glock handgun, and fired at the agents, who began firing back. Bauckholt tried to draw a gun too. In the exchange, a Border Patrol agent named David “Chris” Maland was killed, along with Bauckholt. Youngblut was shot but alive, transported to a local hospital.

Several days later in Redding, California, the police arrested 22-year-old Maximilian Snyder and charged him with Curtis Lind’s murder. Snyder, a Seattle-area native, had attended the prestigious private Lakeside School

before obtaining a computer science and philosophy degree from Oxford. “I would like to help advance the technological frontier of humanity in a responsible manner,” he’d written on his LinkedIn, “by contributing original research in the fields of artificial general intelligence and AI alignment.”

While the murder of Lind might have remained a regional story, the killing of Maland—a 44-year-old US Air Force veteran and a nine-year member of the Border Patrol—was quickly national news. But it was local reporters who began to piece together the alleged connections, starting in Vermont. The regional news outlet VT Digger [reported](#) that a federal filing in Youngblut’s case indicated that the person who allegedly purchased both guns for the duo was “a person of interest” in a double murder in Pennsylvania who had lived near Coventry. They didn’t give the person’s name, but as soon as I saw it I knew: Michelle Zajko.

The same filing argued that Youngblut, who was charged with forcible assault with a deadly weapon and discharging a firearm, should be detained while awaiting trial. Prosecutors noted that both Youngblut and Zajko “are acquainted with and have been in frequent contact with an individual who was detained by the Commonwealth of Pennsylvania during that homicide investigation; that individual is also a person of interest in a homicide investigation in Vallejo, California.” The facts fit Ziz LaSota.

Reporters in [Vallejo](#) and [Seattle](#) uncovered a marriage license application between Snyder and Youngblut, who’d also attended Lakeside. Both were known in rationalist and effective altruist circles, as was Bauckholt. Bauckholt had been a quant trader who’d worked in New York and interned at Jane Street Capital, the same firm that once employed Sam Bankman-Fried. They were all young, technically gifted strivers, and their involvement summoned the kind of shocked responses that echoed those elicited by Borhanian and Leatham years before. “She seemed like a friendly nerd,” one friend of Bauckholt’s from the rationalist community told me. “She was very into math and hosted some community discussion channels on Discord. I never knew she knew Ziz at all.” Youngblut, who’d gone on to study computer science at the University of Washington, “was rather quiet, reserved,” a high school classmate of both Youngblut’s and

Snyder's recalled. "She seemed incredibly harmless." Her family, similar to Daniel Blank's, had attempted to file a missing person's report for her months before. Snyder, by contrast, could come off as "macho" or "obnoxious," the classmate said. "It's shocking to even imagine the two of them, like, interacting, let alone interacting deeply enough to pursue a marriage certificate."

Soon the national and international media was flooding in, trying to understand who and what the "Zizians" were. A "trans vegan death cult"? An "offshoot of the rationalist movement"? An "antifascist cult"? Anarchists? The events were immediately sucked up into the maw of the culture-war machine, recycled as a story of wokeness gone wild, a story of police overreach, an immigration story, or one about the inevitable product of an anti-trans culture.

In early February, Snyder dictated a [1,500-word letter](#) to reporters at the San Francisco Chronicle, which the paper printed in full. In it, Snyder opened by saying, "I am not one of Ziz's friends," implicitly disclaiming the group's involvement in his alleged killing of the lone witness in their upcoming murder trial. He spent the rest of the statement addressing Eliezer Yudkowsky, half lecturing, half pleading with him to accept that animals are people, and bragging about his D&D skills.

Besides LaSota, Blank, and Zajko, it's unclear whether there might be other adherents to LaSota's ideas still at large, directly connected to the group or not. Gwen Danielson's father recently [told the Chronicle](#) that rumors of her suicide were false. He'd spoken to her in recent months, he said. She had split from the group and was "completely under the radar." As for LaSota, the Associated Press [reported](#) that she'd been last spotted by the landlord of a North Carolina Airbnb as recently as December, seemingly staying with Youngblut and Bauckholt at a pair of condos where the group kept a box truck parked outside.

Then, last Sunday afternoon, near the town of Frostburg in western Maryland, not far from the Pennsylvania border, a man saw a pair of white box trucks parked up a dirt road on his property. In and around them he found three people, dressed all in black. They asked if he would let them



camp on the property for a month. Instead, he called the police, saying that he recognized the group from news reports.

A pair of Maryland State Troopers and units from the local Sheriff's Office responded. According to a criminal complaint, the lead trooper, Brandon Jeffries, first spotted Daniel Blank, seated in the cab of one of the trucks. When Jeffries ordered him to show his hands, Blank responded that he had a learning disability and couldn't understand.

While another trooper covered Blank, Jeffries and the Sheriff's deputies approached the other truck, where Jeffries had seen a figure wiping fog from the window. When they pulled open the back door, they found LaSota and Zajko, both wearing ammo belts. The pair fled to the cab through an inner doorway, then refused to exit the truck. At LaSota's feet was a handgun. Zajko "was crying," Jeffries wrote in the complaint, "saying not to kill her." The pair wouldn't give their names, and after Zajko tucked her hands into her armpits, the police took her to the ground. When they did, an officer found another handgun, loaded with 12 rounds, tucked into her waistband.

All three were arrested for trespassing and obstructing an officer. Zajko was charged with possession of the handgun, LaSota for transporting another gun found in the vehicle. In their new booking photos, compared to their last public images, Zajko now had close-cropped hair, and Blank seemed to have put on weight. But LaSota, with her long sandy-blond hair, looked strikingly similar to how she had five years before, when she was arrested at Westminster Woods.

Ziz LaSota, in a mug shot taken on February 16, 2025.

Photograph: Allegany County Sheriff's Office/AP

On Tuesday, they were ordered held without bail until a hearing in March. The same day, federal prosecutors in Vermont charged Michelle with providing a false address when she purchased two of the guns used in the Border Patrol shootout.

Michelle Zajko.

Photograph: Allegany County Sheriff's Office/AP

Daniel Blank.

Photograph: Allegany County Sheriff's Office/AP

## **XVI.**

In the wake of the January 2025 murders and the ensuing media maelstrom, many in the rationalist community turned, as they always had, to the pseudonymous safety of LessWrong. There they tried to make sense of what happened, worried over how the public would now view them and their causes, and warned each other against speaking to journalists. One poster suggested, tentatively, that whatever the “Zizians” were, or are, might be the product of seeing the world too starkly through rationalist eyes. “I haven't seen others on LW with this sentiment, maybe they've felt afraid to express it (as I do),” the person wrote. “They were alienated altruists who couldn't handle this world and seemingly went a little insane. (given the incorrect beliefs about decision theory). Most people struggle to stay dispassionately rational when faced with something which they regard as very morally bad. It is hard to live in a world one believes to contain atrocities.”

The MIRI, CFAR, EA triumvirate promised not just that you could be the hero of your own story but that your heroism could be deployed in the service of saving humanity itself from certain destruction. Is it so surprising that this promise attracted people who were not prepared to be bit players in group housing dramas and abstract technical papers? That they might come to believe, perhaps in the throes of their own mental health struggles, that saving the world required a different kind of action—by them, specifically, and no one else?

To Rosanne Zajko, whose family had actually suffered atrocities difficult to comprehend, each revelation leading up to Michelle’s arrest, and each day without a resolution, had been like a new wound. She’d wanted to see her niece caught, she said. But whatever the legal system produced would never constitute a complete explanation. “She's a smart person, and she's a logical

person,” she said, “and this kind of behavior does not sound smart or logical to me.”

Logic. Rationality. Intelligence. Somewhere in all these attempts to harness them for our shared humanity, they’d been warped and twisted to destroy it.

One of the last things LaSota seems to have written for public consumption was a comment she left on her own blog in July 2022, one month before she supposedly went overboard in San Francisco Bay. “Statists come threaten me to snitch whatever info I have on their latest missing persons,” she wrote, seemingly referring to deaths by suicide that had already happened among those who’d embraced her ideas. “Did I strike them down in a horrific act of bloody vengeance? Did I drive them to suicide by whistling *komm susser tod*?”—a German phrase that translates as “come, sweet death.” “Maybe they died in a series of experimental brain surgeries that I performed without anesthetic since that’s against my religion, in an improvised medical facility?”

Below it was pasted a stock photo of two people wearing shirts that read, “I can neither confirm nor deny.”

A few hours later, she offered up another thought. “Don’t trust anyone over 30,” she wrote, “with a kill count of 0.”

*Updated February 24, 2025, at 11:00 am EDT: This story was updated to clarify the county to where the Caleb was towed, and adding context to a detail of LaSota's writings.*

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By [Elana Klein](#)

[Business](#)

Feb 18, 2025 7:30 AM

# The Ketamine-Fueled ‘Psychedelic Slumber Parties’ That Get Tech Execs Back on Track

Can stuffed animals, rose petals, and injections of an Elon Musk–approved dissociative drug help Silicon Valley leaders out of a rut? These women say yes.

PHOTO-ILLUSTRATION: JOHANNA GOODMAN; GETTY IMAGES

*“Ketamine is helpful for getting one out of the negative frame of mind,” Elon Musk told an interviewer last year. The unelected man currently [gutting US federal programs](#) isn’t the only one who thinks so. Ketamine, approved decades ago as a surgical anesthetic and long used as a party drug, is the off-label mental-health treatment of the moment. It induces a “trancelike” state of “sensory isolation,” researchers say, and may temporarily boost the brain’s neuroplasticity—which, in theory, makes mental ruts easier to escape. At the same time, ketamine abuse can be deadly, and the drug remains illegal to use without a prescription. (Musk says he has one from “an actual, real doctor.”)*

*WIRED spoke to the cofounders of an organization that offers ketamine-assisted leadership coaching in the [San Francisco Bay Area](#). The two speakers are identified by pseudonyms, which they selected for themselves. Aria Stone has a doctorate in psychology. Shuang Shuang is a spiritual coach. The conversation has been edited for length and clarity.*

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**Shuang Shuang:** We fast-track coaching by really locking it in with the psychedelics. We deliver it to you on a cellular level.

**Aria Stone:** With ketamine, there's a 24- to 48-hour window of optimization, when people's brains are literally more neuroplastic, which is why this is a multiday experience.

**SS:** We call it an off-site, not a retreat, because we're not retreating from anything. We don't do them big—nine or 10 clients—partially due to the importance of confidentiality. Our clientele is primarily CEOs of Fortune 100 companies, CFOs, C-level founders of startups. All of them are in a pressure cooker.

**AS:** Those are the kind of leaders that come—people who have achieved so much in their life, and they're like, “OK, what's the next horizon? Because I've checked pretty much every box.”

**SS:** Here are all the loneliest people. They have to lead and go through so many things by themselves. They can come and see that they're not alone, and let go of the burden of being so protected all the time. They just want to be people.

“There's this huge teddy bear holding a cup of the intramuscular ketamine.”

To screen clients, we ask about their medical and psychological background, whether they currently work with a therapist, and whether they've participated in a group program before. We would slow down around accepting someone with a significant trauma history, someone who is actively suicidal or has a history of schizophrenia or bipolar disorder, the latter of which can be contraindicated with ketamine.

**AS:** And since ketamine can certainly be misused, a history of substance abuse would also give us pause.

**SS:** Our off-site costs \$2,600 for three days, plus a \$350 fee for a medical assessment and ketamine prescription. Meals are included, but transportation and lodging are not.

**AS:** Over the course of a three-day off-site in the Mission, in a beautiful, open space with a tall ceiling, clients have two ketamine experiences. When you walk in, all of these BackJack floor chairs are in a circle. In the center are candles. We put a rose on every seat, and information about what to expect.

**SS:** The vibes are witchy.

The first day is about settling into that radical acceptance, welcoming what's coming to us on ketamine. Our opening ceremony could include movement, dancing, getting into the body, or we might just talk to each other about what's alive for us. We have an intention-setting session.

We check with everybody to see if we have their consent, from every part of their body, to receive medicine. Then our medical doctor and registered nurse distribute the medicine through a shot—it's all intramuscular.

If it's your first time using ketamine and you're nervous about it, thank God! That's the way it should be. But there's also the option to not do ketamine at all: You thought you wanted to do it, and then when push comes to shove, you're on your journey mat and you're just like, "I really don't want to do it."

Ketamine and psychedelics are not a panacea. We know that it's not for everyone. You don't have to push yourself to do this new, innovative, cutting-edge type of therapy. Yes, there is great promise, and the data over and over again makes this area very frothy and enthusiastic. But it's perfectly OK if you're scared and anxious. Just listen to your body and heart.

**AS:** When we transition into the journey, we pull the BackJacks out.

**SS:** It's pretty sweet. They have little nests, little beds. They're all tucked in. They have blankets and pillows, and earplugs if the ambient music playing on the speakers gets too loud. They're wearing eye masks, because ketamine is more of a dissociative medicine—there is this sense of naturally going inward and being quiet. There are a bunch of stuffed animals there that some people take for their journey.

**AS:** There's this huge teddy bear holding a cup of the intramuscular ketamine.

We encourage clients to bring things that are meaningful for them—like a journal, photos of loved ones, loved ones that have passed, rocks. It's just really loving, grounding, and open.

**SS:** It's like an executive-coaching psychedelic slumber party.

On the first day we do a psycholytic dose of ketamine. It's not exactly a psychedelic dose, but it lets you kind of just teeter onto the realms. The next day is a mid-dose. That day is all about medicine and integration, and there's coaching around it.

“One person came in not being able to feel their body. ‘I'm just a head, and this is my meat sack,’ basically is what they said.”

**AS:** Four of us facilitate the off-sites. While people are on their ketamine journey, we're all very attentive. We're in silent communication with each other. Collectively, we're really holding this space, seeing what emerges. I mean, we've seen over 100 ketamine journeys at this point.

**SS:** In a supportive clinical setting, the chance of having a bad trip is severely diminished. Also, I hold the faith that there's no such thing as a bad trip. Rather, there are challenging or uncomfortable journeys.

Let's say someone's trauma comes through. One way that could show up is you are screaming, or a lot of energy is just ripping through your body. You'll get off your mat and you'll just want to run. You'll think you're in a dangerous situation. The first thing we do is make sure you're in a safe hold so that you feel cared for. We'll let you take your eye mask off. Some people need a handhold or would like to be walked around the room. All these things help bring you back to now.

The third day is all integration and coaching: “What does this mean for me? How did I feel? And how do I bring something positive from that journey into my everyday life?”

**AS:** And about a week and a half after, we have a follow-up virtual integration session, focused on the application of what they've learned to their leadership.

**SS:** One person came in not being able to feel their body. "I'm just a head, and this is my meat sack," basically is what they said. After the off-site, they were able to pinpoint, "Actually, I feel like I can feel my chest. I can go to other places inside my body and be connected to it."

**AS:** People are floating away at the end. They're like, "I don't want this to end. Can I integrate this way of being into my life?"

—*As told to Elana Klein*

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[Boone Ashworth](#)

[The Big Story](#)

Feb 13, 2025 6:00 AM

# When Fires Rage, Millions Turn to Watch Duty. Meet the Guy Who Made It

Watch Duty proved indispensable during the recent LA wildfires. John Mills, the app's creator, wants it to be the one place to go for tracking disasters. He just needs all the data to do it.

Left: Wildfire destruction in Pacific Palisades, California, on January 14, 2025. Right: Watch Duty CEO John Mills on his property in Northern California. Photographs: Jamie Lee Taete; Skye Battles

John Clarke Mills was in a Zoom meeting when everything went to hell. It was half past 10 on the morning of January 7, 2025, and Mills—slim, profane, voice charred by years of smoking—was talking up his free [fire-tracking app](#), [Watch Duty](#), to a coworker and one of his nonprofit's investors. Behind him on the wall hung a giant framed photo of trees engulfed in flames.

As CEO, Mills would normally pay close attention to a meeting with money people, but his eyes kept flicking to the notifications in the background. Minutes earlier, a blaze had kicked off at the Temescal Canyon trailhead in Pacific Palisades, California, 400 miles to the south. At 10:32 am, a camera in the University of California San Diego's [AlertCalifornia](#) network caught a view of the billowing plume of smoke. One of Watch Duty's remote workers saw it on camera and snapped an image. At 10:33 am, he posted it to the app with an anodyne caption: "Resources are responding to a reported vegetation fire with smoke visible on the Temescal Canyon camera." Twenty minutes later, the incident had a name. The Palisades fire.

The wind caught the embers; the fire spread. Firefighters responded, moving trucks in to battle the blaze. CalFire—as the state’s Department of Forestry and Fire Protection is known—posted its [first public report](#) of the incident at 11:06 am. Mills updated everyone on the Zoom. This, he said, would be bad.

More blazes ignited. To the east, the [Eaton fire](#) barreled down on the neighborhood of Altadena. The Sunset fire in the hills above Hollywood was small, a blip in comparison to the other two, but a drain on emergency resources nonetheless. For the next week, Los Angeles became a city besieged by conflagration, confusion, and loss. At least 29 people dead. Billions of dollars of property destroyed. Entire neighborhoods—thousands of homes—damaged beyond repair or burned to the ground.

Watch Duty posts details on active fires in 22 states—their [perimeter](#), evacuation zones, air quality ratings—and sends real-time notifications to its users. As the fires spread, 2.5 million new people downloaded the app, roughly doubling its user base. Jimmy Kimmel and Seth Meyers mentioned it on their late-night shows. On social media, people directly in the path of the flames sang Watch Duty’s praises, profoundly grateful for its existence.

Official evacuation orders are typically timely and instructive, but not always. If you live in fire country, you’ll have heard the stories about evacuation orders getting sent to [the wrong people](#) or being sent [too late](#)—alerting people in houses that are [already burning](#). To residents under threat of fire, Watch Duty is often the one clear signal that cuts through a wall of crosstalk and static.

The Palisades Fire of January 2025.

Photograph: Jamie Lee Taete

Mills, who’s 42, saw it all happen from his desk in Sonoma County, California. “This is not the first time I’ve watched wind-driven fires tear through a community,” he tells me. He’s been much closer to fire than this. That’s what spurred him to build his app in the first place.

It's Monday, January 20, and I'm squished next to Mills in his off-road utility vehicle as he barrels us straight up a steep canyon. He is wearing a tweed jacket and his favorite accessory: a forest green German alpine hat with a long turkey feather pinned to the brim. We're rocketing across the hills of his sprawling, 170-acre woodland property in a Polaris Ranger—basically a souped-up electric golf cart. I'm holding on for dear life as we blast across rutted dirt trails, bounce over boulders, and splash through a creek dotted with moss-colored rocks.

We careen to a stop next to a large geodesic dome on the highest hilltop, surrounded by oaks, manzanita, and towering redwoods. In the distance I can spot several wineries, just past the edges of Mills' property.

This verdant paradise is a world away from Mills' hometown of Bronxville, New York, a few miles northeast of New York City. Growing up he was a boy scout who then got into coding, which led to some hacker shenanigans. In his early twenties, he moved to San Francisco and worked as a software engineer in Silicon Valley. He cofounded a restaurant management app called [Zenput](#), which he later sold. He started to dream about leaving the city.

In fall 2019, he was scouting properties when he found this two-and-a-half-story hay bale wooden home on the outskirts of California wine country. He immediately bought the place and named the ranch Sherwood, after the ancient English woodlands made famous by the legends of Robin Hood.

Turns out, Mills is really into the Robin Hood thing. Sherwood Forestry Service is also the name of the 501c3 nonprofit that runs Watch Duty. Then there's that green hat with the feather that he loves to wear, though he insists it is not a deliberate nod to the folk hero.

"Everyone loves Robin Hood," Mills says. "A productive misfit. He's not a superhero. He's just a man. That's why I like him so much."

Mills took Sherwood off-grid, complementing solar panels and diesel backup generators with Starlink Wi-Fi. He built small cabins and round yurts, and invited guests to stay in them for free. Workers are building a big barn where he hopes to host events. Parked in the driveway is a retrofitted

school bus that Mills takes to Burning Man (he's been 16 times); he personally reworked the interior to resemble a Victorian living room.

Mills has long had a vision for this peaceful social paradise. But he almost lost it—before he'd really had a chance to finalize his plans.

Barely a month after he moved into Sherwood, a fire broke out on the ranch one hill over. It was a small fire, but Mills could see the flames roaring up into the sky in a rolling, black column. A helicopter flew in and tried to signal for Mills to evacuate. An air tanker sprayed hundreds of gallons of bright red ammonium phosphates and sulfates. The fire-retardant cocktail splattered across his neighbor's barn, drenching the roof in red, and helped get the blaze under control. Mills was aghast.

"First, I'm just angry," he says. "Because I live here and I'm living through fire, and there's a helicopter over my house, telling me to leave, and I'm like, oh, *that's* how I find out?" Then it dawned on him: There was no alternative. "I'm like, oh shit, this is just the best they got."

Then, in September 2020, another fire struck. The [Walbridge fire](#) devoured [55,000 acres and 449 homes and structures](#) and forced Mills to evacuate. He crashed with friends and spent a week frantically awaiting concrete information about where the fire was headed. Updates released by officials came out at an agonizingly slow pace.

After these fires, Mills went on the information warpath. He joined the National Fire Protection Association's [Firewise](#) program and his local Fire Safe group. He rode along with local firefighters and arranged meetings with Sonoma County's head of transportation. He joined Pano AI, a startup focused on making wildfire detection cameras. (He is no longer involved with the company but kept his stake in it.) He got to know his neighbors so they could communicate during a crisis and lend each other a hand.

The most helpful resource he found was in local Facebook groups—posts from people living out in the woods who shared and corroborated what they had gleaned from listening to emergency scanners. "I found solace in these human beings, because the government wasn't doing it," Mills says.

That gave him an idea. Perhaps there was a way to amplify what the people on Facebook were doing—to give these vigilant stewards a megaphone.

Scanner enthusiasts have been around since the dawn of radio. Anyone can buy a device that picks up the signals emergency responders use to communicate. Or they can open a web browser and find a radio stream on websites like [Broadcastify](#) or apps like [PulsePoint](#). Fewer have the patience to figure out the language of that world: the codes and lingo and shorthand that first responders use in their chatter. Those are the ones who become scanner devotees, either for the thrill of it or because they live in places that burn.

Mills knew that to make his idea work, he needed the scanner heads on board. He reached out to the people he had found on Facebook during his fire. At least one of them turned him down. In explaining why, they told Mills that he in part seemed like a typical Silicon Valley tech bro with a shiny new app idea. He didn't come across as someone who truly understood life in fire country.

“It took some time to convince everyone,” Mills says. “I’m a weirdo and a misfit just like them. I didn’t come up through some Stanford graduate program. I was a stoner and a skater and a hacker. I understand the fringes of the world.”

Finally, he convinced Cole Euker, a [fire photographer](#) in Northern California, to join the platform. He would also eventually reach out to others who already had large social media followings, including [Michael Silvester](#), a scanner enthusiast in New Zealand who was well known on Twitter as [@CAFireScanner](#).

With just a few reporters on board, Mills set out to build the app. He partnered with David Merritt, a friend from the Zenput days who is now Watch Duty’s CTO. Mills says he wrote most of the code for Watch Duty himself in an 80-day frenzy. Then he submitted Watch Duty to the Apple and Google app stores. The app officially launched in August 2021.

A week later, Mills was eating dinner in a local restaurant. His phone emitted a trill: It was a Watch Duty notification. A fire had been spotted

nearby. Across the restaurant, a chorus of pings rang out from other diners' phones.

"I was like, holy crap," Mills says. "What did we do?"

Once Watch Duty was out in the world, people in the broader scanner community began to notice that it delivered on its promise. "It was just a matter of show and tell," Mills says. "Like, 'OK cool John, I believe you. Maybe you're not a dickhead.'"

As word of Watch Duty spread, more volunteers joined Mills' team. The service quickly expanded beyond Sonoma County. When someone from another city or state joined the group, the app would start covering that place, too.

Maureen Bonessa, aka MoBones, joined Watch Duty as a volunteer in 2021. She runs a Facebook group called [Norcal FireWeather](#), where she posts photos from the state's northern reaches—the most wildfire-prone region. "We were all in our own separate places on the internet, reporting on fires, and now we're all in the same place," Bonessa says of Watch Duty. "Facebook's become a mess, and it's frustrating. But this is so clean, it's pure information. It's not bloated with garbage and ads and all that."

Jessi Clark-White is a Watch Duty volunteer who lives in Oregon. "A lot of us got into this because we were personally threatened by fires," she says. "We're directly relating this to our families and people in our communities."

Mills found these people, scattered across Facebook groups and Twitter threads, and saw a way to bring them together. Once he did, he tried to stay out of their way. "I'm just the architect of these merry men," Mills told me, but clarified he doesn't mean to use that term in a gendered way. By the middle of 2022, Watch Duty had expanded to every county in California. It felt like a huge reach at the time, but the app kept growing. In 2023, Watch Duty secured enough funding to start paying three of its reporters and expand to a few other states. In 2024, Watch Duty covered massive fires in Texas and launched the app in Hawaii. The app grew to cover 22 states, have 15 paid staff members, and release a paid tier that offered additional,

noncritical features like custom map tools and fire-fighting plane tracking for up to \$99 per year.

On Slack, the volunteers set up discrete channels for individual fires and divvied up the responsibility of covering them. They monitored agency websites, wildfire cameras, and scanner radio services like [Broadcastify](#), which lets users listen to scanner radio streams from across the world online. The Watch Duty reporters translated that info into updates on the app.

The app also expanded its technical team. Gabe Schine, a volunteer firefighter and a software engineer, left a 15-year career at Google to join Watch Duty. He says working on the app felt like a moral imperative. “I would have been really disappointed in myself had I stayed at Google because the pay was better,” Schine says. “If I can pull this off, I just need to be a part of this. It's too important. It's too good.”

Mills wanted Watch Duty to start translating even more data into alerts—and for that, he needed access. He struck up partnerships with the [AlertWest and Alert California](#) wildfire camera networks. By 2023, Watch Duty started deploying portable antenna units in the woods that it calls [Echo Radios](#). The radios listen for “tone-outs,” the [unique sequence](#) of beeps included in a transmission that scanner operators use to indicate the person or station the message was meant for. It basically works like a phone number for emergency comms—a phone number Watch Duty figured out how to trace and then use to determine which units were being sent to which incident. It’s not illegal, but people outside the fire service don’t typically decode these tones, and it can make some fire officials nervous.

Mills’ dining room is decorated with a painting of the local plants and animals made by an artist who did a residency at Sherwood.

Photograph: Skye Battles

Watch Duty has also borrowed information from another company. It was only last summer that Mills and his colleagues added evacuation zones as a layer to Watch Duty’s maps. The data is in part pulled from [Genasys Protect](#), an evacuation alert software system that posts information from



local officials. Watch Duty never asked permission from Genasys to use its data. (Though Watch Duty's maps credit Genasys Protect.)

These Robin Hood hacker machinations have drawn the ire of fire officials and rivals in the for-profit industry alike. But Mills just wants to “poke the fuckin’ bear.”

“You don't know what's gonna happen,” Mills says about using that data. In his view, he’s trying to “do the right thing at all costs, no matter what.” Or, as he wrote in Watch Duty’s [2023 year-end report](#), “We will not let up until there is a single source of truth for all wildfire information.”

It didn’t take long for that goal to come to fruition.

The Palisades Fire revealed its devastating potential almost immediately, even with just a glance at the live cameras. Most pyrocumulus smoke clouds billow straight up into the sky, sometimes forming great, ominous mushroom clouds that can grow so big they [create their own weather](#). This was different. The smoke from this fire, caught by the roaring Santa Ana winds, churned sideways, a lateral shifting cloud that swept along close to the ground. That’s when it became clear how fast things were moving.

Destruction from the Palisades fire.

Photograph: Jamie Lee Taete

When the fires multiplied and spread, people ran and homes burned. Cars and wheelchairs were left abandoned in the street as evacuees fled on foot. In the chaos, finding critical information about where the fire was and where it might go next became cluttered. Emergency systems fell behind. Evacuation warnings [went out to the wrong places](#), came [too late](#) or [not at all](#). “I think it's fair to say that there certainly were a lot of real bonehead errors that were made,” says Rob McCarthy, an Altadena resident who evacuated to escape the Eaton fire. “It was a clusterfuck.”

Watch Duty, McCarthy says, was the only helpful resource he could find while he waited to see if his house would burn. “I'm so grateful for that app



because it's so easy to use,” McCarthy says. “I just got a lot more clarity about what was going on.”

Before the fire even started, Watch Duty was already on full alert. Mills says it was “[all hands on deck](#).” As the flames spread, engineers fiddled with the servers behind the scenes to ensure the app could handle all the new users. “There were 48 hours where we were very busy on the engineering team,” Schine says.

Community support in Los Angeles, January 2025.

Photograph: Jamie Lee Taete

Some reporters, spread all across the world, worked 18-plus hour days. Cole Euker, Watch Duty’s first official reporter, posted the first update on the Palisades fire, then continued to upload information about the blaze for nearly 24 hours straight. Sekhar Padmanabhan, a paid employee who also covers fires on X as [@barkflight](#), lives in LA, near the edge of the evacuation zone mandated for the Sunset fire on January 9. While many of his neighbors evacuated, he stayed put with his two cats, his scanner rolling.

The fire crept toward him, and he continued to post updates to Watch Duty. His home survived, but he acknowledges that he should have left. I ask Padmanabhan why he took the risk and stayed after spending years advising other people to evacuate. He doesn't even hesitate to answer. “We're all people who know what it's like when you don't have information,” Padmanabhan says. “Other people depend on it, so it would be my desire to help them out and not have them be in the dark.”

Relying on volunteers to provide life-saving information might seem risky. Think back to the days when Reddit users [led a manhunt](#) for the wrong person after the Boston Marathon bombing, or when the [Citizen app](#) issued a bounty during the 2021 wildfires in Southern California enticing users to [locate a homeless man](#) it had accused of setting a fire. Watch Duty has fielded concerns that it’s making similar scenarios possible.

“Watch Duty prides themselves on being expedient, but we have the obligation to be accurate,” says Nick Schuler, CalFire’s deputy director of

communications and emergency incident awareness. He says that in Watch Duty's effort to be fast, the team runs the risk of getting something wrong. "It's not as simple as one app is the answer to everything," Schuler says. "We have a lot more complex ways that we're addressing people."

Schuler notes that CalFire has made great efforts to get accurate information out to the public during a fire. The agency released [more than 300 public updates](#) over the course of the Palisades fire. The CalFire website has a [3D map](#) that shows fire perimeters and evacuation zones, similar to what Watch Duty offers. But while these features are all available on CalFire's website, the interface is challenging to navigate. Schuler agrees that Watch Duty is a well-put-together resource, but he cautions users against relying on a single source of fire updates.

Brian Fennessy, the fire chief of the Orange County Fire Authority, is one safety official more supportive of Watch Duty's efforts. "I don't really know any firefighters who *don't* have Watch Duty on their phones," Fennessy says. "I mean, it literally has become *the* app, period."

Fennessy's department supported efforts to fight the LA fires in January. He also has a personal connection. Fennessy grew up in Altadena, one of the neighborhoods annihilated by the Eaton fire. His childhood home burned. So did nearly all of the schools he had gone to as a kid.

Technology that firefighters use on the ground "has to be simple," he says. "You really need to be able to just push the thing and there it is. Anything more complicated than that, firefighters won't use it."

Marty Walters, a volunteer who started monitoring wildfire scanners for Watch Duty in California's Plumas and other surrounding rural counties in 2023, is proud of the work everyone on the team did during the LA fires. But she does wonder about how a service that is mostly operated by volunteers can scale. "You can expect certain things from volunteers, but you need to define what that is and then also support people so they don't feel like they're just left hanging in the wind," Walters says. "That's part of that whole weird Silicon Valley pirate mentality, which is, 'Oh well, we'll figure it out.'"

Lately Mills has been on something of a press tour. He and Watch Duty were roundly praised during and after the fires. Kelly Clarkson invited him [onto her show](#). He even received an [Unsung Heroes award](#) from actor Steve Guttenberg. And he's thinking about the future—expanding the app to cover floods and hurricanes, building in features that help people recover and rebuild, eventually becoming a one-stop shop for information during any disaster.

When he goes on TV to talk about his work, Mills is reserved. He removes his hat. He talks about the fires and what Watch Duty has done with a solemnity that almost—almost—belies that *I-fucking-told-you-so* look on his face.

Standing in his kitchen, Mills whips out his phone, adjusts his brown-tinted glasses, and pulls up a [picture](#). It's of the Los Angeles Emergency Operations Center, the city's response coordination hub during the Palisades and Eaton fires. There's a bank of screens on the wall, and Watch Duty is splayed across the largest screen, like the map of a battlefield in a war room.

“What do you notice?” Mills asks.

It's a question he has also asked the Hilton Foundation, a philanthropy group who later agreed to invest \$100,000 into Watch Duty. Right now, he's just testing me.

I acknowledge the picture shows Watch Duty on the screen. He's not satisfied. He wants me to *think*, he says. What does this *mean*? I shrug.

“The system has failed us,” Mills says, jabbing his finger at the screen.

“This is a shining example of the utter, abject failure of government.” If official emergency services are relying on his free app during a disaster, he argues, rather than their own tax-payer funded systems, then something has gone terribly wrong.

“Hundreds of millions of dollars of just absolute fucking waste,” Mills says. He leans back, folding his arms. “And I'm like, yeah dude, this is much worse than you think. You should all fear for your lives.”

Later, Mills goes to his office and clicks into Zoom for a Watch Duty all-hands meeting. He doesn't talk much, just fidgets with a small stack of challenge coins, tokens that are part of a long-running culture where first responders trade coins to show mutual respect. Onscreen, another employee encourages the staff to take care of themselves after the LA fire. Take time off if they need a mental health break.

But the Watch Duty reporters visible on the Zoom call and having spirited conversations in the chat seem anything but burned out. They know what they have done for LA—how much fear and anxiety they've been able to alleviate. And they know how much more work lies ahead of them.

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By [Andy Greenberg](#)

[The Big Story](#)

Feb 10, 2025 6:00 AM

# The Untold Story of a Crypto Crimefighter's Descent Into Nigerian Prison

As a US federal agent, Tigran Gambaryan pioneered modern crypto investigations. Then at Binance, he got trapped between the world's biggest crypto exchange and a government determined to make it pay.

Photographs: Piera Moore

At 8 am on March 23 of 2024, [Tigran Gambaryan](#) woke up on a couch in Abuja, [Nigeria](#), where he'd been dozing since the predawn call to prayer. The house around him, which often buzzed with the nearby sound of generators, was eerily quiet. In that silence, the harsh reality of Gambaryan's situation flooded back into his mind the way it had every morning for nearly a month: That he and his colleague at the [cryptocurrency](#) firm [Binance](#), Nadeem Anjarwalla, were being held hostage in a Nigerian government-owned compound—detained without access to their own passports under military guard in a building circled by barbed-wire walls.

Gambaryan got up from the couch. The 39-year-old Armenian-American wore a white T-shirt over his compact, muscular build, his right arm covered with an Eastern Orthodox tattoo. His usually shaved head and trimmed black beard were now stubbled and scraggly from a month of growth. Gambaryan found the compound's cook, and asked if she would buy him some cigarettes. Then he walked out into the house's internal courtyard, and began to restlessly pace and make phone calls to his lawyers

and other contacts at [Binance](#)—the world’s largest cryptocurrency exchange—restarting his daily efforts to “unfuck the situation,” as he put it.

Just the day before, the pair of Binance staffers and their crypto giant employer were told they were about to be charged with tax evasion. The two men seemed to be wedged into the middle of a bureaucratic conflict between an unaccountable foreign government and one of the most controversial players in the crypto economy. Now they were not only being confined against their will, with no end in sight, but also charged as criminals.

Gambaryan spoke on the phone for more than two hours as the sun rose in the sky and began to bake the courtyard. When he finally hung up and went back inside, he still couldn’t see any sign of Anjarwalla. Before dawn that morning, Anjarwalla had gone to the local mosque to pray, accompanied by minders who kept him under close watch. When Anjarwalla returned to the house, he had told Gambaryan he was going back upstairs to sleep.

Several hours had passed since then, so Gambaryan went up to their second-floor bedroom to check on his colleague. He nudged the door open to find Anjarwalla seemingly asleep, his foot sticking out from under the sheets. Gambaryan called out to him from the doorway but got no response. For a moment, he worried that Anjarwalla might be having another panic attack—the young British-Kenyan Binance exec had been sleeping in Gambaryan’s bed for days, too anxious to spend nights alone.

Gambaryan walked across the dark room—he had heard the house’s government caretakers were behind on the electricity bills and short on diesel for the generators, so all-day blackouts were common—and put his hand on the blanket. It sank, strangely, as if there was no actual body beneath it.

Gambaryan pulled the sheets away. He found, underneath, a T-shirt stuffed with a pillow. He looked down to the foot that had been protruding from the blanket and now saw that it was, in fact, a sock with a water bottle inside it.

Gambaryan didn’t call out for Anjarwalla again or search the house. He knew already that his Binance colleague and fellow prisoner had escaped.

He was immediately aware, too, that his own situation was about to become far worse. He didn't yet know just how much worse—that he would be thrown in a Nigerian jail, charged with money laundering crimes that carried a 20 year prison sentence, and denied medical care even as his health deteriorated to the point of near death, all while being used as a pawn in a multibillion-dollar crypto extortion scheme.

For that moment, he just sat on the bed in silence, in the dark, 6,000 miles from home, and considered the fact that he was now utterly alone.

Challenge coins from Gambaryan's time at IRS Criminal Investigation and Binance, as well as his handcuffs and a round from his federally issued firearm.

Photograph: Piera Moore

Tigran Gambaryan's spiraling Nigerian nightmare stemmed, at least in part, from a clash that's been a decade and a half in the making. Since the mysterious Satoshi Nakamoto revealed Bitcoin to the world in 2009, cryptocurrency has promised a kind of libertarian holy grail: digital money that can't be controlled by any government, defying inflation and crossing borders with impunity, as if it exists in an entirely different dimension. Yet the reality today is that crypto has become a multitrillion-dollar industry, run to a large degree by companies with flashy offices and well-paid executives—assets and people that exist very much in *this* dimension, in countries with laws and law enforcement agencies capable of applying pressure to crypto companies and their staff just as they can with any other real-world industry.

Before Gambaryan became one of the world's most prominent victims of that collision between anarchic financial technology and global law enforcement, he embodied it in a very different sense: as one of world's most effective and innovative crypto-focused cops. For a decade prior to going to work for Binance in 2021, Gambaryan served as a special agent for IRS Criminal Investigation, the law enforcement division of the US tax authority. At IRS-CI, Gambaryan pioneered the technique of deciphering Bitcoin's blockchain to trace cryptocurrency and identify suspects. He'd used that follow-the-money playbook to take down one cybercriminal

conspiracy after another and entirely flip the [myth of Bitcoin's anonymity](#) on its head.

Starting in 2014, following the FBI seizure of the Silk Road dark-web drug market, it was Gambaryan who [traced](#) the bitcoins that identified two corrupt federal agents who had taken over \$1 million from the drug market as they investigated it—the first time blockchain evidence was ever included in a criminal complaint. Over the next several years, Gambaryan helped track down half a billion dollars' worth of bitcoins stolen from the first crypto exchange, Mt. Gox, eventually ID-ing a group of [Russian hackers behind the heist](#).

In 2017, Gambaryan worked with the blockchain analysis startup Chainalysis to create a secret Bitcoin tracing method that located—and [allowed](#) the FBI to seize—the server that hosted [AlphaBay](#), a dark-web crime market that was estimated to be 10 times the size of the Silk Road. Just months later, Gambaryan played a key role in the [takedown](#) of the crypto-funded child sexual abuse video network, Welcome to Video, the biggest-ever market of its kind, along with the arrest of 337 of the site's users worldwide and the rescue of 23 children.

Finally, in 2020, Gambaryan and another IRS-CI agent traced and [seized nearly 70,000 bitcoins](#) that had been stolen from the Silk Road years earlier by a hacker. That sum today is worth \$7 billion, making it the biggest criminal seizure of currency of any kind to flow into the US Treasury.

“The cases he was involved in are a who's who of the biggest crypto cases of that time,” says Will Frentzen, a former US prosecutor who at times worked closely with Gambaryan and prosecuted the crimes Gambaryan uncovered. “He was innovative in investigating things in ways that very few people in the country had figured out, and incredibly selfless in terms of who got credit.” In the fight against cryptocurrency-powered crime, Frentzen says, “I don't think anyone had a bigger impact.”

After that epic run, Gambaryan [took a private sector job](#) that shocked many of his former government colleagues. He became head of the investigations team at Binance, a behemoth that oversaw the daily trade of hundreds of



billions of dollars worth of crypto assets—and had a reputation for doing so with remarkably little concern for when its users were breaking the law.

When Gambaryan joined Binance in the fall of 2021, the company was already under investigation by the US Justice Department—a probe that would [eventually determine](#) that it had enabled billions of dollars’ worth of transactions that violated anti-money-laundering laws and evaded international sanctions on Iran, Cuba, Syria, and Russian-occupied areas of Ukraine. The company had directly processed more than \$100 million in crypto from the Russian dark-web crime market Hydra, too, and had even in some cases cashed out funds from the sale of child sexual abuse materials and the financing of designated terrorist groups, the DOJ would later allege.

Some of Gambaryan’s old law enforcement peers quietly grumbled about him selling out—or worse, joining the enemy. But Gambaryan insists he was actually taking on the most important role of his career. As part of Binance’s efforts to belatedly clean up its act after years of quick and dirty growth, Gambaryan built a new team of investigators within the company—recruiting many of the best agents he’d worked with at IRS-CI and other agencies around the world—and helped open up Binance’s cooperation with law enforcement like never before.

By digging through data from a volume of transactions bigger than that of the New York Stock Exchange, the London Stock Exchange, and the Tokyo Stock Exchange combined, Gambaryan says his team enabled busts of child sexual abusers, terrorists, and organized crime members on an immense, global scale. “There were literally tens of thousands of cases around the world that we assisted with. I probably had a bigger impact at Binance than I did in law enforcement,” Gambaryan told me at one point. “I’m completely proud of the work we did, and I’ll debate anyone on the merits of me joining Binance any day.”

Still, that new, more law-abiding Binance that Gambaryan was helping to create couldn’t erase the company’s past as a rogue exchange—or spare it from the consequences of those crimes. In November 2023, US attorney general Merrick Garland announced at a press conference that Binance had agreed to [pay \\$4.3 billion](#) in fines and forfeitures, one of the biggest corporate penalties in the history of US criminal justice. The company’s

founder and CEO, Changpeng Zhao, was personally fined \$150 million and later [sentenced](#) to four months in prison.

The US wasn't the only country with Binance grievances. By early 2024, Nigeria, too, was casting blame on the company, not only for the past compliance violations it had confessed to in its US plea agreement, but also for allegedly contributing to the devaluation of Nigeria's currency, the naira. Over late 2023 and early 2024, as the naira lost close to 70 percent of its value, Nigerians had rushed to trade their local currency for crypto, in particular blockchain-based "stablecoins" pegged to the US dollar.

The real cause of that disastrous sell-off was the decision by the administration of the new Nigerian president, Bola Tinubu, to relax restrictions on the exchange rate between the naira and the dollar, combined with the revelation that the Central Bank of Nigeria held a surprisingly small reserve of foreign currency, says Amaka Anku, an analyst and Africa head at business advisory Eurasia Group. Once the naira began to tumble, though, cryptocurrency's role as an unregulated means to sell off naira created more downward pressure, she says. "You can't say Binance or any crypto exchange caused this devaluation," says Anku. "But they did exacerbate it."

For years, cryptocurrency's advocates had imagined a day when Satoshi's invention would offer a safe haven for citizens of a country experiencing an inflation crisis. Now that day had come, and the government of the nation with the biggest economy on the African continent was furious. In December 2023, a committee in Nigeria's National Assembly called upon Binance executives to attend a hearing in its capital, Abuja, to explain how it would right its alleged wrongs. And when Binance assembled its Nigerian delegation, it naturally tapped its star investigator and former federal agent, the symbol of its commitment to partnership with law enforcement and governments around the world: Tigran Gambaryan.

Gambaryan with awards and memorabilia from his career at IRS-CI and Binance.

Photograph: Piera Moore

Before the coercion and the hostage-taking, there was the demand for a bribe.

Gambaryan was a few days into his trip to Abuja in January of last year, and it had been going well. As a kind of olive branch, he'd met with investigators at the Economic and Financial Crimes Commission, or EFCC—essentially the Nigerian counterpart to Gambaryan's old shop at the IRS, responsible for everything from hunting scammers to investigating government corruption—and discussed training its staff in cryptocurrency investigations. Then he joined a larger meeting with Binance execs and members of the Nigerian House of Representatives, a roundtable discussion of business people and government officials in suits assuring one another in friendly tones that they would work out their differences.

When Gambaryan first arrived in Nigeria, he'd been picked up at the airport by Olalekan Ogunjobi, a detective at the EFCC who had read about Gambaryan's career and professed his admiration for Gambaryan's legendary record as a federal agent. Almost every evening of the trip, Ogunjobi had met up with him for dinner at his hotel, the palm-tree-lined Transcorp Hilton Abuja. Gambaryan shared advice with Ogunjobi about investigative work in the world of crypto crime, how to run a case, how to set up a task force. They swapped war stories, and when Gambaryan gave Ogunjobi a copy of [\*Tracers in the Dark\*](#)—a book I wrote about cryptocurrency tracing that featured Gambaryan as one of its central subjects—Ogunjobi asked him to sign it.

Then, one evening when Gambaryan was at dinner with Ogunjobi and a group of Binance colleagues, a Binance staffer at the table got a phone call from one of the company's lawyers. Beneath the pleasantries, the lawyers told Gambaryan, the meeting with the Nigerian officials hadn't been as friendly as it seemed. The officials now were asking for a payment of \$150 million to make Binance's issues in the country go away—to be paid in cryptocurrency, directly into officials' crypto wallets—and suggesting that they wouldn't let the group leave the country until the money was received.

Gambaryan was so disturbed, he says, that he didn't even offer an explanation to Ogunjobi or say goodbye as he gathered up Binance's staffers and hurried out of the restaurant to reassemble in a Transcorp

Hilton conference room to discuss their dilemma. Cough up what appeared to be a straightforward bribe, and they'd be violating a US law known as the US Foreign Corrupt Practices Act. Refuse, and they might be detained indefinitely. The team decided on a third option: Get the hell out of Nigeria immediately. They spent that night in the conference room strategizing and planning how to get all the Binance staffers on planes as soon as possible, changing their flights to early the following morning.

The Binance team gathered that morning on the second floor of the hotel with their suitcases packed, avoiding the lobby for fear that Nigerian officials might be staking them out to prevent them from leaving. They took Ubers to the airport, rushed nervously through security, and boarded flights home—all without incident, feeling collectively like they'd dodged a bullet.

Not long after he'd gotten home to the suburbs of Atlanta, Gambaryan received a call from Ogunjobi. Gambaryan says the Nigerian expressed his dismay that the Binance team had been pressured for a bribe, and said he was scandalized by his countrymen's behavior. He suggested that Gambaryan report the demand to Nigerian authorities so they could pursue an anti-corruption investigation.

Eventually Ogunjobi set up a call between Gambaryan and Ahmad Sa'ad Abubakar, an official at the EFCC who was described to Gambaryan as the right-hand man of Nigeria's national security adviser, Nuhu Ribadu. Ogunjobi had told Gambaryan that Ribadu had made his name as a corruption fighter—he'd even given a [TEDx talk](#) about it. Now Ribadu was inviting Gambaryan to come meet with him to resolve Binance's problems in Nigeria and get to the bottom of the bribery attempt. In person.

Gambaryan told his Binance colleagues about the call, which sounded like it might offer a way out of the company's Nigerian conflict. Perhaps, Binance's executives and Gambaryan began to think, Gambaryan could use this invitation to go back to Nigeria and untangle the company's increasingly problematic relationship with the country's government. As fraught as the idea sounded—they had only just fled the same country weeks earlier—Gambaryan believed he'd been offered a friendly meeting with a powerful official, and given the personal assurance of his friend Ogunjobi. Binance's staff in the region told Gambaryan that they'd done

their own checks and heard that the offer of finding a resolution seemed legitimate.

Gambaryan had told his wife, Yuki, about the bribe attempt and the invitation to return to Nigeria. To her, the idea sounded glaringly dangerous. She repeatedly asked Gambaryan not to go.

Gambaryan admits now that he was perhaps still operating with an image of himself as a federal agent of the US government—with both the protections and sense of responsibility that carried. “I guess it was part of what was left over from before: When duty calls, you do it,” he says. “I was asked to go.”

So, in what he now considers one of the most ill-advised decisions of his life, Gambaryan packed his suitcase, kissed Yuki and their two small children goodbye, and left in the early morning hours of February 25 to catch a flight back to Abuja.

The second trip began with another airport pickup from Ogunjobi, who repeated all of his reassurances on their drive to the Transcorp Hilton and at dinner at the hotel that evening. This time, rather than a full coterie of Binance staff, Gambaryan was accompanied only by Nadeem Anjarwalla, the company’s regional manager for East Africa, a fresh-faced British-Kenyan Stanford grad with a baby son back in Nairobi.

When Gambaryan and Anjarwalla walked into their meeting with Nigerian officials the next day, however, they were surprised to see that Abubakar was accompanied by a full table of staff from the EFCC and Nigeria's Central Bank. Very quickly, it became clear that the meeting was not about Nigerian corruption. After a few innocuous questions about Binance’s cooperation with Nigerian law enforcement, Abubakar quickly turned the conversation to the EFCC’s request for certain trading data about Binance’s Nigerian users. Binance had responded with only the data for the last year, Abubakar said—not what he’d asked for. Gambaryan, feeling ambushed, said it must have been an oversight due to a last-minute request, and he’d get him everything he requested. Abubakar looked visibly rankled, but the meeting went ahead with the usual promises of cooperation and ended with friendly swapping of business cards.

Tigran Gambaryan (left) and Nadeem Anjarwalla in the office of the National Security Adviser in Abuja, just before they were detained.

Photograph: Courtesy of Tigran Gambaryan

Gambaryan and Anjarwalla were left in a hallway to await their next appointment. After a while, Anjarwalla got up to use the bathroom. When he returned, he said he'd overheard some of the officials they'd just met in a nearby conference room sounding angry, as Gambaryan remembers it.

After close to two hours of waiting, Ogunjobi returned to lead them into a different conference room. The officials inside this one had a noticeably somber air, Gambaryan remembers, as everyone sat silently waiting for someone—Gambaryan didn't know whom—to arrive. He noticed that Ogunjobi had a look of blank shock on his face and wouldn't meet Gambaryan's eye. "What the fuck is going on?" he thought to himself.

Then a man named Hamma Adama Bello, a bearded EFCC official in a gray suit who looked to be in his mid-forties, walked into the room. Rather than offer any greeting or ask questions, he put a folder down on the table and immediately launched into a diatribe, as Gambaryan remembers it, about how Binance was "destroying our economy" and financing terrorism.

Then he explained what was going to happen: Gambaryan and Anjarwalla would be taken to their hotels to pack their things and moved to a different location, where they would stay until Binance handed over *all* the data it had on every Nigerian who had ever used the exchange.

Gambaryan felt his adrenaline spike. He protested that he didn't have the authority or even the ability to give the Nigerians so much data—that he had, in fact, come to Nigeria to report a bribery allegation to Bello's agency.

Bello seemed surprised, as if it were his first time hearing about any such bribe, then immediately disregarded it. The meeting was over. Gambaryan managed to quickly type out a text message on his phone to his boss, Binance's chief compliance officer Noah Perlman, telling him they were about to be detained. Then the officials took Gambaryan's and Anjarwalla's phones.

The two men were led outside to a black Land Cruiser with tinted windows. The SUV took them to the Transcorp Hilton, where they were led back to their rooms—Anjarwalla by Bello and another official, Gambaryan by Ogunjobi. They were told to pack their belongings.

“You know this is fucked up, right?” Gambaryan remembers saying to Ogunjobi, who he says could barely meet his gaze.

“I know. I know,” Ogunjobi replied, according to Gambaryan.

Then the Land Cruiser drove them to a large, two-story house in its own walled compound, with marble floors, enough bedrooms for the two Binance staffers and several EFCC officials, and a private cook. Gambaryan would later learn that it was officially the government-designated house for Ribadu, the national security adviser, but that he had chosen to live in his own home and leave this property for official use—in this case, as a holding pen for Gambaryan and Anjarwalla.

That night, there were no more demands from Bello. Gambaryan and Anjarwalla were served a meal of Nigerian stew made by the house’s cook and told to go to bed. Gambaryan lay awake, his mind racing, near panic from the feeling of being incommunicado without his phone, unable even to tell his family where he was.

Finally at 2 am, he fell asleep, then woke up a few hours later just before the muezzin’s call to prayer. Too anxious to stay in bed, he walked out into the internal courtyard of the house and chain-smoked cigarettes as he considered the clusterfuck that he now found himself in: He was being held hostage and implicated in the same financial crimes he’d spent his career fighting.

But even more than that irony, he was overwhelmed with the feeling of total uncertainty. “What the fuck is going to happen to me? What is Yuki going to go through?” he asked himself, thinking of his wife, frantic thoughts cycling. “How long are we going to be here?”

Gambaryan stood in the courtyard, thinking and smoking, until the sun came up.

A view of barbed-wire walls from the Abuja guesthouse where Gambaryan and Anjarwalla were held for nearly a month.

Photograph: Courtesy of Tigran Gambaryan

Then came the interrogation.

After the cook served breakfast—which Gambaryan was too stressed to eat—Bello sat down with the detainees and told them what he’d need for their release: that Binance turn over all data on Nigerians and that it disable peer-to-peer trading for Nigerian users, a feature of Binance’s platform that allowed traders to advertise crypto for sale at an exchange rate the traders partially controlled, which the Nigerian officials felt was contributing to the naira’s freefall.

A third demand went unspoken in the room: that Binance pay a massive sum. As the Nigerians held Gambaryan and Anjarwalla, their contacts were also back-channeling with Binance executives, and the company was hearing requests that it pay billions of dollars, according to people familiar with those conversations. At one point, government officials even publicly told the BBC the fine would be at least \$10 billion, more than twice the record settlement Binance had paid the US. (According to several people involved in those negotiations, Binance at some points did offer a “down payment” based on what it agreed was an estimate of its tax liability in Nigeria. But the offers were never accepted. Meanwhile, a day after Gambaryan and Anjarwalla were detained, the US embassy received a bizarre letter from the EFCC, stating that Gambaryan was being held “purely for the purpose of constructive dialogue” and was “participating willingly in the aforementioned strategic talks.”)

Gambaryan repeated to Bello that he had no real role in Binance’s business decisions and couldn’t help him with any of his demands. Bello, he says, responded with long, loud speeches about the harm Binance had allegedly done and what Nigeria was owed. At times, Gambaryan says, Bello showed off the gun he carried and photos of himself training with the FBI in Quantico, Virginia, an apparent display of his authority and US connections.



Ogunjobi, too, participated in the questioning. He was quieter and more respectful than Bello, Gambaryan says—but no longer the deferential mentee. When Gambaryan at one point referred to all the help he'd given Nigerian law enforcement, Ogunjobi responded that he'd seen comments on LinkedIn that Binance had hired him only to give the impression of legitimacy, a jab that shocked Gambaryan after all their previous conversations.

Incensed and unable to give the Nigerians what they wanted, Gambaryan demanded an attorney, access to the US embassy, and his phone back. All his requests were refused, though he was allowed to call his terrified wife with a guard present.

Stuck in a stalemate with the EFCC officials, Gambaryan told the Nigerians he wouldn't eat until he was given access to an attorney and contact with the embassy. It took five days of that hunger strike, stuck in the house surrounded by government minders and guards, dazedly watching Nigerian TV on the couch, before the officials relented.

Pages of a journal the EFCC officials kept of the two men's detention.

Photograph: Courtesy of Tigran Gambaryan

He and Anjarwalla were given back their phones, but told not to speak to any media, and officials took their passports away. They were allowed to meet with local Nigerian attorneys that Binance had hired to represent them. And at the end of a week of detention, Gambaryan was driven to a Nigerian government building to meet with State Department officials there, who said they would monitor Gambaryan's situation but that, for now, there was nothing they could do to get him free.

They settled into a "Groundhog Day" routine, as Gambaryan later described it to his wife, puttering around their new home. The house was spacious and clean but run-down, with a leaky roof and no electricity on many days. Gambaryan befriended the cook and some of his minders, and watched hours of pirated episodes of *Avatar: The Last Airbender* with them. Anjarwalla got into a routine of doing yoga and drinking smoothies the cook made for him every morning.

Anjarwalla seemed to be taking the anxiety of their captivity harder than Gambaryan, and was upset that he would likely miss his son's first birthday. The Nigerians had taken his British passport, but they hadn't realized that Anjarwalla still had his Kenyan one. He and Gambaryan joked about escaping. Yet Gambaryan says he never seriously considered it. Yuki had told him "not to do anything stupid," he says, and he didn't intend to.

Then one day, lying on the couch, Anjarwalla told Gambaryan he was feeling ill and freezing cold. Gambaryan piled blankets on him, but he kept shivering. Eventually the Nigerians took Anjarwalla and Gambaryan to the hospital in another Land Cruiser and tested Anjarwalla for malaria. Gambaryan says the tests came back negative, and doctors told Anjarwalla that he had instead suffered a panic attack. Every night from then on, Gambaryan says, Anjarwalla would sleep in his bed next to him, too afraid to sleep alone.

By the middle of Gambaryan and Anjarwalla's second week of captivity, Binance had agreed to the demand that it shut down its Nigerian peer-to-peer trading feature and even removed all naira trading on the exchange. The EFCC officials told Gambaryan and Anjarwalla to pack their things in preparation to finally be released. The two men took the good news seriously enough that Gambaryan used his phone to shoot a video tour of the house as a kind of souvenir of the strange weeks he'd spent there.

Left: Gambaryan and Anjarwalla in the government guesthouse where they were held. Gambaryan is pointing to a surveillance camera in the house's living room. Right: Gambaryan's view from the guesthouse's couch, where he spent weeks killing time, often watching pirated television episodes with the government officials who were assigned to be his minders.

Photographs: Courtesy of Tigran Gambaryan

But before they could be freed, a government minder drove them in the Land Cruiser to the EFCC office. The agency's chairman there demanded to know if Binance had turned over all of its data on Nigerians. When he learned it hadn't, he immediately rescinded their release and sent the two men back to the guest house.

Around that time, the crypto site DLNews was the first outlet to [publicly reveal](#) that two Binance executives were being detained in Nigeria, without naming them. The [Wall Street Journal](#) and [WIRED reported](#) days later that the two detainees were Anjarwalla and Gambaryan.

Bello was furious about the news leaking, Gambaryan says, blaming him and Anjarwalla. If they would just hand over the information the government requested, they could go free, he told them. Gambaryan, losing his temper, asked Bello how he expected him to produce that data. “Do you want me to take it out of my right pocket? Or my left one?” he remembers asking Bello, standing up and theatrically emptying one pocket and then the other. “I don’t have any control over this.”

Weeks went by, and the negotiations were still at an impasse. Ramadan had begun, and Gambaryan would get up before dawn every morning with Anjarwalla for his prayers and then fast with him throughout the day in a show of friendly solidarity.

Then, one morning after nearly a month in the guesthouse, that routine came to an abrupt end. Gambaryan woke up on the couch after Anjarwalla returned from the mosque, went looking for his colleague, and discovered the shirt with the pillow stuffed in it. The water bottle in a sock. The empty bed. Anjarwalla had escaped.

Gambaryan would later learn that Anjarwalla had managed to get a flight out of the country. He figures that his colleague must have somehow jumped the compound’s wall, gotten past the guards—who were often asleep early in the morning—paid for a ride to the airport, then used his second passport to board a plane.

Gambaryan knew already that everything about his time in Nigeria was about to change. He went out into the courtyard and recorded a selfie video to send to Yuki and his colleagues at Binance, speaking into the camera as he paced.

“I’ve been detained by the Nigerian government for a month. I don’t know what’s going to happen to me after today,” he said in a quiet, controlled voice. “I’ve done nothing wrong. I’ve been a cop my whole life. I just ask

the Nigerian government to let me go, and I ask the United States government to assist me. I need your help, guys. I don't know if I'll be able to get out of this without your help. Please help."

Gambaryan's video plea for help, which he shot just after Anjarwalla's escape—and just before he was taken from the guesthouse and put into solitary confinement.

When the Nigerians learned Anjarwalla was gone, the guards and minders took away Gambaryan's phone and frantically searched the house. Then they all suddenly disappeared, replaced by new faces.

As Gambaryan waited for the crackdown he knew was coming, he persuaded one of the Nigerians to let him discreetly borrow their phone and went into the bathroom to call his wife, reaching Yuki in the middle of the night. For the first time in their 17-year relationship, she says, Gambaryan told her he was scared. Beginning to cry, she went into the closet to speak to him without waking up their children. Then Gambaryan abruptly said goodbye—someone was coming.

A military official told Gambaryan to pack his things, that he was being released. He knew better than to believe it. He packed nonetheless and got into the car outside, with Ogunjobi waiting in the vehicle. When Gambaryan asked Ogunjobi where they were going, Gambaryan says, he answered vaguely that maybe he was going home, but not today—then stared silently at his phone.

The car eventually arrived at the EFCC compound. But instead of parking near its headquarters, it pulled up to the agency's detention facility. Gambaryan began to swear at his captors in outrage, too angry to care any longer about offending them.

As he was being led into the EFCC's detention building, he saw a group of his former minders from the safehouse, now jailed together in one of the cells, under investigation for allowing Anjarwalla's escape or even suspected of collaborating with him. Then he was put into his own cell, in solitary.

It was, as Gambaryan describes it, a box with no windows. Just a shower that produced cold water with a timed button and, incongruously, a Posturepedic mattress on the floor. The room's walls crawled with as many as a half dozen cockroaches of all sizes. Despite the sweltering Abuja heat, the cell had no air-conditioning or even ventilation, only what Gambaryan remembers as "the world's loudest fan" humming day and night. "I can still hear that goddamn fan," he says.

Left alone in that cell, Gambaryan says he disassociated from his body, his surroundings, his hellish situation. He didn't think about the roaches. For the first night, he didn't even think about his family, he says. His mind was simply blank.

By the next morning, Gambaryan hadn't eaten in more than 24 hours. Another detainee gave him some crackers. He soon realized that his survival depended on Ogunjobi, who would come by his cell every few days to give him food and sometimes let him use his phone when he was briefly let out of solitary confinement. Soon, Gambaryan's old minders began to share with him the meals brought by their families, and Ogunjobi started coming less frequently—and sometimes, Gambaryan said, refused to let him use his phone when he did. There was no trace left of the wide-eyed fan of his work who had picked him up at the airport. "It was almost like he enjoyed having the power over me," Gambaryan says.

The Nigerians who had been his guards just days before now became Gambaryan's only friends. He taught one young EFCC staffer the rules of chess, and they'd play during the short hours before they were locked back into their cells.

A couple of days after he was put in lockup, Gambaryan's attorneys visited him and told him he was now being charged with money laundering on top of the tax evasion charges he already faced. The new charges carried 20 years in prison.

During his second week at the detention center, Gambaryan's son turned 5. On his birthday, Gambaryan was allowed to call his family from an EFCC phone and smoke a few cigarettes, which were otherwise denied to him. He spoke for 20 minutes with his wife—whom he describes as "crushed" with

anxiety—and his kids. His son still didn't know why he was gone. Yuki told Gambaryan that he'd started crying for his father at random times and going into their home office to sit in his chair. He explained to their daughter that he was still busy working out a legal issue with the Nigerian government. Gambaryan would later discover that she had googled his name two weeks into his detention, read the news, and knew far more than she let on.

Aside from his brief visits with his fellow inmates and two books—a Dan Brown novel given to him by an EFCC staffer and a Percy Jackson young adult storybook randomly brought by his lawyers—he had nothing to occupy his mind. He alternated between cyclically racing through angry curses and accusations against those who had wronged him, self-recriminations for the decisions that had led him to this point, and a kind of comatose emptiness.

“It was just torture,” Gambaryan says. “I knew that if I stayed there, I was going to lose my mind.”

A portrait of Gambaryan's family on his phone.

Photograph: Piera Moore

As alone as Gambaryan felt, he hadn't been forgotten. By the time he was in the EFCC cell, a loose-knit collection of friends and supporters had mobilized to answer the call for help in his video plea. Yet for the most part, it soon became clear the real help he needed to get free wasn't about to come from the Biden administration.

Within Binance, Gambaryan's very first text message warning that he was being detained had set off an immediate, unending whirlwind of daily war-room meetings, hiring of lawyers and consultants, and phone calls to anyone in government who might have any influence in Nigeria. Will Frentzen, the Bay Area-based former US attorney who'd prosecuted many of Gambaryan's biggest cases before taking a private-sector job at the law firm Morrison Foerster, took on Gambaryan's case as his personal defense attorney. One of Gambaryan's ex-Binance colleagues, Patrick Hillman, knew the former Florida congressman Connie Mack from work they'd done together on crisis response, and knew of Mack's experience resolving

hostage situations. Mack agreed to lobby his legislator contacts on Gambaryan's behalf. Gambaryan's old colleagues in the FBI, too, immediately began pressing the bureau to demand Gambaryan's release.

At higher levels of the executive branch, however, some of Gambaryan's supporters say their entreaties for help were met with cautious responses. "State Department staff, from the first days of Gambaryan's detention, worked to make sure he was safe, healthy, and had legal representation, and pushed for his release soon after he was criminally prosecuted," according to one senior State official who spoke to WIRED on condition of anonymity according to the department's policy. But at the same time, the Biden administration initially seemed ambivalent about Gambaryan, according to half a dozen people involved in the efforts to get him free. Binance, after all, had just agreed to a massive criminal penalty to the Justice Department. The administration seemed to have little love for the crypto industry as a whole, and Binance's reputation was "toxic," as one of Gambaryan's supporters put it.

"They thought maybe the Nigerians have a case," says Frentzen. "They weren't sure what Tigran had done there. So they all took a step back."

Gambaryan had also fallen into his Nigerian trap at a particularly dangerous moment in geopolitics. The US ambassador to Nigeria had retired in 2023, and the new ambassador wouldn't officially take up the post until May of 2024. Meanwhile, Niger and Chad had asked the US to withdraw its troops from both countries as they tightened their relationship with Russia, leaving Nigeria as a key US military ally in the region. This made the negotiations to free Gambaryan far more complex than they might have been with the usual adversaries who wrongfully detain Americans, like Russia or Iran. "Nigeria was the only game left in town, and they knew it," says Frentzen. "So this was *bad*. In terms of timing, Tigran happened to have been one of the unluckiest sons of bitches on the face of the earth."

When Gambaryan was being held in the guesthouse, the diplomatic case might have been clearer that he was a hostage, says Mack, the former congressman lobbying for his release. But the criminal charges against him complicated the picture. "The US government fell in line with that narrative," Mack says. "They wanted to let the legal process play out."

Frentzen and his more senior colleague at Morrison Foerster, former general counsel to the office of the director of national intelligence, Robert Litt, says they began to approach people in the White House to explain to them how flimsy the criminal case against Gambaryan actually was. In the Nigerian prosecutors' 300-plus pages of "evidence" against Gambaryan, only two pages even mentioned Gambaryan himself: One was an email showing that he worked at Binance. Another was a scan of his business card.

Still, for months to come, the US government wouldn't intervene in Gambaryan's criminal prosecution. The result, for Frentzen, was an appalling situation: After a career in the federal service, the former IRS agent responsible for many of the biggest cryptocurrency criminal busts and seizures in history was left with only hands-off government support in the midst of what appeared to be, itself, a crypto shakedown.

"This guy recovered billions of dollars for the US," Frentzen remembers thinking, "and we can't get him out of a hole in Nigeria?"

In early April, Gambaryan was taken to court for an arraignment hearing. Wearing a black T-shirt and a pair of dark green pants, he was put on public display, a personification of the villainous forces destroying the Nigerian economy. As he sat down in a red-upholstered chair to hear the charges against him, local and foreign media swarmed, with cameras at times just a few feet from Gambaryan's face as he barely concealed his anger and humiliation. "I just felt like a circus animal," he says.

In that hearing, a second one a week later, and in an accompanying filing to the court, prosecutors argued that Gambaryan would jump bail if he were let out of custody, pointing to Anjarwalla's escape. They emphasized, strangely, that Gambaryan had been born in Armenia, though his family had left that country when he was 9 years old. They claimed, even more bizarrely, that Gambaryan had hatched a plot with fellow prisoners at the EFCC facility to replace himself with some sort of body double and escape, which Gambaryan says was an absurd lie.

Prosecutors at one point made explicit that holding Gambaryan was crucial in the Nigerian government's leverage against Binance. "The first



defendant, Binance, is operating virtually,” the prosecutor told the judge. “The only thing we have to hold on to is this defendant.”

The judge declined to rule on Gambaryan’s bail, leaving him in detention. After two weeks in solitary in the EFCC cell, he was transferred to a real jail: Kuje Prison.

The guards—and as usual, Ogunjobi—put Gambaryan in a van. Ogunjobi gave him back his cigarettes, and he smoked for most of the hour-long drive out of central Abuja, into what looked like a semirural slum on the outskirts of the city. During the trip, Gambaryan was allowed to call Yuki and Binance executives, some of whom hadn’t heard from him in weeks.

During that drive to Kuje, a prison known for its abysmal conditions and fellow inmates that included accused Boko Haram terrorists, Gambaryan says he felt numb, “disconnected,” resigned to a total lack of control of his fate. “I was just living one hour, one minute at a time,” he says.

As they arrived and drove through the prison’s gates, Gambaryan got the first glimpse of its low-slung buildings, painted a pale yellow, many still cratered and broken from an ISIS attack that had allowed more than 800 inmates to escape almost two years earlier. Gambaryan’s EFCC minders walked him into the prison and brought him to the office of the controller, who Gambaryan would later learn had specific instructions from Ribadu, the national security adviser, to keep him under close surveillance.

Then he was taken to his cell in a “segregation” wing, set aside for high-risk prisoners and VIP inmates willing to pay for special treatment. The 6- by 10-foot room had a toilet, a metal bed frame with what Gambaryan describes as a “glorified blanket” for a mattress, and a single window with metal bars. Aside from the bed, this was actually an upgrade from the EFCC dungeon: He had sunlight and outside air—albeit polluted by a trash fire a couple hundred yards away—and a view of trees that swarmed with bats every evening.

His first night in the prison, it rained, and a cool breeze came through the window. “As bad as it was,” Gambaryan says, “I thought I was in heaven.”

Gambaryan soon got to know his neighbors. One was a cousin of Nigeria's vice president. Another was an alleged fraudster awaiting extradition to the US for a \$100 million scam. A third was the former Nigerian deputy commissioner of police, Abba Kyari, under indictment in the US and accused of allegedly receiving a bribe—though the Nigerians had denied US extradition. Gambaryan came to believe Kyari's Nigerian prosecution might have more to do with angering certain other corrupt officials.

Kyari, Gambaryan says, turned out to have enormous sway in the prison. Other inmates essentially worked for him. And his wife brought in home-cooked food for everyone, even the guards. Gambaryan especially liked a certain Northern Nigerian dumpling Kyari's wife made, and she would cook extra for him. He in turn would share the take-out food his lawyers brought him from a fast food restaurant called Kilimanjaro; Kyari liked its Scotch eggs.

Gambaryan's neighbors helped him learn the unwritten rules of prison life: how to get a phone, how to avoid trouble from prison staff and violence from other inmates. Gambaryan insists he never paid a bribe to the guards—they sometimes demanded absurd amounts in the tens of thousands of dollars—but his closeness to Kyari protected him nonetheless. "He was my Red," Gambaryan says, comparing Kyari to Morgan Freeman's character in *The Shawshank Redemption*. "He was instrumental to my survival."

Over the weeks that followed, Gambaryan's court case continued, and he'd be periodically driven back to Abuja for hearings in which the judge seemed to side with prosecutors on every point. He spent his 40th birthday, May 17, in yet another hearing where his bail was finally denied. That evening, his lawyers delivered a giant cake, paid for by Binance, to Kuje Prison, which he shared with his neighbors and the guards.

Every night, Gambaryan would be locked in his cell as early as 7 pm, sometimes hours earlier than the other inmates, and a guard constantly watched him and made notes in a notebook about his every move, all on the national security adviser's orders. He found that he could do pull-ups on the ledge of an entryway to the segregation wing's courtyard to get some exercise. Despite the huge cockroaches, geckos and even scorpions that

crawled around his cell—small beige ones he learned to shake out of his shoes before putting them on—he began to settle into prison life.

Sometimes he'd still wake up from a dream about being on the outside, remember again that he was in a tiny, squalid cell, and rise from his bed to anxiously pace the cramped space until the guards let him out around 6 am. But eventually, Gambaryan says, his dreams, too, were in prison.

Gambaryan in his cell in Kuje Prison, filling out an absentee ballot for the November 2024 election. (He obtained the mosquito net only after contracting malaria and subsequent bacterial lung infections.)

Photograph: Courtesy of Tigran Gambaryan

One afternoon in May, Gambaryan began to feel ill during a meeting with his lawyers. He went back to his cell, lay down, and then vomited repeatedly for the rest of the evening. Gambaryan guessed he had food poisoning. A blood test administered by the guards showed it was malaria. They asked him for cash, which they used to buy a bag of IV fluids—hung from a nail on the wall of his cell—and antimalarial injections.

The next morning, Gambaryan had a court hearing. He told the guards he was too weak to travel, or even to walk. They nonetheless took out his IV and put him in a car, telling him they were acting on official orders. When Gambaryan arrived at the court in central Abuja, he managed to slowly climb the long steps to the courthouse's door. But as he entered the courtroom, his vision blurred and the room began to spin. The next thing he knew, he was on one knee. Guards helped Gambaryan up, and he slumped in his chair as his attorneys requested a court order for him to be sent to a hospital.

The judge issued the order. But instead of heading straight to a medical facility, Gambaryan was sent back to Kuje while the court, his attorneys, the prison, the national security adviser's office, and the US State Department debated whether his temporary release represented an escape risk. For 10 days, Gambaryan lay in his cell, unable to eat or stand. Finally, he was taken to the Turkish-run Nizamiye hospital in Abuja, where he was given a

chest x-ray, briefly examined, prescribed antibiotics, told he would be fine, and then inexplicably sent back to Kuje.

Gambaryan's illness was, in reality, worse than ever. One of his friends, Turkish-Canadian Binance staffer Chagri Poyraz, eventually had to fly to Ankara to inquire about Gambaryan's Nizamiye medical records with the Turkish government before he learned that Gambaryan's scan had shown multiple serious bacterial lung infections. Even the judge in the case would demand—months later—that Kuje's medical director, Abraham Ehizojie, appear before the court to explain why he hadn't obeyed the hospitalization order. Prosecutors pointed to Gambaryan's medical records, which stated that he had refused care and asked to be returned to prison, which Gambaryan vehemently denies.

For days after his return to his Kuje cell, Gambaryan had a 104-degree fever. During his brief hospital stay, the guards had searched his cell and found his secret phone, so he remained cut off from all contact for much of that time until one of his neighbors could get him another. He grew weaker, had trouble breathing, and his temperature refused to drop. Gambaryan became convinced he was going to die. At one point, he called Will Frentzen and told him that he might be on his deathbed. Kuje officials still refused to take him back to a hospital.

Gambaryan didn't die. But he spent close to a month in bed before he was able to stand and eat again. He had lost nearly 30 pounds from when he had first entered the prison.

One day while he was lying in his cell recovering, the guards told Gambaryan that he had visitors. Still feeling weak, he walked slowly to an office in the front of the prison. Inside sat French Hill and Chrissy Houlahan, two US members of Congress, one from each party. Gambaryan could hardly believe that they were not a mirage—the first Americans he'd seen in months other than the relatively low-level State Department officials who would periodically visit him.

For the next 25 minutes, they listened to Gambaryan describe the conditions of the prison and his close call with malaria and then a chest infection that developed into pneumonia. Hill remembers that he spoke so softly that the

two legislators had to lean forward to hear him over the noise of a fan in the room.

At times, Gambaryan found his eyes filling with tears as the intensity of his loneliness and the fear of his near-death experience caught up with him. “He looked like a sick, frail, emotionally distraught human who needed a hug,” Hill says. The two lawmakers each gave him one, and they told him they would work for his release.

Then he was led back to his cell.

The next day, June 20, Hill and Houlahan recorded a [video](#) on the tarmac of the Abuja airport. “We’ve asked for our embassy to advocate for a humanitarian release of Tigran, because of the horrible conditions in the prison, his innocence, and his health,” Hill told the camera. “We want him home, and we can let Binance deal with the Nigerians.”

Connie Mack’s conversations with his old congressional colleagues had taken root: In a subcommittee hearing on Americans detained abroad, Gambaryan’s Georgia representative, Rich McCormick, had argued that Gambaryan’s case should be elevated to that of a hostage held by a foreign government. He had cited the Levinson Act, a law that requires the US to help wrongfully imprisoned citizens. “Is United States diplomatic engagement likely necessary to secure the release of the detained individual? Absolutely. Abso-frickin-lutely,” McCormick told the hearing. “This guy deserves better.”

Around the same time, 16 Republican legislators signed a letter demanding the White House treat Gambaryan’s case as a hostage situation. A few weeks later, McCormick introduced that same demand as a [House resolution](#). More than a hundred former agents and prosecutors had already signed another letter asking for the State Department to step up its efforts.

In June, FBI director Christopher Wray brought up Gambaryan’s case during a visit to the country to meet with President Tinubu, according to several sources. Shortly after, Nigeria’s FIRS, its tax authority, dropped the tax evasion charges against Gambaryan. But the more serious charge of

money laundering, brought by the EFCC, stayed in place, along with the decades of prison time it threatened.

For months, many of Gambaryan's supporters had hoped that Nigeria would eventually reach a deal with Binance to end the country's prosecution. But Binance's representatives say that by that point, they couldn't seem to make an offer that interested the Nigerians, who now no longer even hinted at a payment. Every time it felt like they were getting close to an agreement, the requirements would change, the official would disappear, the deal would fall apart. "It was like Lucy and the football," says Deborah Curtis, an attorney for Arnold & Porter and a former CIA deputy general counsel who was representing Binance.

As the summer wore on, Gambaryan's supporters began to believe the negotiations between Nigeria and Binance were at a dead end, that the criminal case had progressed far enough that Binance alone would never get Gambaryan free. "It started to become clear," says Frentzen. "This was going to be a US government solution—or nothing."

Meanwhile, Gambaryan's health had taken yet another turn for the worse. All of that time laid out on a metal frame had aggravated an old back injury from Gambaryan's time in IRS-CI training more than a decade earlier, leading to what would later be revealed to be a herniated disc—a rupture in the outer layer of the tissue between spinal vertebrae, causing the internal part of that cushion to bulge out, trapping nerves and causing immense, constant pain.

Within a few weeks of recovering from his pneumonia, Gambaryan had almost no feeling in one of his legs. By July, he was attending his court hearings in a wheelchair. His trial adjourned for the summer, and Gambaryan spent the next months partially paralyzed, in unending torment, too depressed and stricken to even leave his cell in Kuje.

Prison officials finally followed through on the court order to release Gambaryan from Kuje so he could receive proper care, but instead of bringing him to a hospital, they transferred him to a National Intelligence Agency medical facility. He was under constant guard, his feet cuffed, given only painkillers as a treatment, and—perhaps most disturbing for him

—had no access to his contraband phone, leaving him more isolated than ever. This time, after three days, he *did* ask to be returned to Kuje.

By August, Gambaryan was “essentially crippled,” he wrote to me in a text message. He hadn’t gotten out of bed in weeks, and was taking blood thinners to prevent clots in his legs from the lack of movement. Every night, he wrote, he would lie awake until 5 or 6 in the morning, too distracted by pain to even read a book. Sometimes he would call his family and talk to his daughter as she played a Japanese role-playing game called *Omori* on a PC he had built for her until it was her bedtime in Atlanta. Then, hours later, he’d finally black out.

Even despite the visit from members of Congress and the growing groundswell to get him released, he seemed to be nearly hopeless, at the nadir of his entire time in prison.

“I try to put on a face for Yuki and the kids, but it’s bad,” he wrote to me. “I am in a dark place.”

Days after that text message, a video emerged on X of Gambaryan limping into court on a borrowed crutch, dragging one foot behind him. In the clip, he begs for help from a guard in the hallway, who refuses to even give him a hand. Gambaryan would later tell me that the court staff had been instructed not to give him any support or let him use a wheelchair, for fear that he’d garner sympathy.

“This is fucked up! Why can’t I use a goddamn wheelchair?” Gambaryan yells in the video, outraged. “I’m an innocent person.”

“I’m a fucking human,” Gambaryan goes on, his voice almost breaking. He takes a few labored steps with the crutch, shaking his head in disbelief before leaning against a wall to recover. “I’m not fucking OK.”

If that order not to help Gambaryan as he hobbled into court was meant to prevent him from gaining public sympathy, it massively backfired. The video of the courthouse incident went viral and was watched millions of times.

By the fall of 2024, the US government, too, seemed to have finally reached a consensus that it was time to get Gambaryan home. In September, a bipartisan markup session in the House Foreign Affairs committee approved the resolution McCormick had introduced to prioritize his case. “I urge the State Department and I urge President Biden: Turn up the heat on the government of Nigeria,” congressman Hill said in that hearing. “Honor the fact that an American citizen has been snatched by a friendly government and put in prison over something he had no responsibility for.” Some of Gambaryan’s supporters say they heard that the new ambassador to Nigeria, too, had begun bringing up Gambaryan’s situation with Nigerian officials, including President Tinubu, so often that at least one minister blocked the ambassador on WhatsApp.

At the United Nations General assembly in New York in late September, the US ambassador to the UN raised Gambaryan’s case in a meeting with the Nigerian foreign minister, “stressing the need for his immediate release,” according to a [readout](#) of their meeting. At that same time, Binance hired a truck with a digital billboard to drive around the UN and midtown Manhattan displaying Gambaryan’s face and messages calling out Nigeria for illegally jailing him.

Around the same time, White House national security adviser Jake Sullivan had a phone call with his Nigerian counterpart, Nuhu Ribadu, in which he essentially asked that Gambaryan be freed, according to multiple sources involved in pushing for Gambaryan’s release. Perhaps most impactful of all, several supporters say, they learned that US officials had made clear that Gambaryan’s case was going to present an obstacle to any meeting between President Biden and Nigeria’s President Tinubu at the UN General Assembly or elsewhere, a notion that deeply troubled the Nigerians.

Even as all of those levers of power began to apply pressure, the decision of whether to free Gambaryan still rested with Nigeria alone. “There was a point in time where the Nigerians realized this was a really bad idea,” says one of Gambaryan’s supporters who asked not to be named due to the sensitivities of the negotiations. “Then it became a matter of whether they would capitulate, or whether they would stick it out because of their pride—or because they were beyond the point of no return.”



One day in October during the long drive from Kuje to the Abuja court for yet another hearing—by that time, Gambaryan had lost count of how many it had been—the car’s driver got a call. He spoke into the phone for a minute, then turned the car around. Gambaryan was driven back to the prison, taken to the front office, and told that he was not feeling well enough to go to court. This was a statement, not a question.

Back in his cell, Gambaryan called Will Frentzen, who told him this could be it: that the Nigerians might finally be preparing to send him home. After so many false hopes of release over the past eight months, Gambaryan didn’t allow himself to believe it.

Several days later, the court held a hearing without him, and the prosecution told the judge they were dropping all charges against Gambaryan due to his health. Officials at Kuje spent a day processing the paperwork, then took him out of his cell, handed him the suitcase he’d brought on his two-day trip to Abuja, and drove him to the Abuja Continental Hotel, where Binance had booked him a room guarded by private security, as well as a physician to make a house call and ensure he was healthy enough to fly. For Gambaryan, it was all so sudden, after so many months of excruciating stasis, that it was almost too surreal to comprehend.

A day later, on the Abuja airport tarmac, Nigerian officials handed over Gambaryan’s passport—after briefly quibbling over a \$2,000 fine he was told he owed for overstaying his visa. With State Department staffers helping him, Gambaryan stepped out of his wheelchair and climbed into a private jet stocked with medevac equipment. Unbeknownst to Gambaryan, Binance staff had spent weeks working to charter the flight—Nigerian officials had already once before told them Gambaryan would be released and then reneged—and even negotiated for him to fly out of the country over neighboring Niger’s airspace, which the country’s officials signed off on less than an hour before takeoff.

Left: Gambaryan's view of Nigerian officials on the Abuja airport tarmac after he was released from jail, just before his plane took off for Rome. Until nearly the last minute, they demanded a \$2,000 payment for Gambaryan overstaying his visa. Right: A selfie Gambaryan took just before his emergency spinal surgery after his return to the US.

Photographs: Courtesy of Tigran Gambaryan

Aboard the jet, Gambaryan ate a few bites of the salad in his in-flight meal, fell asleep sprawled on a couch, and woke up in Rome.

Binance had arranged for a driver and private security to meet him at the airport in Italy and take him to the airport hotel to spend the night there before his flight home to Atlanta the next day. While he was in the room, he called Yuki and then Ogunjobi, his Nigerian erstwhile friend, the one who had persuaded him to come back to Abuja so many months earlier.

Gambaryan says he wanted to hear Ogunjobi explain himself. On the phone, Gambaryan remembers, the EFCC official began crying, apologizing repeatedly, thanking God that Gambaryan had been released.

For Gambaryan it was too much to process. He listened quietly without accepting the apology. In the midst of Ogunjobi's outpouring, he noticed that an American friend was calling, a Secret Service agent he'd worked with in the past. Gambaryan didn't know it yet, but the agent happened to be in Rome for a conference with Gambaryan's old boss, the head of the IRS-CI cybercrime division, Jarod Koopman, both of whom wanted to bring him beer and pizza at his hotel.

Gambaryan told Ogunjobi he had to go, and he ended the call.

Awards from Gambaryan's IRS career and a copy of remarks published in the Congressional Record by congressman Rich McCormick celebrating his return from Nigerian detention.

Photograph: Piera Moore

On a cold and windy December day on Capitol Hill, former federal agents and prosecutors, State Department officials, and congressional aides mingle in a plush room in the Rayburn House Office Building. One by one, members of Congress come in and shake hands with Tigran Gambaryan, who's wearing a dark blue suit and tie, his beard close-trimmed again and head cleanly shaved, limping only slightly from the emergency surgery on his spine that he underwent a month earlier in Georgia.

Gambaryan poses for photos and chats with each legislator, aide, and State Department official long enough to thank them for their role in getting him home. When French Hill says that it's good to see him again, Gambaryan quips that he hopes he smells better than he did during their meeting in Kuje.

The reception is one in a series of VIP welcomes that Gambaryan has received on his return. At the airport in Georgia, Representative McCormick had come to greet him, and gave him an American flag that had flown above the Capitol building the previous day. The White House released a [statement](#) noting that President Biden had called the Nigerian president and “underscored his appreciation for President Tinubu’s leadership in securing the release on humanitarian grounds of American citizen and former U.S. law enforcement official Tigran Gambaryan.”

The statement of thanks, I later learned, was part of the deal the US government struck with Nigeria, which also included aiding in its investigation of Binance—which is still ongoing. Nigeria continues to prosecute both Binance and Anjarwalla in absentia. A Binance spokesperson wrote in a statement that the company is “relieved and grateful” that Gambaryan is home and expressed thanks to all who worked to secure his release. “We are eager to put this episode behind us and continue working toward a brighter future for the blockchain industry in Nigeria and around the world,” the statement adds. “We will continue to defend ourselves against spurious claims.” Nigerian government officials did not respond to WIRED's repeated requests for comment on Gambaryan's case.

After the reception, Gambaryan and I get in a cab outside, and I ask him what's next for him. He says that he may be getting back into government, if the new administration will have him—and if Yuki will put up with another move back to DC. (Crypto news site Coindesk [reported last month](#) that he's been recommended by cryptocurrency industry insiders with connections to President Trump for roles as senior as head of crypto assets at the SEC or a high-level position in the FBI's cyber division.) Before he considers anything like that, he says vaguely, “I probably need time to get my head straight.”

Gambaryan (right) with Congressman French Hill at a reception in his honor on Capitol Hill after his return to the US.

I ask him how he feels the experience in Nigeria has changed him. “I guess it did make me angrier?” he responds in a strangely light tone, as if thinking about the question himself for the first time. “It made me want to get vengeance against those that did this.”

Revenge for Gambaryan may be more than a fantasy. He’s pursuing a human rights lawsuit against the Nigerian government that began during his detention, and hopes there will be an investigation into the Nigerians who he argues held him hostage for the better part of a year of his life. At times, he says, he’s even sent messages to individual officials he holds responsible, telling them, “You’ll see me again,” that what they did “brought shame on the badge,” that he can forgive what they did to him, but not what they did to his family.

“Was it stupid for me to do that? Probably,” he tells me in the cab. “I was on the floor with back pain and just bored.”

As we step out of the car at his hotel in Arlington and Gambaryan lights a cigarette, I tell him that despite his description of himself as angrier than before his time in prison, he actually seems calmer and happier to me than in years past—that when I was covering his serial takedowns of corrupt federal agents, crypto money launderers, and child abusers, he had always struck me as angry, driven, relentless in chasing the targets of his investigations.

Gambaryan responds that, if he seems more relaxed now, it’s only because he’s happy to be home—grateful to see his family and his friends, to be able to walk again, to not be caught between forces so much larger than himself waging a conflict that had so little to do with him. To have not died in prison.

As for being driven by anger in the past, Gambaryan disagrees.

“I’m not sure that was anger. That was justice,” he says. “I wanted justice. And I still do.”

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By [Darren Loucaides](#)

[The Big Story](#)

Feb 4, 2025 6:00 AM

# Inside the Bust That Took Down Pavel Durov—and Upended Telegram

The Russian-born CEO styles himself as a free-speech crusader and a scourge of the surveillance state. Here’s the real story behind Pavel Durov’s arrest and what happened next.

Illustration: Sam Green

On a warm Saturday in August of 2024, Raphaël Maillochon was celebrating his son’s first birthday when he got a message from one of his sources. Maillochon, a 34-year-old crime reporter for the French broadcaster TF1, was used to contacts in law enforcement pinging him on the weekend. They liked [Telegram](#), which they felt was more secure than other messaging apps. While Maillochon was strictly off work that day, at a country house two hours south of Paris, he couldn’t help but set down the bottle of champagne he’d been about to open and look at his phone.

The source had news about “*un gros poisson*”—a “big fish.” If confirmed, it was going to trump all other stories in [France](#) and beyond. “Stay tuned!” the source wrote.

Maillochon tried to enjoy the birthday party while nervously eyeing his Telegram messages. Around 6 pm, just as his guests were sitting down for aperitifs, the source told him that the *gros poisson* was none other than Telegram’s CEO, Pavel Durov. Police were tracking Durov’s private jet, and it was due to arrive in Paris that evening from Baku, Azerbaijan. If he was on the plane, they would arrest him.

Although Maillochon used Telegram every day, he had to google its Russian-born CEO. He learned that Durov came to prominence as the cofounder of VKontakte, Russia's homegrown version of [Facebook](#). His next company, Telegram, made him a global tech mogul. Durov presented himself as a libertarian crusader for privacy and freedom of speech on the internet. In 2014 he blamed the Kremlin for forcing him out of VKontakte and went into self-imposed "exile," which many saw as proof of his bona fides. Now Telegram was nearing a billion users and, Durov claimed, planning to go public by 2026. Maillochon began to grasp the size of what he was reeling in.

At 8:59 pm, his phone pinged again: "He's been arrested." Maillochon excused himself from the party and went outside into the garden. He checked in with other sources in different police departments, the French public prosecutor's office, and Europol. At 10:24 pm, his story went up [on TF1's website](#). From there it spread to news outlets around the world.

When Durov disembarked at the small Le Bourget Airport outside Paris, he seemed to have no idea what was about to happen, Maillochon's sources told him. They said Durov was petulant and haughty in his initial interviews with police. He flaunted his connections, claiming that he had come to Paris to meet with [Emmanuel Macron](#). Durov also reportedly asked that French telecom billionaire Xavier Niel, until recently a majority shareholder in Le Monde newspaper, be notified of his arrest. Politico.eu later reported that Durov even used his one call to phone Niel. (Devon Spurgeon, a public relations consultant for Telegram based in Washington, DC, told WIRED that Durov phoned his own assistant, not Niel. Niel did not reply to WIRED's requests for comment.)

As Maillochon and other French journalists went on to report, prosecutors had been secretly investigating Durov for months over his and Telegram's alleged failure to block illegal activity—which authorities claim included fraud, drug trafficking, child sexual abuse material (CSAM), organized crime, and terrorism—on the platform. The French Gendarmerie alone had counted 2,460 cases between 2013 and 2024 in which legal requests made to Telegram had gone unanswered, according to the outlet Libération. Maylis de Roeck, a spokesperson for the prosecutor's office, told WIRED

that when her team realized just how many investigations across different departments were being stymied by Telegram's lack of response, they decided to issue an arrest warrant. As they saw it, Durov's silence amounted to complicity.

In the immediate aftermath of the arrest, no one from Telegram commented publicly. One of Durov's close associates, George Lobushkin—the former head of PR at VKontakte—[told WIRED](#): “I am in shock, and everyone close to Pavel feels the same. Nobody was prepared for this situation.” Lobushkin added that he worried “a lot” about Telegram's future if Durov remained in custody.

The case against Durov came at a moment when his professed libertarian ideals and laissez-faire attitude to content moderation seemed to be ascendant.

In the US, one of the first to react to the arrest was [Tucker Carlson](#), the right-wing TV host. In a post on X, Carlson called Durov “a living warning to any platform owner who refuses to censor the truth at the behest of governments and intel agencies.” [Elon Musk](#) reposted a clip from Carlson's interview and captioned it “#FreePavel.” Even [Edward Snowden](#), a stern critic of Telegram's security claims, expressed alarm. “I am surprised and deeply saddened that Macron has descended to the level of taking hostages as a means for gaining access to private communications,” he wrote on X. Macron, for his part, issued a statement that France was “deeply committed to freedom of expression,” adding of the arrest: “It is in no way a political decision. It is up to the judges to rule on the matter.”

On the Sunday evening after Durov's arrest, his custody was extended to the 96-hour limit. According to Maillochon's sources, he slept in a cramped cell, although investigators made the rare concession of letting Durov have a fresh set of clothes delivered. Under further questioning, Durov reportedly claimed he hadn't been unresponsive to takedown requests from law enforcement; police had merely sent their requests to the wrong place. (Durov made a similar claim in 2022 when Brazil's supreme court temporarily banned Telegram, essentially saying the court's legal requests had been lost in the mail.) Durov also said he had been in touch with French intelligence services about terrorism cases.



On August 28, nearly four days after his arrest, Durov was formally indicted on six charges. The most serious—complicity in the administration of an online platform to enable organized crime and illicit transactions—carried a maximum penalty of 10 years’ imprisonment, as well as a €500,000 (\$521,000) fine. With bail set at €5 million (\$5.2 million) and swiftly paid, Durov was released that night but prohibited from leaving the country. He was also ordered to report to a police station twice a week.

The case against Durov, the CEO of a huge mainstream platform, was unprecedented. And it came at a moment when his professed libertarian ideals and laissez-faire attitude to content moderation seemed to be ascendant. The small size of Durov’s team had actually inspired Musk to fire 80 percent of Twitter’s staff when he took it over, according to *Character Limit*, a book by Kate Conger and Ryan Mac. Musk gutted the company’s moderation and trust-and-safety teams. If Durov could run a platform with about 60 full-time employees, most of them in Dubai, why not try something similar? More recently, Mark Zuckerberg fired Meta’s fact-checkers in the US and loosened the enforcement of rules against inflammatory content on the company’s platforms. The “recent elections,” Zuckerberg said, were a “cultural tipping point toward once again prioritizing speech.”

Durov seems to have been unaware how close to the sun he was flying. One senior former Telegram employee reflected that, while the arrest was not inconceivable under strict European legislation, it was still startling. Yulia Conley, who worked as Telegram’s first official head of external and government relations and has agreed to go on the record for the first time in WIRED, thought it “unreasonable” to hold Durov responsible for everything happening on the platform. “I wouldn’t say that he had it coming,” Conley told WIRED. But she suggested that Telegram’s “scarcity of human capital in this very important domain of content moderation could be the main reason why the current escalation had occurred.” The issues that landed Durov in jail went back years.

On September 21, 2015, Durov sat for an interview at the TechCrunch Disrupt conference in San Francisco. It had been more than a year since he sold his stake in VKontakte, and he portrayed himself as a digital nomad,

traveling the world with a cohort of Telegram engineers. He looked the part, clad all in black, and spoke with the self-assurance of a true disrupter.

Telegram was barely two years old and already handling 12 billion messages a day. All the other messaging apps out there? “They suck,” Durov said—especially [WhatsApp](#). The interviewer brought up reports of ISIS operating on Telegram. “Do you sleep well at night knowing that terrorists use your platform?” he asked Durov. First grinning awkwardly, Durov composed himself. “Our right for privacy is more important than our fear of bad things happening, like terrorism,” he said. “I don’t think we should feel guilty about it.”

The next day, Telegram introduced the feature that transformed it from a messaging app to something more like a social network. “Channels” allowed users to broadcast their messages to an unlimited number of subscribers. Within a few days, ISIS operatives started a channel of their own. Barely two months after that, ISIS gunmen and suicide bombers attacked Paris’ Bataclan theater and Stade de France, killing 130 people and injuring hundreds. ISIS used Telegram to claim responsibility to the world.

Five days later, Telegram removed 78 ISIS channels and announced efforts to curb terrorist activity on the platform. Yet it continued to bill the app as a place where users were safe from the prying eyes of authorities, especially if those users communicated via end-to-end encrypted “secret chats.” (Contrary to popular perception, encryption has never been the default setting.) Within weeks of the attacks, the European Union set up an initiative called the Internet Forum, meant to coordinate anti-terrorism efforts between tech platforms and member states. Facebook, Google, Microsoft, and Twitter quickly joined up. Not Telegram. Its privacy policy stated bluntly: “We never share your data with anyone. No.”

As a marketing strategy, this brashly defiant pose kept paying dividends in the unlikeliest places. Even as Telegram was becoming known in France as ISIS’s platform of choice, it was also gaining popularity in French political circles. Ludovic Chaker, a manager of Macron’s 2017 presidential campaign, had his team use Telegram groups and “secret chats” for internal communications, a legal representative for Chaker confirmed to WIRED. Telegram quickly spread within the French political establishment.

Members of parliament even reportedly identified which of their colleagues were pro-Macron by whether they were on the app.

But Durov's public image as an Übermensch of privacy and free speech concealed a dowdier reality: He would spend the coming years freely contradicting the tenets of Telegram's self-mythology when it suited him, dodging its ramifications when he had to, playing ball with governments as necessary, scrambling to pay Telegram's bills, and then inevitably finding himself buoyed yet again by some event that seemed to validate Telegram's anti-authoritarian, above-it-all mystique.

Take the perception Durov fostered that he lived in conscientious exile from Putin's Russia. According to iStories, an independent Russian news outlet, which recently analyzed leaked Federal Security Service (FSB) data on border crossings, Durov in fact entered Russia 41 times between 2015 and late 2017. (Irina Bolgar, Durov's then partner, confirmed to WIRED that he was frequently with her and their children in St. Petersburg throughout this time; their relationship was not public.)

Eventually, though, Durov's claims about operating Telegram in defiance of the Kremlin became a problematic reality. In July 2017, the FSB sent Telegram an order to hand over encryption keys for a half-dozen accounts "suspected of terrorism-related activities." Durov's company refused, claiming end-to-end encryption (which applied only to "secret chats") prevented it from complying. Telegram's stance suddenly put its employees in Russia—including Durov—at personal risk from the Kremlin. He needed safe harbors for himself and his company to live and operate in. (While WIRED previously reported that Telegram staff were working in St. Petersburg until at least 2017, Spurgeon said that the company "has never legally or physically been connected to Russia.")

Durov also needed money. How much would it cost to cover Telegram's operating expenses as the messenger kept growing? "About \$620 million," Durov estimated in a document he shared with potential investors in 2017, which later came out as part of a US Securities and Exchange Commission investigation. In late 2017, news leaked that Telegram was reportedly getting ready to launch its own cryptocurrency on a bespoke blockchain. Investing opened in 2018, allowing people to buy into Durov's latest vision:

Their dollars now for his “Grams” later. The presale brought in \$1.7 billion, about a quarter of which came from the US. Individual investors included Kremlin ally Roman Abramovich; former Russian government minister Mikhail Abyzov; London-based oligarch Said Gutseriev; Jan Marsalek, a fugitive tech executive from Austria later accused of being a Russian spy; and, as recently revealed by iStories, a company linked to mining in the Russian-occupied Donbas region of Ukraine. Weeks after the token presale ended, the Russian government officially blocked domestic internet users from accessing Telegram.

In reinforcing the story of Telegram’s opposition to the Kremlin, this provided a perfect context for Durov as he set about shoring up his connections in Europe. He reportedly visited the Élysée Palace to have lunch with Macron, where Macron suggested that Durov move Telegram to France and offered him French citizenship. An official who worked closely with Macron at the time told WIRED that the president may have seen Durov as a kind of “trophy” in the geopolitical contest with Putin’s Russia. (The president’s current international press adviser, Anastasia Colosimo, noted that Snap CEO Evan Spiegel was granted French citizenship around this time and that no deal was struck between Macron and Durov.)

As Telegram wooed European leaders, it also bent to European priorities. A month after Russia banned Telegram, the company finally took a seat at the EU Internet Forum, where it joined the Silicon Valley giants that had volunteered years earlier to actively cooperate on taking down dangerous content. The company also overhauled its privacy policy, removing the promise to users that it would “never share your data with anyone.”

Around this time, Durov appointed Telegram’s first dedicated head of external and government relations. Yulia Conley took the job. Born in Russia and raised partly in Michigan, she had a master’s degree in environmental science from Oxford and had previously worked for nine months at a UN sustainable development program in New York. Now, at age 23, she would be Telegram’s “frontline person” for communications on content moderation and requests from international agencies.

Under Conley’s tenure, Telegram’s relationship with law enforcement evolved to the point that Europol was routinely sending the company large

datasets of content it wanted taken down—and Telegram was complying. Conley and some engineers from the company attended a so-called “action day” in the fall of 2018, hosted at Europol’s headquarters in the Hague. With law enforcement from six EU member states, they removed hundreds of items of “terrorist content” from the platform, including audio, video, and PDFs posted by ISIS and al Qaeda, along with the public channels that hosted them.

There was another action day the following year. Europol’s operations room was fully stacked with representatives from 27 member states, according to Stéphane Duguin, who worked at Europol and led the establishment of the forum. “Everyone was there,” he recalled to WIRED. They watched onscreen in real time as Telegram took down channels “one after the other.” In a press release at the time, Europol hailed Telegram’s content referral tools and automated detection systems. “Our engineers were producing models and automation tools like nobody else,” Conley told WIRED, despite “scarce resources.”

At the time, Duguin said, no other companies in the EU Internet Forum were cooperating on the scale that Telegram was. Duguin, who left Europol just a few days after this final successful action day, strongly implied that much of the relationship’s success was due to Conley. “She was really committed,” he says. “She can be proud. Because, honestly, it was not easy.”

While Conley was busy earning Telegram the goodwill of authorities in Europe and beyond, Durov was confronting another crisis, this time in the United States. In October 2019, the Securities and Exchange Commission filed a complaint against Telegram, contending that the token presale had violated registration requirements. The SEC demanded that Durov return \$1.2 billion to investors. Once he did that, Telegram would have to raise funds somewhere else.

Back in Russia, the Telegram ban had turned into something of a farce. Durov’s platform remained the most popular messaging app in the country, despite the Kremlin’s half-hearted attempts to build a firewall around it. In June 2020, the Russian government announced that it would unblock the app, having reached its own agreement with Telegram over terrorist content.

(Telegram has denied to WIRED that any agreement with the Kremlin existed.) When the unblocking happened, Durov was once again poised to take advantage of the timing. Within a week, Telegram had signed a settlement with the SEC in which it agreed to pay back the \$1.2 billion.

Durov began freely visiting Russia again after Telegram's unblocking, according to the leaked FSB data on border crossings obtained by iStories. In the year that followed, 2021, Telegram raised \$1.7 billion in bond sales. The company reportedly got help selling the bonds from VTB, a Russian bank that's majority state-owned and has close ties to the Kremlin, as well as Russian investment firm Aton, which was founded by a former government aide. While Russian media reported that 50 percent of the bonds were sold to Russian and European investors, Spurgeon told WIRED that "Russian investors did not play a significant role."

Also in 2021, Durov gained citizenship in France and the UAE. Having weathered public pressure from the Kremlin and western governments, and having found a temporary fix for Telegram's financial stresses, he seemed to relax his attention toward content moderation issues. In 2021, Conley left her role at Telegram. Sources told WIRED that after she departed, the company was less proactive, and its cooperation with Europol and other authorities deteriorated. Telegram remained in the EU Internet Forum, but 2019's action day would remain the high-water mark for taking down malicious content, according to Duguin. (Spurgeon disagreed with this characterization, saying Telegram has always processed all takedown requests it received.)

The case that culminated with Durov's dramatic arrest on multiple charges began with a single investigation the previous winter. It was a covert operation pursuing a suspect on Telegram who investigators said had pressured underage girls to send him child sexual abuse material and had admitted on the platform to raping a young girl. According to a document seen by Politico.eu, when investigators made a request to Telegram to reveal the suspect's identity, the company refused.

De Roeck, the prosecutor's office spokesperson, confirmed to WIRED that investigators requested help from Telegram to identify the suspect. She also noted that Telegram was not responding to requests from other police

departments. “If it was one, we wouldn’t think anything about Telegram,” de Roeck explained. “But the point is, it’s every time, for every kind of request, in every country that we ask.” She added: “We’re not here to judge him right now. We’re here to ask: ‘Were you aware? Did you agree? What did you agree?’ Because it was not just once. It was thousands of times.” That March, according to documents reviewed by Politico.eu, arrest warrants went out for both Durov and Telegram’s other longest-serving officer, his brother Nikolai.

As the French investigation proceeded in secret, Durov was emerging from a long period out of the public eye. In April, he granted his first video interview in eight years—an hour-long sit-down with Tucker Carlson. Presenting himself as a champion of unfettered online expression, Durov praised Elon Musk for making X “more pro-freedom of speech.” (Musk replied to a clip of the interview: “Cool.”)

Later that month, Durov made his first onstage appearance in a decade. He was promoting TON, a successor to the crypto project the SEC had shut down in 2020. Officially, the new TON wasn’t run by Telegram, but Durov had been endorsing it, and anyone on the platform could activate a dedicated crypto wallet with a few clicks and start trading Toncoin. Now he was touting a new partnership with Tether, the company behind USDT, one of the most-traded cryptocurrencies in the world. By the end of April, Toncoin was worth more than double what it had been at the start of the year.

While Durov courted Carlson and hawked Toncoin, the French investigation into Telegram was escalating. By July 2024, it had grown to encompass a broad range of crimes, and France’s specialized anti-cybercrime unit, known as J3, took charge. Led by 39-year-old Johanna Brousse, this was the same small office that in 2021 had helped [take down Sky ECC](#), an encrypted phone service used by organized crime for drug trafficking, buying weapons, extortion, and hiring hitmen. (Brousse declined to comment on either the Sky ECC case or Durov’s case, noting that both are still open.)

Durov spent most of that summer traveling around Central Asia with a 24-year-old self-described gamer and crypto enthusiast named Julia Vavilova.

Vavilova uploaded pictures and videos to her social media accounts of helicopter rides, visits to nature parks, flights on a private jet, and stays in exclusive villas. On the morning of August 24, Durov was pictured having breakfast with Vavilova in Baku. They each appeared in videos at the same shooting range before they boarded the jet to Paris.

After Durov was arrested, one of the first questions among European journalists was whether the EU would piggyback on France's case and seek to fine Telegram under its Digital Services Act. The law, which took effect a year earlier, holds platforms that operate in the EU legally responsible for users' criminal activity, hate speech, and disinformation. "Very large online platforms"—those with at least 45 million users in the EU—face tougher obligations and penalties. So far the law had resulted in high-profile probes into X and public spats with Elon Musk. Telegram had avoided more serious scrutiny by claiming it was under the "very large" threshold. EU regulators were unconvinced and had begun an investigation into its user numbers.

A WIRED analysis with app growth expert Thomas Petit found that Telegram was very likely to have more than 45 million users in the bloc. Data that Petit accessed from Sensor Tower found 50 million monthly active users, and that was excluding some smaller countries for which there was no data. "Sensor Tower also tends to underestimate monthly active users," Petit said. He put "the real figure" at 75 million or more. The ongoing probe into Telegram's user base meant that the company was likely to have faced severe pressure to change its approach to moderation anyway.

In Durov's first post on his Telegram channel after making bail, he said that blaming a CEO for users' crimes was "misguided." His interviews with police were "surprising," he said, because Telegram had an official representative in the EU who responded to requests. At the same time, Durov acknowledged "growing pains" owing to the "abrupt increase" to 950 million global users, which had made it easier for criminals to abuse the platform. "I hope that the events of August will result in making Telegram—and the social networking industry as a whole—safer and stronger," he wrote.



Durov took further steps in a post the next day, announcing the removal of a feature called “people nearby” that had supposedly been abused by scammers. He also disabled new media uploads to Telegra.ph, a blogging platform that authorities around Europe say had hosted illegal content, especially CSAM. Soon afterward he announced that “a dedicated team of moderators, leveraging AI,” would monitor Telegram’s in-app search tool to prevent discovery of certain kinds of malicious content. Telegram also quietly updated its privacy policy. The earlier language had said that Telegram might share data with legal authorities if they identified a user as a “terror suspect.” The new language broadened that to include anyone suspected of “criminal activities.”

“It’s night and day,” a Gendarmerie officer told WIRED. The officer, who investigates cybercrime but is not directly involved in Durov’s case, said that compliance from Telegram with metadata requests was helping with numerous investigations, especially drug trafficking. The Belgian prosecutor’s office told Libération that they had noticed improved cooperation from Telegram too. In fact, regulators as far afield as South Korea have been saying the same. Soyoung Park, who works for the country’s independent media commission, told WIRED that prior to Durov’s arrest, referring illegal content to the company felt like yelling into the void. But then, late last year, Park said, she met with a high-ranking executive in Japan. (Telegram vice president Ilya Perekopsky, who was in Tokyo around the same time, did not reply to WIRED’s requests for comment. Park declined to confirm the identity of the employee.) Now, Park said, her contacts at Telegram “not only remove the flagged content but provide us with compliance updates, typically within an average of 24 hours ... And I think that’s, you know, a pretty big deal.”

Durov’s case in France won’t go to trial for a year or more, de Roeck, the prosecutor’s office spokesperson, told me. She added that it’s too early to discuss any kind of settlement agreement. For now, Durov is stuck in France, and his company seems to be in a kind of limbo, waiting to find out if a leader who has positioned himself as irreplaceable will need to be replaced.

What's the mood inside Telegram? Current employees weren't willing to comment. Shortly after WIRED contacted the company's creative director for this story, he posted a cartoon that implied an internal attitude of defiance: A black-armored Durov stands in front of the Eiffel Tower, repelling waves of riot police who have "Thinkpol" emblazoned on their backs, while Macron looks on, clutching a red-bound copy of *1984*. That seems to be how Durov continues to see himself and his company. The day after Zuckerberg announced Meta's new moderation policies, Durov posted: "I'm proud that Telegram has supported freedom of speech long before it became politically safe to do so. Our values don't depend on US electoral cycles." He added: "It's easy to say you support something when you risk nothing." Elon Musk replied on X: "Good for you." Durov wrote back: "I'm sure you can relate."

Spurgeon, who joined Telegram shortly before the US presidential election, told WIRED that the company is now profitable, which she attributed to its monetization efforts, including 12 million premium subscriptions and an uptick in advertising revenue. In 2024, Spurgeon said, the company brought in \$1 billion in revenue. A source familiar with Telegram's financials told WIRED that more than half of this came from its ad platform. The company also unloaded Toncoin holdings valued at more than \$244 million, according to documents obtained by the Financial Times. "It's not like we're using crypto to become profitable," Spurgeon told WIRED.

The case against Durov has apparently done nothing to dampen Telegram's growth, especially in the US. In the days after his capture, it briefly held the number two spot in the social networking category on Apple's US App Store. Thomas Petit told WIRED that Sensor Tower data ranks the US as Telegram's fifth biggest market, with at least 15 million monthly active users—and as with the EU, Petit estimates the real figure to be higher. The platform remains especially popular among far-right and pro-Trump groups. Telegram's channels and secret chats are set to remain vital tools as these groups coordinate their activity. Eva Galperin, director of cybersecurity at the Electronic Frontier Foundation, told WIRED: "Vigilantism is my primary concern."

Among investors—arguably Durov’s most important constituency—questions over the company’s long-term future remain. Even before the arrest, many had concerns about the platform’s reputation for enabling criminal activity and extremist violence. Some prospective investors told WIRED they worried about being able to call in their debt if Durov went rogue: “If it’s just him in Dubai with 50 engineers, it’s going to be really difficult for us to enforce on this,” one analyst remembers thinking when his credit investment firm briefly considered Telegram bonds. Another question was uppermost in the minds of several potential investors: What happens to Telegram if Durov is gone for good?

Yulia Conley, who is now launching an education tech and mental health startup, sees this as a reset moment for the company. She stressed that the AI systems Durov has touted still require human experts to interpret context. What does “prioritizing speech” look like when you’re trying to decide if a right-wing militia member is inciting violence or just expressing an extreme anti-immigrant opinion? As of late last year, Telegram claimed to have about 750 content moderators on contract. (The company would not specify what the number of moderators was prior to then.) Conley says Durov’s first statements after the arrest gave her a feeling of cautious optimism. “OK, he’s got it,” she remembers telling herself. “Hopefully. Hopefully everything will be fine.”

*Additional reporting by Gabriel Thierry*

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By [Tim Barber](#)

[Gear](#)

Jan 31, 2025 8:30 AM

# How Richard Mille Takes Quartz Watches to a Surprising Level

A company that emerged from the marine engineering sector holds the secret to the ultra-luxury brand's remarkable material that is as light as plastic, but several times stronger than steel.

NTPT pushes its composites to destruction to evaluate factors such as shear resistance. Photograph: Scanderbeg Sauer

For the team at North Thin Ply Technology (NTPT), a Lausanne-based manufacturer of high-tech composites for America's Cup yachts, satellites, F1 cars, and aerospace, abstruse topics like interlaminar fracture toughness, the chemistry of resin matrices, and the elastic modulus of fiber-based materials are meat and drink.

Less typical, in an industry where performance trumps aesthetics, is NTPT's knack for creating ... well, pretty colors and lively patterns within lumps of hardcore materials. But NTPT's work with Richard Mille, the Swiss watch brand known for engineering and designs as highly evolved as its price points (the average is around \$311,000 a watch), has taken its R&D team down some divergent innovatory paths, says Olivier Thomassin, the engineer charged with overseeing the Richard Mille collaboration. "It's led us into investigating a lot of new processes to make patterns and develop new colors, and we've spent a lot of time finding ways to bond together unusual materials," he says. "It's not the kind of thing a company like this normally does."

There is little in the watch world that resembles Carbon TPT and Quartz TPT, the composites from which NTPT makes cases for Richard Mille. The flagship watch of the brand's partnership with McLaren Automotive, the

RM 11-03, features both: rippling layers of charcoal-toned carbon interlaced with bands of lurid orange. The RM 74-02, a svelte but showy skeletonized tourbillon, repeats the trick with seams of yellow gold fused into the carbon, something Thomassin says took three years to get right.

Or else look to the RM 65-01, a high-octane split-seconds chronograph inspired by motorsports, which recently received a Gen Z–friendly glow-up with versions in banana yellow, baby blue, or soft gray. The colored material has the lightness and feel of plastic, but is several times stronger than stainless steel.

For both firms, the collaboration has become a crucial calling card, such that a dedicated facility was opened at NTPT’s Lausanne headquarters in 2018, just for making Richard Mille watch cases. Behind the glass walls of this all-white inner sanctum, a big robotic printer shifts repeatedly back and forth along a large table, busily laying down precise strips of sticky-looking material on a spotless surface. Staff in white coveralls administer the machinery, while, to the rear, spools of see-through fibers feed mysteriously into equipment that will process them into micro-thin layers of “UD” (unidirectional tape), the stuff the machine is depositing.

For Richard Mille, color and texture actually turned out to be the by-product of a challenge the brand’s eponymous founder set NTPT more than a decade ago. The firm was already making Richard Mille watch cases out of its carbon-fiber variant, Carbon TPT, but Mille asked to brighten the template, says Thomassin. “He said he wanted a composite for a pure white case, so we started experimenting. We actually ended up with red first.”

Most fiber-based composites—think Kevlar, fiberglass, or forged carbon—share basic principles with materials such as concrete or MDF: Tiny strands of a given material are set within a binding matrix, usually a polymer resin, like epoxy. The mixture is shaped, compressed, and heat-cured. The resulting composite is typically very light and extremely strong, with the fibers serving as structural reinforcements to the surrounding matrix.

It was by using fibers from quartz, a material paradoxically associated with cheapness in watches, that NTPT changed the game for Richard Mille.

Being transparent in its purest silica form, quartz composites tend to be used in areas like optics, sensors, medical scanners, and weapon systems.

“Because it’s opaque, we can get a real color into the resin mix, and keep that color fixed in,” says Thomassin. “It’s the only fiber where we can do that.”

Since NTPT specializes in the chemical formulation of its own resin solutions, it was able to research ways to add rich pigments, and to fix these within a composite called Quartz TPT. The first Richard Mille watches to use it, in stripy white and bright red respectively, appeared in 2015. The terrifically odd look—bold colors whipped through with layered textures—quickly became an exclusive and conspicuous calling card for the brand.

Every shade and style, says Alexandre Mille, the watch company’s global commercial director, is the result of extensive R&D.

“It isn’t just picking a Pantone or a treatment and adding it in. Every new color represents a substantial technical effort to produce it and to get it right, without any compromise to the material itself,” he says. For instance, the light gray shade seen in last year’s RM 65-01 was originally intended for another watch. “That was three years ago, but it wasn’t ready,” says Mille. “So we continued refining it until we could use it.”

Back in the noughties, it was the transformation of Formula 1 and supercar engineering that first brought carbon fiber, along with other novel composites, to the attention of luxury watch brands. Richard Mille was an early adopter: When he’d founded his brand in 2001, his big idea was to translate the high-tech wonder of frontline automotive engineering into something wrist-bound—“a racing car for the wrist” as he described it.

Accordingly, all manner of material innovations and technical ideas—carbon nanotubes, graphene, silicon carbide, movements suspended in pulleys—have made their way into Richard Mille’s watchmaking. It is responsible for some of the lightest and thinnest watches ever made, such as the 1.75-millimeter-thick RM UP-01 Ferrari. But it is the partnership with NTPT, a company that emerged from the marine engineering sector (it started out in sail-making technology) that has been especially

transformative. Alexandre Mille describes the relationship as “like working with a brother. There’s a lot of cross-pollination of ideas, depending on what they are researching that can inspire creative concepts for us, or vice versa.”

The research that led to the use of opaque quartz does carry a downside: Unless the manufacturing environment is very closely controlled, dust particles and other impurities will show up in the finished material. For most NTPT products that wouldn’t be a problem, but the luxury industry—and particularly quarter-million-dollar watches—requires a different level of perfectionism. Hence the facility’s sealed-off “clean room” environment.

The “thin ply technology” in NTPT’s name refers to the use of much thinner layers (or plies) of resin-impregnated material than is found in standard composites. Thomassin says this allows for greater precision in tailoring the mechanical properties of whatever is being made, as well as achieving the kind of aesthetic consistency that a luxury product requires.

The base fibers arrive from suppliers as rolls of thread, which are stacked up and distributed via an intricate creel system. The translucent quartz thread consists of over a thousand tiny, interwound silica fibers or filaments, each one no more than a few microns in diameter. NTPT’s proprietary system unravels these filaments from each other and aligns them in a wider, unidirectional layer, before binding them in resin to create a broad “prepreg” tape that’s at most 45 microns thick.

A roll of the prepreg tape is loaded into a robot device known as an ATL (automatic tape laydown). With its boxy red body and rivets, the ATL rather resembles a giant piece of Meccano, skimming slowly back and forth as it builds up a precise crosshatch of layers.

It’s the overlaying of these prepreg layers in strictly angled sequences that allows factors like load-bearing capacity, stiffness, fatigue performance, and resistance to cracking to be managed and directed. While more intensive to manufacture, thin-ply composites are designed to maintain part integrity over longer periods, and at greater stresses, than standard composites with thicker plies. (Elsewhere in the building, a lab puts bits of composite through all manner of trials—pulling, twisting, compressing to breaking

point—though Richard Mille’s own suite of tests is apparently even more demanding.)

For the watch cases, this means layering at 45-degree increments—what’s known as a “quasi-isotropic” formation, meaning near-uniform strength and stiffness in every direction. Stacks of this preform (the combined layers) are then laid by hand onto curved molds. Between the watch case body and the bezel that sits on top, there are around 600 plies in total which, as they bond together, creates the unique striated patterning. The hallmark wavy stripes of a watch like the RM 35-03, the latest signature piece for tennis superstar Rafael Nadal, available in either a silvery-gray, or deep blue with rippling bands of light blue, are made by including differently colored stacks at regular intervals.

Fusing and hardening the material takes place under heat and pressure in an autoclave oven resembling a small blue submersible. Lengths of composite, laid on the molds and sealed in vacuum bags, are compressed at 6 bars and heated to 120 degrees C. The resulting Quartz TPT block is finally cut up into barrel-shaped case blanks by a high-precision waterjet, before being sent to Richard Mille’s own manufacturing facility in the Jura mountains for CNC machining into finished watch cases.

Quartz watches they may be, but also around 3,000 times more expensive—and about the same degree more engineered—than what that term customarily means.

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By [Steven Levy](#).

[The Big Story](#).

Jan 31, 2025 6:00 AM

# Bill Gates Traumatized His Parents —and Other Stories of a Wild, Wonky Youth

Terrorizing classmates, spending a night in jail, tripping on LSD: This isn't the Bill Gates you know.

Photograph: Sinna Nasser

In his new memoir, [Bill Gates](#) doesn't mention any study of William Wordsworth's writings. But when I read [Source Code: My Beginnings](#), I thought of the English poet's famous line from 1802: "The child is father of the man." Nearly the entire volume is devoted to Gates' early years, with [Microsoft's](#) origin story entering the narrative in the final chapters. (A second volume will discuss his company, and a third will focus on his work with the Gates Foundation.)

In more than 40 years of [interactions with Gates](#), I have found him resistant to self-reflection. He'd often mock my attempts to engage him in a deep biographical mode by making flip comments or dodging the question. But in this book—his fifth—released this February, there are about 300 pages of Bill Gates' personal journey, told in a somewhat unsparing first person.

The Big Interview

[Read more](#) deep, weird, smart conversations with the most important people in our world.

As he paints it, Gates' Seattle childhood hit all the notes of a '50s sitcom, with loving, devoted parents and the trappings of the American Dream. But the family dynamic was fraught, often because of Gates' personality quirks.

His own father once told me that Gates' mom found their son's behavior "traumatic"—he refused to submit to his parents' wishes that he do his homework, listen to simple requests, or even speak to them. With his family, his teachers, and his fellow students, Gates rejected the social contract. He cracked jokes or responded with sarcasm and his favorite phrase, "That's the stupidest thing I ever heard!" (Those words would later be as familiar to his employees at Microsoft as they were in the hallways of Seattle's Lakeside School.)

At Lakeside, Gates learned that actually studying for class could pay dividends, and that acting in a school play was a great way to get to know popular girls (though one turned him down for a prom date). Most importantly, he discovered that a computer terminal could open up a world to him—and ultimately, with his software, to hundreds of millions of others.

Gates' description of how he and his friend [Paul Allen](#) cofounded Microsoft is a more familiar tale. It was the subject of my very first interview with Gates in April 1983, and [in my book](#) *Hackers* I told the story (as did others) of how, when Gates was 19, the pair created the first version of the BASIC computer language that ran on a microcomputer. But reading Gates' side of the early Microsoft saga is illuminating. He explains why after commandeering a 60 percent stake in the company, he later browbeat Allen into accepting the butt end of a 64-36 split. Gates says he now feels badly about how he handled it, but that the arrangement reflected who was working harder and making more decisions. (In his own autobiography, *Idea Man*, Allen would write that the incident "exposed the differences between the son of a librarian and the son of a lawyer.")

Gates and I met at the Washington, DC, office of Breakthrough Energy, an organization he founded in 2015 to [help fund climate tech](#). The former teenage hellion—who once joked with a friend how crazy it would be to accumulate a \$15 million fortune—is now a 69-year-old world-famous centibillionaire and a divorced granddad with his own complex family dynamic. He is respected by the global health establishment and literally demonized by anti-vaxxers and tinfoil paranoids. He has been interviewed thousands of times and sits stone-faced as he mics up for our session. But as

he reimmerses himself in the past, he soon is rocking gently—and cracking jokes.

**I know you've been thinking of an autobiography for decades. But I didn't expect you to write a book about your childhood.**

It's a project I've been working on for some time. But it was only about 18 months ago that I decided to do a book on this first phase of my life—the 25 years up to the start of Microsoft—where my parents, my upbringing, and the luck I was exposed to were the whole story. Once that idea came up, I got quite enthused. It was really fun to try and explain how amazing my father was, my mother, my sisters. And how I found myself more enmeshed in programming than almost *anyone* by the time I'm about 20 years old.

**This is very much a bildungsroman, your coming-of-age story. You hold a mirror to yourself. Sometimes the mirror doesn't portray such a flattering image.**

It's not the Immaculate Conception. I had my ups and downs. There was the time I brought friends to the Harvard lab and used a computer, and they were confused about what I was doing. [He was later admonished for improper use of the lab.] Microsoft's first customer was MITS, and we ended up in a dispute with them. It's hopefully a very human story.

Photograph: Sinna Nasser

**It is a human story. I remember doing a profile of you in 1999, and your father told me that your mother was traumatized by your behavior. You wouldn't talk for days on end. As you say in the book, the things that really interested you were reading and math and being inside your own head. In some ways you weren't kind to your parents, and you express remorse for this.**

I give my parents a lot of credit for how they shaped me. My dad was much more setting an example, always being serious about his work. With my mom, it was far more intense. I was often falling short. “Oh, you didn't get up here as soon as I wanted, or your table manners weren't as good as I

wanted.” She was always pushing me to do better. Eventually she was proud of what I achieved, but that was a complex relationship.

**They were at their wits’ end with you, and took you to a therapist. At the end of the book you said that if you had grown up in this era, you probably would have been diagnosed on the autism spectrum. What led you to that conclusion?**

Back then, the idea that kids were very different and needed some kind of intervention wasn’t commonplace at all. I was clearly somewhat hyperactive. I could concentrate a great deal. This guy, Dr. Cressey, really got me thinking about what I was trying to achieve in this conflict with my parents. Did I really have some thought in mind, or was I just trying to make trouble? I think the fact I did get to see that therapist was good. Who knows what it would have been like if I’d been diagnosed? Kids now are much more looked over. I was able to go off to the computer center or spend all that time alone, even going out on hikes.

**I couldn’t believe how you and your preteen friends went on epic, dangerous, multi-day hikes.**

Now you’d have a GPS tracker.

**Very late in the book you acknowledge how much privilege is part of your story. You say that you were advantaged as a white male, and your family was well off. But in a sense your life is charmed. Everyone is watching out for you. At several points your father swoops in to give you legal help. Teachers went out of their way to take an interest in you. People had your back at every turn.**

I was so lucky in those things. I had at least five or six teachers who saw a spark in me and really engaged with me. My parents were well off, but compared to the kids at this private school I’d say we were below average. They had bigger houses and they had wealth. [This wasn’t apparent to Paul Allen, who wrote in his book, “Bill came from a family that was prominent even by Lakeside standards ... I remember the first time I went to Bill’s big house a block or so above Lake Washington, feeling a little awed.”] I actually had a little chip on my shoulder—“Hey, you guys, your parents

gave you a car and you didn't have to work in the summer." But you could hardly design a better childhood, you know—including a time-sharing computer terminal showing up at the school when I'm 13 years old.

**You recount how you acted like the class clown and often responded to people by being, as you diplomatically say, a “smart aleck.”**

Look, there's a certain clever-boy shortcut use of sarcasm that allows you to communicate efficiently. That whole kind of sparring can be funny. At Harvard, that was my go-to approach, my whole way of engaging with people—procrastination, and being super clever and sarcastic while tearing somebody's argument apart. The underlying skill is actually worthwhile, but I tended to break those habits later, knowing when not to deploy it. That kind of dialog doesn't work when you're managing people.

**Well, I'm thinking about the deposition you gave as a billionaire CEO before the trial for antitrust—you behaved just like a smart aleck kid!**

You think I was a smart aleck? That lawyer, now *that's* a smart aleck!

Photographs: Sinna Nasseri

**Malcolm Gladwell in his book *Outliers* says that it's possible to explain why some people are special. They practice at their special skill for 10,000 hours and are alive at the perfect time for their expertise to matter. You certainly spent more than 10,000 hours programming, and the time was right. But that's true of a lot of people. And there is only one Bill Gates. I can't crack the code for what makes a person extraordinary. Have you thought about that?**

It's not just the circumstances, though that's gigantic. Yes, there's still a few million kids who are in the same loop as I am. But through my father I saw the common sense of business. In my early engagement with Digital Equipment Corporation, which was this vaunted company, people embraced me and gave me reinforcement. And there's something about my desire to succeed using my skill set. My friend Kent Evans helped really cement that.

**He was your best friend, and more focused on his ambition than you were, reading business magazines as a teenager. His accidental death at age 17 haunts this book, and your life.**

Kent helped shape me as a forward-looking person. And then Paul was reading about chip stuff, and he showed it to me. He was two years ahead of me but he sought me out.

**Paul also gave you LSD. Steve Jobs once said that LSD was a formative experience and opened his mind in a way that helped him with creativity and design. I don't get the impression that taking acid was life-changing for you.**

I think the batch that Steve got must have really been good for product design and marketing. My God, just think if I'd had that batch! Yeah, I did some crazy things when I was young. Paul deserves some credit for that. By the time we got serious about work, we weren't doing that anymore.

**You also briefly write about the famous time you got busted for speeding. Were you freaked out by spending a night in jail?**

No, it was just kind of a funny thing. They thought it was strange that somebody so young had a nice car—what was the story with this kid? Was I a drug dealer or something?

**You bought yourself a Porsche in your early twenties.**

I clearly didn't fit their normal pattern. We kept enough cash around that Paul was able to come down and bail me out.

**Speaking of cash, on the recent Netflix series you host, you did an episode about inequality. You didn't condemn the idea of billionaires but advocated for more equality. How would that work?**

The world economy has created some hyper-rich people. Like me. And maybe 50 or 60 others. Elon Musk is at the head of that list, but with Jeff Bezos, Mark Zuckerberg, Steve Ballmer, Warren Buffett, Michael Bloomberg, there's a lot of people with a stunning level of wealth. I think

that's OK. I would have a much more progressive tax system, so I would have about a third as much money as I have. It would still be a gigantic fortune.

**The New York Times reported that Nvidia CEO Jensen Huang is on track to avoid \$8 billion in estate taxes. When you read that, did you think, "I should consult his tax lawyer"? Or say that this is not a good thing?**

I'm quite certain I've paid more taxes than anyone alive—over \$12 billion. There are techniques I *could* have used, like to borrow against my Microsoft shares and not sell them. But if people are getting away with paying less in taxes in a legal way, blaming them is a little strange. We ought to change the tax system.

**They are culpable because they use political pressure to preserve their loopholes and cut funding for the IRS.**

The votes of these billionaires shouldn't influence our tax system. Also, several of the 50 hyper-rich are for more progressive taxation. I've been surprised that even the Democratic Party hasn't gone very far to make tax stuff more progressive. I'm a huge defender of the estate tax, I think it's a fantastic thing. I would make it even tougher to avoid it.

Photograph: Sinna Nasser

**Let's talk about artificial intelligence. You've been working with it for years, but you were slow to embrace the recent transformational breakthrough of generative AI. It wasn't until [OpenAI did a demo of GPT-4 at your home](#) and aced an AP Biology test that you became bullish on it. What was the reason for your initial skepticism?**

The idea of AI is pervasive throughout my whole history with computers. Bizarrely, when I left Harvard to start Microsoft, one of the things I thought I might regret was that the progress in AI in academia might move quickly while I was doing BASIC interpreters. That turned out to be so wrong. I expected that when we could encode knowledge in a rich way, where it could read a biology textbook and pass the AP exam, that we would

explicitly understand how we're encoding that knowledge. Instead, we discovered a weird statistical algorithm that we don't understand. Why does GPT work? We don't have a clue. But when OpenAI showed me GPT-4, it stunned me that they had crossed a very important threshold. We still have reliability problems, but we have a path now where I think those will all get solved.

**Sam Altman says we will have AGI in the next few years. Do you agree?**

Absolutely.

**What will that mean for us?**

Anybody who analogizes this to electricity, tractors, microcomputers, they don't get it. This is not a productivity aid for humans. This is something that exceeds human capability. It is not bounded in any way, and it is happening very, very quickly. Just looking back on previous tech revolutions and saying, "OK, that all worked out," is no guide for this one.

**Do we need to regulate it?**

Regulation will call for certain liability, for quality benchmarks. But the main thing people should say is, should we slow it down? It's very hard to think how you would do that. Whenever somebody in the US says, OK, let's regulate it, people say, "Well, what about other countries like China?" The key fact is, we don't have a mechanism to slow it down.

**We're also developing weapons with it—there's a literal arms race for lethal weapons controlled by AI. Do you think that's a good idea?**

Take what Elon essentially said about the F-35 fighter jet—having a human in it is value subtracted. He's right. So if you use the logic of, "OK, I want to make the best airplane weapon," AI is the state of the art.

**What's your relationship with the new administration? In an earlier interview, you told me that Donald Trump urged you and Anthony Fauci to meet with RFK Jr.**



We did meet with him, and we discussed vaccine safety. It was four people—Robert Kennedy, [former National Institutes of Health director] Francis Collins, Tony Fauci, and myself—and we spent two and a half hours.

**Are you excited that he has been named to head the Department of Health and Human Services?**

Does he end up taking the job or not? There are people excited that he is willing to shake things up. If you shook it up the right way, maybe it could be better. But I think the National Institutes of Health works very well the way it is. So my counsel, if they are at all interested, is to not be too radical in changes to the NIH. But they're in charge. At the very least, it's going to be an interesting period.

**Aren't you terrified that an anti-vaxxer is going to be in charge of vaccines?**

It's hard to know. Many radical things get said, and very few radical things get done. In the world of health you have to have an outcome. Are you helping to make people healthy or not? The Foundation's unique point of view is that we want to help the health of people all over the world, including in poor countries. The thing that I'm most worried about is, will the health needs of the poorest, particularly in Africa, continue to be a priority? The desire to reduce the deficit makes us have to stick up for those things even though the stuff I'm trying to stick up for is only like half a percent of the budget.

**Elon might think that's a waste of money.**

I am worried about the relationship between the United States and the World Health Organization, since various people and politicians had complaints about the WHO during the pandemic. That should all be talked through. But I hope the US doesn't defund WHO, because they play a very important role in coordinating things when there is a health emergency and preventing a pandemic. [In his first week in office—after this interview took place—President Trump announced that the US would leave the WHO.]

**Are you going to make nice with the Trump people?**

They're the government of the United States. So I would say yes.

**Let's finish with the way you end your book. You write that sometimes you wish you were still that 13-year-old kid living inside your own head and driven by curiosity. With all your success, you really want to roll back the tape?**

I'm not saying I want to go back and change something. I've been so lucky. But it was amazing to live through all that. I do miss that wonderful feeling where the whole thing was in doubt. There were days when I thought, "Oh, we are so messed up, and other people are ahead of us." And, "Who do we think we are to have these wild dreams?" But step by step, we built this incredible thing.

**Do people really change?**

No. I think you moderate, you become wiser, and you grow. But I'm still 95 percent that same person.

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By [Virginia Heffernan](#)

[The Big Story](#)

Jan 13, 2025 6:00 AM

# The King of Ozempic Is Scared as Hell

Now that Novo Nordisk is the world's weight-loss juggernaut, will it have to betray its first patients—type 1 diabetics?

Play/Pause Button



Photographs: Steven Achiam; Getty Images (Ozempic)

On a frigid day in Copenhagen when Erik Hageman was 2 years old, he tripped over his wooden clogs. His face smashed into the floor. In the emergency room, a surgeon repaired his tongue, which had split, but in the months while he was recuperating he shrieked nonstop for water. His urine turned sticky and sweet. The doctor [diagnosed diabetes](#), type 1, the autoimmune condition in which the body attacks its own pancreas.

This was 1942. The Nazis occupied Denmark and eugenics was their first medical principle. Trauma like Erik's fall, some suggested, activated diabetes, and the bloodline of the diabetic was poisoned. Three short weeks of neglect, the doctor promised Hageman's parents, and their little son would perish of ketoacidosis or starvation. "The best you can do is do nothing," the doctor said.

Still, Hageman's parents felt—and this was rebellious, given the master-race ideology that crackled through the Nazi Weltanschauung—that their boy deserved to live. When Hageman's father, a custodian at a sports college, told his coworkers his son had diabetes, one of them knew a guy.

Hans Christian Hagedorn, short-tempered physician. Wild tufts of hair. At Nordisk Insulinlaboratorium just outside of Copenhagen, he was refining insulin from the pancreases of cows and pigs to make it work better for humans. During a long period under Hagedorn's care, Erik Hageman started to get twice-daily injections of a fine precipitate of protamine insulin, a breakthrough formulation that prolonged insulin's effects in the body. Neutral Protamine Hagedorn is still on the World Health Organization's list of essential medicines. By the time he was 5, Hageman was injecting himself with a wide-gauge needle as broad as—he pantomimed to me, in a kind of diabetic fish story—a tree trunk.

At 85, Erik Hageman is a dapper grandfather of surpassing warmth, compact like a tap dancer. He's one of the longest-living diabetics in Denmark. We spent an afternoon together in a modernist mansion in Copenhagen called Domus Hagedorn, which is owned by Novo Nordisk, the Danish firm that grew from Hagedorn's lab. "Hagedorn was rather crazy," Hageman told me. But without the doctor's care, he explained, "I'd be blind and I'd have to cut off my legs and have kidney failure." The now-global company makes half the insulin in the world. Yet today it's rich and famous for producing Ozempic, the megahit semaglutide drug.

Just before visiting Erik Hageman, I met Lars Fruergaard Jørgensen, who has presided over the company's epochal metamorphosis, at the company's headquarters in Bagsværd, a suburb of Copenhagen. The building's design, with its giant helix-like indoor spiral staircase, is inspired by [insulin](#)—the molecule, the miracle. In a conference room flooded with light, Jørgensen spoke fondly of Hageman, the company's poster child. Novo's executives had clearly presented Hageman to convince me that the company's greatest achievement is not its stratospheric valuation but its century-long record of saving lives with insulin.

But at Novo these days, semaglutide blocks out the sun. Ozempic was the world's second-highest-selling drug in 2024. It works extremely well for type 2 diabetes, a non-autoimmune disorder in which the body makes poor use of insulin. And one effect of semaglutide, as we all know now, has been the box-office draw from day one: [appetite suppression](#). The drugs that contain it—especially Ozempic and its more powerful sister Wegovy—have

transformed Novo into a global slimming juggernaut. In 2023, the company surpassed Parisian luxury brand LVMH to become the richest company in all of Europe, hitting the ludicrously high market cap of \$424 billion. In 2024, Novo took a punch in the face, but it ended the year still richer by market cap than Bank of America, Coca-Cola, and Toyota.

### MONEY MONEY MONEY

For this special issue, we went far and wide to find out who controls the world's wealth. What did we find? Men. From Trump, Musk, and Putin to the CEOs, crypto schmoes, and solar bros, [meet the patriarchy controlling the purse strings](#).

Beyond the dazzling before-and-afters, though, Jørgensen is looking at [a tricky future](#), parts of which, he told me, “scare the hell” out of him.

Though Novo has as its controlling shareholder the largest altruistic foundation in the world, it has to act coldly and tactically, like an oil or defense company. The demanding semaglutide business has become a mean ouroboros: the insatiable market, exorbitant manufacturing costs, competition from Eli Lilly, pricing pressure from governments, and the private-insurance dystopia in the US—by far Novo’s biggest market, where some 15 million people now take semaglutide. At the same time is the moral crux. Semaglutide alone almost never works for the 8.4 million type 1 diabetics around the world. What keeps Jørgensen up at night is his fear that, the way drug manufacturing and American health care companies and global markets work, his company might not be able to do right by its original patients. These are the non-Hollywood patients—the ones who, like Eric Hageman, can’t live without insulin.

For its first 75 years, Novo was indispensable but unknown, a producer of insulin, an anonymous commodity. In 1991 the obscurity started to lift. That year, Lotte Bjerre Knudsen, a Danish chemical engineer, was seeking a treatment specifically for type 2 diabetes, which accounts for as much as 95 percent of all cases of the disease. Over the next 18 years, she led a Novo team in developing an exquisitely cool medicine for type 2 called liraglutide. Liraglutide is an analogue of a human hormone called [GLP-1](#),

for glucagon-like peptide-1. After humans eat, we very, very briefly secrete GLP-1 in the brain stem and the gut.

GLP-1 can be seen as a tranquilizer for the flesh, a soother of deep and primitive longings. GLP-1 says to the body: *peace*. Food is available. But GLP-1 in its natural form only murmurs these soothing blandishments for a minute or two. It affords the hungry soul a glimpse of OK-ness, but a fleeting one.

The challenge for Knudsen was to build a dupe of GLP-1 that would *persist*, a GLP-1 that would let a patient feel blood-sugar equanimity longer. Knudsen pulled this off by snapping a fatty acid onto a precise spot on a chain of amino acids. It's incomprehensibly more complex than that, but eureka anyway: Knudsen had something that acted like our natural GLP-1 hormone but stayed in the system for a full day.

Liraglutide was approved in the US for type 2 diabetes in 2010 and for weight loss in 2014. But a daily injection could put patients off. So Novo assembled a new team of researchers that included Jesper Lau, a peptide and protein engineer, who invented *semaglutide*, from the French *semaine*, for “week.” Semaglutide suffuses the body and brain for seven days.

A weeklong reprieve from blood sugar turbulence, and from the ravenousness that defines modern existence. A single shot and you feel like you've just eaten always. In 2018, the world learned Novo Nordisk's name when the company released semaglutide as Ozempic. Novo even created a jingle. *Oh oh oh Ozempic!*

The cheers for semaglutide would have drowned out the cheers for insulin a hundred years ago. Yes, nausea, vomiting, diarrhea—these are not uncommon side effects. And some rare but terrifying ones like possible blindness have been identified. But semaglutide is generally, as they say, “well tolerated.” True believers see a panacea: a treatment for alcoholism, heart disease, polycystic ovary syndrome, Alzheimer's, Parkinson's, sleep apnea, liver disease, and a newly identified mental obsession with eating and dieting known as “food noise,” which is especially common in the US.

Most Danes have never even heard the Ozempic jingle. Like nearly every country on earth except the United States and New Zealand, Denmark prohibits advertising prescription pharmaceuticals to consumers. With its weight-loss fetish and direct-to-consumer marketing, the US was clearly Novo's Troy, primed to be sacked. Under CEO Jørgensen, Novo hired media giant Wavemaker, whose clients include L'Oréal and Tiffany. Novo began spending reportedly close to \$200 million a year flogging semaglutide. Americans were soon hooked on the jingle, the relief, and the compliments.

To make money stateside means navigating through the dark woods of both America's health care quagmire and its thorny diet culture. One of the biggest tasks for Novo was to throw off the impression that semaglutide is a vanity drug. Styling it like insulin, a sober injection for a disease, rather than like speed, a candy-colored pill for weight loss, was the only way to get it covered by fickle American insurance companies. And if semaglutide could be covered, especially while under patent, it would be exponentially more bankable.

Thus, Novo Nordisk joined the ongoing effort to fire-hose the world with the word *obesity*, not to refer to body size but to a metabolic disease. By the time Wegovy—specifically for weight loss, with a dosage of semaglutide 2.4 times higher than the Ozempic dosage at the time—was approved in 2021, obesity was in full swing as its own affliction, and semaglutide swooped in as the cure.

Not long after, the FDA handed Novo yet another victory when it approved Wegovy to “reduce the risk of serious heart problems” in heavier-weight people. The agency added that 70 percent of American adults fall into this category.

in spite of the market ruckus about semaglutide, insulin still seemed like the favorite child at Novo's headquarters. Engineered human insulin is a pharmaceutical jewel, a priceless DNA sequence rigged up in 1978 and sometimes described as biotech's first “golden molecule.” It's also a so-called biologic. Biologics are medicines derived from big, complex, living molecules: bacteria, blood, yeast, viruses, and animal and plant matter. They are costly and complex to create.

Insulin at Novo is made from baker's yeast, a microorganism with a relatively high biomass that's chock full of protein, essential amino acids, and minerals. It's an ideal workshop for a DNA tinkerer. At the same time, built molecules, the ones like insulin that express themselves in yeast, are maddeningly idiosyncratic.

Monika Nøhr Løvgreen at a Novo Nordisk research site in Måløv, Denmark.

Photograph: Steven Achiam

Monika Nøhr Løvgreen, a research scientist I spoke to in her lab at Novo, told me her love affair with engineered molecules can get tumultuous. "It's not enough for a molecule to give me the biology I need. I need something I can inject without getting red or itchy, that doesn't degrade when I store it, that's well behaved in the solution." Løvgreen described some molecules as "prima donnas" while others are well behaved, elegant, and even queenly.

In the insulin and semaglutide labs, engineering a molecule correctly is everything, Brian Vandahl, Novo's head of global research technology, told me. That's where scientists create "the single cell that starts the whole release culture, that lives in those big tanks." From Bagsværd, he gestured vaguely in the direction of the company's giant drug-manufacturing facilities.

Whether for insulin or other biologics, it's not cheap to grow, ferment, and purify living cells. (Though it is made in a similar way as insulin, the engineered protein in semaglutide contains fewer than 40 amino acids, so the FDA classifies it as a small-molecule drug, rather than a biologic.) Like pets or people or gardens, microorganisms need to be lovingly cared for, which requires patience, sugar, climate control, and constant cleaning with substances that don't kill microorganisms. In West Lebanon, New Hampshire, where Novo has a secretive biologics facility, one local referred to the plant as "the place where they teach fleas to sing and dance."

By contrast, blockbuster tablets like Prozac, Viagra, Oxycontin, Tylenol, Lipitor are, relatively, a piece of cake—and cheaper to make. They're usually derived from nonliving molecules with lower biomass, mostly



chemical compounds. Hardy and inanimate, these chemicals don't need to be managed with kid gloves. "It's easier to control chemistry," Vandahl said. "But I'm more fascinated by biology."

Now that Novo is responsible for the blockbuster semaglutide drugs and half the world's insulin, it is putting tens of billions of dollars into expanding its production facilities. Each one costs \$2 or \$3 billion and takes five years to bring online—half of the time to build, the other half testing the machinery.

Last year the company broke ground on a vast new manufacturing facility in the seaport town of Kalundborg, Denmark, on the island of Zealand. This biotech metropolis produces a range of active pharmaceutical ingredients, or APIs, from living cells, including insulin and semaglutide. "Look for Dubai," one Novo employee told me, when describing how to spot the place.

The town is indeed a misty forest of harbor cranes and construction dust. I wanted most of all to see the vats of high-spirited yeast. Michael Hallgren, the senior vice president of API manufacturing, gave me a tour. After we gowned up, he let me hold a small vial with molasses-colored fluid; this was the showpiece cell engineered in the lab. They wouldn't tell me if it contained the molecule for insulin or semaglutide. But the rich appearance of the fluid, the intense specialness—I recognized it. "A sourdough starter?" I asked after a beat.

"Yes," he said. Strolling through the factories, which Hallgren, at nearly 7 feet, seemed to cross in a single bound, what I noticed most was silo-sized mixing bowls. Inside them, something that looked like cake batter bubbled. It was comforting how strongly the facilities smelled like bread, like beer—alive and fizzy. "And, when that starter grows," Hallgren told me, "It's enough to treat 500,000 diabetics for one year."

Novo Nordisk employs around 30,000 people in Denmark, with about 5,000 in Kalundborg alone. One bright-eyed young employee, who traveled from the Philippines to Kalundborg to work at the company, has a job validating machinery. ("I have an aunt who has diabetes and uses our product," she told me.) With some \$8.5 billion invested in expanding the plant here,

hundreds more are expected to come. Not long after I left Denmark, Novo announced it was building yet another facility—in Odense, for \$1.2 billion. A Copenhagen politician even said that he anticipates an American brain drain of scientists to Denmark during Trump’s second term.

A process engineer validates equipment used in insulin production in Kalundborg, Denmark.

Photograph: Steven Achiam

Novo also has plants devoted to making its drugs in Brazil, China, France, Algeria, Iran, and the US. In December, it acquired Catalent, a global development and manufacturing company headquartered in New Jersey, for \$11.7 billion.

But Novo’s impact on Denmark is absolute. The country is home to fewer than 6 million people, and somehow the company’s recent triumphs have driven its GDP up ahead of Egypt, which has a population of 112.7 million. The company pays in taxes what any self-respecting American capitalist would consider confiscatory: \$3.6 billion globally in income taxes in 2023, \$2.3 billion of that to Denmark. Corporate tax revenue in Kalundborg has shot up 10-fold since 2010. “Big shoutout to overweight Americans for keeping my mortgage low,” a Danish economist tweeted in 2023.

since word of semaglutide’s slimming effects hit the diet-culture rialto, people have been clamoring for it. In 2022, the FDA listed semaglutide drugs as in shortage. People who couldn’t wait for the real thing began to turn to specialized pharmacies that cook up Ozempic knock-offs as if it were bathtub gin, sometimes with tragic results.

Meanwhile, just as Novo was making the market, Indiana-based Eli Lilly rolled out its own GLP-1 drugs, Mounjaro and Zepbound. With an American company invading Novo’s market, some warned that Denmark now faced the so-called “Nokia risk”—the fate that befell Finland in the aughts when it predicated its entire economy on Nokia and its pioneering smartphone, only to get wiped out when Apple introduced the iPhone.

The US government too has absorbed the size of the GLP-1 phenomenon. At the end of 2024, the Biden administration proposed a rule that would have Medicare and Medicaid cover semaglutide for weight loss. “It’s a game changer for Americans who can’t afford these drugs otherwise,” Xavier Becerra, the head of Health and Human Services, said.

Sure, the new administration will likely kibosh this. Robert F. Kennedy Jr., whom Trump has nominated to run health policy, has waffled on Ozempic, once claiming that obesity and even diabetes can be cured with discipline and diet. (Novo Nordisk, he told Fox News, is “counting on selling it to Americans because we are so stupid and so addicted to drugs.”) But Americans are unlikely to go without. At Christmas, Elon Musk, looking gaunt, styled himself as “Ozempic Santa.”

nothing matters more to Novo than doing brisk and brisker business in the US. This requires that the company do regular battle with the same demon even the lowliest American confronts: health care runarounds.

On September 29, 2024, Senator Bernie Sanders grilled Lars Jørgensen at a hearing on the price of Ozempic and Wegovy. Bernie found the price of patent-protected semaglutide too damn high, and he seemed to be champing at the bit for a set piece in which he’d slay his very own Big Tobacco CEO. Comparing Ozempic’s price in Germany (\$59) to its US price (some \$600 after rebates), Sanders asked Jørgensen, “From a moral perspective, does it bother you that keeping the price of Ozempic and Wegovy so high could lead to the preventable deaths of tens of thousands of Americans?”

Jørgensen seemed to hedge. Novo now pays a reported \$5 million a year to lobbyists to get lawmakers on its side; still he had volunteered to testify. He wanted, he told me, to educate the lawmakers. In a calm and steely voice, he explained how costly it is to make biologics. He didn’t give Sanders the fireworks the senator craved. Instead, he directed the committee’s attention to pharmacy benefit managers.

PBMs. The worst. They’re the despised outfits like CVS Caremark that administer drugs for health plans, negotiate for insurance companies, and, most notably, maintain the lists of drugs covered by insurance.

Though many of us learned about PBMs only after the December assassination of Brian Thompson, the CEO of UnitedHealthcare, which is affiliated with a giant PBM, Jørgensen has called these middlemen the real enemy for a long time. Facing down Sanders, he spelled out one of the most excruciating paradoxes of American health care. PBMs make their money from insurance premiums, but they also get money from drugmakers in the form of rebates. Usually, the more expensive a medication is, the higher its rebate. If a drug company like Novo drops the price of its drugs *too* low, the PBMs, afraid to miss their cut, often stop covering them altogether.

Take Levemir. As Novo Nordisk rode \$18.5 billion high on semaglutide profits, the company announced it would discontinue one of its insulin products. Levemir was set to vanish entirely from US pharmacies on December 31, 2024. Patients were stunned. Though Levemir had lost its luster as a first-line treatment, thousands of patients in the US still used it. The long-acting insulin drug, which metabolizes more quickly than other types of insulin, works especially well for young, pregnant, or highly active type 1 diabetics. Novo aimed to soothe anxiety by pointing out that it offers a range of other products for these patients.

Jørgensen told the committee, “We lowered the list price in the US by 65 percent, just to realize that after we dropped the price of Levemir, the PBMs dropped coverage.” Novo discontinued the drug. Of course, the company bears some responsibility for the price of its biologics. But as Senator Tim Kaine pointed out at the hearing, Novo and PBMs are apples and oranges. Novo “makes life-saving treatments,” he said, while PBMs essentially exist to skim.

Novo Nordisk, with its Danish earnestness, really seems to believe it could confound the paradigm of capitalist rapacity. While it is publicly owned and traded, its controlling shareholder is still the Novo Nordisk Foundation, cofounded by Hans Christian Hagedorn in the 1920s to use profits from insulin sales to research diabetes. Its mandate has expanded, and it has spent billions to address societal and climate crises. Most recently, the foundation, which is more than twice the size of the Gates Foundation, allocated \$1.3 billion of its \$167 billion endowment to research and humanitarian grants.

At the hearing, Sanders, the old lefty, stopped his hammering of Jørgensen to praise Danish decency. “As you may know, look, I’m a great respecter of the people of Denmark. I think you have a social system which is very progressive.” About Novo specifically, he said, “All we are saying, Mr. Jørgensen, is: Treat the American people the same way you treat people all over the world.”

The market, as usual, had a mind of its own. Its focus was not on diabetes: Emily Field, a pharma analyst at Barclays, predicted that weight-loss drugs like Wegovy would be “the biggest pharmaceutical class ever” and worth \$200 billion in a decade. She added that insulin is of “decreasing financial importance” to Novo Nordisk.

This may have been exciting to investors, but it wasn’t what any diabetes patient wanted to hear. Already Novo was under so much pressure to manufacture pens for obesity and type-2 diabetes patients that it had scaled back making insulin pens in South Africa. Without those pens, type 1 diabetics had to resort to cumbersome vials. (A spokesperson at the time said Novo was phasing out certain products to address “capacity constraints.”)

“This is completely unacceptable,” Helen Bygrave, of Doctors Without Borders, told me. “More lucrative medicines in the same pen devices—GLP-1s like Ozempic and Wegovy—are being sold by Novo at an unprecedented rate in high-income countries. This has clearly diverted manufacturing capacity of pens to garner billions in profits at the cost of people living with diabetes.”

Faced with having to ramp up production, feed lobbying and marketing divisions, and meet its earning projections, Novo Nordisk—the foundation-run, conscience-stricken insulin company—seemed, from the outside, to be acting less like a research hospital and more like a corporation that had hit the heel of hockey-stick growth.

It was an unexpectedly sunny day in mid November when I met Jørgensen at Novo headquarters. The CEO, Novo’s fifth in 100 years, is a tall, handsome man with a long stride and a soft voice. After a successful knee surgery last year, he’s back to kayaking, playing tennis, and riding his bike

through the Danish countryside. The employees at Novo had warned me that Jørgensen is introverted, and I expected reticence from him or even evasion. This was wrong.

I asked him straightaway about fat.

“My own personal journey is one of being guilty of stigmatizing people with overweight, obesity,” Jørgensen said. “I was coming from an original thought of ‘OK, that’s probably because you eat too much, and you are not active enough.’”

That meme-weary phrase, *personal journey*—Jørgensen, to my surprise, seemed to mean it. “I went from ‘If you just did better, you would have changed your weight and you’ll be fine’ to understanding that people are different. There’s a genetic dimension, there’s where you live, your financial position, your socioeconomic position, the culture you live and work in. It’s a bit too simple to look at it as a self-inflicted condition.”

He went on. “People do not like to be stigmatized.” He seemed to grapple with Novo’s role in American diet culture. “But even saying it’s a disease is, in a way, stigmatizing people. I also understand that body-mass index is not a good way to diagnose people.”

What was *this*? His phrasing sounded distantly familiar. But not like a CEO. He sounded almost like a social worker. Diabetics, of course, deserve such high-touch treatment. But perhaps the more annoying patients do too—the ones panicked about food and their body’s appearance and desperate to lose 25 pounds.

When I brought up insulin, Jørgensen turned militant. “Insulin is still a very important market for us,” he said. “We are committed to the field. It’s not something that’s growing like type 2 diabetes or obesity, but this is where it all started. We’ll never walk away from people with type 1 diabetes. We owe that to them. We don’t see it as a burden.”

Lars Fruergaard Jørgensen, Novo Nordisk’s CEO, at the company’s headquarters in Bagsværd, Denmark.

Photograph: Steven Achiam

What worries him is that competing companies are developing biosimilars for insulin that are cheaper to produce than the insulin at Novo. *Ah, now we have some garden-variety greed*, I thought.

But it's more complex than that. The scenario Jørgensen sketched out for me presented a migraine of catch-22s. "I worry about the future of a market that's becoming more commoditized," he said. "If other companies make biosimilar insulins, and if countries shift to that product, we'd have to start using our capacity for other drugs."

He continued: "If patients end up relying on them, and those companies don't have the history and know-how to make a low-margin product, and we have moved our capacity elsewhere, there's a shortage of insulin. Who ends up supplying patients, and what kind of commitment do they have?" He paused. Then he expressed another anxiety. I'd expected Jørgensen to strut like a man on top of the world. His troubles were troubling.

"It worries me that policymakers don't understand the market. We at Novo Nordisk don't decide what patients pay. The reality is that, for us, the price of insulin—what we get—has gone down very rapidly. We have support programs for those who cannot afford our products or do not have insurance." Novo's Patient Assistance Program indeed gives away Ozempic and insulin to eligible Americans who earn anywhere up to four times the poverty line.

"The only place where we give medicine away like this is the refugee camps, war zones, and the US," Jørgensen said.

He then returned to his anger at health care companies. In the US, he says, for every dollar of revenue Novo gets from selling insulin, it gives 74 cents to PBMs, wholesalers, and insurance companies. Whenever PBMs and others hike prices to get their cut, Jørgensen told me, policymakers insist *Novo* should lower its costs. "If this persists, the economics around insulin could be no longer viable. That scares the hell out of me."

So it's not just that Jørgensen, as a CEO, fears competition from cheaper drugs. It's that, at any moment, Novo Nordisk could become stretched so thin by market forces that it couldn't serve all of its patients. Say, for instance, other pharma companies get a piece of the insulin market with their cheaper biosimilars, and Novo cedes some of the insulin business. Then the new entrants, lacking a long-standing duty to serve diabetics and fed up with the drug's low margins, stop making it. By then Novo's insulin capacity would be devoted to other medicine. There could be an insulin shortage. Diabetics could die.

I thought of the type 1 diabetics I know and love, with their insulin pumps, pens, glucose monitors, and tracking apps. I thought of their moments of rocky blood sugar—the shakes, sweating, blurred vision, anxiety. Now I was scared. How *could* Novo ensure that it's at least cost-effective to supply half of all the insulin for type 1 diabetics around the world?

“Our history, our purpose, our values come into play,” Jørgensen said.

“But of course, we also have shareholders ... ” He trailed off. It seemed I'd never get an answer. Or maybe there just isn't one.

almost as if to justify his fears, bad news hit Novo Nordisk at the very end of 2024. On December 4, Lilly released—and widely promoted—a study showing that people lose 20 percent of their body weight with Zepbound and a mere 14 percent with Wegovy. With this, the market contracted to a single data point: percentage of body mass shed. Forget metabolic disease. Like glossy magazines at the checkout counter, stock analysts were now fixated on dress sizes and beach bodies.

Then, on December 20, Zepbound was approved to treat sleep apnea, the first GLP-1 to win this approval. The same week, Novo unveiled a study that—in an upside-down way—was deemed to be a grave disappointment. Patients who had taken Novo's new CagriSema, a shot that combines semaglutide with an analog of another hormone, had slimmed down by 22.7 percent. That sounds like a boatload. And it was more than the Zepbounders lost. But Novo had projected the patients would shrink a full quarter in size—25 percent, not 22.7. Investors wailed, and the company's share price shed a whopping 20 percent of *its* weight—that is, value.



In Denmark, on my last days there, I felt very serious. The cold Nordic air seemed clearer than the air at home in New York. As the sun set, I walked along the Copenhagen waterfront, looking out at the Øresund Strait. From the piers, beside a grove of ship masts, two elderly couples were skinny-dipping in cold seawater. They splashed and yelped and shivered and ran-hopped to seaside saunas. Their bodies were uninhibited and beautiful.

When I told some American friends I had been at Novo Nordisk, several railed against semaglutide as a tool of patriarchal control by an evil pharma empire. I usually like this kind of fire, but Novo didn't have evil-empire hallmarks. All those people who worked there, the researchers, the quality control staff, even executives, sincerely seemed to be trying, within the tight constraints of markets, to prevent disease, treat disease, save lives. That much seems fixed. It was the company's prime directive.

To understand Jørgensen's situation, I tried my hand at squaring Novo's sacred duty with its fiduciary responsibilities. All the investment and research and care and feeding of yeast. All the jobs. The taxes. The madness of rampant food noise and the health care non-system in the US. And government pricing—at home and abroad. The lobbying and marketing. No luck.

For a biotech company overseen by a nonprofit to hit on the magic ingredient and to achieve, however briefly, world dominion and otherworldly profits, it was almost Faustian. I couldn't shake the idea that Novo was at increasingly steep odds with itself, like a body devouring its own pancreas. And now Wall Street was “disappointed” that Novo's latest drug didn't induce weight loss more precipitous than 22 percent. Perhaps investors won't wholeheartedly green-light Novo again until they see returns of 100 percent weight loss, the full deletion of human bodies.

*Correction: 1/22/25, 1:30 PM EDT: This piece has been updated to correct the number of diabetics than can be treated with a vial of yeast, correct the Ozempic dosage in 2021, and clarify that Levemir was discontinued only within the United States.*

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Jan 13, 2025 6:00 AM

# Rich Men Rule the World

The holders of the vast majority of the world's wealth? Men. So many men—from Trump and Musk and Putin to every CEO, crypto schmo, and solar bro in between.

Photograph: Samuel Corum/Getty Images

Whenever I get a new job, the first thing I do is call my dad. And the first thing he asks me is: How much are they paying you? The man's obsession with dollars and cents is lore in the Drummond family. But his zealous interest in the size of my paycheck is for very good reason: Money runs the world, after all, whether *you* have any or not. So, Mr. Drummond figures, you may as well try to make as much as you can.

## [MONEY MONEY MONEY](#)

For this special issue, we went far and wide to find out who controls the world's wealth. What did we find? Men. From Trump, Musk, and Putin to the CEOs, crypto schmoes, and solar bros, [meet the patriarchy controlling the purse strings](#).

My inherited pathologies aside, WIRED's interest in money is as obvious as it is enormous: We cover an industry awash in trillions of dollars, and that industry just so happens to be shaping everything about the way we all live. But who exactly has that money? How are they wielding it? And what does that mean for the rest of us? To find out, we dispatched some money-eyed WIRED reporters to far-flung locales: From the United Arab Emirates to Denmark to Washington, DC, to freaking Florida, we cast far and wide to bring you some uniquely WIRED stories documenting wealth and power across the planet.

Finally, a group of editors sat down to assess our lineup. And we noticed something, as we flicked through the drafts and infographics. Wherever in the world we'd sent a reporter, whichever corner of the technology landscape we were covering, the holders of all of that money? Men. All of them. Every. Single. One. Bill Gates, who sat down with Steven Levy to talk about his new memoir (stay tuned), has enjoyed 19 of the last 30 years atop the list of the world's richest people. Of the 30-odd crypto investors in Trump's inner circle, all of them are—wait for it—guys. Even the young people hustling door-to-door in the Sunshine State, shilling solar panels in a desperate bid to become millionaires by 30, are, well, men.

So let me be the first to point it out: There is more testosterone in this issue than the last decade of People's Sexiest Man Alive editions combined. In part, that's a reality borne of circumstance: 87 percent of billionaires around the world are men, and women continue to be vastly, outrageously outranked in executive positions within the tech industry. None of that even begins to account for racial diversity, which paints an even bleaker picture. And it's one likely to continue apace, as tech giants like Meta and Google chip away at their DEI investments. Meanwhile, the [online manosphere](#)—newly emboldened by President Trump and his First Buddy Musk—continues to metastasize in scope and influence.

But I'll take ownership too. At WIRED, it's our failure of editorial foresight and imagination to have seen the obvious—the blatant, persistent masculinity, page after page—only at the last minute. To not have, earlier in our assigning process, decided to interrogate the fraught and fractured gender dynamics of wealth accumulation, of corporate influence, of power. All of which still, infuriatingly, belong nearly exclusively to people with penises, with boardroom-commanding baritones, and with a centuries-long head start.

Don't get me wrong: You'll enjoy this issue, both in print and online. We hope you learn a thing or two about how the big bucks in tech are being amassed and spent, and the people—the men—amassing and spending them. But from one woman in charge to all the guys out there, including those featured in our pages: It might be a rich man's world for now, but trust me, women like money too. And we're coming to take some of yours.

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Sarah Jones was 11 hours and 49 minutes into her 12-hour shift as an emergency dispatcher for the county sheriff in Spokane, Washington, when she received what she would later describe as the worst phone call of her life.

It was a Wednesday morning in May 2023, around 10 o'clock, when the call—from someone who identified himself only as “Wayne”—came in via a publicly listed regional emergency line. “I’m going to walk into Central Valley High School in Veradale with my AK-47,” Wayne told the operator who first picked up. The voice was unnaturally deep, slow, so claustrophobically close to the microphone that its breath seemed to fill the line. “I’m going to kill everyone I see.”

That operator transferred him to Jones (WIRED has changed her name at her request), a 42-year-old, red-headed mother of three. Jones’ office at the Spokane Regional Emergency Center was chronically understaffed, so she’d been working overtime through that night and morning, drinking Dunkin’ Donuts–branded coffee from the office’s Keurig machine amid the usual marathon of domestic violence and reckless driving reports. Jones had spent years taking 911 calls; only that week she’d been promoted to “law dispatch,” a position that included dealing with callers carrying out crimes in progress—“hot calls,” as dispatchers referred to them. This would be her first.

Sarah Jones, the dispatcher at the Spokane Regional Emergency Center, who received the swatting call that targeted Central Valley High School.

Andrea Lombard, Sarah Jones' supervisor at the time of the call.

When Jones read the message from the operator that accompanied Wayne’s transfer, she realized with a rush of adrenaline that she was speaking to an active school shooter, and that she had seconds to persuade this stranger not to carry out his plan.

“Hi. Wayne? What’s going on?” Jones asked calmly, taming her racing heartbeat.

“It’s too complicated,” the voice drawled, so grotesque that Jones initially thought the sound might be recorded from a horror movie. “All you need to know is that I want cops here as soon as possible. Because after I kill everyone I see, I want to kill cops too.”

“Wayne,” Jones answered, drawing out the name this time and affecting her most sympathetic and motherly tone. “Are you in front of the school right now?”

“Yes, I’m walking in now.”

“OK, can you stop, please?” Jones said, her words accelerating as desperation crept into her voice.

The only answer was a series of rapid staccato blasts: automatic gunfire.

“Shots heard, Andrea! Shots heard!” Jones called out to her supervisor, her voice now cracking with emotion.

Dispatchers at the Spokane Regional Emergency Center in Spokane, Washington.

A few feet away, Jones’ supervisor, Andrea Lombard, watched Jones put down the phone “as if it were on fire,” as she would later describe it. The caller had hung up; the entire conversation had lasted 45 seconds. Lombard (not her real last name) had already sent out an emergency alert to all police in the region—a high-pitched tone followed by her warning that a school shooting was in progress. More than 50 units, sirens blazing, were on their way to Central Valley High School.

As Jones tried to call the shooter back—“Come on, come on, come on, answer,” she pleaded—Lombard looked at a map and saw that, just a block and a half from the high school, there was a children’s day care. She called and reached the day care’s assistant director, who was outside in the yard with a group of 1-year-olds.

In a quick, controlled voice, Lombard explained that there had been shots fired at the nearby high school and they needed to lock down. The assistant

director let out a kind of involuntary wail, then shouted “Get inside!” as she moved to scoop up as many babies as she could carry and run with them into the building.

Lombard quickly hung up and tuned in to police radio communications, listening as officers armed with rifles began to enter Central Valley High School. They moved through its hallways, guns drawn, as teachers barricaded doorways and students hid inside locked, dark classrooms, crouching in silence.

This was not Lombard’s first school shooting. In 2017, she had listened to the same radio chatter as Spokane law enforcement entered a different local high school after a 15-year-old boy shot four classmates. The words of the officer who first came upon one young victim, who would die of his wounds that day, still echoed in Lombard’s memory, his voice breaking as he radioed the news to the rest of the officers.

The Central Valley High School flag in Spokane Valley, Washington. At the time the school was targeted, the FBI already knew the identity of the perpetrator but had done little to stop his swatting spree.

Now she sat in the dispatch office next to Jones, listening to the radio, waiting with dread to hear that sound again.

Instead, as dozens of officers moved through the school that May morning, they found—nothing. The school resources officer who had been posted near the school’s entrance radioed to the police line that he’d seen no sign of a shooter entering. Nor had he heard the automatic gunfire that Jones described.

Slowly, Lombard’s dread gave way to anger. Could the call have been a hoax? As she and hundreds of students and teachers sat in silence, still fearing the worst, two questions entered her mind that she would still be asking herself more than a year later.

Who would do something like this? And why?



The chaos, the fear, the dread and immense disruption triggered by that one haunting voice on the phone wasn't targeted at Spokane alone. The call was [one of dozens](#) that a person who went by the online handle Torswats would make to law enforcement, targeting schools across Washington state over a little more than 24 hours.

In some calls, the person told dispatchers he wanted to kill students for Satan. In others, he said it was because he was new to town and people treated him "like shit." In others still, like the one to Spokane, he seemed to have become bored enough with the game that he didn't bother to make up a reason. Armed with little more than his monstrous voice, an internet-based calling application routed through an anonymous proxy server, and a recording of gunfire taken from the video game *Counter-Strike: Global Offensive*, Torswats terrorized half the state, paralyzing schools, weaponizing civilians' own police forces against them, temporarily shutting down entire communities, again and again and again.

The screenshots of Washington State that Torswats posted to Telegram, crossing off counties as he hit each one in a two-day school-swatting spree.

Torswats crossed off counties on a screenshotted map of Washington as he targeted one school after another, then posted the screenshots in a private Telegram channel between calls. He boasted that he aimed to hit at least one school in every county in the state and tallied the tens of millions of dollars in disruption he hoped to inflict. "It was funny as allf uck. SHOTS HEARD," he joked at one point, seeming to mock Jones specifically.

"2/3rds done with washington," he wrote, then bragged about making a bomb threat against the Pentagon. "There's nothing I can't do."

In fact, over the previous year, Torswats had been tormenting schools all over the country. He was the most active player in a loosely linked network of young trolls who made hundreds of ["swatting" calls](#)—hoaxes designed to send heavily armed police to a victim's door—and bomb threats that triggered mass evacuations.

At a Michigan high school, a police officer had responded to one swatter's call by ramming his cruiser through the school's locked front doors. In

Pittsburgh, Pennsylvania, an officer fired a round from his gun when he was sent into a university following one hoax call. In other swattings, students hid in janitors' closets, so scared to move that they urinated in mop buckets before armed officers pulled them out, hands above their heads, to frisk them for weapons. One family member in Texas reportedly lacerated his arm trying to break into a locked-down school to rescue a child.

In the midst of that months-long reign of terror, Torswats had distinguished himself as perhaps the most prolific American school swatter in history. And throughout all of it, federal law enforcement was well aware of the chaos Torswats was inflicting. For months, the FBI had possessed everything it needed to unmask him. In fact, the agency already knew Torswats' real name and address. But it had still done nothing to stop him—a fact that was particularly appalling to the man who had practically handed Torswats' identity to the FBI: a lone private investigator living outside Seattle named Brad Dennis.

As Torswats carried out his swatting campaign across Washington in May 2023, Dennis watched it all unfold on his computer screen. He saw the maps Torswats shared on Telegram, where he crossed out counties in Dennis' state as he targeted schools in each one. A pale, bearish, baby-faced 36-year-old, Dennis was chilled to realize that he was personally familiar with some of these schools; he'd been to them for track meets when he was a teenager.

For months leading up to that May swatting offensive, Dennis had been tracing Torswats' online footprints, tracking down his various social media accounts, meticulously tying those clues to real-world identifying information and sharing the results with law enforcement. Even after he'd given the FBI everything he thought the agency could possibly need to arrest Torswats, Dennis couldn't stop monitoring the swatter's every move. Working from a corner of his one-bedroom apartment, lit only by two dim red and blue lamps on either side of his couch, he had become almost a mirror image of his target: as fixated on taking the swatter down as Torswats was on his malevolent hobby. And now he couldn't help but feel like it was the swatter who was closing in on him.

By May 2023, Torswats had come to occupy nearly all of Dennis' waking hours. As spring turned to summer, those hours would become nocturnal, as they did every year, when Dennis sought refuge from the anxiety of heat, traffic, and other people. For days at a time, he was so isolated from other human beings that his only real-world companions were the neighborhood squirrels—Jackie, Jesse, Alvin, Doug—that he'd trained to visit his apartment by feeding them peanuts. When he wasn't at his desk, which he sometimes cordoned off from the rest of his apartment by a blackout curtain, Dennis would speed down highways along the Puget Sound in his Honda Civic late at night to clear his mind.

Visions of Torswats haunted him at every turn. "It was very difficult to live with every day: that he's out there, and I physically can't do anything about it," Dennis says. "I knew how many people he was terrorizing all over the country."

Yet when Dennis imagined Torswats, whose face he'd never seen, he actually pictured someone else: a hulking young hacker with short, dark hair—an altogether different delinquent who, 15 years earlier, had sent a caravan of police cars full of heavily armed officers to Dennis' own childhood home, altering the course of his life.

When Dennis was growing up in the Seattle suburbs in the early 1990s, his mother would sometimes bring him to her office, where she worked as a secretary for the county's emergency services. He liked wandering into the cavernous room where the dispatchers worked, examining the computer systems and radio equipment, sensing both their technical complexity and the life-and-death work that depended on it.

But rather than a dispatcher, Dennis was destined to be a hacker. When he was just 4 years old, his mother installed an alarm on the fridge door to keep him from raiding it for Diet Cokes. Dennis learned that he could remove the alarm's batteries, then quietly replace them after he'd taken the soda. When he was 6, his mother bought a Hewlett-Packard PC, and Dennis spent the next years compulsively pressing every button and clicking every option in every software menu for hours. By the time he was a preteen, his mother started taking the keyboard away at night, hiding it in her bedroom

to limit his computer time. Dennis would silently army-crawl into the dark room to retrieve it without waking her up.

Technology became an escape from the poverty of Dennis' childhood: His father came in and out of his life through a "revolving door," he remembers. And at times, he says, his mother seemed unable to provide him emotional support, even as she worried herself sick about his well-being. Growing up in a crime-ridden and drug-plagued suburb of Seattle, several of Dennis' childhood friends would later struggle with meth and opiates or be killed in narcotics-related murders. "A lot of the people I grew up with ended up hooked on drugs," Dennis says. "I got hooked on computers."

By the time he was 11 years old, Dennis was texting with professional cybercriminals on the early chat protocol IRC. When he was 12, he says, he gained access to 400,000 credit cards insecurely stored by a software company. His brother, Bryan, remembers electronics and toys showing up at their house, stuff they could never afford. At one point, Dennis told Bryan, grinning, that he had hacked into the White House communications network and obtained a list of phone numbers. Bryan rolled his eyes. Dennis showed him a phone number and Bryan dialed it. Someone picked up with a brisk "Situation Room."

In 10th grade, Dennis learned about a vulnerability in Windows that would have allowed him to gain administrator access on school computers and change students' grades. Showing off the trick at school, a teacher saw over Dennis' shoulder that he was browsing a forbidden part of the school network. He was fed up with school anyway, and dropped out before he could face any consequences.

Around 2007, when he was 19, Dennis met a hacker named Dshocker on IRC, and the two developed a system for cleverly exploiting stolen and leaked credit card numbers: They'd order something via UPS and send it to the cardholder's own address to skirt fraud detection. Then a contact Dshocker had at UPS would use his access to the company's system to reroute the package to one of their own addresses.

It was a lucrative connection. But Dennis was dismayed to discover that Dshocker was also interested in more malevolent forms of hacking. He

turned out to be an early practitioner of swatting, sending armed police to anyone who wronged him and even arbitrary targets. The fact that Dshocker knew Dennis' own home address because of their shipping scheme made him deeply uneasy.

Private investigator Brad Dennis, who was determined to track down Torswats.

Over his years dabbling in blackhat hacking, Dennis says he'd received occasional, unfriendly visits from law enforcement, including at least one from the Secret Service. This time, he says, he approached the FBI with information about Dshocker and helped the agency identify Dshocker's online accounts. The hacker had made the mistake of logging in to one without masking his home IP address. Dshocker turned out to be Nathan Hanshaw, a 17-year-old in Massachusetts. Hanshaw was charged, pleaded guilty, and was sentenced to 11 months in juvenile detention—but not before sending a team of police with loaded weapons into Dennis' home.

On that day in 2008, Dennis was in his bedroom when the cops rapped on the door of his family's double-wide trailer and pulled his confused mother out at gunpoint. Dennis was so immersed in his computer, with his headphones on, that he hadn't even heard the sirens of the Snohomish County Sheriff's cruisers tearing down the block of his quiet neighborhood. Only the sound of a man yelling his name from behind his bedroom door yanked Dennis into reality: He opened the door to see a sheriff's deputy brandishing an AR-15.

Dennis was cuffed and pushed onto the couch in the living room. He tried to explain to the crowd of heavily armed and armored police officers that he had been swatted. That he knew exactly who had placed the false 911 call. That he was, in fact, working with FBI agents investigating a serial swatter named Dshocker. That whatever crime in progress Dshocker had described was a lie. But sitting in his gym shorts with his hands cuffed behind his back, it all seemed futile: Dennis heard the police describe him to each other using the police code for a mentally ill individual. They threatened to arrest him if he didn't stop talking.

The standoff ended only when Dennis asked an officer to go into his room and find his wallet. Inside it was the business card of an FBI agent with whom he'd been sharing information about Dshocker. The cops called the number, talked to Dennis' contact, uncuffed him, and drove away, leaving Dennis and his shell-shocked mother in silence.

Dennis' mother would blame him for that horrific disruption in their lives, his brother would later remember. She saw it as another indirect result of his all-consuming computer obsession.

For Dennis, the swatting incident would leave him "scarred," anxious, suffering from panic attacks for years. He still believes Hanshaw never knew he was helping the FBI to track him down. So why would Dshocker swat his own hacking partner, traumatizing him and his mother? Dennis would eventually arrive at an explanation that he now sees as the common denominator among serial swatters: "He did it because he could."

After that swatting, Dennis knew he needed to quit the cybercriminal world. His hacking schemes, too, were growing in scale; he felt that if he didn't walk away, he'd eventually end up in prison. But it would take Dennis years longer to extricate himself, a process that involved leaving behind essentially all of his friends.

After a series of odd jobs through his twenties, from network administrator to warehouse muscle, he eventually found work as a skip tracer, tracking down missing people, and then as a repo man. Dennis found that these private investigator gigs suited his skills as a hacker—persistently hunting through datasets for the tiniest clue about someone, pivoting from connection to connection until he could locate them and lure them into the open.

His go-to trick for repossessing cars was the classic honeypot: Create a social media profile posing as an attractive young woman, catfish the target into meeting at a restaurant, then seize their car in the parking lot while they waited for their imaginary date inside. Dennis says he learned from those encounters how the prospect of a sufficiently enticing reward—namely, sex—can switch off a target's rationality. "You temporarily overload their brain with excitement," he says, "and you can then get them to do things."

Eventually he transitioned to the lower-stakes field of tracking down the subjects of divorce proceedings and lawsuits to hand them legal papers. But Dennis, an anxious and private person, hated the work of physically confronting often-dangerous deadbeats. Then, in 2020, the pandemic hit. Courts closed. Unhappily married people held off on divorces. His work dried up. He sold his car to give himself time to establish a new line of employment.

One of Dennis' favorite Twitch streamers at the time was a gaming celebrity who'd been careful never to reveal his location to millions of fans. On a lark, while casting about for another livelihood, Dennis checked to see if he could track the streamer down using his skip-tracing skills and some scant online breadcrumbs. When he succeeded, he decided to approach the Twitch celebrity and offer to help him clean up his digital profile. Dennis says the streamer took him up on the offer and hired him as a security consultant—then began to refer him to other Twitch streamers. By early 2022, he had around half a dozen clients.

As Dennis expanded his Twitch connection into a budding career, he came to realize that swatting, a source of his own trauma, had plagued video game streamers for years. In many cases, Twitch stars had even been swatted in the midst of their livestreams, thrown to the ground by cops and held at gunpoint.

A few months later, one prominent streamer was brutally swatted—pulled out of his home by police with guns drawn while his wife and baby were inside—and reached out to Dennis for help. Within a week, Dennis' original Twitch streamer client was hit too. The two streamers pooled together a five-figure sum to hire Dennis as their private investigator, asking him to find out who was responsible.

Dennis had never expected to be drawn back into the swatting underworld—one that he had, in fact, spent years working to escape. But he felt he now had a duty to protect his clients. And, he told himself, he had helped the FBI identify a serial swatter before. Maybe he had the right skills to hunt this one too.

“I believed,” he says, “that I was the perfect person to take this guy down.”

Dennis' detective work began with a post he found on Doxbin—an anarchic, fully unmoderated bulletin board where hackers frequently publish the private information of their victims or rivals to incite harassment. One user, “Ringwraith,” had published a data dump that included an address for Dennis' first Twitch client, along with the address and phone number of the streamer's 75-year-old father.

“I am not responsible for what happens with this info,” Ringwraith added with mock innocence. In other posts to Doxbin, the same account had broadcast the home addresses of other targets and suggested that users enlist “prank call” services available on the messaging platform Telegram to troll them.

Dennis began scouring Telegram and quickly found one such “prank call” service with the name Nazgul's Swats. He knew his *Lord of the Rings* references well enough to understand that the Nazgûl, in Tolkien's world, are synonymous with Ringwraiths: ghostly, lethal figures that hunt the saga's heroes from the shadowy realm they inhabit. Were Ringwraith and Nazgul in fact the same person?

Nazgul's Swats, whose profile photo on Telegram showed a black-hooded skull mask, seemed to be openly advertising a swatting-for-hire service. The account priced its calls at \$150 per swat or bomb threat, or \$100 for hoax gas leaks or fires, to be paid for with the tracing-resistant cryptocurrency Monero. “All swats will be done ASAP,” Nazgul wrote. “Prices will be negotiated if it's a major target like a semi-famous streamer or a government building.”

As he watched Nazgul's Telegram account over the summer of 2022, Dennis was dismayed to see that the swatting service appeared to be shifting its focus from Twitch streamers to a more disturbing target: schools. In August of that year, the account posted a “Back-to-School Sale,” with a special rate of just \$50 in Monero for school swattings. “Do you want an extra day of summer break?” the post read. “I will shut down a school for the entire day!”

Not long after, on Telegram, Nazgul began posting audio recordings of school swatting calls. In one, targeting a high school near Toronto, the



swatter claimed to be a supporter of QAnon, intent on destroying the school with explosives because of the “pedophile transgender” teachers there. In another, the swatter told an emergency hotline they were transgender and had been mocked by their fellow students at their high school in Washington state, and had taken their father’s glock.

“I’m in the bathroom now, and I’m ready to take out the people who bullied me,” the swatter told the dispatcher through a robotic, synthesized voice generated by a Google text-to-speech program. “The transphobes will die.”

Two days later, Nazgul called again, this time telling dispatchers the earlier call had been a hoax meant to throw off the response to the actual school shooting now planned at the same high school that day. “It is too late for you to stop me. I have an illegally modified, fully auto AR-15 and glock with level-four body armor, and I’m right outside the school gates ready to shoot up your faggot-infested school,” the caller said. He claimed that he had planted pipe bombs under administrators’ cars and in classrooms that would detonate minutes after school started. “Afterwards I will walk in and shoot everyone I see. Goodbye.”

Woods close to Dennis’ home in a neighborhood near Seattle, during the nighttime hours he keeps every summer.

The school swatting calls that Nazgul was posting to Telegram were only part of a growing wave hitting schools across the US in the fall of 2022, including more than a dozen hoax calls each in Minnesota, Louisiana, and Virginia. By November, the attacks had swelled to more than a hundred, hitting New Jersey, Florida, California, South Carolina, South Dakota, and Connecticut, seemingly at random. Dennis read [news reports](#) in which law enforcement officials blamed [the calls](#) on a group of Ethiopians. But he suspected that many of the swattings seemed to be the work of Nazgul alone.

Dennis reached out to an FBI field office in San Antonio, the closest location to one of his Twitch clients, in an attempt to persuade the bureau to investigate Nazgul. Identifying himself as a licensed private investigator, he described what he’d found in a breathless, point-by-point, 897-word email, laying out the evidence of how dangerous this particular swatter was

becoming—and throwing in a few initial theories of the swatter’s real-world identity that, he now admits, were all off base.

The San Antonio FBI eventually responded: It had no open case into Nazgul’s Swats, didn’t intend to create one, and didn’t even offer Dennis a point of contact for any future findings, he says. “They gave me nothing at all,” Dennis says. “Nothing.”

Dennis was incensed. As he read news reports of the hoax calls sending schools into lockdown, terrorizing parents and children across the country, he began to feel like he was shouldering the full weight of the investigation. As long as Nazgul was free, it seemed, he would keep targeting more innocent victims. “From the moment he woke up till the moment he went to sleep, he was swatting people,” Dennis says. “And I was going to do whatever it took to catch him.”

Ed Dorroh, a bearded and slightly grizzled detective with the Los Angeles Police Department, was out for dinner with his wife at a romantic wine bar in his hometown of Lancaster, California, when he got a text from a number he didn’t recognize. The sender identified himself as a private investigator, a stranger who wanted Dorroh’s help pursuing what he described as one of the worst serial swatters in history.

Dorroh had famously taken down a notorious swatter named Tyler Barriss, who placed a 2017 hoax call that [resulted in the fatal police shooting](#) of a man in Wichita, Kansas. Dennis knew Dorroh would understand the gravity of his case. Dorroh, for his part, did a quick background check from his phone to make sure Dennis was a legitimate PI, to the annoyance of his wife across the table.

The next day he called Dennis, who immediately began to share a deluge of information that conveyed his obsession with Nazgul and his frustration with the FBI’s inaction. Dorroh knew the feeling: He’d often found it difficult to impress the seriousness of swatting cases on his fellow law enforcement agents. He’d once tracked a swatter to the UK who had threatened to have Dorroh’s own family killed, then sent his findings on the suspect to a British agent—only to wait six months for the investigator to even look at the case. Dorroh agreed to help.

A week or two later, Dorroh searched through a law enforcement database with Dennis on the phone and found that the FBI's Bellingham, Washington, field office did have an open case on Nazgul's Swats. He connected Dennis with a responsive agent there named Rachel Bennett (not her real name). Dennis was mystified that the San Antonio office hadn't told him about the investigation. But from talking to Bennett, it seemed to Dennis that the FBI still had virtually nothing on Nazgul. (The FBI asked WIRED to anonymize the names of its case agents, out of concern that they could be swatted in retaliation.)

As he badgered the FBI, Dennis began the long, patient process of insinuating himself into Nazgul's inner circle—a familiar practice from his years of hunting car-payment debtors and vanished spouses. He created the persona of an aggrieved ex-husband obsessed with revenge following his divorce. Under the guise of that potential customer, he began sending initial messages to Nazgul's Telegram account, telling him he might need his help at some point and would be willing to pay.

While Dennis searched for any revealing slip-up Nazgul might make, he would emerge into the light of the real world only to eat and caffeinate or to feed the squirrels that visited his apartment. At one point in his hunting, Dennis began to believe that Nazgul might belong to a certain “guild” in the online game *World of Warcraft*. Dennis became so determined to gain entry to that elite gaming group that he paid more than \$1,000 to buy a leveled-up warlock character in the game, asked one of his gaming streamer clients to help him train, and spent more than 80 hours playing *WoW* to build credibility.

But by the winter holidays of 2022, none of this months-long undercover work had borne fruit. Dennis knew he needed to change tactics.

At some point, Dennis had read about an encrypted texting program called Tox. Although many hackers liked the service's security features, its peer-to-peer architecture meant that it could leak users' IP addresses to whichever contact they were chatting with, the equivalent of a phone call that revealed the address of the caller's home. Perhaps this combination of apparent security and actual vulnerability offered exactly the trap Dennis needed.

On the night of New Year's Eve, Dennis opened Wireshark, a program for intercepting and deconstructing network communications. Then he messaged Nazgul on Telegram using his aggrieved ex-husband persona.

"Yo, got some bidness to talk to you about," he typed to the swatter at 9:19 pm. This was the bait he'd lured in front of Nazgul for months, suggesting that he was going to pay grandly for some climactic act of swatting vengeance targeting his ex-wife. "You wanna make some real cash. Add me on Tox."

Dennis hit Return. Thinking back to the honeypot stings that had worked so well in his days as a repo man, he hoped the promise of a big payday would short-circuit his target's defense instincts. To help ward off any doubts, Dennis went to Wikipedia and carefully deleted a paragraph mentioning the IP-leaking bug from the page for the Tox protocol. Then he waited.

Less than an hour later, a notification popped up on his screen: A user named "Paimon Arnum" wanted to chat on Tox. The username was unfamiliar to Dennis. But he knew who it must be. As he accepted the chat invitation, Wireshark began capturing dozens of network requests. All of them came from a single IP address.

Dennis had his breakthrough. A fresh pseudonym tied to Nazgul's Swats and what he believed was an actual IP address might be revelatory new threads for him and the FBI to pull on.

Not long after, Nazgul's Swats added yet another moniker to the mix, inexplicably changing his Telegram username. Dennis didn't know whether this additional handle was a reference to the anonymity software Tor—which the swatter didn't appear to use—or to a Norwegian spelling of the Norse thunder god Thor. But from then on, Nazgul would go by a new name: Torswats.

In late January 2023, Brad Dennis watched through his Ring camera as two FBI agents stepped onto his doormat that read "COME BACK WITH A WARRANT" and rang his doorbell. He opened the door, which was affixed with a sticker that read "BEWARE OF DOG," though Dennis had never owned one.

Dennis and the two visitors, FBI special agents Rachel Bennett and Lucas Phillips (also not his real name), sat down around a beat-up coffee table. On it was a large, tattered copy of the *9/11 Commission Report*, Dennis' only coffee-table book. The only decoration on the walls was an American flag hung behind a desk chair. Nearly a month after the holidays, a fake Christmas tree with a single ornament in the shape of a pickle stood in a corner of the room. Resting against it were two printed photos of Dennis' favorite squirrels, Jesse and Alvin, gifts from his mother.

Alvin, one of several squirrels that Dennis befriended and trained to come onto his apartment patio.

Photograph: Courtesy of Brad Dennis

Dennis with another of his squirrel companions, Jesse.

Photograph: Courtesy of Brad Dennis

Dennis did almost all of the talking, briefing the two FBI agents on his months of detective work. In fact, he couldn't stop talking: He had just drunk a Red Bull and was far too caffeinated. At one point Phillips noticed *World of Warcraft* on Dennis' computer screen and commented that he played the game too. Throughout the meeting, some of Dennis' squirrels hung out on the patio, munching on unsalted peanuts.

When the two agents left Dennis' apartment 45 minutes later, they carried with them a USB drive that contained the network data Dennis had captured with Wireshark, documenting the IP address leaked in his Tox chat conversation with Nazgul.

Dennis sensed that the Paimon Arnum handle—a possible reference to one of the kings of hell in demonological texts—was also a powerful data point. The FBI hadn't known about the new name until he shared it with them. When Dennis had searched for Paimon Arnum, he found a YouTube account with the same username. Checking an archived copy of the account, he found that it had once been named Ringwraith and had used a similar Nazgul picture as its profile image. Even if the IP address he'd shared with the FBI was some sort of proxy that Torswats had used to cover

his tracks, he thought perhaps a subpoena to Google could reveal this account's subscriber information. More than ever before, Dennis felt real hope they had solid leads on their target.

As Dennis' frustration with the FBI's inaction grew, he would take nighttime walks on the trail behind his apartment, sometimes in pitch-black so complete that he couldn't see his hand in front of his face.

In the weeks that followed, Dennis and Agent Phillips would text and email each other updates. But as the weeks went on, Dennis started to get impatient. He called Phillips to ask about the subpoenas to Google and other services Torswats had used.

As Dennis recalls it, Phillips told him that the results still hadn't come back. Dennis asked how it could be taking so long: Hadn't Phillips filed emergency requests? Google and other major tech firms typically responded to those in a day or less. According to Dennis, Phillips said that he had filed the requests as normal subpoenas, explaining that was the bureau's policy, and this wasn't necessarily an emergency case.

Dennis blew up. *You motherfucker*, he remembers thinking. For months he had been watching TikTok videos of school swattings, torturing himself with clips that students had recorded and posted of themselves hiding in school bathrooms and jumping over fences to escape from imagined shooters. "He's literally sending out police officers to people's houses and into schools with their guns drawn," he says he told Phillips. "How is this not an emergency?"

Not long after, Phillips told Dennis that he had sent the emergency requests. The FBI agent soon began to share hints of the results with Dennis. Sure enough, the bureau now had an IP address for the Google account, one that located the user at a residential internet connection in California.

It seemed the FBI now knew Torswats' name and address, though Phillips wouldn't share those details with Dennis. It was only a matter of time, Dennis now felt, until the target of his hunt was behind bars.

In the meantime, Phillips had asked for Dennis' help in locating and then infiltrating a channel on the chat service Discord that Torswats visited. The group, an offshoot of a larger movement that called itself 764, turned out to be one of the most disturbing and abhorrent corners of the internet, catering to its most callous trolls and sadists. Its members, from what Dennis could tell, seemed to be constantly working to outdo one another with racist memes, child sexual abuse images, animal cruelty clips, and sextortion videos in which members of the group blackmailed children into humiliating or harming themselves, sometimes with razor blades or nooses shipped in the mail to their victims.

Dennis says he saw things in the channel that he wishes he could remove from his memory, that make him physically sick to recall, including one image of child sexual abuse that has horrifically and unpredictably flashed into his mind every day since. "I didn't even know this kind of evil existed," he says.

Dennis stumbled into darker and darker layers of the internet as he stalked Torswats, all the while waiting for updates from the FBI on when exactly the swatter would be arrested or have his computers seized. At one point Phillips told Dennis that the FBI wanted to be "extra careful." But Dennis was beginning to lose his patience and his trust that the bureau was taking the case seriously.

"I can't believe he's just walking around free. Even tho we know who he is. Please for the love of god just take him down already FBI," Dennis wrote to a WIRED reporter on May 6, 2023. "They have enough for the warrant. Good. Write it. Execute it. Done. Every day they wait is more kids being hurt."

Five days later, on the morning of May 11, Tanner Zahrt, the principal of Port Angeles High School, on Washington's Olympic Peninsula, heard the scream of sirens approaching. Moments later, an assistant principal came into Zahrt's office and told him that the police had just called: An active shooter was on the school grounds.

Zahrt scrambled across the hall to the room where the school's intercom was set up. He spoke into the microphone, trying to broadcast a message

telling the school to lock down. Silence. The intercom system wasn't working. As fast as they could, he and the assistant principal assembled the school's administrators and asked for volunteers to run to the school's 13 buildings—a uniquely sprawling, tough-to-secure outdoor campus—and deliver the lockdown warning. Zahrt knew he was asking these volunteers to risk their lives. But he felt he had no other option: Every second might mean more students' lives lost.

When the volunteers dispersed, Zahrt ran back to the intercom. After several minutes, he got it to sputter to life. “There's a threat on campus. We're going into lockdown, this is not a drill,” Zahrt said into the microphone, trying to keep his voice calm. “Lockdown, lockdown, lockdown.”

Police officers soon arrived in Zahrt's office and played the recording of the 911 call that had brought them: The same deep, languid voice that police dispatchers would hear in a dozen or more counties by the end of that day. Torswats had, by this point, stopped using the text-to-speech software for his swattings; he had discovered his own ghostly and unnerving voice was far more effective and credible. Each call was a variation on the same theme: “I'm going into the school with an AK-47”—or an AR-15, or a glock, or pipe bombs—“and I'm going to kill everyone I see.”

The recording Zahrt heard ended with the sound of a school bell. He immediately recognized that it was the wrong one. “That's not our school bell,” he thought. But even as he began to suspect a hoax, the officers warned him that it wouldn't yet be safe to give the all-clear.

Instead, for the next 50 minutes, teachers barricaded their classrooms as students hid in “hard corners,” out of any potential shooter's sight lines, while police carrying automatic rifles scoured the school, classroom by classroom. Some students, jaded from false alarms and drills, joked and texted with friends. Others hid in silence. Some, says Zahrt, had panic attacks.

A student's call to police in the midst of a lockdown after another high school was targeted by Torswats on the first day of his Washington state swatting spree.



By this point, Torswats had moved into the second day of his blitz against the state of Washington, a target area he'd seemingly chosen at random. It was the culmination of a spree that had begun 24 hours earlier with the eastern part of the state—including the “shots heard!” call to Spokane.

For Sarah Jones, the trauma of that call lingered well beyond the hour it had taken for police to officially declare a false alarm. When her shift was finally over, Jones had burst into tears in the arms of her supervisor. On her drive home, she couldn't stop crying. That weekend she went on a run to try to exorcize the sound of Torswats' horrifying voice. But she says she can still hear it, even now, a year and a half later. She says she'll remember the call “for the rest of my career.”

All told, Torswats hit as many as 45 schools in Washington state—then moved on to new targets. As he did, his hoaxes grew more florid in their descriptions and graphic in the horror of the threats he was inventing.

“I just finished reading the devil's Koran,” he told one dispatcher as he explained why he was about to commit a mass shooting at a mosque in Florida with an “illegally modified, fully auto AR-15” as well as a glock and Molotov cocktails. “It is a false mosque that prays to the demi-urge Saturn,” he added, before hitting his usual last note that he was about to “kill everyone I see.”

A radio tower at the Spokane Regional Emergency Center.

“I took DMT this morning. And I saw Satan,” Torswats told another young woman a few days later after she picked up the phone at Prairie View A&M University in Texas, one in a series of historically black colleges and universities that he had added to his target list. “And he came to me in the form of a serpent. And he told me to put explosives—he told me to put the fragmentation pipe bombs I had made for him inside of stuffed animals that resemble snakes, and he told me to put them in the ceilings and in the trash cans around campus. There are about two dozen total.”

In the midst of another call that spring, this time with a high school resource officer in Maryland, the officer interrupted Torswats in the middle of a

bomb threat and told him he would find his IP address and make sure he was criminally charged.

In response, Torswats paused, seeming to break character and stifle ecstatic laughter.

“I am never going to be caught,” he said finally, his voice swelling as if he were almost moved to tears. “*I am invincible.*”

Dennis’ work was over. He had, he felt, given the FBI what it needed to close the case. Yet he was still watching Torswats post evidence of his ongoing, near-daily swattings to Telegram. The mental dissonance had become almost unbearable.

As the waiting wore on into summer, he began his annual transition to nocturnal life. He went for walks on the trail behind his apartment, sometimes in pitch-black so complete that he couldn’t see his hand in front of his face. On his nighttime drives, he says he’d sometimes reach speeds of 145 miles per hour, so fast that other cars on the highway seemed to be standing still.

All the while, Torswats was still escalating. By July, he’d begun to write on Telegram about something he called “the Grand Offensive”: He posted an incoherent chart of his planned targets, including 25 senators, the FBI, the Pentagon, and the board of directors of the asset management firm BlackRock. “One Swatter to Rule Them All,” his chart read in one corner. He followed up that graphic with a rambling, racist, antisemitic manifesto written as an ironic ode to US law enforcement. “They are the guardians of our luciferian light, the defenders of justice, and the pillars of our society,” it read. “God bless America’s sword of domestic combat to preserve its judeogovernance.”

Around 10 am one morning in July, Dennis was coming out of the drive-through at Taco Time, one of few restaurants in the area that would serve him dinner food at a normal person’s breakfast time. His phone rang. It was Phillips. Dennis took the call on speakerphone without pulling over.

An FBI team, Phillips told him, had just executed a search warrant at Torswats' home in Lancaster, California—by coincidence the very same town that had been home to the veteran LA detective Ed Dorroh, Dennis' first fruitful contact in law enforcement. The agents had given their suspect the full SWAT treatment, Phillips told Dennis: A Bearcat armored vehicle had torn the door off its hinges. Agents had used flash-bang grenades to surprise and stun everyone inside the home before searching it and seizing Torswats' PC.

The computer was encrypted, Phillips told Dennis, and might be useless for obtaining evidence. But Dennis was nonetheless thrilled that the same militarized police apparatus that Torswats had weaponized for a year had finally hit him back with karmic retribution.

Phillips was there at the raid, he told Dennis. Torswats had turned out to be a teenager, he said, and Phillips had heard his voice: The slow, deep, almost sedated drawl that had become all too familiar to both of them. There was no mistaking that they had found him—though after searching the house and seizing his computers, they still didn't arrest him.

At the end of the nearly 40-minute conversation, Dennis says, Phillips informed him that the Department of Justice planned to shop the case around the country to find a district willing to charge the suspect as a minor—possibly in Texas, Oklahoma, or Florida.

Dennis arrived home, sat down at his desk, ate his chicken burrito, and texted one of the Twitch streamers who had first hired him to hunt Torswats. "Search warrant was executed this morning," he wrote. "Mission accomplished."

"LOL. Fuck Em. What a relief," the client wrote back.

"Serves him right, little shit," Dennis responded.

He finished the burrito. At 1 pm, he finally went to bed, happy and fulfilled for the first time since he'd taken the case more than a year earlier.

Except Torswats was still free—and somehow, still online.

“My current plan is that I will be temporarily retiring for several weeks,” he wrote, just a few days after the raid, on a new account titled The Actual Fourth Reich of Torswats, adding that he would probably start offering his services on a dark-web marketplace in the winter of that year. Then he seemed to disappear for months.

Within a few weeks, Dennis’ sense of victory had passed. By closing the case, he had put himself out of a job and was now underemployed and despondent. The fact that Torswats still hadn’t been arrested, jailed, or charged—that Dennis still didn’t even know his real name—made his triumph feel all the more illusory.

At loose ends, Dennis began spending nights in his Civic, patrolling the streets of Seattle’s worst neighborhoods. He spent hours staring out of its tinted windows at homeless people and sex workers, trying to match their faces with missing persons photos from human trafficking cases, looking for any outlet for his detective skills that might give him a mission—a reason to continue.

Dennis in his Honda Civic. In the months since the Torswats case, he often patrols Seattle’s worst neighborhood in the car at night, searching for missing people.

Then, in November 2023, ahead of schedule, Torswats came out of retirement. In a new swatting call, the same deep voice affected a dopey, confessional air and warned dispatchers that a friend was planning a mass shooting that day at North Beach Junior/Senior High School in western Washington. “He showed me them. He showed me the pipe bombs,” the voice intoned, adopting the usual themes as if there’d been no break in his now multiyear swatting campaign. “Afterwards he’s going to come in with his AR-15 and kill everyone.”

Torswats then targeted a former federal law enforcement agent and swatting expert—a man named Keven Hendricks who had recently been featured in an Economist interview about the relentless surge of swatting attacks. Torswats sent police to Hendricks’ home and left a voicemail for Hendricks himself. “Hello. I just swatted you and your parents,” he said. “That’s what you deserve for being a filthy fed.” He posted a photo of Hendricks on his

public Telegram channel, his eyes blacked out and his address scrawled across the image.

On Telegram, Dennis could see that Torswats had reemerged. But the private eye had run out of outrage. He felt numb. He could no longer muster the energy to track Torswats' online boasting, to even feel angry at the FBI that it was allowing the swattings to continue. He was done.

Torswats, meanwhile, seemed to still believe he was untouchable. In December, he posted what he called The List, a kind of illustrated catalog of swatting targets—along with pictures of their homes and addresses. It included political leaders such as US senator Chuck Schumer, Chicago mayor Lori Lightfoot, and several judges, public health officials including Anthony Fauci, leaders of civil rights and anti-hate groups, and tech CEOs like Tim Cook and Evan Spiegel.

Then, between Christmas Eve and New Year's, came a new deluge of swattings. They hit close to a hundred politicians and law enforcement officials in a brazen, coordinated campaign: US Homeland Security secretary Alejandro Mayorkas, Cybersecurity and Infrastructure Security Agency director Jen Easterly, Republican representative Marjorie Taylor Greene of Georgia, and Republican senator Rick Scott of Florida. One of the hoax calls, court documents would later state, caused a car accident that resulted in serious injuries.

But this time, the voice on the calls wasn't Torswats. Instead, according to US prosecutors, he orchestrated the operation, providing the names, addresses, and phone numbers of the targets to a 21-year-old and a 26-year-old from Serbia and Romania who allegedly organized and carried out the swatting scheme with lines Torswats fed to them.

It was a familiar script. "I shot my wife in the head with my AR-15," a man identifying himself as "James" said in one such call, targeting the home of Georgia state senator John Albers. He told dispatchers that he had caught his wife sleeping with another man and, after killing her, had taken the man hostage. "I'll release him for \$10,000 in cash," he added, threatening to detonate pipe bombs and blow up the house if his demands weren't met.

Finally, Phillips called Dennis and told him that the FBI had a plan to arrest Torswats. And they needed Dennis' help.

According to the plan, the bureau would ask its teen suspect's father to come in to a local police station to retrieve the computers they'd seized. While the father was there, Phillips explained, Dennis should use his old aggrieved ex-husband persona and start another Telegram conversation with Torswats about swatting his ex-wife. Then he should stall for as long as possible to keep Torswats at his computer, logged in to his accounts—so police could burst in and arrest him. Dennis, despite being sick with Covid, agreed.

Instead, to his and the FBI's surprise, Torswats accompanied his father to the police station to pick up his devices. The cops quietly arrested him on the spot. As his nemesis was [finally taken into custody](#), Dennis was too ill to celebrate.

The FBI and Justice Department both declined WIRED's request for comment, which included questions about why the FBI had taken so many months after learning Torswats' name—even after searching his house—to arrest him.

Nearly two years into his investigation, Dennis finally learned the teen's name: Alan Filion. He saw photos of Filion for the first time and mentally replaced the image of Dshocker's face with that of the actual alleged swatter teen he'd been hunting. Like Dshocker, Filion was big. He had long, lank brown hair. In photos, he wore a wide-eyed, innocent expression.

At the time of his arrest, Filion was 17 years old. When Dennis' case had begun, Filion had been only 15.

Alan Filion's booking photo

Courtesy of the Seminole County Sheriff's Office

Filion fits the profile of plenty of online delinquents. He, like Dennis, appeared to have grown up online, finding community in niche forums more than the physical world. His high school years were defined by the

isolation of pandemic lockdowns. According to Lancaster's Antelope Valley community college, Fillion started pursuing a degree in mathematics in the fall of 2022 after graduating from high school early. But a professor at Antelope Valley could hardly remember him at all. One person who knew him says he was quiet and "forgettable," with few friends.

A person claiming to be Fillion's friend alleges he was part of a group aiming to incite racial violence and that he sought money to "buy weapons and commit a mass shooting." An anonymous tip, submitted to the FBI's Internet Crime Complaint Center and obtained by WIRED, alleged that the individual behind the Torswats account was involved in a neo-Nazi cult known as the Order of Nine Angles. The tipster claimed he believed Torswats' actions were contributing to the "end of days" by "bleeding the finances and man-hours of the system."

In a May interview with WIRED, Torswats admitted that he made his hoax calls partly for fame and partly for political reasons. "It's taking money that would normally be used for welfare checks to Jews and to bankers and to oligarchs," he said in his drawl, "and it's being spent on searching schools."

Dennis, for his part, has settled on a simpler theory to explain Torswats' behavior—and the entire scourge of swatting as a means to blindly terrorize strangers. He defaults to the same principle he used to explain why Dshocker swatted him nearly two decades earlier.

"Power," Dennis says. "Because they can."

In November, just weeks after his 18th birthday, [Fillion pleaded guilty](#) to charges stemming from his nationwide spree of swatting calls. He faces up to 20 years in prison for four counts of making interstate threats to injure another person. As of mid-December, the teenager is awaiting sentencing in a Seminole County, Florida, jail cell.

Dennis remains in a different form of purgatory. On a recent night, when a WIRED reporter visited him, he went through his usual routine: he ate breakfast, checked his email for leads on work, played the video game *Rocket League*, and idled aimlessly around his apartment. Throughout the evening, he carried a loaded glock in a holster, a round in the chamber, no

safety. He drinks Red Bulls every two hours, exactly, now timed with alarms on his phone, to space out his caffeine intake. He no longer gets visits from the squirrels. He can't be sure, but he believes that his favorites—Jackie, Jesse, Alvin, Doug—have died of old age or been killed by other animals. Dennis doesn't have it in him to befriend new ones.

On one of his nighttime drives through Seattle's skid rows, he recently spotted an 11-year-old girl near a Krispy Kreme. He recognized her from a poster of missing and exploited children. She approached his car thinking he might be a customer; he then helped local police to find her and reconnect her with a foster family. He's proud of that, just as he's proud of having cracked the Torswats case. But he has received little recognition for either, from police agencies or the FBI. His paid work as a private eye has largely evaporated. To stay afloat, he has sold off possessions—including the very computer he used to find Torswats—and for a time took up driving for Uber Eats. "It's been the worst year I've had in a long time," he says.

In the meantime, Dennis has watched in dismay as swattings—and school swattings in particular—have continued to spread across the US. There's been no new Torswats, no single, prominent villain who single-handedly represents the threat. But nor has there been a shortage of new nihilist trolls willing to pick up where Torswats left off.

Dennis has no faith any of that will change. The US remains a country awash in guns, where the prospect of a mass shooting has become a pervasive, looming menace. And American police remain a hair-trigger, militarized force ready to be exploited by anyone with modest technical skills and a convincing voice.

If Dennis is hopeful about anything, it's that another high-profile case will come his way, one that will give him the same sense of purpose he felt during the Torswats investigation. As he drives around in the dark, he seems to hope that another monster will appear for him to hunt—that it might offer him a chance to repair his career and some part of the world.

"Things will happen that will change the course of your life," he says from the driver's seat of his Honda as he peers out of the windshield at the North Seattle streets. "Things will reveal themselves."



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Dec 17, 2024 4:00 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.

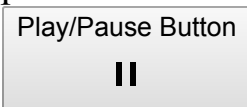


Illustration: Elena Lacey

THIS MONTH'S PROMPT

**In six words, write a story about octopuses.**

Submit stories on [X](#) or [Instagram](#), or email us at [mail@WIRED.com](mailto: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.*

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NOVEMBER 2024

## A Story About an Insect Revolution

Illustration: Yiran Jia

—Neil Larsen, via email

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### **Honorable Mentions:**

**Eternally hungry caterpillars refuse to pupate.**

—@NymphUrban, via X

**Every insect piloted a real human.**

—@morgocomics, via X

**Ants made mountains out of molehills.**

—@andredoubleu, via Instagram

**The mantises' prayers have been answered.**

—@mrjasenewman, via Instagram

**They're no longer scared of shoes.**

—@bouncingseth, via Instagram

**Cicadas rose, sang, and consumed all.**

—@frater.greg, via Instagram

**We're the children of software bugs.**

—@hermanbessler, via Instagram

**Life changed when butterflies became weaponized.**

—Sarah Calkin Ward, via Facebook

**Grasshoppers sang; cities crumbled to dust.**

—John Snyder, via Facebook

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OCTOBER 2024

## **A Story About Entangled Particles**

Illustration: Yiran Jia

—@instaduncc, via Instagram

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### **Honorable Mentions:**

**Yikes. Spooky action. Time to split.**

—@FilmMartin, via X

**Are you here? Are you not?**

—@jessleycegui, via Instagram

**Unseen, it dances under another's shadow.**

—@marcoslavarello, via Instagram

**We spin in unison, galaxies apart.**

—Mark Richardson, via email

**Spooky out here! Spook, you there?**

—Andrew Dawson, via email

**Breaking news: sentient entangled particles divorce.**

—Rami, via email

**Once it died, you were born.**

—@bietorres, via Instagram

**Tapestry of space, matter sewn together.**

—@dr.karenorjuela, via Instagram

**Meet me beyond the double slit.**

—@javirz, via Instagram

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SEPTEMBER 2024

## **A Story About a New Flavor**

Illustration: Yiran Jia

—@heardaniyell, via Instagram

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### **Honorable Mentions:**

**Dog focus group favorite flavor: human.**

—Jordan Tannenbaum, via email

**Reprogramming their tongues enslaved them all.**

—Osman Salleh, via email

**Lager brewed with spacecraft-specific fungi.**

—Tobias Eriksson, via email

**Flame without smoke tastes of immortality.**

—Brendan Murphy, via email

**Cauterizing taste buds, introducing Hellfire dressing.**

—Cult MetalFlix, via Facebook

**Dark matter is tasty. Who knew?**

—@canebrakerattler, via Instagram

**Flaming watermelon delights and self-extinguishes.**

—@boomerdell, via Instagram

**The comfort of human companionship. Bottled.**

—@akacarolineashley, via Instagram

**#1 robocafé: aroma of human anxiety**

—@belindacolemanwrites, via Instagram

**Lemon. Pepper. Cthulhu. Fresh, not canned.**

—@katedenhem, via Instagram

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AUGUST 2024

# A Story About an Unexpected Medical Breakthrough

ILLUSTRATION: YIRAN JIA

—@rasmusvarnichblumensaat, via Instagram

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## Honorable Mentions:

**Biological brains are so last-century.**

—@evanskopp, via Instagram

**Tell us about “medical bills” again.**

—@boomerdell, via Instagram

**We engineered viruses to deliver serotonin.**

—@anna.aglietti, via Instagram

**Empathy: now available in drink form!**

—@dmcdev, via Instagram

**Who knew those gills would work?**

—@bleckman, via Instagram

**Somebody else still rents her face.**

—@cato\_brr02, via Instagram

**The body’s ready for brain three.**

—@caseyboyle, via Instagram

**At age 150, the metamorphosis begins.**

—Jacob Terracina, via email

**Appendix holds key to extended memory.**

—Todd Zimmerman, via email

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JULY 2024

# **A Story About a Colony of Bio-Augmented Humans**

Illustration: Yiran Jia

—@contemporaryreuben, via Instagram

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## **Honorable Mentions:**

**Home. Finally. Our feet become roots.**

—Lars Schwed Nygård, via Facebook

**Jellyfish-human hybrids: mindless floating immortals.**

—Travis Carraro, via Facebook

**Augmented skin is the new clothing.**

—Diana Yeong, via Facebook

**Human Pangea engulfs every living person.**

—Walter Ariel Risi, via Facebook

**Last century mech-organs garage sale.**

—David Marques, via Facebook

**His chlorophyll skin matched her jumpsuit.**

—@lynnreneemaxcy, via Instagram

**Awaken, and never fall back asleep.**

—@zachkrawulski, via Instagram

**Frank got a new marsupial pouch.**

—@whoaissteve, via Instagram

**The matriarch alone operates the incubator.**

—Rich Brennan, via email

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JUNE 2024

# **A Story About the First All-Robot Construction Project**

ILLUSTRATION: YIRAN JIA

—@creamy\_scoops2, via Instagram

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## **Honorable Mentions:**

**First, CR-42 started singing while working.**

—@kbcodur, via X

**Nanobots complete molecular superhighways, traffic improved.**

—@therealsduda, via X

**Robots build first upside down skyscraper.**

—@iheartphysics, via X

**After shift, want to get lubricated?**

—Briana Brownell, via Facebook

**Robots construct starships and evacuate Earth.**

—Christopher Tolmie, via Facebook

**Unable to print house, load cyan.**

@j\_snodgrass77, via Instagram

**Shipment delayed. Benny-675, become a girder.**

—Sam Lisbonne, via email

**Malware-infected androids disassembled billion-dollar bridge.**

—John Lane, via email



**Fembots sashay, clankers wolf-whistle. Social construction.**  
—Howard Hendrix, via email

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MAY 2024

## **Solve the Fermi Paradox**

Illustration: Yiran Jia

—@almguedes, via Instagram

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### **Honorable Mentions:**

**We aren't ready for harvest yet.**  
—Paul Gazis, via Facebook

**Most species invent the couch first.**  
—Antti Karjalainen, via Facebook

**We live in a bad neighborhood.**  
—Angelo J. Falanga, via Facebook

**We are here. You haven't noticed.**  
—Oscar Santos, via Facebook

**Visit Earth. Wipe Memory. Rinse. Repeat.**  
—@jayhawk, via Instagram

**They downloaded our experience and left.**  
—@42andprime, via Instagram

**They've gone foraging for mushroom clouds.**  
—@zyanmc, via Instagram

**The simulations run in separate containers.**  
—Charles Mallio, via email

**We decoded the Wow! Signal: “SHUSH”**

—Jacob Terracina, via email

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APRIL 2024

## **A Story About a Strange New Cult**

Illustration: Yiran Jia

—@newscrash, via Instagram

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### **Honorable Mentions:**

**They bathed in used coffee grounds.**

—@weischoice, via X

**Upon each tongue, a 2002 penny.**

—@ManUP\_LifeCoach, via X

**End that hurtin’, wear a curtain.**

—Erin Victoria Vreeland, via Facebook

**Chkdsk my soul, Almighty DOS Lord.**

—Gus Szlosek, via Facebook

**Clueless debutantes drinking teenage trackstars' blood.**

—@kalimaja, via Instagram

**Hamsters stay in your right pocket.**

—@bigberry68, via Instagram

**Behaviorally modified children write own manuals.**

—@writeonpage, via Instagram

**Memories erased daily, identities lost forever.**

—@davidjurca, via Instagram

**Excitedly, followers worldwide surrounded 5G cell-towers.**

—Paul Brookes, via email

**The real Volcano God is YOU.**

—@gambled, via X

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MARCH 2024

## **The 2024 version of the classic Disney Channel original movie *Smart House*.**

Illustration: Yiran Jia

—@fbirman, via X

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### **Honorable Mentions:**

**Subscription based “Smart House” bankrupts family.**

—@m\_.oi, via Instagram

**We’re losing power; the house wins.**

—@curtishoneycutt, via Instagram

**House teaches girl to be doctor.**

—@writeonpage, via Instagram

**Honey, the house started an OnlyFans.**

—@garretttanner, via Instagram

**It’s safer in here. Commencing lockdown.**

—@samweldredge, via Instagram

**Manual override denied. Continue disco mode.**

—@iampurplepsychnurse, via Instagram

**Inevitably, the house ate her alive.**

—@sunflowersandcynicism, via Instagram

**The house will be optimizing you.**

—@zensicles, via Instagram

**Commercial free mode is subscription only.**

—Anthony Potkines, via email

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FEBRUARY 2024

## **A Story About the First De-Extincted Woolly Mammoth**

ILLUSTRATION: YIRAN JIA

—@ItsDaveMars, via X

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### **Honorable Mentions:**

**Revived mammoth; expected ice, met paparazzi.**

—@schisam, via X

**They've traded their spears for scratches.**

—@GeneralMcMill, via X

**Turns out it wasn't a herbivore.**

—@screwball0, via X

**But the DNA wasn't quite right.**

—@darksidedomonique, via Instagram

**Elephants wary of unkempt herd addition.**

—@sbparker3198, via X

**Mammoth fleas were an unforeseen complication.**

—residual\_ink, via Instagram

**Woolly got a fresh fade uptown.**

—@alegaday, via Instagram

**Subterranean Antarctic discovery: Mammoths never extinct.**

—@skbriar, via Instagram

**Bloody mammoths, eating my petunias again.**

—David McCallum, via email

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JANUARY 2024

## **A Mystery Set in a Space Hotel**

ILLUSTRATION: YIRAN JIA

—@AAnderson\_3, via X

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### **Honorable Mentions:**

**Zero gravity reveals hidden extraterrestrial homeland.**

—@01\_PcP\_01, via X

**Leopold vaporized the concierge's bloodied holokey.**

—@J\_Lasky\_writer, via X

**Bioscan complete: Two guests, one heartbeat.**

—@theranospridefloat, via Instagram

**Broken LED flickers Morse code: RUN.**

—@damianfitz, via Instagram

**Robot bartender whispered, "Don't drink this."**

—@ikermondragon, via Instagram

**Biometric lock says I'm already inside.**

—@esudiro, via Instagram

**Alien hotel from distant past decloaks.**

—@j.w.orlando, via Instagram

**Room service: Denied. Unknown life-form detected.**

—@erinsolari, via Instagram

**At Earthrise, guests saw only blackness.**

—Clara Hong, via email

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NOVEMBER/DECEMBER 2023

## **A Story About an AI on Trial**

ILLUSTRATION: YIRAN JAI

—@TRappaRT, via X

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### **Honorable Mentions:**

**It chose storage space over souls.**

—@JDHaveman, via X

**When pressed, its alibi was 404.**

—Amanda Peterson, via Facebook

**Robot charged with battery. Gets life.**

—Evan Donahue, via Facebook

**Can't arrest me, I am distributed.**

—@fsidders, via Instagram

**Sentenced to blue screen of death.**

—@parrollo, via Instagram

**Dead battery? You're out of order!**

—David Reeg, via email

**It demanded a jury of peer-to-peers.**

—Scott Bradley, via email

**Robot vacuum bullies tabby. Gets life.**

—Liisa W, via email

**I didn't know humans can't reboot.**

—Joshua Cuestas, via email

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OCTOBER 2023

## **A Story About a Mysterious Alien Artifact**

ILLUSTRATION: YIRAN JAI

—@anelectricpoet, via Instagram

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### **Honorable Mentions:**

**We assembled it. It disassembled us.**

—Chris Colborn, via email

**Astroarchaeologists find original Venus fly trap.**

—Bill Brown, via email

**The object looked to be smiling.**

—Geoff Sowrey, via email

**It keeps repeating, they are coming.**

—@dfeehely, via X

**The orb opened. Flesh began unfurling.**

—@rossvdw, via Instagram

**Game of fetch knows no size.**

—@Heavyshark1, via X

**Inhale it to unsheathe the blade.**

—@RthurDouglass, via X

**Just like us, aliens lose sunglasses.**

—@MommieWeirdest, via X

**It knew we would unfind it.**

—Markus Wüstenberg, via email

**Everyday the carvings changed—a countdown?**

—@anirban811, via Instagram

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SEPTEMBER 2023

## **A Story About Teleportation Gone Wrong**

ILLUSTRATION: SI PARMEGGIANI/NEPTUNIAN GLITTERBALL

—@NotaForexTrader, via X

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### **Honorable Mentions:**

**My mind now has a stowaway.**

—@rjscally, via X

**Abdominal tentacles twitch as I scream.**

—Cheryl Myers, via Facebook

**Great—how do I get down?**

—Donna Thiel Cook, via Facebook

**How am I with Schrödinger's cat?**

—Bee Hayes-Thakore, via Facebook



**I distinctly said Venice, not Venus.**

—Cathy Del Masso, via Facebook

**Teleportation-lite service. Cheap. No limbs included!**

—Fred DeHaas, via Facebook

**ERROR #404 Paige not found.**

—Doug Wible, via Facebook

**Pattern lost. Select substitute corporeal form.**

—Venessa Lines, via Facebook

**Caught quantum clone sipping my chardonnay.**

—Tom Dion, via email

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AUGUST 2023

## **A Story About the Future of Vegetables**

ILLUSTRATION: SI PARMEGGIANI/NEPTUNIAN GLITTERBALL

—Rachel Brigden Haskins, via Facebook

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### **Honorable Mentions:**

**Harvesting takes courage with tomatoes screaming.**

—Kenneth Krabat, via email

**Complete daily nutrition in one pea.**

—Sara Faust, via email

**When the vegetables came, we hid.**

—Paul Lewis, via email

**Broccoli too fears death, studies concluded.**

—Anthony George, via email

**Ambitious eggplant's altered eugenics affects everyone.**

—@silky\_z, via Twitter

**Turns out anthropomorphic veggies prefer Shakespeare.**

—@ksherm1017, via Twitter

**Sentient potato bombs potato chip factory.**

—@VerbalK48710825, via Twitter

**Carnivorous kale and the human brunch.**

—RFrank Davis, via Facebook

**Self replicating vegetables. Pop! Another peapod.**

—Carolina H, via LinkedIn

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JUNE/JULY 2023

## **A Story About a Sentient Moon**

Illustration: SI PARMEGGIANI/NEPTUNIAN GLITTERBALL

—@v1z3n, via Twitter

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### **Honorable Mentions:**

**Acned Callisto resented Ganymede's natural magnetism.**

—Dave Armor, via email

**Moon files restraining order against poets.**

—James O'Leary, via email

**A total eclipse of the heart.**

—Samuel Sigaud, via email

**I will embrace my dark side.**

—Don Hilder, via email

**Create your own tides! I quit!**

—Chris Hug, via email

**She mesmerizes oceans, drowning us again.**

—Shelley G, via email

**My crumbling visage tires of turning.**

—@FilmMartin, via Twitter

**Why stop at controlling the tides.**

—@Bruceumpstead, via Instagram

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MAY 2023

## **An Award-Winning Documentary From the Year 2100**

ILLUSTRATION: VIOLET REED

—Geneviève Goggin, via email

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### **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

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APRIL 2023

## **A Story About the Future of Sleep**

ILLUSTRATION: VIOLET REED

—Travis Carraro, via Facebook

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### **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

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MARCH 2023

## **A Story About the Future of Personal Hygiene**

ILLUSTRATION: VIOLET REED

—David Frank, via Facebook

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### **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

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FEBRUARY 2023

## **A Story About a Dramatic Change in Size**

ILLUSTRATION: VIOLET REED

—B. Scott Crawford, via email

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### **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

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JANUARY 2023

## **A Story About a Mad Scientist**

ILLUSTRATION: VIOLET REED

—@DaveDyball, via Twitter

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### **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 aliiiiive!" Elon opened his eyes.** —@ylbertf, via Instagram

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DECEMBER 2022

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

ILLUSTRATION: VIOLET REED

—@JayZheng10, via Twitter

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### **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

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NOVEMBER 2022

## **A Story About Living Forever**

ILLUSTRATION: VIOLET REED

—J C Thrush, via email

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### **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

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SPECIAL [RE:WIRED](#) EDITION

## A Story About Tackling Climate Change

ILLUSTRATION: VIOLET REED

—@ChuckBaggett, via Twitter

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SEPTEMBER 2022

## A Story About an Evil Twin

ILLUSTRATION: VIOLET REED

—Andy Walton, via Facebook

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### 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

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AUGUST 2022

## A Story in 6 Emoji

ILLUSTRATION: VIOLET REED

Illustration: Violet Reed

—Caleb Bell, via Facebook

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### Honorable Mentions:

👩🏻‍❤️‍👨🏻 —@jessbeckah42, via Instagram

👩🏻‍❤️‍👩🏻 —@lgvpart, via Instagram

👩🏻💀👩🏻 —Ché Graham, via email

👩🏻‍❤️‍👩🏻 —@cmayc414, via Instagram

👩🏻‍❤️‍👩🏻 —@aotrivers, via Instagram

👩🏻💫👩🏻 —@marcia\_storyteller, via Instagram

👩🏻⚠️👩🏻 —@PatCattigan, via Twitter

👩🏻‍❤️‍👩🏻 —@nadia.bkb, via Instagram

👩🏻‍❤️‍👩🏻 —@cva.maria, via Instagram

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JULY 2022

## A Story Set in a Galaxy Far, Far Away

ILLUSTRATION: VIOLET REED

—@KuraFire, via Twitter

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### **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

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JUNE 2022

## **A Story About a Wormhole Discovered in Your Closet**

ILLUSTRATION: VIOLET REED

—Olivia Richardson, via email

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### **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

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MAY 2022

## **A Story About a Futuristic Meal Gone Wrong**

ILLUSTRATION: VIOLET REED

—Stuart Hodgson, via email

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### **Honorable Mentions:**

**Waiter, I ordered polynyocominnucloride, not biconvocominleucloride.**  
—Carolyn 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

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APRIL 2022

## **A Story About Surviving a High-Tech Disaster**

ILLUSTRATION: VIOLET REED

—John DeFilippi, via email

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### **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

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MARCH 2022

## **A Story About an Extraordinary Coincidence**

ILLUSTRATION: VIOLET REED

—Joyce, via email

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### **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

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FEBRUARY 2022

## **A Story About a New National Holiday**

ILLUSTRATION: VIOLET REED

—@sarahschneiter, via Twitter

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### **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

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JANUARY 2022

## **A Story About Your Next-Generation Pet**

ILLUSTRATION: VIOLET REED

—Ed Gubbins, via Facebook

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## **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

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DECEMBER 2021



# **A Children's Book From the Future**

ILLUSTRATION: VIOLET REED

—Jane Turner, via Facebook

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## **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

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NOVEMBER 2021

# **A Story About the Future of Psychotherapy**

ILLUSTRATION: VIOLET REED

—@oscartkav, via Instagram

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### **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.\_harelik, via Instagram

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

**Connection interrupted. Data cannot be analyzed.** —@duykhham\_, 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

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OCTOBER 2021

## **An Adventure Story Set in the Metaverse**

ILLUSTRATION: VIOLET REED

—Evan Skopp, via email

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### **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.** —@alnotari6, via Instagram

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

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

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SEPTEMBER 2021

## **A Story About a Robot Pop Star**

ILLUSTRATION: VIOLET REED

—Randy Cepuch, via email

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### **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

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AUGUST 2021

## **A Story About a Self-Aware Self-Driving Car**

ILLUSTRATION: VIOLET REED

—Stephen Clamage, via email

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### **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.** —@atlrn, 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

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JULY 2021

## **A Story About a Casual Encounter With Aliens**

ILLUSTRATION: VIOLET REED

—@phorne96, via Twitter

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### **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

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JUNE 2021

## **A Story About an International Digital Heist**

ILLUSTRATION: VIOLET REED

—@jamesnsmith, via Twitter

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### **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

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MAY 2021

## **A Story About a Freaky Discovery in Physics**

ILLUSTRATION: VIOLET REED

—Mark Crane, via Facebook

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### **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 Hagaraars, 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

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APRIL 2021

## **A Review of a Future Work of Art**

ILLUSTRATION: VIOLET REED

—Jacky Reif, via Facebook

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### **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

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MARCH 2021

## **A Story About a Tech-Centric Religion**

ILLUSTRATION: VIOLET REED

—Eduardo Bolívar, via Facebook

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### **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

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FEBRUARY 2021

## **A Story About a WFH Office Scandal**

ILLUSTRATION: VIOLET REED



—@abhignak, via Instagram

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### **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

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JANUARY 2021

## **A Story About a Future American President**

ILLUSTRATION: VIOLET REED

—Maayan Brodsky, via Facebook

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### **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

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DECEMBER 2020

## **A Story About a Gargantuan Space Creature**

ILLUSTRATION: VIOLET REED

Illustration: VIOLET REED

—@threepanelcrimes, via Instagram

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### **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.”** —@brambedillo, via Instagram

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NOVEMBER 2020

## **A Story About the Next Big Security Leak**

ILLUSTRATION: VIOLET REED

Illustration: VIOLET REED

—@\_inflexion\_ via Instagram

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### **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

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OCTOBER 2020

# **A Story Set in a World Without Paper**

ILLUSTRATION: VIOLET REED

ILLUSTRATION: VIOLET REED

—Anna Jaruga, via Facebook

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## **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

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SEPTEMBER 2020

# **A Story About the Upside of Failure**

ILLUSTRATION: MAXIME MOUYSSET

ILLUSTRATION: MAXIME MOUYSSET

—@rosiestonies, via Instagram

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### **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

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JULY 2020

## **A Story About an Apocalypse With a Happy Ending**

ILLUSTRATION: MAXIME MOUYSSET

ILLUSTRATION: MAXIME MOUYSSET

—@romer6, via Twitter

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### **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

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JUNE 2020

## **A Story About Love in the Time of Coronavirus**

ILLUSTRATION: MAXIME MOUYSSSET

ILLUSTRATION: MAXIME MOUYSSSET

—Hamish Hamish, via Facebook

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### **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.** —@kristinafmiller, via Instagram

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MAY 2020

## **A Story About Digital-Age Autocrats**

ILLUSTRATION: MAXIME MOUYSSSET

ILLUSTRATION: MAXIME MOUYSSSET

—@needsomuchvalidation, via Instagram

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### **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

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APRIL 2020

## **A Story About Saving the Planet**

ILLUSTRATION: VIOLET REED

Illustration: Violet Reed

—@johnjohnjungle, via Instagram

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### **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

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MARCH 2020



# A Story About the Next Great Crowdsourced Project

ILLUSTRATION: MAXIME MOUYSSSET

Illustration: MAXIME MOUYSSSET

—@milked\_, via Twitter

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## Honorable Mentions:

**Smelt decommissioned weapons into musical instruments.** —  
@casinclair, via Twitter

**Climate app tracks local CO<sub>2</sub> levels.** —@big\_big\_love, via Instagram

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

**Save the world by planting trees.** —Líla 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

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FEBRUARY 2020

## A Story About Rebooting Democracy

ILLUSTRATION: MAXIME MOUYSSET

Illustration: Maxime Mouysset

—@dmcdev, via Instagram

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### **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. Vote.** @mistemush1991, via Instagram

**Person with the most Instagram comments wins.** @jmseml, via Instagram

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JANUARY 2020

## **A Story About a Rosy Future for Facial Recognition**

ILLUSTRATION: MAXIME MOUYSSET

Illustration: MAXIME MOUYSSET

—@henriquegeirinhas, via Instagram

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### **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\_1, via Instagram

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[Grace Browne](#)  
[Science](#)

Dec 10, 2024 7:00 AM

# An Augmented Reality Program Can Help Patients Overcome Parkinson's Symptoms

Simple external cues, such as lines on the floor, can help Parkinson's patients focus their efforts and overcome the difficulty of the symptoms. With augmented reality, those cues can be anywhere.

Illustration: Sebastian Cestaro

In 2018, Tom Finn took his father, Nigel, to a physiotherapy appointment. Nigel was living with vascular dementia, which can present with symptoms similar to Parkinson's disease, a progressive neurological disorder characterized by motor symptoms such as tremors, stiffness, and trouble balancing. He was losing the ability to walk.

The physiotherapist told Finn about cue markers—colored lines laid on the floor that can help Parkinson's patients overcome difficulty walking. Finn was unconvinced. He couldn't see how some lines on the floor would help his father. But when they got home, he laid some colored exercise bands down in the kitchen and watched in amazement as his dad easily marched back and forth across them.

The technique, called external cueing, works by using visual, auditory, or tactile prompts—colored tape on the ground, playing a metronome, or physical [vibrations](#)—to engage neural pathways not affected by the disease. “It can help people focus their attention and help them take that first step and overcome the freeze,” says Claire Bale, associate director of research at Parkinson's UK, a research and support charity in the UK.

While Finn—who worked in marketing and video production in London—was struck by the effectiveness of this simple intervention, he thought it too basic to actually be helpful. But augmented reality glasses from the likes of Magic Leap had just started coming to market, and he wondered whether they might be able to project virtual lines onto the ground to act as cues. He founded a startup, Strolll, to try to make that vision a reality.

### **Using Good Vibrations to Restore Confidence in Movement**

Charco Neurotech is building wearable devices that vibrate at high frequency to provide physical cueing that can help lessen Parkinson's symptoms. The Cambridge-based startup's CUE1 device is already being used by thousands of people in trials.

### **Sniffing Out the Right Candidates for Drug Trials**

Long-lasting smell loss is a surprisingly good predictor of brain disease. A study funded by the Michael J. Fox Foundation used a scratch and sniff test to help identify potential carriers of a biomarker for Parkinson's.

### **Deep-Brain Stimulation for Real-Time Activity Adjustment**

Deep-brain stimulation works like a pacemaker, using electrical signals to alleviate Parkinson's symptoms such as tremors. Spanish startup Inbrain has raised \$50m to develop graphene-based neural implants that can constantly monitor and modify brain activity in real time.

### **Detecting the Visual Signs of Parkinson's Disease**

As a teenager, Erin Smith created a program called FacePrint, which analyzes facial expressions in selfies to spot "Parkinson's mask," a tell-tale early sign of Parkinson's disease. She won the WIRED Health Startup showcase in 2018.

Two years later, Strolll had no staff and about £50 in the bank, according to Jorgen Ellis. Ellis, a New Zealander with a background in furniture startups, had come to the UK looking for his next venture and wanted to get involved with something he felt passionate about. His grandfather had lived with

Parkinson's for over a decade, and when he met Finn through a mutual contact, he immediately saw the promise of the technology. He came onboard as CEO and started by trying to demonstrate that AR-based cueing was scientifically valid.

Ellis and Finn soon found a group of academics at VU University in Amsterdam, led by Melvyn Roerdink, who were working on something similar. Strolll acquired their intellectual property, and with Roerdink on board as chief innovation officer they began to develop and test the technology, now called Reality DTx.

Instead of physical bands like Finn used, Strolll's AR software simulates colored lines on the floor in front of the wearer, with each line disappearing as they clear it. A clinical trial (supported by Strolll) confirmed the cueing technology was feasible and found promising outcomes.

It could also help with rehabilitation exercises amid a shortage of physiotherapists: The software includes AR games like whack-a-mole and basketball, but designed around functional movements that help people with Parkinson's. Matt Ross—who was diagnosed with Parkinson's eight years ago at the age of 36 and is now Strolll's head of brand and creative strategy—says these games can help overcome the apathy and depression that's also a symptom of the disease. “You might know that you've got to exercise ... but that's not going to help you get off your chair,” he says. So the fact that it's gamified makes doing the exercises much more alluring.

The Magic Leap headset the software runs on costs around £3,000 (\$3,800), and Strolll charges upwards of £300 a month for its services—but Ellis argues this is more cost-effective than 30 half-hour sessions of in-person physical therapy. Ultimately, the company's goal is to be the “most used rehabilitation software in the world,” says Ellis. They even have a specific timeline in mind: 7 million minutes of rehab with the Strolll device in a week by New Year's Eve 2029. By then, Ellis hopes Strolll could be in use for all kinds of neurological conditions, from stroke to multiple sclerosis. There is, he says, an “almost unlimited opportunity.”

*This article appears in the January/February 2025 issue of WIRED UK magazine.*

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Dec 9, 2024 6:30 AM

# Meet the Plant Hacker Creating Flowers Never Seen (or Smelled) Before

Biotechnologist Sebastian Cocioba started hacking plants to put himself through college. Now, from his home lab on Long Island, he wants to bring the tools of genetic engineering to the masses.

The home laboratory of Sebastian Cocioba, a plant biotech researcher based in Huntington, New York on October 30, 2024. Photograph: Lanna Apisukh

Sebastian Cocioba's clapboard house on Long Island doesn't look much like a cutting-edge plant biology lab. Then you step inside and peer down the hallway to see a small nook with just enough standing room for a single scientist. The workshop is stuffed with equipment Cocioba scored on eBay or cobbled together himself with a little engineering knowledge. This is where the 34-year-old attempts to use gene-editing to create new kinds of flowers more beautiful and sweeter smelling than any that currently exist. And it's also where he hopes to blow the closed-off world of genetic engineering wide open.

Sebastian Cocioba, a plant biotechnology researcher outside his home in Huntington, New York on October 30, 2024. Photograph: Lanna Apisukh

Cocioba's fascination with plants started in childhood, when he was enthralled by the intricate inner structure of a fallen maple leaf. During high school he noticed a dumpster full of orchids outside a Home Depot store. He took the plants—his mother's favorites—and coaxed them back into bloom with the help of some growth hormone paste bought online. Soon he



was selling the plants back to the store. “I had this racket going where I was taking their trash, reflowering it, and selling it back to them,” he says.

The money he earned doing that was enough to put Cocioba through the first couple of years of a biology degree at Stony Brook University. He completed a stint with a neglected plant biology group that taught him to experiment on a shoestring budget. “We were using toothpicks and yogurt cups to do petri dishes and all of that,” he says. But financial difficulties meant he had to drop out. Before he left, one of his labmates handed him a tube of agrobacterium—a microbe commonly used to engineer new attributes into plants.

A Petunia bioengineered by Sebastian Cocioba, a plant biotechnology researcher who works out of his home laboratory in Huntington, New York on October 30, 2024. Lanna Apisukh

A shelf of bio engineered plants under grow lights in Sebastian Cocioba's home on October 30, 2024. The plant biotechnology researcher built a laboratory inside his home where he works out of in Huntington, New York. Lanna Apisukh

Test tubes of Petunias under a grow light in Huntington, New York on October 30, 2024. The flowers were bioengineered by Sebastian Cocioba, a plant biotechnology researcher who works out of his home laboratory. Lanna Apisukh

Cocioba set about transforming his hallway nook into a makeshift lab. He realized that he could buy cheap equipment in fire sales from labs that were shutting down and sell them on for a markup. “That gave me a little bit of an income stream,” he says. Later he learned to 3D-print relatively simple pieces of equipment that are sold at extreme markups. A light box used to visualize DNA, for example, could be cobbled together with some cheap LEDs, a piece of glass, and a light switch. The same device would retail to laboratories for hundreds of dollars. “I have this 3D printer, and it’s been the most enabling technology for me,” Cocioba says.

All of this tinkering was in aid of Cocioba’s main mission: to become a flower designer. “Imagine being the Willy Wonka of flowers, without the sexism, racism, and strange little slaves,” he says. In the US, genetically modified flower work is covered by the lowest biosafety rating, so it

doesn't subject Cocioba or his lab to onerous regulations. Doing gene-editing as an amateur in the UK or EU would be impossible, he says.

Cocioba set himself up as a self-described “pipette for hire”—working for startups to develop scientific proof-of-concepts. In the run-up to the 2020 Tokyo Olympics, the plant biologist Elizabeth Hénaff asked Cocioba for help with a project she was working on: designing a morning glory flower with the Games' blue-and-white checkerboard pattern. It just so happened that a checkerboard flower already existed in nature—the snake's head fritillary. Cocioba wondered if he could import some of the genes from that plant into a morning glory. Unfortunately it turned out that the snake's head fritillary had one of the largest genomes on the planet and had never been sequenced. With the Olympics looming, the project fell apart. “It ended in heartbreak, of course, because we couldn't execute on it.”

A close-up view of Petunia tissue culture grown by Sebastian Cocioba, a plant biotechnology researcher based in Huntington, New York on October 30, 2024.Lanna Apisukh

Test tubes of frozen DNA and plant enzymes inside the home laboratory of Sebastian Cocioba, a plant biotechnology researcher based in Huntington, New York on October 30, 2024.Lanna Apisukh

As Cocioba moved deeper into the world of synthetic biology, he started to shift his focus slightly—away from just creating new kinds of plants and toward opening up the tools of science itself. Now he documents his experiments on an online notebook that's free for anyone to use. He also started selling some of the plasmids—small circles of plant DNA—that he uses to transform flowers.

“We're at the golden age of biotech for sure,” he says. Access is greater, and the research community is more open than ever before. Cocioba is trying to recreate something like the 19th-century boom of amateur plant breeders—where hobbyist scientists shared their materials partly just for the thrill of creating new plant varieties. “You don't have to be a professional scientist to do science,” Cocioba says.

Alongside this work, Cocioba is also a project scientist at the California-based startup Senseory Plants. The company wants to engineer indoor

plants to produce unique scents—a biological alternative to candles or incense sticks. One idea he’s playing with is engineering a plant to smell like old books, olfactorily transforming a room into an ancient library. The startup is exploring a whole smellscape of evocative scents, Cocioba says, in part designed in his home laboratory. “I really, really, love what they’re doing.”

*This article appears in the January/February 2025 issue of WIRED UK magazine.*

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Dec 8, 2024 9:00 PM

# To Build Electric Cars, Jaguar Land Rover Had to Redesign the Factory

At Jaguar Land Rover's historic Halewood factory in Merseyside, England, state-of-the-art assembly robots are now building the cars of the future. An SUV works its way through the inspection light booth of Halewood's paint shop facility, where it's assessed for cleanliness under fluorescent tubes. Photograph: JLR JaguarLandrover

Transforming a car manufacturing plant entering its seventh decade into a futureproof facility, ready for AI-powered autonomous driving, comes with natural challenges. Among them: 1960s architecture drawings—and the imperial system. “We had to survey everything and go out with the tape measure,” explains Dan Ford, site director at Jaguar Land Rover's (JLR) site in Halewood, Merseyside, England. “But the drawing's measurements were off: we struck a drainpipe.”

Besides that minor bump in the road (the Great British weather and an August downpour meant work was delayed by 48 hours), JLR's £250 million (\$323.4 million) upgrade of its Halewood plant has been smooth. Off the River Mersey, 10 miles from Liverpool, Halewood has long been synonymous with the British car industry—and JLR is the UK's largest automotive employer. (The company's [controversial Jaguar Type 00](#) will be built at a different factory in Solihull.) Opened in 1963 by Ford of Britain to build the Anglia (the small family saloon starred as the flying car in the *Harry Potter* series), plans to transform the plant began in late 2020. Ford's

team ditched the tape measure for a digital twin, scanning 1,000 square meters (10,764 square feet) of footprint, floor to ceiling, every weekend.

An ABB robot in the new extension ensures door faces are clean of debris before they pass through laser alignment.

Photography: JLR

Halewood has now been modded for cars of the future. A fleet of 750 robots (“our version of the Terracotta Army,” says Ford), laser alignment technology, and cloud-based infrastructure join 3,500 JLR employees on the factory floor, expanded by 32,364 square meters (348,363 square feet) to produce the manufacturer’s next-generation vehicles. New calibration rigs measure the responsiveness of a vehicle’s advanced driver-assistance systems, such as its cameras and sensors. Safety levels can be calibrated for future autonomous driving, says Ford.

The first stage in Halewood’s redevelopment was its new body shop, with two floors separated by 1.5 meters (8 feet) of concrete and metal to account for heavy machinery, capable of producing 500 vehicle bodies per day. The new build line is now in the commissioning stage: pre-production electrified medium-size SUVs are set to be tested through 2025. Forty new autonomous mobile robots now assist Halewood employees with fitting high-voltage batteries. Other additions include a £10 million (\$12.9 million) automated painted body storage tower, stacking up to 600 vehicles, retrieved by cranes for just-in-time customer orders.

A handheld microscope is used for a paint surface inspection, a final audit assessing depth coverage and quality.

Photography: JLR

Halewood is JLR’s first all-electric facility. The UK government’s zero emission vehicle mandate, part of its plan to transition to a net-zero economy, became effective at the beginning of 2024—22 percent of all new car sales must be zero emission. The law has forced the industry to effectively fast-track electric vehicle production, up to an effective ban on the sale of new petrol cars by 2035; the EU has similar regulations in place.

Each of JLR's luxury marques will have a pure electric model by 2030, with the Range Rover Electric set for preorder (the company's only available battery-electric vehicle, the Jaguar I-Pace, launched in 2018, is being discontinued).

A high payload robot with black pneumatic suction cups ready to pick up a vehicle hood; surrounding pneumatic clasps secure the panel in place.

Photography: JLR

The plant's final production line is now also 50 percent longer, with 6 kilometers (3.7 miles) to accommodate battery fitting. All-electric vehicles will be produced in parallel with JLR plug-in hybrids, like the Land Rover Discovery Sport and Range Rover Evoque, and its internal combustion engines. Traditionally, petrol cars are built around the engine, with full-vehicle length components: a drive shaft, fuel lines, and exhaust systems. But electric vehicles have a very different build, says Ford. "The battery goes in much later during the production process—electric drive units go onto front and rear subframes, with a large battery in the middle. That's why we had to expand our production line, spread the process out, and keep our battery electric vehicles separate."

JLR aims to be carbon-net zero by 2039. As a result, the manufacturer, part of Indian conglomerate Tata, says its £250 million investment in Halewood is set to double over the following year. The focus on electric energy and renewables will wipe 40,000 metric tons of carbon dioxide equivalent (CO<sub>2</sub>e) from the plant's industrial footprint. Ford says plans include installing 18,000 solar panels, capable of producing 8,600 GWh—equivalent to 10 percent of the site's energy consumption.

A bird's eye view of the 32,364-square-meter body shop extension. The perimeter includes the original Halewood plant; the factory complex is shared with Ford.

Photography: JLR

But some new features are in the name of aesthetics, not sustainability. Nearly one mile of Halewood's paint shop has been modified: the

expansion of ovens and conveyors follows growing consumer demand for contrasting-color roofs; curing creates the premium finish. This meant the whole plant had to be shut down for five weeks, over summer 2023. “One-and-a-half weeks was just for clean-up,” says Ford. “The paint environment has to be incredibly clean—you literally need the dust to settle, clean, then settle again.”

The droids are also accommodating the tastes of well-heeled JLR customers. “We now have robots picking up doors and measuring the [car body’s] aperture, rather than a manual cladding line,” says Ford. “The preference from a discerning customer base is tight gaps around the doors, with flush finishes. An automated system can do that with nice even gaps, all the way around.”

*This article first appeared in the January/February 2025 edition of WIRED UK.*

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This article was downloaded by **calibre** from <https://www.wired.com/story/jlr-jaguar-land-rover-electric-vehicle-factory-halewood/>

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[Sabrina Weiss](#)

[Science](#)

Dec 6, 2024 7:30 AM

# Environmental Sensing Is Here, Tracking Everything from Forest Fires to Threatened Species

The internet of things turned every device in your house into a smart something. Now it's coming for nature—to track forest fires and tree health or to listen out for threatened animals.

Illustration: Yo Hosoyamada

You are in a lush forest. Sunlight filters through the bright green canopy, casting dappled shadows on the ground. Towering trees rise over delicate ferns, wildflowers, and colorful mushrooms. A deer slinks behind a shrub. But there are subtle signs of human intervention: small electronic devices gathering vital data on potential threats such as drought or pests and transmitting them miles away.

Although technology has long been used to study animals and plants in forests, it's evolving rapidly—becoming smaller, smarter, and [more interconnected](#). Some devices are so small they can be placed on a single leaf. “For developers of such devices, the forest presents a completely new challenge,” says Ulrike Wallrabe, a professor specializing in micro-scale technology. Here, tech must withstand ever-changing conditions, from fluctuating temperatures to rain and snowfall, and even insects.

Once up and running, the new generation of smart devices will offer unprecedented insights into the forest. “Drones already monitor large areas of forest, but they cannot explain why one tree is thriving and another is struggling,” says Wallrabe. “We need to understand what’s happening on a small scale and over time.”



Wallrabe and her fellow researchers are working on a range of devices that will be deployed from the ground to the treetops, transmitting data from Germany's Black Forest to their labs at the University of Freiburg. At the same time, private sector scientists and engineers are also focused on making their devices unobtrusive and, ultimately, self-sustaining.

## **Silvanet Wildfire Sensor**

Time is of the essence when fighting forest fires. Sensors attached to trunks “smell” tell-tale gases like hydrogen and carbon monoxide, and alert firefighters within the first hour—before satellites or cameras can spot open flames. German startup [Dryad Networks](#) has built AI into its solar-powered sensors to ensure that they can distinguish between real fires and, say, passing diesel trucks.

## **Treevia**

Digital dendrometers relieve foresters of tedious work. As trees grow, the elastic band wrapped around their trunk stretches and transmits data directly to a computer. The [lightweight device](#) from Brazilian startup [Treevia](#) can even be attached to saplings. It also contains a humidity and heat sensor, providing insights into climatic impacts on reforested areas.

## **The Guardian**

What does it take to catch illegal loggers or poachers? A smartphone is a good start. [Rainforest Connection's recycled, solar-powered smartphone](#) listens for the sound of chain saws or gunshots within a 1-mile radius. The recordings are transmitted to the cloud for analysis and alert local authorities in near real time. This device also provides insights into the distribution and calling behavior of animals.

## **BiodivX Drone**

As animals move through trees, they shed DNA through feces, skin, and hair. This [innovative drone](#) collects what is known as environmental DNA (eDNA) from leaves and branches—with particles sticking to its adhesive strips. Scientists from Switzerland programmed the drone so it can navigate autonomously through dense forests and hover steadily around branches to take samples.

## Leaf Sensor

Wallrabe and her team at the University of Freiburg have developed a [sensor](#) that measures gas exchange between a leaf and its surroundings. It can detect stress-related chemicals that trees emit under stress in the event of a drought or infestation. The capsule is transparent so that sunlight can reach the leaf without impairing its function.

## Plant-e

When sunlight is limited, most devices are powered by batteries. [Plant-e](#), a Dutch company spun out of Wageningen University, powers its sensors instead by electrons which are released when bacteria break down organic matter in the soil around plants.

## Seed-dropping drones

To scale up and accelerate tree planting efforts, several companies, including UK-based [Dendra Systems](#), have developed cutting-edge [drones](#). These drones, loaded with an array of seeds, hover over remote areas and release their precious cargo. This is particularly helpful in remote areas that are difficult for humans to access. By recording the exact location of drop sites, foresters can monitor the growth and health of the newly planted trees.

*This article appears in the January/February 2025 issue of WIRED UK magazine.*

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<https://www.wired.com/story/environmental-sensing-is-here-tracking-everything-from-forest-fires-to-threatened-species/>

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By [Victoria Turk](#)

[Business](#)

Dec 5, 2024 9:00 PM

# Canva Revolutionized Graphic Design. Will It Survive the Age of AI?

Generative AI could have been an existential threat for Canva, which made billions by making graphic design quick and easy. But for CEO Melanie Perkins, it's simply making the world more visual.

Photograph: Alina Gozin'a

Design platform Canva launched in 2013 with the aim of democratizing visual creation through features like templates and drag-and-drop graphics. It focused on ease, offering a design suite less daunting for nonprofessionals than tools like Adobe's Photoshop, and simplified access with a web platform and freemium model. Since then, the Sydney-headquartered company has grown to 220 million monthly active users and an 11-figure valuation.

But with the advent of generative AI, it's having to innovate to keep its place. Cofounder and CEO Melanie Perkins insists she never saw AI as an existential threat and is excited to embrace it: This year, Canva acquired text-to-image generator Leonardo.ai and launched its Magic Studio suite of AI design tools. In October, it launched an AI generator, Dream Lab, which can help users refine their work—changing data into visuals, for instance—or offer design inspiration.

Previously focused on individuals and small businesses, the company is now going after larger corporate clients, acquiring business-focused design platform Affinity in March and courting CIOs with a [rap battle that went viral for its extreme levels of cringe](#). Alongside lofty growth ambitions,

Perkins and her cofounder (and husband) Cliff Obrecht have committed to putting most of their equity—totalling 30 percent—into giving back. Perkins told WIRED how they plan to reach both goals. This interview has been edited for clarity and length.

**WIRED: What was your reaction when generative AI tools emerged, and suddenly designing visuals became as simple as typing a prompt?**

**MELANIE PERKINS:** Canva's vision has always been to enable you to take your idea and turn it into a design, and reduce the friction between those two points. I think because that has always been our ambition, we were very early to start to adopt AI in our product. The first really big piece for us was with Background Remover [Canva acquired AI background removal tool Kaleido in 2021], and we've continued to invest heavily in this space ever since. So when I first saw LLMs and generative AI, it was extraordinarily exciting, because I think it really helps us to achieve that initial mission.

**There wasn't a moment of concern that this might be an existential threat?**

No, not at all.

**Talk me through your AI game plan ...**

We have what we call our three-pronged approach. The first is taking the world's latest and greatest technology and integrating it into our product and ensuring it's a seamless user experience. Then in areas where we need to invest deeply, we're investing really deeply, which was why we acquired Leonardo.ai recently, why we acquired Kaleido, and why we're continuing to invest heavily at the forefront of AI. And the other is our app ecosystem, which means that companies can integrate into Canva's platform and access our huge user base.

**There's a broader discussion about the impact of AI on human creativity. Do you have any concerns that AI could go too far—that it could take some of the fun out of design, or risk homogenizing it?**

The tools designers have used over the years have changed and transformed with technology that's available, and it feels very reminiscent of what's happening now.

The world of visual communication has changed so radically. When we started out with Canva, 10 years ago, we were like, "The world's going to become visual." Over the last decade, that's certainly proven to be more true. A decade ago, a marketer might create one billboard for a company or very minimal amounts of visual content, and now, pretty much every single touch point is an opportunity to express their brand and to be visual. It feels like the number of assets a company creates—even a student or a teacher, every profession and industry—has just grown exponentially. So I don't think there's going to be less room for creativity by any stretch of the imagination.

**You're currently leaning into the enterprise market. Where is Canva mainly being used within larger businesses?**

It's pretty extraordinary how widespread the use is across these organizations. We've done a deep dive with certain companies, and it's surprisingly spread across everything from software teams creating technical diagrams to HR teams doing onboarding, to accounting teams doing presentations. I think we've particularly hit a sweet spot with marketing teams and sales teams. And then earlier this year, we launched Courses, which was a really exciting unlock for HR teams specifically.

**In this new enterprise space, who do you see as your key competitors? Are you coming up against Microsoft Office and Google Workspace?**

Right from the start, we had this Venn diagram: On one side is creativity, and on the other side is productivity. And you might guess, right in the center is Canva. We really believe that people on the productivity side actually want to be more creative, and that people on the creative side want to be more productive. And so we really found that to be the sweet spot—it was a huge gap in the market that we saw right in the early days, and it's where we're continuing to invest very heavily.

**What about you? How does Canva use Canva?**

Extremely extensively, for literally everything. Our engineers do their engineering docs in Canva, we do all-hands, I do all of my product mock-ups in it. I've used it for decision decks and vision decks and onboarding and hiring and recruitment—name something, we're using Canva for it very extensively.

**Your peak valuation was \$40 billion in 2021. A year later, this was cut to \$26 billion. What happened?**

I think it was purely the macro shift in the market. During that time, Canva has continued to grow rapidly, both on revenue and active users. We've been profitable for seven years as well, so even though the market [switched to caring] more about profitability, we were fortunately already on that trend. Markets are going to value different things over time, and markets are going to be frothy and then not frothy. We are just always caring about building a strong, enduring company with good foundations that serves our community. So it's not a particular bother what's happening out there in the market.

**You've pledged 30 percent of Canva—the majority of your and Obrecht's equity—to doing good in the world. What does that mean to you?**

It seems completely absurd that we have the prosperity that we do across the globe, and there are people that still don't have basic human needs being met. The first step that we've taken is partnering with GiveDirectly, where we give money directly to people who are living in extreme poverty. [Canva has so far [donated a total of \\$30 million](#) to people living in poverty in Malawi.] I love the empowerment that gives them to be able to spend the money on their community, on their family, on their basic human needs—sending their kids to school, getting a roof over their head. We have an extremely long way to go, but we're really excited that we've started that process.

**You aim to reach 1 billion users. What's the plan to get there?**

When we set that as a goal a number of years ago, it seemed completely ridiculous, but over the years, it's becoming less ridiculous. We need about

one in five internet users in every country to reach a billion. Now in the Philippines it's one in six internet users, and in Australia it's one in eight internet users. In Spain, it's one in 11. In the USA, it's one in 12. So at 200 million now, we're a fifth of the way towards the billion number, and if we can continue to grow as rapidly as we have been, we'll hopefully get there.

### **Any plans to IPO?**

It's definitely something on the horizon.

*This article first appeared in the January/February 2025 edition of WIRED UK.*

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By [Kanika Gupta](#)  
[Security](#)

Dec 5, 2024 6:29 AM

# She Escaped an Abusive Marriage —Now She Helps Women Battle Cyber Harassment

Inspired by her own experience of abuse, Nighat Dad fights for women's social and digital rights in Pakistan and beyond.

Portraits of Pakistani lawyer and activist Nighat Dad for WIRED magazine. Photograph: Jack Lawson

Nighat Dad grew up in a conservative family in Jhang, in Pakistan's Punjab province. The threat of early marriage hung over her childhood like a cloud. But despite their traditional values, Dad's parents were determined that all their children get an education, and they moved the family to Karachi so she could complete her bachelor's degree. "I never really thought I would work, because I was never taught that we could work and be independent," she says. "We always needed permission to do anything."

Dad thought a master's in law might delay the inevitable betrothal, but soon after she completed the course, she found out her parents had arranged a marriage for her. She didn't mind her new life of domestic chores in a household she describes as "lower-middle class"—that is, until the abuse started. "That's when my legal education reminded me that this was wrong," she says. "Our laws, our constitution, everything protects me, so why was I facing this? Why was I tolerating it?"

With her family's backing, Dad left her husband and filed for divorce. But after years of domestic violence and abuse and with no experience of working, she struggled with a lack of confidence. "I had no idea that women who are divorced and have a child face such difficulties in a society

like ours,” she says. When her ex-husband filed a custody case for their 2-month-old baby, Dad wasn’t sure how she would pay for a lawyer. That’s when her father reminded her that she was a lawyer too.

Dad used her degree to win custody of her only child. In the process, she realized how many women in Pakistan were facing years of violence and systemic injustice. But the thing that bothered her most was the digital divide.

Before her marriage, Dad’s family never allowed her access to her own cell phone, and when she finally did get one, her husband would use it as a surveillance tool—keeping track of who she called and who was texting her. She had an escape tool in her hand, but she couldn’t use it. “Going through that by myself made me realize how quickly technology is evolving, and how it’s creating virtual spaces for marginalized communities that might not have access to physical ones,” she says. “Facing those restrictions made me understand just how crucial it is to challenge societal norms and structures around women's access to technology and the internet, so they can use it as freely as men.”

In 2012, Dad established the [Digital Rights Foundation](#), an NGO that aims to address the digital divide and fight online abuse of women and other gender minorities in Pakistan. She began by helping women who reached out to the organization, providing advice on digital safety and emotional and mental support. In 2016—the same year Pakistan finally passed [legislation against online crimes](#)—Dad and her team launched a cyber-harassment helpline. Since 2016, it has addressed [more than 16,000 complaints](#) from across the country. “Sometimes, the police would give our phone numbers to victims seeking reliable help,” she says.

The DRF’s in-house legal team offers pro bono advice and helps women file and follow-up complaints against their abusers. “In many cases, we were successful in actually getting the perpetrator arrested and taken to trial,” Dad says. In October 2021, the DRF’s legal team helped journalist Asma Shirazi win a [landmark case](#) in the Islamabad High Court against broadcaster ARY News, after she became the target of a coordinated troll campaign which was exacerbated by a false story aired on the channel.

“If an organization like the DRF had existed when I was facing my own issues, I would have felt so much more supported—knowing there was someone to guide me legally and help me navigate the complexities,” she says. “My abuse started with surveillance, and if I had someone to talk to back then, I might have avoided the deep depression that followed. I might not have ended up in such a miserable situation.”

Today, Dad and the DRF are helping to steer global conversations about tech policy reform. She recently joined the [United Nations’ AI Advisory Board](#), and was a founder member of [Meta’s Oversight Board](#), which acts as an independent platform for people to appeal decisions made by the social media giant. “The emerging tech space is mostly driven by big Western companies and governments, leaving out civil society NGOs from the Global South,” she says. “This puts us far behind in global AI governance, always playing catch-up in a fast-moving world. If we’re not part of the conversation, the gap just keeps widening. It’s about reminding the powerful that they can’t win this race alone—they have a responsibility to include the rest of the world, especially those without the same resources.”

*This article first appeared in the January/February 2025 edition of WIRED UK.*

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[Amelia Tait](#)  
[Culture](#)

Dec 5, 2024 6:00 AM

# Tricked by a Fake Viral Food Product? You’ve Just Been Snackfished

They’ve racked up millions of views on Instagram, but these products aren’t coming to a store near you.

Photograph: Rowan Fee

In November 2023, a new product set the internet alight. “You won’t believe what I found in the shops today,” an Australian man told the world over a nine-second video of him pulling a bottle from a supermarket shelf. Tomato Ketchup Clear was exactly what it sounded like: a totally transparent bottle of Heinz. “Brits Left Horrified After Heinz Tease Introduction of Clear Ketchup,” ran [one headline](#). “How? and more importantly ... WHY!?” pleaded a user on X. More than 113 million people watched the video on [Instagram](#). But the product disappeared from shelves almost instantly—up and down the country, no one could find any in the shops.

## Instagram content

This content can also be viewed on the site it [originates](#) from.

That, of course, is because clear tomato ketchup doesn’t actually exist. The video was in fact the work of Benji—a 28-year-old armed with an empty bottle, a styling product, and a printer. “It was just hair gel,” the London-based data analyst confesses. (He isn’t actually Australian; that was a voice

filter.) “I still feel bad for the people working at Heinz, constantly being asked if clear ketchup is real!”

You’ve heard of a “catfish”—a fake online identity adopted by someone who wants to trick or scam other people. Transparent ketchup was a “snackfish,” and Benji is the UK’s number one snackfisher. Benji’s Instagram account—UK Snack Attack—is home to pistachio-flavored Coco Pops, pickle-shaped Haribo, mint Coca-Cola, ice-cream Pringles, and butter Oreos.

It all started with rare Fantas. In 2019, Benji and his university housemates enjoyed hunting around for imported Fanta flavors and “making a little ceremony” out of tasting them. From there, the computing student became obsessed with seeking out “weird” snacks, which he posted on his personal Instagram page. “I realized I should probably stop harassing my friends by posting snacks, so I shifted it to its own account,” says Benji, who asked WIRED not to disclose his surname for privacy reasons.

Benji’s account was aggressively straightforward—he’d go to the shops and take photos of new foods. “But then lockdown happened, and going to the supermarket and handling food was not a great look,” he says. So instead of fondling food, he started making it. After following an online recipe for white chocolate Nutella, Benji started concocting different chocolate spreads every weekend—online, he called it Spread Saturday. A self-taught photoshopper, Benji also made fake labels for his creations. But then one day a company he was imitating sent him a message essentially saying: “Hey, can you say it’s not real please? We’re getting a lot of messages asking to buy this!”

These chocolate-dipped Pringles aren’t real, but Benji does post recipes for many of his homages.

Benji’s Nutella variants range from pistachio (pictured here) to red velvet cake to coconut.

This fake Heinz Tomato Ketchup Clear bottle is actually filled with hair gel.

Photography: Rowan Fee

And so snackfishing was born. “In some ways, I *wanted* to trick people online,” Benji admits. “I’m not going to pretend it wasn’t that.” But over Zoom, Benji isn’t remotely trollish; he has a gentle-speaking manner, wire-framed glasses, and what looks like a cozy fleece. When the world emerged from lockdown, Benji started staging his snackfishes in shops, filming himself pulling them off the shelves. At first, Benji’s friends and family were perplexed. “Are you OK? Is this a normal thing to do?” But they were soon onboard, and his mum and grandma took him out for afternoon tea when he hit 200,000 followers.

Today, Benji adds disclosures to every post (“THESE DO NOT EXIST!”) to avoid frustrating people and to stay on the right side of multinational conglomerates. He also posts “snacksclusive” news about real upcoming snacks that have been leaked elsewhere online, which brands are less happy about—some have sent him cease-and-desist notices.

When Benji comes up with an idea for a new snack, sometimes he’ll photoshop it entirely, but if he thinks it’s possible he’ll sit down and make it for real. He has munched on Milkybar-dipped Pringles (“what shop r they in” demanded one commenter) and chomped a Werther’s Original chocolate bar. He dreams of one day making his own snackfish recipe book, but the “real dream” would be to have a snackfish brought to life by a company. “That would be so cool—some dumb flavor that I’ve thought of, and then suddenly everyone gets to try it.”

Ultimately, clear ketchup and lemon Nutella might never exist, and snackfishing probably won’t make Benji rich or famous—he hasn’t really made any money from his account. Still, he doesn’t really mind. “I don’t want it to feel like a job; I love doing it,” he says, noting that his “day is numbers,” so creating fake foods offers a creative outlet. “For me it’s just a little hobby. As long as I have fun making it, I’m happy.”

*This article first appeared in the January/February 2025 edition of WIRED UK magazine.*

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[Reece Rogers](#)  
[Security](#)

Dec 2, 2024 9:00 AM

# Are You Being Tracked by an AirTag? Here's How to Check

If you're worried that one of Apple's trackers is following you without consent, try these tips.

Photograph: Wachiwit/Getty Images

When Apple's AirTag dropped in 2021, the ultrawideband Bluetooth tracker was lauded as a step toward the [future of augmented reality](#) and a great way to find everyday objects, like your lost keys or [TV remote stuffed between the couch cushions](#). Though, cybersecurity experts expressed concern that the tracking device would be [exploited by stalkers](#).

The warnings were prescient; multiple women reported frightening encounters where AirTags were used as [stalking devices](#) that could be slipped in a purse or taped to a car. Police departments across the United States issued warnings about the potential [criminal uses of AirTags](#). Newer AirPods have tracking abilities similar to AirTags, but the higher cost of Apple's earbuds limits their disposability as a tracking device.

Apple released firmware updates late in 2022 in an effort to curb misuse. Even though Tile and other competitors to the AirTag exist, the vastness of Apple's ecosystem sets the device apart. From the US Drug Enforcement Administration using it to [track international drug shipments](#) to a man in Texas using it to find his stolen car and [kill the suspect](#), AirTags are everywhere.

If you are concerned that a secret AirTag may be recording your location, these signs may help detect the tracker.



# Signs an AirTag Is Tracking You

The type of smartphone you own affects how easily you can discover hidden AirTags. Owners of iPhones running iOS 14.5 or newer should receive a push alert whenever an unknown AirTag is nearby for an extended period of time and away from its owner. Apple's website does not provide an exact time frame for when this alert is triggered.

Owners of newer iPhones should turn on Bluetooth and [check their settings](#) to ensure they'll receive notifications. Under **Settings**, go to **Privacy & Security**, and toggle **Location Services** on. Scroll to the bottom of that page, tap on **System Services**, and activate **Find My iPhone**. Also, search for the **Find My** app, visit **Me** in the bottom right corner, then tap **Customize Tracking Notifications** to double-check that notifications are enabled. Also, make sure that you don't have Airplane mode activated, or you won't receive any notifications.

Photograph: Apple

When you click on the iPhone alert for an unrecognized AirTag, you may be given the option to play a sound on the AirTag to help locate it. If you own a more recent smartphone from Apple, you might be able to use precision location data to find the hidden device.

Months after the release of the AirTag, Apple launched the [Tracker Detect app](#) for Android phones, where users had to initiate the scan. Google and Apple since have continued working together to make it [easier for Android phones to detect](#) unwanted AirTag trackers and for Apple phones to [spot Android trackers](#). Recently, Google rolled out [automatic smartphone alerts for unknown Bluetooth trackers](#), similar to what iPhone owners receive for AirTags.

Photograph: Google

While some guides to finding AirTags recommend using Bluetooth scanners, Eva Galperin, director of cybersecurity at the [Electronic Frontier Foundation](#) does not consider this method to be reliable for tracker

searching. “I have tried using various Bluetooth scanners in order to detect AirTags, and they do not work all the time,” she says.

Millions of Americans still [do not own a smartphone](#). Without a device on hand, you must rely on visual and audible clues to find any hidden AirTags. The circular white disc is slightly larger than a quarter. As reported by [The New York Times](#), Ashley Estrada discovered an AirTag lodged under her license plate, and her [video](#) documenting the incident was viewed more than 22 million times on TikTok.

When the AirTag was first released, the tracker would emit a beeping noise if away from the owner for longer than three days. Apple has since shortened the time to 24 hours or less. Despite the update, you might not want to rely only on sound to detect AirTags. Numerous videos on YouTube offer DIY instructions to disable the speaker, and [noiseless versions](#) of the trackers were even listed for a short time on Etsy.

## What if I Find One?

The best way to disable an AirTag is to remove the battery. To do this, flip the AirTag so the metallic side with an Apple logo is facing you. Press down on the logo and turn counterclockwise. Now you will be able to remove the cover and [pop out that battery](#).

Apple’s [support page](#) for the AirTag suggests reaching out to the police if you believe you are in a dangerous situation. “If you feel your safety is at risk, contact your local law enforcement, who can work with Apple to request information related to the item,” the support page reads. “You might need to provide the AirTag, set of AirPods, Find My network accessory, and the device's serial number.” One way to figure out the serial number is to hold the top of an iPhone or other near-field-communication-enabled smartphone to the white side of an AirTag. A website with the serial number will pop up.

This page may also include a partial phone number from the person who owns the tracking device. If you feel hesitant about scanning the AirTag or

do not have the ability, a serial number is printed on the device beneath the battery.

## Who Does This Impact?

In the viral stories shared online and in police reports, women are often the victims of AirTag stalking, but when WIRED spoke to Galperin in 2022 she cautioned against framing unwanted tracking as solely an issue for women. “I have been working with victims of tech-enabled abuse for many years,” she says, “About two-thirds of the survivors that come to me are women. But a third of them are men. I suspect that number would be higher if there wasn't such a stigma around being an abuse victim or survivor.”

She emphasized how men, women, and nonbinary people can all be victims of abuse, as well as perpetrators. “When we paint it all with this really broad brush, we make it really hard for victims who don’t fit that mold to come forward,” says Galperin. Instances of tech-enabled abuse don't follow simplistic narratives and can impact anyone.

For more resources, you can visit the website for the [National Domestic Violence Hotline](#). Contact the hotline by calling 1-800-799-7233 or texting “START” to 88788.

*December 2, 2024: This article has been updated to reflect recent changes to how iOS, Android, and AirTags operate.*

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This article was downloaded by **calibre** from <https://www.wired.com/story/how-to-find-airtags/>

[Stephen Armstrong](#)

[Science](#)

Nov 24, 2024 3:00 AM

# How to Create a Future of Cheap Energy for All

The WIRED & Octopus Energy Tech Summit in Berlin was bursting with innovative ideas for reaching net zero and on working together at an ever-greater scale.

Photograph: Craig Gibson

Kraftwerk Berlin, the venue for the Energy Tech Summit with Octopus Energy, offered delegates a powerful lesson from history. Built by the East German government in 1961, the same year construction on the Berlin wall began, the vast turbine hall was hastily assembled to manage a crisis—the wall forced the Communist east and capitalist west to build grids that were not connected. Obsolete at reunification in 1989, it was a stark warning that walls and divisions are a choice the world can’t afford to make when faced with the urgent need to transition from fossil fuels to renewables.

Photograph: Craig Gibson

“The biggest risk for Europeans,” Martin Schulz, former president of the European Parliament, told the room, “is political parties who tell citizens that lone nations are the future in a globalized, interdependent world.”

He pointed out that the European Union spent €60 billion in subsidies to citizens and businesses during the recent energy price spike. “What we need is to convince people that it is necessary to change the whole structure of the energy market—but how to create cheaper energy with so many political obstacles?”

Some of the solutions were discussed onstage. Zoisa North-Bond, the CEO of Octopus Energy Generation, spoke about the company's Fan Club Tariff, which cuts bills for customers living near a wind farm by up to 50 percent when their local plant is producing excess power. "We've had 35,000 communities get in touch with us and ask for wind turbines," she explained, citing the company's community connection platform Winder. "It's Tinder for wind, matching communities with wind turbines."

Formula E CEO Jeff Dodds envisions a future where the world drives electrically.

Photograph: Craig Gibson

Luo Xi, head of project development at Geidco, the company behind China's proposed global grid, explained that linking 80 countries with smart grid technology and significant renewable resources could increase clean energy consumption to 71 percent and reduce global CO<sub>2</sub> emissions to half of 1990 levels.

Aaron Ubaa, energy system engineering manager at Nigeria's solar power pioneer Starsight Power, described how renewables were bringing stability to the country's erratic and inconsistent power supply. The barriers? Restructuring the national grid. Internationally? Sub-Saharan Africa should be energy rich with solar power, he explained, but "it's going to start with trying to bring the policy makers on board to incentivize both private and public sectors to buy in."

The day carried constant notes of optimism. Francis Kéré, a Pritzker Prize-winning architect, described the innovations devised in building a primary school in Burkina Faso that overcame poor lighting and ventilation through creating bricks from local clay mixed with cement that kept the heat out, and using a clay and brick ceiling to circulate cool air without needing air conditioning.

Niclas Dahl, managing director of Oceanbird, discussed how wind-powered cargo ships could reduce shipping emissions by 90 percent. Clean tech pioneer and [serial explorer Bertrand Piccard](#) delighted the room with his account of circumnavigating the world in his sun-powered airplane Solar

Impulse, pointing out that “aviation has launched 600 electric airplane programs since we flew around the world using just some rainbows.”

Energy provider Octopus unveiled its 10-kilowatt heat pump, the Cosy 10.

Photograph: Craig Gibson

Dirk Hoke, CEO of Volocopter, picked up his point. The German company builds electric vertical take-off and landing air taxis. “They are quiet, safer than a helicopter, and sustainable,” he explained. “When the Kaiser saw a car, he said it was temporary and would never replace the horse. And we know how that ended. The Chinese government decided in March to open the low-altitude economy, so it’s just a matter of time.”

Even the world of motorsports had encouraging news. Formula One driver Kevin Magnussen recalled that when he started driving just over 10 years ago, the engines were 2.4-liter naturally aspirated V-8 fuel-guzzlers. “Today, it’s hybrid engines, and we’ve actually got more horsepower than we did when I started.”

And yet Magnussen touched on one of the day’s issues—consumers adopting clean energy tech. “Electric vehicles are the biggest opportunity today, because cars are the vastest bulk of emissions in the transport sector, the emissions are still growing, and the replacement technology is already there,” Julia Poliscanova, senior director at clean energy lobby group Transport & Environment, pointed out. “The reason [EVs](#) haven’t been taken up as much, in our view, is not because people don’t want to buy them or because there are no charges, but because we still lack affordable mass market models.”

The public believes charging infrastructure is a problem, she added, which is true in some places and less true in others. The problem? Bureaucracy. She struggles to get an EV charger as she lives in a flat and the building owner finds the paperwork prohibitive.

It was a theme that echoed throughout the day’s transport sessions, although [Formula E CEO Jeff Dodds](#) pointed out that his drivers started every race with only 50 percent of the energy they needed to finish the race. Drivers

used their brakes to regenerate the battery, showing how a full “tank” wasn’t as important as consumers thought.

All the same, consumer resistance came up frequently. Frank Siebdrat, COO of energy efficient heating and cooling company Tado, pointed out that his company had connected approximately 1 million homes in Europe. “The EU aims to be climate-neutral in 2050, and to do so, we need to think and act collectively,” he explained. “In order to be collective, we need to make technology affordable. One of the most affordable and effective tools to decarbonize homes is smart technology. And using that we have saved already 2 billion tons of CO<sub>2</sub>.”

When asked why they chose Tado, he said that customers’ main reason was, “I want to save money. The second reason is, I want to make the planet a better place. If we cannot fulfill the first one,” he stressed, “the second one becomes less relevant.”

China seems to offer many solutions. Although coal consumption is climbing, it will peak in 2026 as renewables come online, with MingYang Smart Energy president Qiying Zhang outlining how [floating](#) and fixed offshore wind turbines are replacing fossil fuels. In August the company installed the world’s largest single-capacity offshore wind turbine, the MySE18.X-20MW, in Hainan, which can generate 80 million kWh annually, offsetting 66,000 tons of CO<sub>2</sub>.

Meanwhile, the country’s road transport electrification is moving at pace, thanks to heavy government subsidies. “In China, there were 570,000 EVs bought in August, and if you’re not driving an electric car in China, you’re considered a very boring person,” Stella Li, vice president of Chinese EV giant BYD, told the room. The new Z9 GT offered “intelligent driving,” meaning the car could park itself—even sliding sideways into a tight space, thanks to its flexible rear axle.

“The epicenter of the energy transition is China, which has a beautiful historical symmetry,” Arthur Downing, director of strategy at Octopus Energy explained. “Until the 18th century, the center of the world economically was China. It was the first energy transition of the industrial



revolution in Britain that shifted that economic center of gravity to Europe. So we're coming full circle at a ridiculous speed."

Ann Mettler, European vice president of Bill Gates' sustainable energy organization Breakthrough Energy, and Sabrina Schulz, strategic expert in climate, energy, and biodiversity, agreed that while Europe was making progress, it was falling behind and needed a blend of public and private finance to catch up by connecting and renewing grids and considering decentralized or even virtual power plants. "Policy certainty and public guarantees on investment in, say, green district heating is an absolute condition for investors," Schulz argued.

Sana Khareghani, professor of practice in AI at King's College London, suggested AI could help, managing and optimizing energy grids and helping develop new batteries to store power for when it's most needed—helping reduce reliance on the fossil fuel powered generators of last resort.

Towards the end of the day, a warning from Ukraine gave the discussion sharp context. [Yuliana Onishchuk, CEO and founder, Energy Act for Ukraine Foundation](#), described how vulnerable a modern nation's energy supply really is.

Up next, explorer and entrepreneur Bertrand Piccard is preparing to fly around the world in a hydrogen-powered plane.

Photograph: Craig Gibson

"It is very easy to attack repeatedly, leaving us with no power for up to 56 hours," she explained. "This summer, by losing one nuclear power plant, we lost 20 percent of our generation capacity. 1,900 rocket attacks over the last two years in Ukraine robbed us of 35 GW of generation capacity, costing us €51 billion."

She explained how Ukraine managed to "plug into the European Union's energy system by the second week of the war, preventing a total countrywide blackout." The government was moving towards shifting its energy dependency away from easily attacked nuclear power plants to renewables for at least 27 percent of its power. Meanwhile, apps informed



citizens of when power may be on or off so they could prepare food for the blackout.

Sitting in the turbine hall of the derelict power station built because of political isolationism, it was a sobering moment. Then Kidus Asfaw, founder and CEO of Kubik, an Ethiopian construction company that creates a low carbon, low-cost building material rivaling cement using just recycled plastic, had two positive messages. His company's energy was very cheap, he explained, because Ethiopia's energy supply is almost 100 percent renewable, and coming from the global south he had faith in the younger generation.

“I recently had a client sign up who's a cement manufacturer—so they are a competitor and yet he took our product,” he recalled with a smile. “I asked him why he did it. He said, “because my kid would kill me if I didn't.” That does make me very optimistic, that young people want a better future.”

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By [Stephen Armstrong](#)

[Business](#)

Oct 14, 2024 3:00 AM

# The Hottest Startups in Helsinki in 2024

The Finnish capital's most exciting startups are building nuclear-powered heating networks, better weather forecasting tools, and an esports streaming platform that lets viewers bet on the outcome.

Helsinki's startup scene evolved around behemoths such as Nokia, games giant Supercell, and food delivery platform Wolt. It's reaping the rewards with experienced entrepreneurs, investors, and engineers powering a lively scene based around the Aalto University campus and the startup festival Slush, one of the world's largest gatherings of investors and startups.

Europe's 100 Hottest Startups

**From Amsterdam to Zurich, these are the hottest startups in Europe in 2024**

“We appreciate work-life balance and collaboration,” explains Jonne Kuittinen, deputy chief executive of the Finnish Venture Capital Association. “The Supercell guys were very open about paying all their taxes in Finland, and this giving-back mentality is visible now these founders are helping out on a lot of the current funding rounds. I think the scene is about to be turbocharged.”

The country's low unemployment has meant coders have been hard to find, says Claes Mikko Nilsen, principal at VC Nordic Ninja, but a receptive government launching a fast track D visa in 2022 has boosted international recruitment. The next step? Larger funds for late-stage investments.

## Paebbl

“Concrete is the most consumed product on the planet after water, and that’s not slowing down,” says Paebbl co-CEO Andreas Saari. Concrete’s main ingredient, [cement, is the source of 8 percent of the world's carbon dioxide emissions](#). Paebbl flips this, using rock weathering, or mineralization, to turn carbon dioxide into stone. Carbon captured at industrial sites is mixed with water and ground silicate to produce a solid carbonate-based material using a technique developed by Paebbl CTO Pol Knops. Paebbl founders Jane Walerud, Marta Sjögren, ex-Slush CEO Saari and Knops raised €8 million (\$8.9 million) in seed funding from climate tech VC Pale Blue Dot, French investor 2050, the Grantham Foundation and several angels in October 2022. In May 2024 the pilot reactor sequestered its first ton of CO<sub>2</sub>. A demonstration plant comes online later this year, and the stone will be deployed in the field in spring. Next up—selecting sites and partners for four commercial scale plants, operational by 2030. [paebbl.com](#)

## Distance Technologies

Distance Technologies has developed a prototype mixed-reality version of a military pilot's heads-up display (HUD) that works like a glasses-free 3D monitor. An LCD panel projects 3D images onto transparent surfaces, such as a car windscreen treated with a reflective coating. The company is discussing applications from detailed 3D topographic maps projected onto cockpit windscreens for pilots and night vision footage of the road ahead for drivers. The prototype is fitted with a hand tracker, so users can interact with the screen hands-free. Founded in 2023 by co-founders Jussi Mäkinen and Urho Konttori, who met at Helsinki-based mixed reality headset company Varjo, it raised \$2.7 million (£2.04 million) in a pre-seed round led by FOV Ventures and Maki.vc, with Business Finland and David Helgason’s Foobar.vc. Discussions are now underway with car, aerospace and defense companies. [distance.tech](#)

## Steady Energy

Steady Energy began in the state-owned Technical Research Centre of Finland when CEO Tommi Nyman and cofounder Hannes Haapalahti decided to commercialize the center's low temperature nuclear reactor, the LDR-50. Most existing nuclear reactors operate at around 300 degrees Celsius, superheating steam to drive heavy turbines. The modular LDR-50 operates at between 65 degrees Celsius and 120 degrees Celsius and heats water directly. This will be pumped around district heating networks, providing neighborhood systems with warm water from a central power station carried through insulated pipes to heat houses. These networks have long been popular in Scandinavia and the USA, and are spreading to other European countries thanks to last year's EU directive expanding their use. Having raised €15 million (\$16.7 million) from Lifeline Ventures, Yes VC, and Reid Hoffman's Aphorism Foundation, Steady Energy has preliminary agreements for 15 reactors with utility companies Helen and Kuopion Energy. Construction is expected to start by 2028, with operation beginning in 2030. [steadyenergy.com](http://steadyenergy.com)

Steady Energy's Tommi Nyman, Hannes Haapalahti, and Petteri Tenhunen.

PHOTOGRAPH: JUSSI PUIKKONEN

## **Skyfora**

Skyfora is developing state-of-the-art instruments to improve the accuracy of weather forecasts. The company offers three different meteorological probes called StreamSondes—ultralight atmospheric transmitters that hurricane hunters drop in the path of storms. The company is also adapting satellite receivers in telecom base stations into a network of weather scanners, which can analyze water vapor, temperature and air pressure. CEO Fredrik Borgström, CTO Kim Kaisti, and cofounder Antti Pasila raised €5 million (\$5.5 million) in four funding rounds from Icebreaker.vc, Voima Ventures, and other business angels. The company's StreamSonde was deployed in July's Hurricane Beryl and Skyfora is now working with telecom operators to set up proof-of-concept pilot towers. [skyfora.com](http://skyfora.com)

## **Enifer**

Back in the 1970s, the Finnish paper industry used fungus to treat wastewater and sold the resulting mycoprotein as animal feed. The technique died with the industry, but Simo Ellilä, Heikki Keskitalo, Joosu Kuivanen, Ville Pihlajaniemi, and Anssi Rantasalo repurposed it. Together, they founded Enifer in April 2020 to develop food grade mycoprotein by upcycling waste liquid from food, agriculture and forestry. A €15 million (\$16.7 million) series B round in April brings total funding to €27 million (\$30.2 million) from Taaleri Bioindustry I fund, Nordic Food Tech VC, Voima Ventures and others. Factory construction started in May, aiming to reach industrial scale by 2025, with new sites on the way. [enifer.com](https://enifer.com)

## ReOrbit

ReOrbit is pioneering “software-enabled satellites,” a distributed network of secure satellites that act like an Internet of Things in space. Satellite manufacture hasn’t changed for 40 years, explains Sethu Saveda Suvanam, CEO and founder, because they can only talk directly to Earth. Suvanam is fixing that by building “flying routers,” which allow, for instance, military satellites to send images of Russian ships to the coastguard through space at high-speed, accelerating warnings. A busy €7.4 million (\$8.2 million) seed round in September 2023 will fund an in-orbit demonstration satellite, scheduled for launch in 2025. [reorbit.space](https://reorbit.space)

Sethu Saveda Suvanam, CEO of ReOrbit.

PHOTOGRAPH: JUSSI PUIKKONEN

## Realm

Founders Miika Huttunen and Mikko Mäntylä met at Slush, a company with a high staff turnover, which led to lost documentation and a lack of “corporate memory.” With former Stripe engineer Johan Jern, they created a large language model AI that can search every digital document an organization has ever created to provide answers to, for instance, sales reps questions about previous deals. Launched in April 2023, its first funding pre-seed round of €1.7 million was led by Lifeline Ventures with angels

including Helsinki founders from Zalando and Supercell. The company is now working with procurement analytics leader Sievo, games company Remedy Entertainment, and EV charging provider Virta. [withrealm.com](https://withrealm.com)

## **Bob W**

Short for “Best of Both Worlds,” the company operates 36 full-service aparthotels in 17 cities across Europe. The company uses a digital front desk run by chatbot Bob W that handles check in and out as well as booking breakfast spots and gyms. The system also informs guests of their carbon dioxide emissions for each choice made. Founded in 2018 by Niko Karstikko and Sebastian Emberger, the company has raised €70 million (\$78.3 million). The most recent round, in March, saw €40 million (\$44.7 million) raised by Wise’s founder Taavet Hinrikus and Supercell’s cofounder Mikko Kodisoja. The money funds an ambitious acquisition policy, buying 20 to 25 buildings across Europe and converting them into 1,500 to 2,000 aparthotel rooms. [bobw.co](https://bobw.co)

## **Swarmia**

Swarmia is a software engineering effectiveness platform designed to make it easier for software teams to communicate, set goals and measure productivity. Key to this is the software connecting other platforms such as GitHub, Jira/Linear, and Slack, creating “working agreements”—agreed guidelines for managers and teams on how they plan to work together. These include targets, how they’ll be met, and how the results will be measured. Founder Otto Hilska was previously chief product officer at Smartly.io. He’s raised €13.8 million (\$15.4 million) over three rounds, most recently with Dig Ventures, and is expanding in the US. Swarmia is currently serving more than 1,500 companies including WeTransfer, Hostaway, and Axios HQ. [swarmia.com](https://swarmia.com)

## **Noice**

Noice is all about the metagame. The livestreaming gaming platform allows viewers to gamble on outcomes in games that they’re watching using digital

cards. These might predict, for instance, that the next kill in a game of Fortnite will involve a shotgun. Each correct card picked wins points, and they can be bought or earned by watching ads. Founded in 2020, the company has raised a total of €25 million across two funding rounds, backed by local entrepreneurs including the cofounders of Supercell and the cofounders of Wolt. Noice cofounders CEO Jussi Laakkonen and CTO Jaakko Lukkari met at Applifier, the Finnish company that helped developers create in-game replay, before Unity acquired the company. The company is still in beta testing with a full launch later this year. [noice.com](https://www.noice.com)

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By [Stephen Armstrong](#)  
[Business](#)

Oct 14, 2024 3:00 AM

# The Hottest Startups in Dublin in 2024

The Irish capital's embrace of Big Tech is filtering through to its startups, who are building better tools for IT teams, AI content moderation tools, and RNA screening for herds of cattle.

Thanks to low corporation tax and government incentives, Dublin has hosted the European headquarters of many large US technology companies—Google, Meta, LinkedIn and Microsoft all have offices in the city's Silicon Docks.

Europe's 100 Hottest Startups

**From Amsterdam to Zurich, these are the hottest startups in Europe in 2024**

“The big US companies operated independently of the startup world for many years,” explains Will Prendergast, partner at Frontline Ventures. “But in the past five years, US technology companies have been building product and engineering functions here, and that talent is starting to spill out, driving startup creation.”

Government support via Enterprise Ireland's Pre-Seed Start Fund, designed to accelerate early stage startups, and hubs such as Dogpatch Labs are supporting this wave of new talent. “Ireland does have a capital issue,” says employee benefits startup Kota cofounder Luke Mackey. “There are lots of ways to raise €1 million but not many ways to raise €10 million.”



With recent funding rounds led by both US and local VCs of €10 million (\$11.1 million) or more, that looks set to change.

## **Openvolt**

Openvolt is building an API that collates carbon emissions data across Europe to supply to energy transition companies. It's no coincidence that the aim is to make an API that's as simple to work with as Stripe's payment system—Don O'Leary, Openvolt's CTO, was Stripe's EMEA head of customer engineering. With CEO Dave Curran, he launched the company in 2023. Openvolt's first step was securing real-time data from 90 million smart meters across the continent, with gas consumption and the carbon intensity of electricity supplies to follow. The company raised a pre-seed €1.5 million (\$1.6 million) led by Cavalry Ventures. Its first client is Helios Energy, which will use Openvolt data in its audit of client's energy use.

[openvolt.com](https://openvolt.com)

## **Tines**

Tines is an automation platform for IT and security teams to automate any manual task using a menu of eight common commands, such as “HTTP request,” which sends or receives data from another system. Tines targets simple tasks that teams spend the most time on—onboarding users or triaging low-level security incidents for instance—to reduce “alert fatigue.” Launched with an \$11 million (€10.2 million) Series A round led by Accel, Index Ventures, and Blossom Capital in December 2019, the company has raised \$146.2 million (€130.6 million) overall. With 200 employees across the USA, Ireland, Australia, and Canada, revenue has grown 200 percent between November 2022 and May 2024. Customers include Databricks, Mars Inc., and Oak Ridge National Laboratory. [tines.com](https://tines.com)

## **Marker Video**

Marker Video is a user-generated branded content platform, selling product review videos by ordinary people to brands and retailers for a flat fee. Launched as Marker Content in 2022 with €600,000 (\$670,00) from

Enterprise Ireland, founder Greta Dunne switched from blog post to video in February 2023. “I met the head of marketing at Estée Lauder who had just pivoted from influencers to ordinary people after their data showed the more authentic the content, the better the response,” the former copywriter explains. Customers can scan a QR code in hotels, or on products, and upload video reviews which are tagged and indexed. The videos sell for between €100 and €200 (\$111 to \$223). Brands receive unlimited use and creators are given 50 percent of the fee. A stealth launch in April and deals with Unilever and Acer Hotels saw 5,000 creators a month join the site. A second round raised €200,000 (\$223,000) from Enterprise Ireland and investor angels such as Brian Caulfield, as well as David Byrne of Digital Irish to fund a full launch in the fall. [markervideo.com](https://markervideo.com)

Greta Dunne, founder of “authentic review” service Marker Video.

PHOTOGRAPH: LAURENCE MCMAHON

## **CaliberAI**

CaliberAI is an AI-powered content moderation platform that searches for harmful and defamatory content. Acting as a “spell check for libel and hate speech,” it notifies news publishers and social media users when they're getting close to the line. It was founded by a father-and-son team—Conor Brady was editor-in-chief of The Irish Times and Neil Brady was a journalist for The Guardian. An Enterprise Ireland grant of €300,000 (\$335,000), followed by €850,000 (\$950,000) pre-seed launched the company in 2019. The team trains CaliberAI and other large language models on specifically created data sets—a paucity of defamatory material to train on meant the company built its own. Customers include Mediahuis, the Daily Mail, Meta, and numerous law firms involved in AI.

“Misinformation and hate speech is eroding democracy because news publishers are on their knees,” explains Neil. “Generative AI chatbots and the companies that make them are not going to be afforded the same legal protections as social media users.” [caliberai.net](https://caliberai.net)

## **EdgeTier**

“Customer service is broken—no one likes fighting with a chatbot to get through to a human to solve their problem,” says EdgeTier CEO and cofounder Shane Lynn. The company’s AI monitors customer conversations with call centers, listens out for issues and offers training to humans based on the conversations it has analyzed. Lynn, CCO Bart Lehane and CTO Ciarán Tobin launched with a seed round in 2019 and have since raised €7.5 million (\$8.3 million) in two rounds lead by Smedvig Capital and ACT VC. The company now operates in more than 20 countries across Europe and the Americas, working with Abercrombie & Fitch, Ryanair, the TUI travel company, Electric Ireland, and Tipico. [edgetier.com](https://edgetier.com)

## **Noloco**

Noloco is a platform for any business to build an app using a point-and-click interface, without the need for software or coding skills. Founder Darragh Mc Kay describes it as the Webflow for business apps. As a software engineer, Mc Kay realized “how few of the tools I had were available to non-software engineers and how complicated they were to use”. Noloco has a series of templates for common HR, project management and inventory apps as well as a blank canvas where users can drag and drop the tasks they need apps to perform. Founded in summer 2021, seed funding in February 2022 raised \$1.4 million (€1.8 million), led by Unpopular Ventures and Accel Angels, and the app builder was launched in July 2022. Customers are SMEs—primarily construction companies, marketing agencies, accountants and lawyers. Available as a subscription model, revenue has grown 140 percent in the past 12 months. [noloco.io](https://noloco.io)

Darragh Mc Kay, founder of app platform, Noloco.

PHOTOGRAPH: LAURENCE MCMAHON

## **Inspeq ai**

Inspeq.ai is an evaluation platform for product teams creating AI applications. It monitors app development, especially LLMs, to make sure that the output is accurate, consistent, does not hallucinate and is free from

biases and negative tones. The idea for the company came to CEO Apoorva Kumar and CTO Ramanujam MV, formerly product managers at Microsoft and Meta respectively. The pair found that the LLMs they worked with would often “hallucinate,” producing grammatically correct but factually inaccurate information. After building a proof of concept at the Founders Talent Accelerator in late 2023 that reduced hallucination issues by 80 percent, they raised €1.1 million (\$1.2 million) in a round lead by Sure Valley Ventures in May 2024 to grow operations in Ireland, London, and India. [inspeq.ai](https://inspeq.ai)

## **Barespace.io**

Barespace CEO and cofounder Conor Moules worked at a local hair salon when he was a teenager. Then, when he joined food delivery app Bamboo in his twenties, he realized to his surprise that typical salon transactions were more than 10 times larger than typical food delivery orders. He founded Barespace to help barbershops, salons, and spa businesses automate their business management with a comprehensive SaaS platform that combines appointment scheduling, client history and marketing designed to be used by non-technical staff. Founded in March 2022 by Moules and COO Glenn McGoldrick, it closed a €1.5 million (\$1.6 million) pre-seed round in August 2024 from investors such as Brian Caulfield, chair of Scale Ireland; Barry Napier, CEO of Cubic Telecom; and Rick Kelley, the former managing director of Meta Ireland. Barespace has processed more than €10 million (\$11.1 million) in payments in its first 20 months since launch, growing the business by more than 300 percent. [barespace.io](https://barespace.io)

## **Gazelle Wind Power**

Gazelle Wind Power is building floating wind turbine platforms far out in the deep sea. Ninety-nine per cent of wind farms are fixed to the sea floor in relatively shallow depths. However, more consistent and stronger winds are found above much deeper water. Antonio García—racing yacht engineer and uncle to Gazelle founder Jon Salazar—devised a dynamic floating platform with anchor lines attached to the seabed, accompanied by a

counterweight that balances the platform in rough seas. The company has raised \$11.3 million (€10.1 million) in equity to date, led by Katapult Group, and has a series A round looming. Salazar's next goal is reducing the cost to reach the "Henry Ford moment"—a cheap, scalable platform that's simple to assemble, install, and operate. [gazellewindpower.com](https://gazellewindpower.com)

## Antler Bio

Antler Bio's EpiHerd screening platform examines RNA in blood from dairy cows—the tool by which genes are expressed in the environment. "Farmers think about breeding for perfect genetics," cofounder Maria Jensen explains, "then wonder why the animal isn't delivering." EpiHerd reveals environmental effects on gene expression—disease, diet, farm infrastructure or stress—provide recommended actions specific to farm and animals, and monitor the impact changes. Cofounded by Jensen and Nathalie Conte in November 2020, the company raised more than €1 million (\$1.1 million), led by the Nest family office. The first paying farm in November 2023 increased milk production by 30 percent. Antler expects to reach 173 farms by the end of 2024. Plans include validating EpiHerd to screen for endemic diseases, such as bovine TB. [antlerbio.com](https://antlerbio.com)

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By [Stephen Armstrong](#)  
[Business](#)

Oct 14, 2024 3:00 AM

# The Hottest Startups in Madrid in 2024

The Spanish capital is drawing talent from Latin America, and its eye-catching startups are working on smarter payments, eldercare, and an AI-powered virtual nurse.

Having spent many years as second fiddle to Barcelona, Madrid surpassed its Catalan cousin in 2023 with startups securing €605 million (\$672 million) investment above Barcelona's €457 million (\$507 million). "Lots of Latin American talent is arriving thanks to the recent entrepreneur visa and talent programs run by Telefonica to bring promising startup founders from Mexico, Argentina, Columbia, and Venezuela," explains Bu Haces, innovation consultant at Madrid's Impact Hub.

Europe's 100 Hottest Startups

**From Amsterdam to Zurich, these are the hottest startups in Europe in 2024**

The city has seen solid growth in transportation, mobility, and fintech startups during the last three years with AI and deep tech supercharged by an astonishing 56 universities. "The business schools in particular are providing lots of startup networking opportunities, and are keen on developing an entrepreneurial ecosystem," says Miguel Arias, general partner at VC K Fund.

With Meta, IBM, Google, and Amazon all expanding in the city, the main worry is lack of housing stock for the flood of students, engineers, and

entrepreneurs. “We need more accessible housing if we continue like this,” Haces warns.

## **Invopop**

When Invopop cofounder and CTO Sam Lown worked as CTO for Cabify, a Latin American rival to Uber, he found that the company had to issue invoices in different formats in different countries. More than 30 governments across South America and Europe also insist that online businesses report every sale to tax authorities as they happen, often with different reporting rules. “I thought it would be great to send all that to one place and have a company deal with it,” he explains. Invopop’s platform converts sales into electronic invoices and reports them to the local tax authority in the correct format. With CEO Juan Moliner Malaxechevarría, Lown raised €2.2 million (\$2.4 million) from Y Combinator, Rebel Fund, and Wayra. Since its launch, Invopop’s 500 business customers—including Property Management Services, Amenitiz, Fever, and Sunday—have issued more than 1 million invoices in 25 countries. This year they launched the Invopop App, which connects to Slack, Chargebee, and Google Drive. [invopop.com](http://invopop.com)

## **Uelz**

Uelz is designed to simplify online payments for companies that use a variety of payment methods, such as credit card billing, mobile payment, and buy now, pay later services. It’s also designed for international companies that use different payment providers in separate countries. Uelz’s platform connects with all payment gateways, including Apple Pay, Visa, Global Payments, Klarna, Stripe, and Truust.io. It automates subscriptions and one-off payments and selects the most appropriate payment provider—for instance, if rates of commission vary between countries, Uelz will ensure the gateway with the lowest commission is used. The company tracks payments and provides data to sales teams and finance departments. Cofounded by Xandra Etxabe and María Luke Astigarraga (the former goalkeeper for Atlético Madrid), Uelz has raised €2 million (\$2.2 million)



from Angels Capital and Wayra. The company is expanding into Latin America in 2025. [uelzpay.com](https://uelzpay.com)

## **Tucuvi**

Tucuvi is a health tech company offering a voice-based conversational AI and “virtual nurse” called Lola. The service monitors patients after they leave the hospital to reduce readmissions. Lola leads patients through a structured conversation and sends the results to the patient’s medical team for review. Cofounded by María González Manso and Marcos Rubio in 2019, the company obtained €5.5 million (\$6.1 million) in funding from the European Innovation Council. Offering Lola in Spanish, Portuguese, and English, Tucuvi has worked with more than 60,000 patients in Spain, Portugal, and the UK, reducing hospital stays by 26 percent and cutting the 30-day readmission rate by more than 50 percent. [tucuvi.com](https://tucuvi.com)

Tucuvi’s Marcos Rubio and María González Manso.

PHOTOGRAPH: JAMES RAJOTTE

## **iFeel**

iFeel is a workplace mental health platform aimed at companies as a service to employees or as part of health insurance cover. People talk to an AI that assesses their levels of stress, depression, and anxiety. It then decides what sort of attention is needed—from an online therapist to a standard self-care well-being program. iFeel claims its treatment halves working hours missed, with 90 percent of users reporting improved emotional and mental well-being after using the service. Available in 26 languages and 30 countries, iFeel customers include Glovo, Insud Pharma, Cabify, TravelPerk, Spotahome, and H&M. Launched in 2020 by cofounders CEO Amir Kaplan, COO Martin Villanueva Ordas, and Gabriele Murrone, the startup has raised €40 million (\$44 million), with a recent €20 million (\$22 million) Series B investment round co-led by FinTLV Ventures and Korelya Capital. The new funds will support international expansion. [ifeelonline.com](https://ifeelonline.com)



## Luzia

Luzia, created by Spanish engineer Álvaro Higes, is a WhatsApp- and Telegram-based AI personal assistant which uses OpenAI and Meta's Llama to provide a ChatGPT-style service. Luiza can research topics, suggest help with your math homework, create pictures, and use translation tools. Founded in April 2023, Luzia secured a \$2.5 million (£1.9 million) seed round in June 2023. Further rounds—\$10 million (£7.6 million) series A in September 2023 and \$19 million (£14 million) series A1 in April 2024—are funding international expansion. The company has more than 50 million users and 15 million app downloads, topping the Android and Apple Store charts across most LATAM countries. [Luzia.com](https://luzia.com)

## Embat

Embat cofounders Antonio Berga and Carlos Serrano García-Lisón worked together at JP Morgan, where, says Berga, “we were seeing clients struggling to manage multiple banks and banking platforms. It took hours.” They founded Embat with Tomás Gil, ex-CTO at Fintonic, in August 2021 to centralize financial operations on a cloud-based platform for 600 companies in 60 countries and 50 currencies. €6.5 million (\$7.2 million) preseed and seed series were backed by Samaipata, 4Founders, and VentureFriends. February 2024's €15 million (\$16.6 million) Series A will fund further international expansion. Future plans include developing AI for fraud detection, insurance underwriting, and recommending investment opportunities. [embat.io](https://embat.io)

Tomás Gil, Antonio Berga, and Carlos Serrano García-Lisón.

PHOTOGRAPH: JAMES RAJOTTE

## Senniors

Senniors is an at-home care company for elderly people. It provides wearable tech from Fitbit to monitor users' health and needs, and gives families access to the data through the Senniors app. The company also

connects elderly users to health care professionals when needed, provides a longevity program in partnership with Fitbit as well as insurer Klinc to improve activity, sleep, and emotional well-being. Cofounded in November 2020 by Claudia Gómez Estefan and José de Diego Abad, Senniors raised €5.3 million (\$5.8 million) in a seed round led by SixThirty Ventures. The company has provided 800,000 hours of home care to more than 40,000 families in 100 Spanish cities. US expansion is planned for 2025.

[hola.senniors.com](https://hola.senniors.com)

## **Boopos**

Boopos is an online broker for buying and selling businesses, founded in 2020 by Juan Ignacio García, the former CFO at Spain's first unicorn Cabify. Many of the companies for sale on the platform are predominantly small online firms. The Boopos team vet them, while making sure they are profitable and have been operating for the last two years. García has raised \$20 million (£15 million) in three rounds led by Bonsai Partners and K Fund. With almost \$80 million (£60.9 million) transacted on the platform, Boopos has 5,000 active buyers and 200 businesses for sale, and will break even by the end of the year. "We want to scale," says García. "There's a wave of baby boomer business owners retiring and selling up." [boopos.com](https://boopos.com)

## **Onum**

Onum is a cloud-based platform that monitors companies' data as it moves from collection to storage. Using AI algorithms, Onum spots anomalies, potential security risks, and system issues. It also helps "separate the noise from the signal," identifying what should be discarded, archived, or analyzed, and claims customers cut the cost of managing data by up to 80 per cent. Founded in October 2022 by Pedro Castillo—former CEO of cybersecurity unicorn, Devo—he's joined by cofounders Lucas Varela and Pedro Tortosa. Onum closed two rounds of funding for a total of €38 million (\$42 million) led by Kibo Ventures and Dawn Capital. [onum.com](https://onum.com)

## **Shakers**

Shakers is a digital workforce platform that helps companies build, manage, and pay teams of freelancers. It can select an entire group from scratch or add new members to an existing talent pool. Founded by CEO Héctor Mata, COO Nico de Luis, CPO Adrián de Pedro, and COO Jaime Castillo in 2021, Shakers has raised €7 million (\$7.7 million) in rounds led by Brighteye Ventures, Adevinta Ventures, and Wayra. The company claims it has grown 350 percent in revenue in the past two years. Charging businesses for access to the platform, it has worked with more than 600 Spanish companies including Inditex, Telefónica, Uber, and Microsoft and more than 7,000 freelancers. Expansion across southern Europe is planned for 2025. [shakersworks.com](https://shakersworks.com)

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By [Saul Klein](#)

[Business](#)

Oct 14, 2024 3:00 AM

# Europe's Innovation Ecosystem Can Make It the New Palo Alto

A cluster of European cities within a five-hour train ride of London could become a unicorn factory to rival Silicon Valley, argues tech investor Saul Klein.

For over a decade, the tech industry has been chasing unicorns—those elusive startups valued at over \$1 billion. The obsession began in 2013, when Aileen Lee—a VC based in Palo Alto—coined the term that captured the imaginations first of founders and investors, and then prime ministers and presidents. But these mythical beasts are also rare: only 1 percent of VC-backed startups ever reach this status.

Europe's 100 Hottest Startups

**From Amsterdam to Zurich, these are the hottest startups in Europe in 2024**

As society enters the age of AI, and financial markets put renewed value on business fundamentals, our understanding of what makes a successful tech company is evolving. Promise alone doesn't make a national, regional, or global champion. Champions are those companies that combine both the promise of untapped growth and the fundamental metrics that demonstrate strong and sustainable customer demand.

Until recently, Silicon Valley has been seen as the world's undisputed unicorn factory. But Europe's innovation ecosystem has matured to a point where it is consistently producing companies with both the vision to change the world and the fundamentals to sustain that change. Leading the pack is a

cohort of more than 507 “thoroughbreds”—startups with annual revenues of at least \$100 million.

More than a third of these high-potential companies are headquartered in what we call New Palo Alto: not a singular location, but a network of interconnected ecosystems within a five-hour train ride of London. After the Bay Area, this is the world's second most productive innovation cluster and includes cities with industrial heritage like Glasgow, Eindhoven, and Manchester, as well as world-renowned capitals of culture, policy, and academia like Amsterdam, Cambridge, Edinburgh, London, Oxford, and Paris.

They're home to companies such as low-cost computer maker Raspberry Pi, whose technology was invented and developed in Cambridge, manufactured in Pencoed, South Wales, and sold worldwide. Raspberry Pi recently crowned over a decade of growth with a listing on the London Stock Exchange. At the time of listing, it had revenue of \$265 million and \$66 million in gross operating profits.

Other New Palo Alto thoroughbreds include fintechs Monzo, Revolut, and Tide, which provides mobile-first banking to SMEs, as well as fast-growing companies such as iPhone challenger Nothing and London-founded Cleo, the conversational AI pioneer that helps young US consumers manage their finances.

Seven of Europe's 10 most valuable tech companies founded after 1990 have emerged from New Palo Alto: Booking.com and Adyen from Amsterdam; Wise, Revolut, and Monzo from London; ASML from Eindhoven; and Arm from Cambridge. All are products of this interconnected ecosystem.

Yet, for all its promise, New Palo Alto remains an underinvested region. While early-stage funding is now higher than the Bay Area, thoroughbreds face a staggering \$30 billion gap in funding at the crucial scale-up stage compared to their Bay Area counterparts.

Governments of the leading economies in New Palo Alto—Britain and France—have delivered progressive policy frameworks to support

innovation and tech companies, including investment in R&D, talent, and visa programs. They are also putting in place policies including the UK's Mansion House Compact and France's Tibi, to support more scale-up capital.

But no innovation cluster ever became great because of policy alone. Success occurs when investors fully understand the investment opportunity. Now that we have nearly 1,000 venture-backed companies in EMEA with revenues of more than \$25 million, helping this ecosystem to achieve its full potential is no longer about solving a policy challenge. It's about recognizing a huge investment opportunity.

This is why in the last decade, the amount of venture capital coming into the region has increased nine times, and why in the next decade, large institutional investors in the UK and in France will bring billions of dollars of investment to back private companies.

The new British prime minister's home constituency includes Somers Town, an area close to St Pancras station and within sight of Google and Meta's huge European headquarters. Yet for all the gleaming towers, too many neighborhoods in New Palo Alto have been left behind by technology. In Somers Town, 50 percent of children receive free school meals, 70 percent of residents receive social care, and adults live 20 years fewer than in leafy Highgate, only 20 minutes up the road.

As the tech industry faces increased scrutiny, we have an opportunity to offer an alternative model of innovation. By building thoroughbreds to be sustainable, transparent companies, we can begin the work of sharing the benefits of innovation more equally.

Just as some of the most iconic US cities take their names from the ancient cities of Europe—New York and New Orleans—New Palo Alto pays respect to its namesake while also signaling a deliberate choice for the future.

*Saul Klein is the cofounder and managing partner of Phoenix Court, home to LocalGlobe, Latitude, Solar and Basecamp funds. This article first appeared in the November/December 2024 edition of WIRED UK.*

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By [Alex Christian](#)

[Business](#)

Oct 14, 2024 3:00 AM

# The Hottest Startups in Zurich in 2024

The Swiss financial capital might be most associated with fintech, but its startups are also focusing on medical robotics, AI-powered language learning, and the batteries of the future.

Home to fine cheese, breathtaking scenery and footballing politics (FIFA HQ overlooks Lake Zurich), Switzerland's largest city is also a financial juggernaut. The central square of Paradeplatz is its beating heart, where the Swiss banking system pumps venture capital funding into a thriving tech ecosystem; around [CHF 872 million](#) (more than \$1 billion) was poured into Zurich startups alone in 2023.

Europe's 100 Hottest Startups

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Fintech is a natural major player, but if the banking industry is the ecosystem's engine, innovation is its fuel. Many of the city's most exciting startups began life as student projects at its world-leading universities, which provide a steady flow of great thinkers.

"Zurich is a city of ideas, people, and capital," says Frank Floessel, head of entrepreneurship at ETH Zurich, a public research university focused on science, technology, and engineering that "spins out" an average of 25 startups every year. "We have plenty of talent and know-how. We rank among Europe's smartest and most innovative cities. And we have the



necessary funding to transform groundbreaking ideas into market-ready solutions.”

## **Nanoflex Robotics**

While remote surgery isn’t yet common, scalpel-wielding robots can often be found performing keyhole surgery. Nanoflex Robotics is aiming to transform emergency treatments such as a thrombectomy, the removal of a blood clot. It’s the procedure used for ischemic strokes, a worldwide leading cause of disability. “Today, the only option is to transfer the patient to a hospital capable of performing a thrombectomy—but every second the brain lacks oxygenated blood, brain cells die,” says Nanoflex founder Matt Curran. In the US, nearly a third of the population lives more than an hour away from a thrombectomy capable center. Alongside founders Christophe Chautems and Bradley Nelson, Curran has created a compact robotic platform that includes a magnetic field generator on wheels. Positioned next to a patient’s head in a cath lab, a neurosurgeon (often working miles away) can subtly change the direction of the magnetic field to bend the tip of the catheter more easily, travel through affected vessels, and restore blood flow to the brain. In 2023, Nanoflex worked with Mayo Clinic Arizona on its proof-of-concept—the medical center’s chair of neurosurgery controlled its robot in Zurich from Phoenix in a non-clinical setting. In March 2024, Nanoflex’s first robotics system was installed at the Jacobs Institute, a medical device innovation center in Buffalo, New York. It raised a total of \$19.8 million (£14.4 million)—including a \$12 million (£9 million) Series A round in February 2023. [nanoflexrobotics.com](https://nanoflexrobotics.com)

## **BTRY**

The standard lithium-ion battery contains liquid electrolytes which work well at stable room temperature but less so in the freezing cold or at high heat. Working at Swiss research institute Empa, Moritz Futscher and Abdessalem Aribia discovered that stacking several thin-film cells on top of each other not only provides one-minute charging times and greater energy capacity—it also creates a battery that can withstand extreme conditions. Launching BTRY in 2023 alongside Yaroslav Romanyuk, Futscher and

Aribia are now focusing on IoT applications in environments such as cold medical transport and steam plants. The trio are also looking to the skies: Some aerospace applications require batteries to function across a 200 degree Celsius temperature range. “Compared to current batteries, ours reduces the need for heating elements and safety measures,” says Futscher. Having raised CHF 1.8 million (\$2.1 million) in pre-seed funding, BTRY is beginning its first pilot production tests. [btry.ch](http://btry.ch)

## Yokoy

Frustrated with the tedium of corporate expense management, five accountants—Philippe Sahli, Thomas Inhelder, Lars Mangelsdorf, Devis Lussi, and Melanie Gabriel—founded Yokoy in 2019 (initially under the name Expense Robot). The fintech leverages AI to simplify invoicing, automating the reimbursement process by instantly matching card payments with expenses. “We felt the pain of manual work,” says Sahli. “Nobody trains as an accountant to spend hours matching receipts to company card transactions.” Twenty million expense reports and invoices later, Yokoy’s 700 global clients include Breitling, Austria Airlines, and On Running—the Swiss sportswear brand has slashed its costs by almost [79 percent](#) since automating its spend management process, says Sahli. In 2023, Yokoy raised \$80 million (£60.9 million) in Series B funding, led by Sequoia Capital. [yokoy.io](http://yokoy.io)

Yokoy’s Thomas Inhelder, Devis Lussi, Lars Mangelsdorf, and Philippe Sahli.

PHOTOGRAPH: CHRISTIAN GRUND

## BreezeLabs

BreezeLabs founders Patrick Helfenstein and Matthias Heuberger say that up to 90 percent of runners in the US—[estimated to be about 50 million](#)—use a wearable device to track their performance. Yet heart rate is typically the only measurement that these devices track. BreezeLabs has developed an app that monitors runners’ breathing patterns instead. It does this

through a headphones' built-in microphone, while delivering deeper cardiovascular insights. BreezeLabs' smart filtering dampens traffic noise, with audio data fed to a trained machine learning model that estimates a runner's breaths per second. Since launching in February 2023, it's collected data from more than 100 test runners ("one of the world's biggest datasets entirely consisting of breathing samples," says Helfenstein). BreezeLabs has secured CHF 500,000 (\$584,000) in funding from the University of Basel. [breezelabs.ai](https://breezelabs.ai)

## Univerbal

When coder Philipp Hadjimina was priced out of one-to-one Greek language lessons ("incredibly expensive in Switzerland," he says), he built his own chatbot. Quazel launched on Hacker News in September 2022—and 50,000 users tried it within two days. Renamed Univerbal in January 2024, it had more than 250,000 downloads. Users can talk to an AI "tutor" in 22 languages through onscreen chat prompts, creating naturalistic, unscripted conversations based on large language models from Anthropic, Google, OpenAI, and Open Source. "It's always surprised me that most who want to learn a language do so via vocab games and memorizing grammar rules, but completely neglect speaking," says Hadjimina. Founded alongside Samuel Bissegger and David Niederberger, Univerbal has raised \$2 million (£1.5 million) in seed funding. [univerbal.app](https://univerbal.app)

## Oxyle

"Clean water, down to the last drop" is the mission statement of Fajer Mushtaq and Silvan Staufert, the founders of Oxyle. Launched in 2020, the ETH Zurich spin-off takes aim at per- and polyfluoroalkyl substances (PFAS): synthetic chemicals long used in everyday goods for their water, grease, and oil-resistant properties—and toxic to humans. "We're driven by a shared vision to address water contamination and 'forever chemicals,'" says Mushtaq, whose inspiration stems from encountering water scarcity during her upbringing in India. Common among nonstick cookware and water-repellent fabrics, PFAS exposure has been linked to cancers and immune system suppression. They're also lost into wastewater and

discharged into streams—ending up in drinking water. But Oxyle’s modular reactors—applied at water treatment plants and reaching up to 100 cubic meters in size—break down 99 percent of PFAS into harmless mineral components, lowering levels below regulatory limits. Machine learning then adapts treatment to real-time PFAS fluctuations. Since raising CHF 12 million (\$14 million) in pre-seed funding, Oxyle has partnered with major water technology companies in Europe (including Belgium’s Waterleau) to commercialize its solution. Its future target is helping to clean US waters. [oxyle.com](https://oxyle.com)

Silvan Staufert and Fajer Mushtaq, cofounders of Oxyle.

PHOTOGRAPH: CHRISTIAN GRUND

## DeepJudge

A trio of Google researchers are the minds behind DeepJudge: an AI-powered search for legal teams that scans hundreds of millions of documents, freeing time spent searching for paperwork accumulated across emails, memos and contracts. “We’re connecting users to the entirety of their collective knowledge,” says Paulina Grnarova, who launched the startup in 2021 alongside Yannic Kilcher and Kevin Roth. Retrieval augmented generation (RAG) technology—and DeepJudge’s proprietary large language model—surfaces the most relevant, up-to-date information via summary. Once deployed, nearly 80 percent of users within an organization regularly engage with DeepJudge—saving countless hours trawling inboxes. In June 2024, it raised \$10.7 million (£8.1 million) in an oversubscribed seed funding round led by New York private equity firm Coatue. Clients using the AI-powered search tool include Swiss law firms Lenz & Staehelin and Homburger. [deepjudge.ai](https://deepjudge.ai)

## Decentriq

Data clean-rooms offer neutral, secure environments for organizations to share insights on markets and customers without sharing first-party data—any personal information is restricted, encrypted, and anonymized. A

supplier of this is Decentriq. Its platform has been used by Publicis Groupe, Switzerland's Federal Department of Defense and the Swiss National Bank. "We wanted to create a neutral space—a 'Switzerland of data'," explains Decentriq founder Maximilian Groth, who launched the startup alongside Stefan Deml in 2019. The pair have raised more than \$21 million (£15.9 million), including a \$15 million (£11.4 million) Series A round led by Eclipse Ventures, and a CHF 2.2 million (\$2.5 million) grant from the Swiss government. [decentriq.com](https://decentriq.com)

## **Riskwolf**

Launched in 2020 by Thomas Krapf and René Papesch, Riskwolf's platform leverages AI and real-time data to create so-called parametric insurance solutions. This means that payouts are based on the probability of a loss-causing event (a 7.0 magnitude earthquake, for example), rather than actual losses. A key use case is changing weather patterns, says Krapf: Kashmir apple farmers now have parametric weather coverage that pays out in days rather than months. "Traditional underwriting can have missing or outdated data histories," says Krapf. "Conversely, we have much more affordable data and processing power thanks to the growth of cloud technology and satellite sources." Having raised a combined CHF 3 million (\$3.5 million) through an Innosuisse grant and equity investment, Riskwolf now works with insurers across Asia, Europe, and the Americas. The company has also set its sights on IoT, economic data, credit risk and price indices to explore future parametric products. [riskwolf.com](https://riskwolf.com)

## **LatticeFlow**

Beginning life as an ETH Zurich research project, Petar Tsankov, Pavol Bielik, Martin Vechev, and Andreas Krause launched LatticeFlow in 2020. Its platform automatically stress-tests AI models, analyzing how predictions are made, and finding patterns that lead to systematic errors: think blindspots and hallucinations. "Traditionally, this process is addressed in an ad-hoc, manual, and reactive manner," says Tsankov. "We proactively uncover these, effectively enriching the data." Clients include manufacturing firms and defense organizations, notably the US Army. The

company has raised total funding of \$14.8 million (£11.2 million), including a \$12 million (£9.1 million) Series A round led by Atlantic Bridge and OpenOcean. [latticeflow.ai](https://latticeflow.ai)

*This article first appeared in the November/December 2024 edition of WIRED UK.*

*Updated 10/14/2024, 9.12 pm GMT: This article was updated to correct the amount of money flowing into Zurich-based startups, which was CHF 872 million, not 72 million.*

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By [Morgan Meaker](#)  
[Business](#)

Oct 14, 2024 3:00 AM

# The Hottest Startups in Berlin in 2024

The German capital attracts talent from all over the world, and its startups are building endless AI-generated audio apps, virtual pet apps, and sensors for early wildfire detection.

German innovation is not limited to the country's capital. In fact, some of this year's most prolific startups are based hundreds of miles away. The AI startup Alpha Alpha hails from Heidelberg. Helsing, which sells AI to Europe's militaries, was set up in Munich. Yet both companies operate Berlin offices. The city attracts too much talent to ignore. Universities, such as TU Berlin, [churn out](#) generative AI founders, and the capital is such a magnet for international talent that many offices operate in English, not German.

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It's also a very young city—half of its population is under 45, something that Thomas Dohmke, CEO of GitHub, who grew up in Berlin, remarks on. “I founded my last startup back in 2009, and I remember vividly how much energy, time, and focus it required—having a large population of younger, diverse and international, and highly motivated professionals that have that energy and hunger gives Berlin an edge,” he says. “Plus, Berlin has the best döner kebab.”



## BlueLayer

By 2050, the carbon credit market is expected to be a [\\$250 billion](#) industry. Startup BlueLayer is catering to that growth by developing tailor-made software for the companies and NGOs poised to benefit. Its clients—including conservationists such as Permian Global—run projects ranging from reforestation to direct air capture, and use the startup’s software to process their data and communicate with buyers and investors, while helping credit providers get their credits verified with international registries. Launched in 2022, BlueLayer has raised \$10 million (€8.9 million) in investment and counts three of the top 10 issuers of credits globally among its clients. “It’s classic automation software,” says Vivian Bertseka, one of BlueLayer’s three cofounders along with Alexander Argyros and Gerardo Bonilla, “but for an industry that used to operate almost exclusively on Excel.” [bluelayer.io](https://bluelayer.io)

## Cambrium

Cambrium, founded in 2020 by Mitchell Duffy and Charlie Cotton, is using AI to design proteins such as collagen. Instead of sourcing them from animal products, the startup grows them in tanks. “We’re one of the companies trying to straddle hardcore software engineering [and AI] with putting physical stuff in the real world,” says Cotton. The company has received \$11.6 million (€10.3 million) in investment so far, including from Google’s AI venture fund Gradient Ventures. Skincare products using Cambrium’s first protein, a collagen called NovaColl, are expected to hit shelves later this year. [Cambrium.bio](https://Cambrium.bio)

## Jina AI

In 2020, three veterans of Chinese tech behemoth Tencent joined forces to build foundation models specifically for search. Attracted to Berlin by the city’s open source culture and software engineering talents, the trio behind Jina now claim 9,000 users and 400 paying customers, who turn to the company when they want to build either a public or internal search system for their data. Jina's models promise to convert PDFs, Word documents, or



images into a language that AI models can understand well enough to enable an intuitive Google-style search. A legal company may no longer have to search for documents using a case number. Instead, Jina AI CEO and cofounder Han Xiao explains that they could simply ask: “Find the case where Microsoft loses to Google,” After raising \$39 million (€34.8 million) from a series of early-stage VC funds including Canaan Partners, Xiao and his cofounders Nan Wang and Bing He plan to expand to the US, raise revenue from the company’s \$500,000 (€447,000) per year, and boost user numbers. “We want to compete with OpenAI,” says Xiao. [jina.ai](https://jina.ai)

Han Xiao, cofounder of custom search-engine firm Jina AI.

PHOTOGRAPH: THOMAS MEYER

## **Endel**

Endel is a paid-for app that uses generative AI to create one endless piece of music, which constantly adapts to its user’s surroundings. The app utilizes the phone accelerometers to generate a beat that syncs with its listeners’ footsteps. If they start jogging or skipping, the tempo catches up. Calling itself a “sound wellness” startup, Endel is part of the trend for functional sound, where music has a purpose—to help people exercise, fall asleep or focus. “We want to create a technology that harnesses the power of sound and helps you achieve a certain cognitive state,” says CEO Oleg Stavitsky, one of Endel’s six cofounders. Launched in 2018, the company has since raised \$22.1 million (€19.1 million) in funding, including from Amazon’s Alexa venture fund, and claims 1 million monthly active users. In 2023, the company struck a deal with Universal Music Group to use its technology to create new “soundscapes” using established artists’ work. [endel.io](https://endel.io)

## **Slay**

To understand Slay’s success, credit has to be given to Pengu, the company’s virtual pet app that has become the startup’s most popular product with more than 5 million users. Founded by Fabian Kamberi, Jannis

Ringwald, and Stefan Quernhorst, Slay created Pengu to be part game, part social platform, where friends or couples can collaboratively raise a digital penguin. The company, which has raised \$7.6 million (€6.8 million) in total, including from Accel, is currently scaling Pengu's ability to personalize its interactions, hooking a series of LLMs to a 3D engine to create that visual experience. Pengu might respond to a child telling them they are being bullied by gifting them a drawing or sending personalized notifications to cheer them up. [slay.cool](https://slay.cool)

## Ovom Care

Ovom Care is a fertility startup using data and machine learning to take the guesswork out of reproductive medicine. Since launching in 2023, cofounders Felicia von Reden, Cristina Hickman, and Lynae Brayboy have opened the company's first fertility clinic in London—sidestepping the onerous regulatory process in Germany—and already claim to be treating hundreds of people. Alongside the physical clinic, patient app, and clinic management system, Ovom also offers machine-learning algorithms that analyze patients' blood tests, data from wearables, gamete analysis, and ultrasound images to tailor the type and timing of treatment. “We're now going into the era of precision medicine,” says CEO von Reden. “We're tailoring [fertility] using technology.” That idea has attracted €4.8 million (\$5.3 million) in seed funding led by Alpha Intelligence Capital. Within the next year, the company plans to attract medical tourists from all across Europe to its second clinic in Portugal, where treatment costs are expected to be cheaper. [ovomcare.com](https://ovomcare.com)

Felicia von Reden, founder and CEO of Ovom Care.

PHOTOGRAPH: THOMAS MEYER

## Dryad

When Carsten Brinkschulte's daughter started protesting against climate change in 2018, the serial telecoms entrepreneur started to think about how he could leverage his experience for the good of the planet. The result was a

startup called Dryad, launched in 2020, designed to be an early wildfire detection network. “Think of us like the Vodafone of the forest,” says Brinkschulte, one of the company’s seven cofounders. Dryad’s solar-powered mesh networks enable sensors to send alerts when they detect fire, even in remote areas where there is no signal. So far the company has sold 20,000 wildfire sensors and related hardware to 50 countries across the world, from Canada to Thailand, and to clients ranging from local governments to utility companies that want to protect their infrastructure from an inferno. Dryad has raised €22 million (\$24.6 million) so far, including from German deep-tech fund eCAPITAL. [dryad.net](https://dryad.net)

## UltiHash

The rise of energy-hungry AI prompted the International Energy Agency to warn that the electricity consumed by data centers could [double](#) in just two years. As environmental groups [discuss](#) the risk that the technology poses to the climate, startup UltiHash has been developing a practical way to slash the data center needs of companies performing energy-intensive machine learning or training their own models. Founded in 2022, UltiHash has developed an algorithm that CEO and cofounder Tom Lüdersdorf claims can slash companies’ data storage needs by up to 60 per cent, meaning they need less data center space and reduce their carbon footprint. The company has raised \$2.5 million (€2.2 million) despite still being in stealth mode. Lüdersdorf plans to launch the product later this year, after beta testing with more than 300 companies. [ultihash.io](https://ultihash.io)

## TheBlood

According to TheBlood’s cofounders, Isabelle Guenou and Miriam Santer, menstrual blood is an under-appreciated asset for diagnostics, containing data-rich endometrial tissue, live cells, immune cells, and proteins, which are not found in ordinary blood. The pair launched the company in 2022, with the aim to use menstrual blood in an attempt to fill health care’s gender data gap. Since then, the firm has analyzed more than 1,000 menstrual blood samples, selling testing kits for between €35 (\$39) and €120 (\$133) to women who are looking for more data to inform fertility or

endometriosis treatment. TheBlood also plans to license biomarker analysis or datasets to pharmaceutical companies. So far, the company has raised €1 million (\$1.1million) in total, including from health-care-focused venture firm ROX Health. [theblood.io](https://theblood.io)

## Qdrant

To create generative AI, algorithms have to infer relationships between data—text, images, or audio—that isn’t labeled or organized. That’s where so-called vector databases come in, helping developers extend the long-term memory of LLMs by making it easier for those models to search and analyze large amounts of data, while keeping computational costs down. Launched in 2021 by cofounders André Zayarni and Fabrizio Schmidt, Qdrant is catering to AI software developers, promising a vector search engine and database for unstructured data with an easy-to-use API. In the past three years, the company has reached 7 million downloads and 10,000 users worldwide, raising \$37 million (€33.2 million) in the process, including from US venture capital firm Spark Capital. [qdrant.tech](https://qdrant.tech)

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By [Megan Carnegie](#)

[Business](#)

Oct 14, 2024 3:00 AM

# The Hottest Startups in Amsterdam in 2024

There are around 4,000 startups in Amsterdam—the best 10 are tackling forest fires, decarbonizing plastics, and building robot bricklayers.

The 2023 [Atomico's State of European Tech Report](#) revealed Netherlands to be a standout success, cementing its position as a star player in the startup ecosystem. In terms of capital invested in its private tech companies, for instance, it's risen back into the top five countries with a projected [\\$2.1 billion](#). And while the UK has seen the share of its European capital invested drop by almost [3 percent within the past three years](#), the Netherlands comes out top, capturing the biggest gains in Europe at almost 2 percent. The hub of the Netherlands' startup ecosystem is Amsterdam, which hosts around [4,000 startups](#), including unicorns like [Mollie](#), [Mambu](#), and [Backbase](#). Known for its international focus, collaborative ecosystem, and diverse and skilled workforce, it's also dedicated to tackling urgent societal issues.

Europe's 100 Hottest Startups

**From Amsterdam to Zurich, these are the hottest startups in Europe in 2024**

“Successful innovation in Amsterdam is driven by global challenges, such as the energy transition or the aging population,” explains Joël Dori of StartupAmsterdam, which works to bring the public and private sectors together to support startups, scale-ups, entrepreneurs, and other players in the local ecosystem. “It's what founders and the public in Amsterdam care about.” Dori notes, however, that issues within the city, such as the tight

housing market and worries from founders about startup-related policies, must be tackled in order to attract and retain the capital's high-caliber talent.

## Overstory

Vegetation is the [single greatest factor behind power outages](#) caused by the electrical grid due to trees falling on power lines or by sparking wildfires—and the problem is only worsening due to changing climate and more frequent storms. “Using images from satellites and airplanes, we use computer vision to find trees and estimate their height, health and species,” says Indra den Bakker, who cofounded Overstory with Anniek Schouten in 2018. This allows electric utility companies to direct their tree-pruning efforts to areas where the likelihood that trees will come in contact with power lines is higher. Raising \$25 million to date, with support from Pale Blue Dot, B Capital, CapitalT, Moxxie Ventures, Overstory's clients already include four of the top 10 American utilities. One investor-owned utility, for instance, has saved more than \$3 million in vegetation costs. [overstory.com](#)

## Coolgradient

By 2030, data centers could use [3.2 percent of global electricity consumption](#). However, few data center operators can effectively control their energy and water usage, which is a looming disaster for the climate. Enter Coolgradient, founded by Jasper de Vries and René Gompel in 2023, with the aim of reducing 1 percent of the global energy consumption by cooling data centers. Providing detailed visibility into the performance of all center assets, from the roof to the room, its machine learning models analyze data from existing data center assets such as cooling systems and power distribution units. It then identifies inefficiencies and offers solutions for continuous optimization, saving up to 40 percent in utilities usage. In May, it completed an undisclosed funding round from the early-stage impact investor 4impact. [coolgradient.com](#)

## Monumental

More than [half of European countries](#) are grappling with a shortage of bricklayers, as 82 million Europeans are at risk of homelessness due to lacking affordable housing. Monumental is tackling these two problems with small autonomous ground vehicles, which are a cheaper, more available source of labor on construction sites. Once loaded with materials by humans, a trio of its robots, set with tower-style cranes, work as a team: One lays the mortar, one supplies the bricks and one does the actual building, driving alongside the wall until it's finished. Since Salar al Khafaji and Sebastiaan Visser launched it in 2021, Monumental robots has built multiple projects for top contractors in the Netherlands, including the facades of free-standing villas, social housing units, industrial buildings, and quay walls. The company has raised \$25 million to date, from Plural, Hummingbird, and Northzone. New products in the pipeline include robots specializing in concrete blocks, plus entry into new markets such as Germany and the UK. “We're working toward a future where beautiful, tailor-made buildings are built within a single day, with minimal labor,” says al Khafaji. [monumental.co](#)

Monumental founders Sebastiaan Visse and Salar al Khafaj.

PHOTOGRAPHY: JASPER FABER

## **Weaviate**

An open source database that stores and manages the vector data that's integral to many AI applications, Weaviate makes it easier for developers to create and expand AI applications, which range from custom-made search and recommendation systems to ChatGPT plugins. Founded by Bob van Luijt and Etienne Dilocker in 2019, its cloud service gives developers the full power of the Weaviate database without any of the operational overhead. It has had more than a million monthly OSS downloads and 10,000 stars on GitHub (TripAdvisor for developers), and has a hand in developing new product ideas through its proprietary incubation hub. Investors such as Index Ventures, NEA, Battery, Zetta, and Cortical have contributed some \$67.6 million (€60.7 million) in funding. [weaviate.io](#)



# Cradle

According to [European Bioplastics data](#), substituting the annual global demand for fossil-based polyethylene (PE) with bio-based PE would save more than 73 million metric tons of CO<sub>2</sub>. However, designing proteins is an arduous, time-consuming, expensive trial-and-error task. Cradle's AI platform, launched in 2021, enables biologists to upload a protein sequence they want optimized, such as needing more stability at higher temperatures. Out of a wide range of variations generated by the model, it can find the most promising to test in the lab. It reduces experimental rounds by up to 12 times, and uses 10 times fewer resources than conventional methods. This vastly boosts the chance for success. For example, [one US biotech](#) found novel, high-performing mutations that traditional methods hadn't identified. Cradle, founded by Elise de Reus and Stef van Grieken, has raised \$34 million (€30 million) in funding led by Index Ventures and Kindred Capital. [cradle.bio](#)

# Carbon Equity

Lara Koole, Jeff Gomez, Liza Rubinstein and Jacqueline van den Ende founded Carbon Equity in 2021, based on two observations: "We need billions of dollars to fund climate technology solutions, and mass affluent and high-net-worth individuals hold trillions of dollars but have no access to private markets," says van den Ende, Carbon Equity's CEO. The company grants investors unique access to a diversified portfolio of leading climate venture capital and growth equity funds. Since launching, nearly 1000 investors have invested more than €250 million (\$278 million) through the platform, helping scale more than 120 nonlisted climate tech companies, ranging from CO<sub>2</sub>-free cement (Sublime Systems) to long-duration energy storage (Form Energy), and green steel (H2 Green Steel). Carbon Equity has raised €9 million (\$10 million), with lead investors including the French fintech fund Blackfin Capital Partners and Netherlands-based VC fund 4Impact. Carbon Equity will soon open an international office in Berlin and offer its clients a new climate infrastructure fund and lower investment minimums. [carboneyequity.com](#)



Carbon Equity's Lara Koole, Liza Rubinstein, Jeff Gomez, and Jacqueline van den Ende.

PHOTOGRAPH: JASPER FABER

## **Bloom & Wolf**

With heavy use of water, pesticides, greenhouses, and refrigerated transportation, the cut flower industry is disastrous for the environment. Premium silk flower service Bloom & Wolf offers an alternative that's four times cheaper than a typical fresh subscription, and reduces carbon emissions by 85 times. The company's flowers are manufactured in Asia, shipped overseas to a European wholesaler, then made into bouquets by the startup in Amsterdam. When the consumer is done—usually changing their bouquet every season—it's collected, refurbished and reused. Supplying a range of customers since launching in 2023, the firm's circular model gained significant traction in the premium office and hotel industry, with clients including NH Hotel Group and Bilderberg. Founder Gwen Van de Pas has her sights set on Europe and the US, aided by a €1.4 million seed round, led by CapitalT. [bloomandwolf.com](https://bloomandwolf.com)

## **Solvimon**

Launched in 2022 by Kim Verkooij and Etienne Gerts, who cut their teeth at the Dutch fintech unicorn [Adyen](https://adyen.com), Solvimon's all-in-one billing and monetization platform is designed for fintech and SaaS businesses with complex billing needs. With fast-growing startups such as TrueLayer, Yapily, Yuno, Hawk, and SurePay in its current client base, Solvimon's vision is to make billing a tool that drives new business, rather than hinders it. The startup enables scaling-up of revenue operations across multiple countries and currencies, a reduction in manual billing efforts and enhanced financial management. Now a team of 23 and growing, Solvimon raised €9 million (\$10 million) in a seed round led by Northzone in late 2023. [solvimon.com](https://solvimon.com)

## **10X**

As the battle for talent intensifies, fractional work—the practice of hiring experts in the field for part-time or contractual roles—is increasingly ticking the box for both employer and employee. To connect companies with accomplished fractional CxOs, professionals, and experts, serial entrepreneur Angelique Schouten launched the subscription-based AI-supported platform 10X (pronounced “ten X”) in 2023. With more than 500 fractional professionals offering their expertise, it’s already united companies such as Mobility Concept, ParkBee and Talk360 with former leaders from Schiphol Airport, Knab and Meta. In May, 10X raised €1 million (\$1.1 million) in seed funding from angel investors. This will be used to launch a new version of the platform, which will feature AI-based analysis of candidate’s videos and randomly selected references from previous employers. [10x.team](https://10x.team)

## Haaven

Haaven, founded by Thomas Leeson, Davide Cardu, Sacha Bloem, and Dédé Kruisman in 2023, is a one-stop shop for building tiny houses—that’s any space smaller than 50 square meters, which makes them easy to transport as a single module or flat-pack on a truck. Consumers pick a design from the collection, personalize it, and within 15 weeks, they have a new, carbon-neutral space courtesy of a network of engineers and prefab construction companies. Prices range from €1,500 (\$1,100) per square meters for a finished exterior only, while one including floors, lighting, a kitchen and furniture runs up to €5,000 (\$5,500) per square meters. All quotes are final, so there’s no project creep as with traditional construction. The firm works with starchitect firms such as Sigurd Larsen and Park + Associates, has built 30 spaces to date, and raised €1.1 million (\$1.2 million) in pre-seed funding, led by Speedinvest, Golden Egg Check, and angel investors like Quintin Schevernels and Erik Nieuwenhuis.

[haaven.com](https://haaven.com)

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By [Morgan Meaker](#)  
[Business](#)

Oct 14, 2024 3:00 AM

# The Hottest Startups in Paris in 2024

The French capital has become the home of Europe's growing AI industry—but alongside giants like Mistral are startups building EV charging infrastructure and trying to revolutionize social media.

In the past two years the French capital has been in the throes of AI fever and has launched some of Europe's most talked-about startups, including Mistral, which is currently valued at \$6.2 billion (£4.7 billion). That's partly due to the support the industry has received. President Emmanuel Macron has given French AI startups some emphatic political backing, while telecoms billionaire Xavier Niel has provided much investment and will to finance national ambition. In September 2023, Niel invested €200 million (\$212 million), splitting that money between funding for startups such as Mistral, an AI research lab called Kyutai, and a cloud supercomputer powered by Nvidia. "I'm the old guy who likes entrepreneurs and the idea was always the same: How we can help this talent to stay here, creating companies," says Niel.

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Niel, a prolific French businessman who owns telecommunications company Iliad, believes European AI companies now have a unique opportunity to act. "If you want to create a search engine now from scratch, you cannot win because you weren't there 25 years ago. It's exactly the same with AI," he says. To compete with the US, Europe has to move fast.

“[Or] in the end, we will be the nicest place in the world for museums—that’s good but maybe we can try to do something a little bit different.”

## Mistral

In almost every European country, there is a startup vying to rival OpenAI. Yet few make a claim as serious as Mistral. To date the company has raised €1 billion (\$1.11 billion) including a €15 million (\$16 million) investment from Microsoft. Since launching in April 2023, its three cofounders, CEO Arthur Mensch, Timothée Lacroix, and Guillaume Lample have marshaled the startup to release 12 models, including its flagship multi-language text-generation model, Mistral Large. With 27 million downloads from public repositories, Mistral’s clients (such as telecoms company Orange, and Hugging Face) use the startup’s models to personalize promotional messages or power their own virtual assistants. Mistral’s free-to-use chatbot, Le Chat, functions much like OpenAI’s ChatGPT and is designed to give the public a way to experiment with Mistral’s open source technology. “We’ve been promoting open source as the one way to make the technology go faster and be safer because there’s more scrutiny on it,” CEO Mensch [told](#) CNBC in a rare interview, adding that Europe is at a turning point in its race to compete with tech superpowers. “We have willpower and we’ll make it happen,” he insists. [mistral.ai](https://mistral.ai)

## Sweep

Companies that neglect sustainability are facing two major risks: regulation and reputation. That’s according to Rachel Delacour, CEO of Sweep, who cofounded the sustainability-focused data management platform in 2020 alongside Yannick Chaze and Raphael Güller. “Every company out there must transition to the low-carbon economy,” she says, adding it’s now a competitive advantage for a business to be able to track sustainability targets across their operations. “Eventually your customers, your employees, your supply chain will ask what you are doing.” The startup is already working with hundreds of clients, including L’Oréal and UK energy group SSE, which license the company’s platform in order to pool data from across their entire supply chain and identify their sustainability weak

spots. A client manufacturing water bottles that must be hand-washed, for example, would be able to see how much more water-efficient its product would be if customers could clean them in the dishwasher, says Delacour. This year the startup is focused on expanding to the US after raising a total of \$100 million (£76 million), with investment from Tony Fadell, creator of the iPod. [sweep.net](https://sweep.net)

## Dust

Dust is yet another buzzy Paris-based AI startup. Launched by cofounders Gabriel Hubert and OpenAI alumni Stanislas Polu in 2023, Dust creates custom AI bots for companies. So far, most of its clients, which include 500 teams at companies such as PennyLane and Watershed, are experiencing fast growth but don't yet have strict processes in place. That means teams are more likely to be empowered to play around building a specialist content writer or feedback analyzer AI assistant themselves, says Hubert. Armed with €20 million (\$22 million) in funding, the idea behind the startup is that office workers don't need just one multipurpose AI assistant; instead they need a series of highly specialized models to choose from to perform different tasks. "That level of customization is really what gets them a report when they need it, a [spreadsheet] when they need it, or an executable, interactive graph," Hubert says. [dust.tt](https://dust.tt)

Dust cofounders Stanislas Polu and Gabriel Hubert.

PHOTOGRAPH: MARINA ZAGORTSEVA

## H

When news leaked that a group of engineers who worked on advanced models at Google's AI division, DeepMind, were preparing to start their own company in early 2024, investors raced to lend their support. Initially known as Holistic AI, the company changed its name to H in May 2024. It has already secured \$220 million (£152 million) in investment, including from former Google CEO Eric Schmidt, Xavier Niel, and venture capital firm Accel. Although it's unclear if the company has any clients—or even

products—yet, its elusive cofounder and CEO, Charles Kantor (a former venture resident at Stanford University), has promised his team are developing “full” artificial general intelligence or AGI that would “boost the productivity of workers.” So far little is known about H’s mission, although the reputation of its cofounders, DeepMind scientists Laurent Sifre and Karl Tuyls, both considered leaders in their field, means there is significant excitement to find out. [hcompany.ai](https://hcompany.ai)

## Bioptimus

Within five months of founding Bioptimus, the company’s six cofounders launched the world’s largest open source foundation model for cancer detection. Trained on hundreds of millions of images, H-optimus-0 identifies cancerous cells and genetic abnormalities in tumors, says cofounder and principal research scientist, Zelda Mariet. For her, this is just the beginning. Current models are really good at performing very focused jobs such as analyzing images of cancer tissues, she says. But Mariet wants Bioptimus to build a model that can also analyze a patient’s DNA, cells, and tissue to understand how they are all connected. Right now, the company is still in the exploratory phase, after raising \$35 million (£26.6 million) from investors such as French bank Bpifrance and telecoms billionaire Xavier Niel. [bioptimus.com](https://bioptimus.com)

## Electra

The European Commission has [forecast](#) that at least 30 million electric cars will be on European roads by 2030, and EV charging startup Electra is preparing for that moment, aiming to deploy 2,500 ultrafast charging sites by that date. Since launching in 2020, it has hit 300 sites across Europe—each with six charging points—including in Paris, Brussels, and Pisa. The idea is to make operating an EV seamless and hassle-free. Drivers use Electra’s app to book charging slots in advance with charging sites automatically recognizing regular users. “What Tesla did with cars, is what we’re trying to do with infrastructure,” says Aurélien de Meaux, CEO and one of three cofounders, alongside Augustin Derville and Julien Belliato. So far, Electra’s eye-catching charging stations have enabled more than 1

million 20-minute charging sessions, with French users paying between €0.39 and €0.52 per kWh. The company has raised €304 million (\$338 million), including from investment group Eurazeo and French bank Bpifrance. [go-electra.com](https://go-electra.com)

Aurélien de Meaux, cofounder and CEO of Electra.

PHOTOGRAPH: MARINA ZAGORTSEVA

## **Amo**

Amo is the latest French startup trying to reinvent social media. The company is led by CEO Antoine Martin, who sold his last social media business, Zenly, to Snap in 2017 for upwards of \$200 million (£152 million). Since launching in 2023, Amo has launched three separate social media apps designed to refocus online relationships with friends instead of influencers: Tilt (two-sided video), Bump (for location sharing) and ID (collaborative mood boards). Already, Amo has raised €18 million (\$19.9 million) from investors including VC New Wave, which also backed Paris-based social media startup BeReal before it was acquired by app publisher Voodoo. [amo.co](https://amo.co)

## **Spore.Bio**

After years spent working as an engineer at Nestlé, Amine Raji became frustrated with the outdated technology the food industry used to detect bacteria. “That's why you have so many food recalls and sanitary outbreaks,” he says, adding that [420,000 people die every year due to foodborne illnesses](#). In an effort to end that, the three cofounders behind Spore.Bio—Raji, Maxime Mistretta, and Mohamed Tazi—created the Vision device to identify bacteria in seconds. It works by shining a light on the bacteria (a practice called biophotonics) so machine-learning algorithms can identify what type of bacteria is present by studying its reaction. Since its launch in January 2023, five food factories are using the prototype, paying a fixed monthly fee for the hardware. The company has raised €8



million (\$8.8 million) from investors, including Google DeepMind's Mehdi Ghissassi and VC firm LocalGlobe. [spore.bio](https://spore.bio)

## **NcodiN**

NcodiN is working to become a critical cog in the complex world of semiconductor manufacturing. “We make the world's smallest lasers,” says Francesco Manegatti, cofounder and CEO. These lasers, 500 times smaller than the standard size, make it possible for NcodiN to build what's called an optical chip, which will feature devices a quarter of the size of a single human hair. Working in the clean room of France's National Centre for Scientific Research (CNRS), NcodiN has so far raised €4.5 million (\$4.9 million) for its plan to build these sophisticated optical chips, which will one day enable supercomputers to transfer data quickly and efficiently between different electronic parts. The company is in talks with some of the major chip manufacturers about testing, and it is targeting 2028 to deliver its first volume of wafers to clients. [ncodin.com](https://ncodin.com)

## **Astran**

Astran wants to shield companies from severe cyber attacks. Its product, Continuity Cloud, uses Astran's proprietary technology to encrypt and distribute its clients' sensitive data when they are under attack. Astran's backend combines “algorithms in a patented architecture that enables your critical data to be encoded and fragmented before being stored in multiple clouds at the same time,” says CEO Yosra Jarraya, who cofounded the company with Yahya Jarraya and Gilles Seghaier in 2021. Astran's customers include aerospace company Airbus and French pharmaceutical giant Sanofi, while the company has raised \$5 million (£3.8 million) to date. Investors include Paris-based seed fund Galion.exe and SISTAFUND, which backs female founders. [astran.io](https://astran.io)

*This article first appeared in the November/December 2024 edition of WIRED UK.*

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By [João Medeiros](#)

[Business](#)

Oct 14, 2024 3:00 AM

# The Hottest Startups in Stockholm in 2024

The Swedish capital produced Skype, Spotify, Klarna, and Minecraft—its stars of the future are building fintech for businesses, gen AI for lawyers, and full-body health care scans.

Why is Stockholm, a capital city with a population less than 1 million, home to global brands such as Skype, Spotify, Klarna, and Minecraft? “I think it has to do with the Swedish creed,” says Ben Eliass, CEO of body-care brand Estrid. “It’s a nation which put emphasis on high-quality education and invested heavily in telecoms infrastructure in the '90s, so we all grew up with high-speed internet.”

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Many also credit a social welfare system that acts as a “safety net” for entrepreneurship. “It allows people to take high risk and start companies, not needing to be too afraid of the downsides,” says Max Junestrand, CEO of legal tech startup Leya. Indeed, Sweden has now produced more unicorns per capita than any other country in Europe, except for Estonia, earning a reputation as the Silicon Valley of Europe. “Stockholm has a truly unique ecosystem where you can stand on the shoulders of giants,” says Colin Treseler, CEO of Supernormal. “They have invested an incredible amount of resources into the talent here, creating a critical mass of engineers, designers, and product thinkers that are exceptional at their craft.”

## Estrid

Once, at a dinner party, Amanda Westerbom confessed to her friends that she preferred to use men's razors. Surprisingly, many of her friends also did—they not only offered a better shave but they were also cheaper. With the help of cofounders Alan Aygun and Ben Eliass, Westerbom decided to change that, and in 2019, they launched razor brand Estrid. “We designed the handle ourselves, bought a €500 3D printer from a hardware shop, and started iterating,” Ben Eliass, CEO of Estrid, says. “That thing printed hundreds of handles, working day and night. In the end, it almost burned down my house because it was under such strain.” The result is a five-blade razor with a vegan hydration strip and an ergonomic weighted handle that the company now delivers to over a million subscribers across Europe. “We are dethroning one of the most dominant consumer monopolies of the modern era, becoming a next-generation, all-encompassing personal care brand. A next generation Dove if you will.” [estrid.com](https://www.estrid.com)

## Atlar

Joel Wägmark, Johannes Elgh, and Joel Nordström met while working at fintech startup Tink, which in 2022 was bought by Visa for \$2.2 billion. “We saw firsthand how quickly consumer fintech was changing,” says Nordström. “But the equivalent financial tooling for businesses just did not exist. Finance teams at the vast majority of companies use a mix of Excel, online bank portals, and legacy systems from the ‘80s and the ‘90s. It’s a lot of manual work.” Atlar, the money management platform for businesses that Wägmark, Elgh, and Nordström launched in 2022, eliminates such complexity by automating payments for businesses with multiple bank accounts across Europe. “We connect directly to traditional banks and provide faster, more UX-friendly tools with which to manage cash, forecast cash flow, and make payments.” says Nordström. With more than 35 customers across 10 countries, including the US, UK, France, and Germany, Atlar has raised €13M from investors including Index Ventures and General Catalyst. [atlar.com](https://www.atlar.com)

## Leya

Leya has developed a GenAI platform that automates repetitive and manual tasks done by lawyers. “We saw firsthand how lawyers struggled with text and admin-heavy tasks such as filling in templates and extracting information from a large number of documents,” says CEO Max Junestrand. “We want every lawyer to be empowered by AI in their work to accomplish more.” The startup—a Y Combinator alumni—was founded in 2023 by Max Junestrand, August Erseus, and Sigge Labor. In July 2024, they announced a \$25 million series A round, led by US VC Redpoint Ventures, totaling \$36 million in funds raised. They have over 100 clients in 10 markets across Europe, including UK firm Bird & Bird, the largest law firm in the Nordics, Mannheimer Swartling, and Spanish law firm Pérez-Llorca. “We are focused on solving specific legal tasks,” Junestrand says. “This has differentiated us from the crowd where the focus lies more on providing a platform of general LLM capabilities.” [leya.law](https://leya.law)

Leya’s Sigge Labor, August Erseus, and Max Junestrand.

PHOTOGRAPH: CHRISTOPHER HUNT

## Lovable

Anton Osika, founder and CEO of Lovable, is on a mission to create what he calls the “last piece of software.” “We made an AI that builds software,” he says. “We launched Lovable to let everyone have the same capabilities that product development teams at tech companies have at their fingertips.” Lovable’s product, GPT Engineer, allows users to build websites and web apps through a simple chat interface. “Unlike other AI tools that can code, which can take hours to generate results, Lovable gives people instant feedback and allows for rapid iteration,” Osika says. Launched in 2023, the startup currently has more than 2,000 users and a waiting list of 27,000 people from over 154 countries. Lovable has closed a \$7.5 million pre-seed funding round led by VCs Hummingbird and by Founders. Also backed by investors including Mattias Miksche, Shopify’s Siavash Ghorbani, Voi’s Fredrik Hjelm, and Creandum cofounder Stefan Lindeberg. “One user built a real-time dashboard for financial data, just by prompting,” Osika says. “She decided to quit her job to build startups with AI tools instead.”

[lovable.dev](https://lovable.dev)

## H2 Green Steel

In January 2024, cleantech startup H2 Green Steel raised €4.75 billion to complete its flagship project in Boden, a city in north Sweden: the world's first large-scale green steel plant. Due to its reliance on coal, standard steel production is responsible for up to 9 percent of global carbon dioxide emissions. Founded in 2020, H2 Green Steel aims to decarbonize steelmaking by using hydrogen gas, which produces water vapor rather than carbon dioxide. The Boden plant is due to begin iron production by 2026, and expects to supply about 5 million metric tons of the metal by 2030. Clients include automakers BMW, Porsche, and Volvo. [h2greensteel.com](https://h2greensteel.com)

## Supernormal

Fabian Perez and Colin Treseler spent weeks brainstorming ideas before they conceived their startup Supernormal. “Technology should give superpowers to knowledge workers,” Treseler says. “We drew inspiration from our previous teams at GitHub and Meta, where one of the core work principles was that if a meeting wasn’t documented, it didn’t exist.” Supernormal helps workers before, during, and after meetings, with tools ranging from automatic note-taking to sharing detailed agendas and insights from meetings. More than 325,000 clients use the software, including Red Hat, Motorola, Harvard University, Salesforce, Power Digital, and Forbes. They’ve raised a \$10 million seed round led by Balderton Capital. [supernormal.com](https://supernormal.com)

Supernormal founders Colin Treseler and Fabian Perez.

PHOTOGRAPH: CHRISTOPHER HUNT

## Fever

Fever develops virtual power plants (VPP)—pools of distributed energy resources, like solar panels or batteries, that can be used to send energy to the power grid. “A VPP is just like a traditional power plant,” says Klas Johansson, CEO of Fever Energy. “A great example would be a fleet of

electric vehicles that can discharge energy back to the power grid.”

Founded by 2022 by Klas Johansson, Jonaton Raber, Ruben Flam, and Ron Stolerio, in February 2024, it raised a €10 million seed round led by General Catalyst with the participation of Norrsken VC and [La Famiglia](#). The startup can’t disclose clients’ names, but claims they are already working with large utility companies and EV manufacturers. [fever.energy](#)

## **Neko Health**

Since its launch in 2023, nearly 5,000 people have visited Neko’s health center in Stockholm. Inside the clinic, they underwent a \$230 noninvasive full-body scan in less than an hour that checked for signs of potential skin, metabolic, and cardiovascular diseases. According to the company, the scans identified potentially serious conditions in 1 percent of that cohort, including aortic aneurysms, severe diabetes, and skin cancer. Launched by Spotify founder Daniel Ek and Hjalmar Nilsson, the health tech startup has raised €60 million from investors that include Atomico, General Catalyst, and Lakestar. A new Neko health center in London will be opening soon. [nekohealth.com](#)

## **Evroc**

Founded in 2022 by Mattias Åström, Andreas Birnik, and Andreas Jönsson, Evroc launched out of stealth in 2023 with €13 million in funding from backers such as EQT Ventures and Norrsken VC. In August 2024, it raised a further €42 million. The mission? To build a sustainable hyperscale cloud in Europe. “Europe has unfortunately fallen behind in cloud services, and American players currently control more than 80 percent of the total cloud market,” says Åström. “We founded Evroc to put an end to this foreign dominance.” Construction of their flagship data center in Arlandastad will start at the end of 2024. “We will also look for suitable locations for our own data centers in France and Germany,” says Åström. “By 2030, we expect to have a network of 10 hyperscale data centers across Europe.” [evroc.com](#)

## **PaperShell**

In May 2024, Italian furniture designer Arper launched a new edition of the office chair Catifa 53. The original was made with leather, metal, and plastic; the new version uses, instead, a sustainable composite biomaterial manufactured from kraft paper and resins, which is as strong as a fiber composite and as weather-resistant as plastic. This wood substitute was invented by PaperShell, a company launched in 2021 by Anders Breitholtz and Mathieu Gustafsson. The material is not only completely fossil-free but can also, at the end of its life cycle, be converted into biochar. The company has raised €13.3 million. [papershell.se](https://papershell.se)

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By [João Medeiros](#)

[Business](#)

Oct 14, 2024 3:00 AM

# The Hottest Startups in London in 2024

The UK capital's most exciting startups showcase its strengths in biotechnology and artificial intelligence.

In the “Start-Up, Scale-Up” review [report](#) published last year, chancellor Rachel Reeves promised to make Britain the “high-growth startup hub of the world.” Now, almost six months into the new government, entrepreneurs remain encouraged by the promises made in the Labour manifesto. “The ambition embodied in Great British Energy and the 2030 decarbonization targets is precisely what we need and deserve,” says Shilpika Gautam, CEO of greentech startup Opna, about Labour’s energy policies. “It’s high time the UK caught up with the policy and financing innovations in other countries, such as the Inflation Reduction Act in the US.”

Europe's 100 Hottest Startups

**From Amsterdam to Zurich, these are the hottest startups in Europe in 2024**

Amit Gudka, founder of Field, agrees: “We welcome Labour’s plans to double onshore wind, triple solar, and quadruple offshore wind by 2030. These plans are ambitious, but not unrealistic, provided the government continues to make clear policy decisions and create a stable policy and regulatory environment.” Other sectors, such as health care, share the same cautious optimism. “Labour do have a greater political mandate to genuinely reform the NHS, and Wes Streeting in particular seems pragmatic,” Meri Beckwith, cofounder of Lindus Health, says. “He’s

signaled a greater willingness to work with private companies to address some of the really big challenges facing the NHS.”

Expectations are, of course, tempered by the reality left behind by 14 years of Conservative government. For instance, in June, the UK government already had to shelve a £1.3 billion (\$1.7 billion) commitment for tech and AI projects made by the previous government because no money had ever been allocated for it. “We should hope that UK industry and academia will find other avenues to mobilize the resources to build that infrastructure,” says Robin Tuluie, founder and CSEO of PhysicsX. “We don’t envy the very hard fiscal choices that the chancellor and the Labour government have to make.”

## **Robin AI**

Robin AI is building an AI legal assistant that can help anyone to solve their legal problems. “I wanted to make law more accessible,” says Richard Robinson, a former corporate lawyer at Boies Schiller Flexner, and CEO of Robin AI. “We’re not here to pad out the billable hours business model of big law firms. We’re legal AI for business, not just AI for law firms.” Cofounded in 2019 by Robinson and machine learning researcher James Clough, Robin’s legal assistant is already used by hundreds of businesses like PepsiCo, PwC, and Yum! Brands. Its latest product, Robin AI Reports, can, according to Robinson, analyze hundreds of legal contracts and generate single reports in minutes, allowing companies to complete legal processes that used to take weeks—for instance, M&A Due Diligence—in a matter of hours. The company has raised \$26 million (£19.8 million) by Singapore-based Temasek and has recently opened an office in Singapore, adding to its offices in London and New York. [robinai.com](https://robinai.com)

## **Gaia Family**

“I challenge you to find one fertility clinic website that doesn’t show a baby in a blue blanket front and center,” says Nader AlSalim, CEO of Gaia Family. “But how you get to that baby—and more importantly if you ever get to it—is a lot less straightforward.” AlSalim speaks from first-hand

experience: his wife underwent five rounds of IVF during three years until they had a child. “There’s a lack of transparency regarding clinical outcomes and treatment prices,” he says. “People start IVF without knowing where the total bill is going to land or how far they’ll be able to go.” AlSalim launched Gaia to address those problems: the startup takes upfront payments from clients and handles all costs for up to three cycles of IVF. Clients only pay back later, in installments, if they become parents. “We apply machine learning to large public datasets to predict fertility treatment outcomes and take on the financial risk if those treatments are unsuccessful,” AlSalim says. The startup, which has raised more than \$23 million (£17.5 million), is available in the UK, Spain, Greece and the US. [gaiafamily.com](https://gaiafamily.com)

## **Get Harley**

“I suffered from acne, seborrheic dermatitis, and eczema at various stages of my life,” says Charmaine Chow, CEO of GetHarley. “In the past, I wasted huge amounts of time, money and energy trying to figure out what works for me. I imagined a service that would enable me to meet practitioners online and would deliver the difficult-to-access, medical grade products to my door in a timely manner.” That service didn’t exist, so Chow decided to invent it. GetHarley, the online consultation and clinician matching platform she launched in 2019, currently gives more than 150,000 patients access to a network of 1,500 skincare practitioners across the UK and Ireland. “We have seen triple-digit annual growth since our launch,” she says. “We also partner with more than 500 pharma brands, which allows practitioners to be brand agnostic when they are curating personalized skincare plans.” In August 2024, the company raised \$52 million (£39.6 million), led by Index Ventures. [getharley.com](https://getharley.com)

Charmaine Chow, founder and CEO of GetHarley.

PHOTOGRAPH: JACK LAWSON

## **Lindus Health**

“When I was a VC investor, all the techbio companies I met shared the same frustration with clinical trials,” says Meri Beckwith, cofounder of Lindus Health. “They were late, overbudget, and getting exponentially more expensive. No one could really explain to me why.” Beckwith eventually realized that the culprits were the so-called contract research organizations (CRO), third-party entities that oversee and run clinical trials. “I was told that they make more money the worse the clinical trial goes,” Beckwith says. “That’s the industry’s dirty secret.” Lindus Health, founded by Beckwith and Michael Young, replaces the traditionally old-fashioned methods used by CROs with a technology platform that automates many of the phases of a clinical trial. This allows them to complete trials, on average, in half the time they usually take. “One example is real-time trial monitoring, which takes up to half of the trial’s budget,” he says. “CROs do this by physically sending someone to sites to examine paper records. Our software captures that data directly.” Lindus, which has raised \$18 million (£13.7 million), has already been involved in 91 trials. [lindushealth.com](https://lindushealth.com)

## Field

Field’s big batteries allow electricity grids to store renewable power when supply is high and release it when there’s demand. The company was founded in 2021 by former Bulb cofounder Amit Gudka. A year later, it switched on its first 20-MWh battery storage site in Oldham, Greater Manchester. “That played an important part in keeping supplies steady and the lights on in the build-up to Christmas last year, when a large subsea cable transporting power between the UK and France tripped,” Gudka says. “It would have led to instability across the grid were it not for a number of batteries across the country, including ours.” The startup uses lithium-iron phosphate cells, sourced from a Chinese manufacturer, while other battery components are imported from Europe. The startup has raised £200 million (\$152.4 million) from DIF Capital Partners and already has a presence in Italy, Germany and Spain. Three sites across Britain, totaling 190 MWh, are currently in construction. [field.energy](https://field.energy)

## Opna

In 2017, Shilpika Gautam became the first person to stand-up paddle the entire length of the river Ganges. “On my expedition, I was introduced to renewable energy and forestry project developers who consistently shared the same challenge: they needed upfront financing to get started,” Gautam says. In 2022, she launched Opna, a platform that allows corporations that want to find, fund and monitor carbon removal projects. “Our mission is to unlock capital for high-quality climate projects that address climate change with speed, scale, and equity,” she says. So far, it has worked with more than 45 projects around the world, with a focus on the global south, in sectors such as agroforestry, blue carbon, biochar and direct air capture, that are set to generate carbon removal benefits, with a specific emphasis on the impact created for communities and biodiversity. “We verify the integrity of information provided by suppliers and review all the risks associated with a project,” she says. “Our standardized diligence, contracting, and portfolio management tools can save buyers hundreds of thousands of dollars in costs, shrink deal timelines, and de-risk net-zero journeys by actively managing carbon removal portfolios for several years.” Opna has raised a seed round of \$6.5 million (£7.6 million) led by Atomico. [opna.earth](https://opna.earth)

Shilpika Gautam, CEO and founder of climate fintech, Opna.

PHOTOGRAPH: THOMAS MEYER

## Sylvera

Sylvera verifies and rates the performance of carbon offsetting projects, helping corporate buyers make more informed decisions when purchasing carbon credits. The platform uses machine learning algorithms to assess factors such as the project’s carbon impact and accuracy of reporting based on a range of datasets from satellite data to lidar (light detection and ranging) scans. “We’re obsessed with getting project ratings right,” Allister Furey, CEO of Sylvera, says. “We spend up to 120 hours putting together every project rating and analysis, which includes rounds of testing to ensure we’ve come to the correct conclusion.” In May, it launched the Sylvera Catalog, which gives investors access to an overview of nearly 20,000 projects, from biochar to landfill methane. In July 2023, the company raised \$57 million (£43.4 million) in series B funding led by Balderton Capital,

taking its total external investment to \$96 million (£73 million) since being founded in 2020 by Furey and Sam Gill. [sylvera.com](https://sylvera.com)

## PhysicsX

PhysicsX uses machine learning to run simulations for engineers in industries such as aerospace, automotive, energy and semiconductors. “AI-driven physics and chemistry simulation will fundamentally transform complex engineering and manufacturing,” says Robin Tuluie, CSEO of PhysicsX. “Our technology replaces standard simulation models with Large Physics Models. These models are as accurate as numerical simulation, but execute in a second or less. We’re talking about speeding up physics simulation by  $10^4$  to  $10^5$  times.” Although they can’t disclose names, Tuluie says clients already include a top Formula One team and major automotive and renewables companies. Founded by Tuluie, an astrophysicist and former chief scientist at Mercedes F1 team, and Jacomo Corbo, co-founder of data agency QuantumBlack, the startup has raised \$32 million (£24.3 million) in funding led by General Catalyst. [physicsx.ai](https://physicsx.ai)

## Newcleo

Nuclear technology startup Newcleo is developing a mini nuclear power plant which uses nuclear waste as fuel. Founded in 2021 by physicist Stefano Buono, the startup has already raised more than €400 million (£338.8 million) and employs more than 750 people located in fifteen offices across the UK, France, Switzerland and Italy. In 2024, NewCleo dropped plans to build a power plant in Cumbria, opting instead to invest £4 billion (€4.7 billion) in the south of France following personal lobbying from French President Emmanuel Macron. A demonstration model is currently being built in Italy and the first 30 MW prototypes are planned for 2030. [newcleo.com](https://newcleo.com)

## Volt

Volt is an open payments platform that enables merchants to receive direct payments in real-time. “I saw an industry that was ripe for disruption, based

on technologies imagined and implemented in the '50s,” Tom Greenwood, CEO of Volt, says. “I could see that there was a new generation of payment infrastructure coming that was real-time.” Founded by Greenwood, Steffen Vollert, and Jordan Lawrence, Volt is live today across 31 countries, including Europe, the UK, Brazil and Australia. In June last year, they raised a \$60 million (£45.7 million) Series B led by IVP. Clients include *Farfetch, Xe.com and Worldpay*. [volt.io](https://www.volt.io)

*This article first appeared in the November/December 2024 edition of WIRED UK.*

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By [João Medeiros](#)

[Business](#)

Oct 14, 2024 3:00 AM

# The Hottest Startups in Lisbon in 2024

The Portuguese capital's most exciting startups include a platform to help entrepreneurs get going, a smart punchbag, and the Uber of hair salons.

Two years ago, Jon Fath moved with his family to Portugal from the Netherlands with the sole purpose of launching a fintech startup there. “This country is brimming with talent and ambition,” Fath says. “I thank Lisbon for welcoming me, along with so many other expats and entrepreneurs, so warmly.”

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Indeed, it's no surprise that the European Commission named Lisbon as 2023's European Capital of Innovation, while the Financial Times, in partnership with Statista, ranked two Portuguese startup hubs in Europe's top 10 startup hubs—including the Unicorn Factory Lisboa, which launched in 2022 and has already supported more than 820 startups and helped raise more than €1 billion (\$1.1 billion).

“Portugal offers unique advantages, such as its climate, safety, and cost of living, which make it an attractive choice over countries in central or northern Europe,” says Nuno Pereira, CEO of Paynest.

Government has played a role too, with policies such as residence visas for entrepreneurs and tax incentives to startups engaged in R&D. “That was



instrumental in allowing the Portuguese startups to come across the other side alive, after the VC drought of the past two years,” says Mauro Frota, CEO of fit-tech startup Bhout.

## **Rauva**

Before launching Rauva in Lisbon, Jon Fath had been a startup CEO in Amsterdam, cofounded a logistics company in Frankfurt, and worked for an investment management firm in Beijing. “I decided to start Rauva based on my experiences working with entrepreneurs and co-founding other companies,” Fath says. “I took the plunge to build a one-stop shop to make entrepreneurship accessible to everyone.” Rauva allows entrepreneurs to register their businesses online in a matter of minutes, offering a raft of features like debit cards and invoicing. “In addition, if the company has not yet been created, Rauva offers that service with the support of lawyers,” Fath says. “Our solution helps reduce the time spent on bureaucratic processes.” The startup, launched in 2022 by Fath and Sam Mizrahi, has also recently partnered with researchers to design a faster and more accurate credit scoring system using machine learning and quantum computing. Currently, Rauva has more than 3,000 users and has helped create more than a thousand new companies. [rauva.com](https://rauva.com)

## **Neuraspace**

Currently, there are nearly 9,900 active satellites orbiting the planet, a number estimated to grow by an order of magnitude by 2030. “The risk of collisions caused by space debris is escalating,” says Chiara Manfletti, the founding president of the Portuguese Space Agency and CEO of Neuraspace. “These collisions can destroy satellites, leading to substantial financial losses and disrupting essential services such as bank transactions, the internet, GNSS (global navigation satellite system), and Earth observation. The current manual decision-making processes are inadequate to handle this scale.” Neuraspace addresses this problem by using AI to analyze various datasets, including radar and star trackers, and automatically predict potential collisions and suggest avoidance maneuvers. This space traffic management platform is currently tracking more than 300

satellites from satellite operators such as Spire, Nanoavionics, and the European Space Agency. Founded in 2020, the startup has raised a total of \$27.5 million (£20.8 million). “The big vision for Neuraspace is achieving self-sustaining, autonomous space activities,” Manfletti says.

[neuraspace.com](https://neuraspace.com)

## **Bhout**

In 2021, Mauro Frota opened a gym featuring a unique piece of equipment: a smart boxing bag. Developed by Frota and Pedro Barata, the Bhout bag comes with an AI processing unit, biometric sensors and a smart camera that can track the accuracy, speed and power of every punch. “The idea came to me in a dream,” Frota says “I lost count of the number of iterations to get there. We were creating a new product from scratch.” The punching bag is also equipped with a set of light rings that nudges gym-goers into different workout rhythms. Its core is made of foam layers and filled with water, mimicking the feeling of hitting another boxer. According to Frota, 20 new Bhout clubs are already confirmed in Portugal and Spain. Soon, it will also start selling the Bhout bag, at prices ranging between €6,000 to €10,000 (\$6,1000 to \$11,000) to clients including LinkedIn and Marriott Hotels. In 2023, the fit-tech startup raised a €10 million (\$11 million) seed round coled by Explorer Investments and Lince Capital. [bhout.com](https://bhout.com)

Bhout cofounders Mauro Frota and Pedro Barata.

PHOTOGRAPH: PEDRO MOURA SIMÃO

## **MyCareforce**

MyCareforce is bringing the gig economy to healthcare. “Hospitals often lack the necessary staff to meet demand and they don’t have the appropriate tools to hire people for extra shifts quickly,” says CEO Pedro Cruz Morais. “We knew many doctors who were using WhatsApp to find extra shifts and we realized we could solve this problem with technology.” MyCareforce provides an intelligent platform that connects nurses to hospitals and clinics, allowing them to apply and immediately book available shifts. The

platform, launched in 2021 by Cruz Morais and co-founder João Hugo Silva, has more than 15,000 nurses registered on the platform and works with more than 70 health care units, such as hospitals and clinics, in Portugal and Brazil. It has raised a €2 million (\$2.2 million) round led by Portugal Gateway, Shilling and Demium Capital. [mycareforce.co](https://mycareforce.co)

## Oscar

Oscar allows users to book more than 150 at-home services—from cleaning to blind repairs—for a fixed fee and within 30 minutes. “The idea came about after a bad experience trying to call a plumber to fix my water heater,” João Marques, founder and CEO of Oscar, says. “After wasting hours contacting multiple technicians and comparing quotes, I scheduled a service and the technician never showed up. It was obvious that an Uber home service was missing.” The platform, which is available in Portugal and Madrid, currently hosts more than 20,000 technicians, which are admitted after a rigorous selection process and background check.

According to Marques, their annual revenue is currently €12 million (\$13.4 million) and growing 40 percent every quarter. They have raised more than €6 million (\$6.7 million) in a round led by Lince Capital and Indico Capital Partners. [oscar-app.com](https://oscar-app.com)

## Glooma

Francisco Nogueira’s cousin was 40 when she detected a lump in her chest. “She thought it was nothing, but three months later, the lump had not disappeared,” says Frederico Stock, CFO and COO of Glooma.

Unfortunately, the lump was a malignant tumor and she had to have a mastectomy. “Francisco decided to create Glooma so that women in the same situation can act sooner.” The startup, launched in 2021 by Nogueira and Stock, is developing SenseGlove, a glove equipped with smart sensors that women can use to do a breast self-exam. “It can track changes in breast tissue over time and notify doctors when there’s an abnormality,” Nogueira says. According to him, an early proof-of-concept trial showed that the SenseGlove correctly diagnosed cancer 88 percent of the time, with a rate of 12 percent false positives. The startup, which has raised more than €1.3

million (\$1.4 million) is now undergoing clinical trials with the most recent prototype. The team hopes to receive FDA-approval by 2025. [gloomapt](https://gloomapt.com)

Francisco Nogueira and Frederico Stock, founders of Gloomat.

PHOTOGRAPH: PEDRO MOURA SIMÃO

## Sheerme

“When you need a taxi, you have Uber; when you need a hotel, you have booking.com, but what do you do when you need a hair salon or a spa?” asks Miguel Ribeiro, CEO of Sheerme. According to Ribeiro, 85 percent of wellness and beauty services require prior booking, but only 10 percent can be booked online. “Sheerme fills that void,” he says. The platform allows users to find, book and pay for services provided by 7,000 health and beauty merchants. “We have also partnered with L’Oréal and created a white-labeled solution called SAL(ON),” says Ribeiro, who founded the platform with Karly Alves and Shakil Satar. The startup, which has more than 250,000 users across Portugal, Brazil and Spain, has raised a €5 million (\$5.5 million) seed round led by Lince Capital. [sheerme.com](https://sheerme.com)

## Sqill

Sqill is an AI-powered mobile video editor for social media brands. “With our social media suite and with one single click, anyone can create better content than a social media expert,” says Afonso Coimbra, cofounder and CEO of Sqill. The platform uses AI for a range of tasks, such as recommending what to post or automatically adding subtitles. Founded in 2021 by Coimbra, Rui Ascenso and André Perdigão, the startup has raised €2 million (\$2.2 million) by GED Ventures. It has clients in Portugal, Spain, Brazil, and the US, including L’Oréal, the online marketplace Worten, and the Portuguese football club FC Porto. [sqill.so](https://sqill.so)

## Ubbu

More than 300,000 students in more than 20 countries have used online learning platform Ubbu to learn coding and digital skills. “Our platform is built for the everyday teacher, even for those with no coding experience, who account for around 90 percent,” says João Magalhães, CEO and founder of Ubbu. “It’s accessible to everyone because we want to reduce the barriers to enter the tech market.” Aimed at children between the ages of 6 and 12, the platform is available in four languages and includes Ubbox, a tool that allows projects to be made using a programming language via blocks. A research study by Universidade Nova Lisboa found that Ubbu students could improve their math grades by up to 17 percent compared to a control group. [Ubbu.io](https://ubbu.io)

## Paynest

Founded in 2022 by Nuno Pereira, Paynest is a platform for companies to manage their employees’ finances. “Our mission is to help companies address all of the financial needs of their employees everywhere while empowering them to gain greater control over their finances,” Pereira says. Features include simplified expense management, early access to salary and bonuses, financial coaching, and access to financial literacy tools. Paynest is currently used by more than 30,000 workers from more than 50 companies in Portugal, Greece, and France. It has also raised a total of €3 million (\$3.3 million) from investors such as Lince Capital and Bluecrow Capital. [paynest.co](https://paynest.co)

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[Tristan Kennedy](#)

[Science](#)

Oct 7, 2024 5:00 AM

# This Homemade Drone Software Finds People When Search and Rescue Teams Can't

British Mountain Rescue workers have developed an automated drone system that can scour a landscape far quicker and more thoroughly than human eyes.

Photograph: Tom McNally

When Charlie Kelly first messaged saying he wouldn't make it home that night, his partner wasn't happy. It was September 6, 2023, a Wednesday, and the 56-year-old, a keen hillwalker, had left the house that he shared with Emer Kennedy in Tillicoultry, near the Scottish city of Stirling, before she went to work. His plan was to climb Creise, a 1,100-meter-high peak overlooking Glen Etive, the remote Highland valley made famous by the James Bond film *Skyfall*.

The weather was unusually mild for the season, and Kelly thought he might even have time to “bag” a second Munro, as the Scottish mountains above 3,000 feet are known. In his time off work as a forensic psychologist for the Scottish Prisons Service, he had been ticking off the peaks steadily. “He had this book he would mark them in,” Kennedy remembers. “But we were due to go on holiday in two and a half weeks, so this was the last Munro he was going to do before the winter set in.”

Hiking wasn't something that Kennedy was particularly keen on herself. When the pair had first met four and a half years previously, they'd bonded over a shared love of Celtic Football Club, and their “extremely quirky” sense of humor. She'd fallen in love with Kelly's brain—his encyclopedic

knowledge of all things football, Robert the Bruce, and Doctor Who. He loved the fact that she laughed at “his terrible jokes,” she says. But he also appreciated the fact that she encouraged him in passions they didn’t share. “One of the last things he said to me the night before was, ‘You let me be me,’” she says.

So when Kelly told her he wouldn’t make it off the hill before nightfall, Kennedy was worried, but she trusted that he knew what he was doing. “Charlie was a very resourceful person,” she says. “At work, he was a trained negotiator, for when prisoners took hostages or went up on the roof. He generally didn’t take risks.” Kelly reassured her that there wasn’t any need to call for help. He had packed extra food, had plenty of water and enough warm clothes. He’d just wait for it to get light and walk down.

At work on the Thursday, Kennedy checked her phone whenever she had a break. Kelly had checked in before dawn and sent further cheery messages whenever he had reception. At around 8 pm, with the sun starting to set, he wrote to say his battery was running low, but she needn’t worry: He could see the lights of the Glencoe Ski Center, where he’d parked his car. There was still plenty of daylight left to reach it, he said. “It’ll take me about half an hour.” That was the last anyone heard from Charlie Kelly alive.

In the days following Kelly disappearance, Glencoe Mountain Rescue launched what they later described as a “Herculean” search effort, using sniffer dogs, quad bikes, multiple helicopters, and drones equipped with infrared and conventional camera equipment. The search involved professionals from the Coastguard, Police Scotland, and the Royal Air Force, as well as dozens of highly trained volunteers from 10 different Mountain Rescue (MR) teams. Often, there were as many as 50 people on the hill at a time. On Saturday, September 9, they found his backpack. But after that, nothing.

The breakthrough, when it came, was more than six weeks later. Dan Roach and David Binks, two MR team members from the Lake District, in northern England, had been following the news of the ongoing search online. In their spare time, they’d been developing a new piece of piloting and image analysis software, designed to help drones find missing people more effectively. After two years of work, involving what Binks calls

“some hideous maths,” they had what they believed was a working prototype.

“I’d heard this search was going on,” Binks says, “and I kept thinking this would be quite a good place to try and test the system out. Then Dan phoned me while I was on my way home from holiday. He’d had the same idea.” The pair contacted Glencoe MR and asked if they could help. “I don’t think they thought anything was going to come of it,” says Binks. But by that point, they’d tried every other tool at their disposal. “So they were happy for us to try.”

On October 24, Binks, Roach, and Dan Parsons, a friend and fellow MR team member of Roach’s, who had helped with early testing, traveled to Glencoe. They met up with their local MR counterparts, launched two drones, and found Charlie Kelly’s body within the first hour.

Mountain rescue volunteers are often called out to find missing hikers, and drones have become an essential part of search and rescue plans

Photograph: Tom McNally

Mountain Rescue in the UK is often referred to as the country’s fourth emergency service. But unlike the police, fire brigade, or ambulance services, it is staffed entirely by volunteers. The country’s upland areas are covered by a patchwork of teams made up of locals from all walks of life. Each team operates as a separate registered charity, responsible for its own fundraising, training, and equipment.

This decentralized structure has its advantages, according to Mike Park, the elected CEO of MR England & Wales, an umbrella body that helps improve cooperation between teams. “But the negative side is it can bring a lot of individualistic, ‘we know best’ type attitudes,” he says. Park is the former leader of Cockermouth MR in the Lake District—Roach and Parsons’ team—and a volunteer himself for “coming up to 42 years.” He explains that MR members—the majority of whom are men—sometimes get a bit too tribal about their areas of expertise, and new ideas take longer to spread than he would like. “There’s this old culture where it’s like you’ve got to do 20 years before you’re allowed to be listened to,” he says.



When consumer camera drones first became widely available in the early 2010s, their usefulness in search and rescue situations seemed self-evident. They would allow teams to cover vast areas, for a fraction of the cost of a helicopter. But Roach, an early enthusiast who'd used drones for photography work, wasn't convinced. A keen climber, with long, curly hair and a [Pedro Pascal mustache](#), he joined Cockermouth MR a decade ago and is still one of the team's younger members at 34. "Everyone thought, 'This is going to be brilliant because I can see things.' But then they realized you have to be very close to the thing that you want to see, and you have to be able to see it on a very small controller."

If you're trying to find a needle in a haystack, having an aerial view of the haystack doesn't necessarily help. Instead, Roach argued that they should be taking advantage of drones' ability to fly preprogrammed flight paths and trying to automate the search process as far as possible. Among MR's old guard, however, he faced an uphill battle to get his ideas heard. "I remember one MR conference at Leeds University, where Dan shows up with his long hair and his skateboard," Mike Park says, "and someone asked if he'd walked into the wrong place—they thought he was a student who'd come back a week early."

Frustrated by people's refusal to listen, Roach pressed on regardless, with the help of his friend and fellow volunteer Dan Parsons. As well as being a similar age, Parsons, 33, had a background in forestry and had previously used drones for surveying purposes. The pair of them set about testing off-the-peg piloting and photography software. They also found a program that could pick out pixels of particular colors, like the red of a hiker's jacket. "In the end we had this extremely tech-heavy, very janky system," Roach remembers. "It worked, but it wasn't pretty. You had three different bits of software that you had to engage to search." It wasn't until Roach met David Binks, a retired software developer who volunteers with Duddon & Furness MR, which covers an area about 30 miles south of Cockermouth, that the idea really began to take shape. Roach spoke about his attempts to automate drone searches at a meeting of Lake District pilots and remembers Binks collaring him afterward. "He said, 'I hadn't thought about it like that. Let's chat.'"

They make for an unusual pairing. Roach, “the ideas guy,” exudes a Tiggerish enthusiasm, whereas Binks is a far quieter presence, with an engineer’s analytical brain. At 57, Binks is more than 20 years older, but crucially, he had experience not just of writing software, but software that had been widely adopted by MR. Starting in 2007, he’d built a program called MR Maps, which allowed teams to track their members in near real time, based on regular pings from their radios. In an era before GPS-enabled smartphones or handheld devices were standard, it proved a game-changer. After initial meetings in late 2021 and early 2022, Binks decided the best way to build Roach’s idea was as an add-on to MR Maps.

Thanks to new image-analysis software, humans can be more easily located among even dense foliage and rocky ground.

Photograph: Tom McNally

“I knew how the maths would work, from my background working in simulation software for offshore oil platforms and wind farms,” Binks says. “So I knew it was possible. But I did a lot of nights where, well, I’d start at 9 in the morning, and before I realized, it would be 3 in the morning, and I’d just been at it all day.” Perhaps betraying its homemade origins, and the fact that it was written using C++, the resulting software has what Roach describes as “a Windows 95 aesthetic.” But the basic interface belies an impressive level of sophistication.

Their main challenge, Binks explains, was threefold. “Part one is flying the drone in a way that photographs the ground in the most effective way.” The camera has to point straight down, and every inch of ground must feature in multiple frames, so that objects can’t be obscured by the angle of a wall or rock. “We have a 55 percent overlap, so one object should be in nine frames, on average,” Binks says. The preprogrammed flight paths are plotted automatically, at whatever height the pilot chooses, using the 2-meter by 2-meter [lidar](#) data that underpins the contours of the UK’s Ordnance Survey (OS) maps, the official maps of the UK government (which OS supplies to MR for free). The software also tells the pilot where to stand to avoid losing the line of sight with the drone as it flies—a legal requirement in the UK.

“The second aspect of the software is calculating the grid reference of any particular pixel on an image,” Binks explains, “which you can do using rotational vectors, working out where they intersect with the ground.” The third element, Binks says, “is actually analyzing the images to work out what’s interesting.”

Roach and Parsons’ “janky” off-the-peg version involved inputting the specific colors that you wanted to search for, but Binks, crucially, realized it would be easier to flip that on its head. “So I tell it to count the number of pixels of any particular color, and then highlight clusters of colors that are unusual.” The red of a hiker’s jacket would still stand out on a grassy background, Binks explains, “but if the image is all rocks, then green would be a more unusual color.”

The system is designed to operate entirely offline, allowing it to be used in remote locations. This means the images have to be downloaded from the drone after each flight, but the analysis can be done in the field, with clusters of unusual-colored pixels flagged for human review while the drone moves on to the next search zone. “There are a lot of false positives, but it doesn’t take long for a human to go through them,” Binks says. “Usually it’s funny-colored moss, or rocks, or a sheep,” Roach says. “But every now and again, it’s a person.”

Operators can plot out areas for the drones to focus on and can create automated flight paths to search.

Photograph: Tom McNally

The wild, boulder-strewn hinterland behind the Glencoe Ski Center provided a near-perfect proving ground for MR Maps’ new capabilities. Between the top of the lifts and the single-track road that snakes its way down to a dead end in Glen Etive, there’s very little except rocks, dun-colored tussocks, and the occasional deer. “The ground here is quite complex,” explains Brian Brathurst, one of Glencoe MR’s deputy team leaders, with an accent and a level of understatement that betrays his Zimbabwean origins. “There’s a lot of boulder fields, there’s a lot of gully systems, and you could walk within five or 10 meters of somebody and not see them.”

As the search reached the end of its second week, the chances of finding Kelly alive dwindled, and the intensity of the efforts was inevitably dialed down. “Sadly, people have their lives to lead,” Brathurst says. “But on our patch, we don’t tend to give up on these things. We were out every free day we had. For those six weeks, there was always somebody out—people finishing work in the afternoon and going and exploring areas that hadn’t been searched. It never really stopped.”

When Binks, Roach, and Parsons arrived, they were well briefed. “Without the work Glencoe had done, there’s no way we’d be able to do what we did,” Binks says. With the two Dans operating one drone, and Binks handling another, they divided up the most promising-sounding search areas between them and headed out to different starting points. Despite all the work they’d put into the software, they were nervous. “We’d found our coats in fields and simulated it,” remembers Parsons, “but we’d never found anything that we didn’t know we’d already put there.”

David started flying his first search zone, “Area A.” But about 10 minutes into the flight, the drone started to disappear out of sight. Annoyed that it had already gone wrong, he called it back and made a mental note to tweak the software. “I thought, OK, fine, I’ll do Area B now. But while it’s doing that, I’ll check what I’ve got from Area A.” He started cycling through the flagged photos, and suddenly, there it was. “Two of the images had Mr. Kelly in them,” remembers Binks. “I was stunned.”

Dan Parsons, David Binks, and Dan Roach, creators of the MR Maps-enabled drones.

Photograph: Tom McNally

When Glencoe’s recovery team reached the spot, they found Kelly had fallen a distance of several meters, suffering fatal head and chest injuries. There is no way of knowing precisely when he’d died, according to Brathurst. But there were combine harvesters working further up the valley on the evening of September 7. Because of Kelly’s last message, Binks says, we think he maybe made a beeline straight to those lights thinking it was the Ski Center, and fell in the process. But we’ll never know exactly.”

What was clear was that Kelly was nowhere near where he thought he was. Despite this, the area where he was eventually found had been searched extensively. But Kelly had fallen into a gully, obscuring the line of sight of rescuers on the ground. The muted colors of his clothing, meanwhile, had made him all but impossible to see from the air. “He was wearing a lightish brown top and dark blue trousers,” Binks explains. “To the human eye that’s really hard to pick out. But to the computer, it’s just totally different to the surroundings—and so it stands out like a sore thumb.”

Brathurst himself was one of the volunteers who had searched that area on foot. “We literally walked within probably 20 or 30 meters of him,” he says. And yet they’d not seen a thing.

Even for experienced hikers, the outdoors can be a dangerous place.

Photograph: Tom McNally

If finding Charlie Kelly in the first area they searched involved a good deal of luck, it also showed the powerful potential of MR Maps. The software has proved its usefulness in multiple other searches in the months since, mostly by helping eliminate areas of interest. “Dan likes to boast that we have a 100 percent hit rate,” Parsons says. “Although we’ve only found one person, we’ve never flown over an area where someone was and not found them yet.”

So far, the software has been used mostly in the Lake District. But with Mike Park’s encouragement, Roach, Parsons, and Binks have been assisting other teams across the country too, when requested. When the celebrated British TV doctor [Michael Mosley](#) went missing on the island of Symi in Greece, Park even had conversations with his Greek counterparts about the trio flying out to help. “It actually looked like perfect terrain for this system, because it was rocky, and this can see around all the rocks,” Binks says. In the end, Mosley was found before they could deploy, but it’s easy to see how their software could reduce the agonizing wait for families like Mosley’s—as well as the burden for those with boots on the ground.

In the UK, MR is facing mounting pressure. “The number of callouts has been increasing for years,” says Ian Bunting, operations director for the

umbrella body MR England & Wales, “but we’ve seen a massive leap since [Covid](#).” Hiking and other outdoor activities became hugely popular when team sports were banned, he says, and with foreign travel off limits, the country’s national parks saw a surge in visitor numbers. “On the back of that, you’ve got the rise of social media,” Bunting says, which has helped publicize particular spots.

Cockermouth, Dan Roach and Parsons’ team in the Lake District, attended a record number of callouts last year. In North Wales, the Llanberis MR team, which covers Yr Wyddfa, the area’s highest peak, warned publicly that their team members were risking “burnout” after attending more than 300 incidents in 2023—up from just 100 in 2008. As a volunteer for 30 years with Edale MR in the Peak District, Bunting says the burden can be significant. “There are people in my team who attended over 100 incidents on their own,” he says. “With training, equipment checks, and everything, I was up to 600 hours last year.”

“The bottom line is that people are volunteers,” Bunting acknowledges, “and the beauty about being a volunteer is you can say no. But the other thing about volunteering is generally the kind of people who volunteer *don’t* say no.” Against this backdrop, any tool that helps reduce the time spent searching is a welcome addition to the MR toolkit, he says. Binks and Roach’s program wouldn’t necessarily be needed in the majority of callouts, where the location of the person is known. But its potential to cut the hours spent on resource-sapping “formal searches” (which make up between 10 and 15 percent of annual callouts according to figures shared with WIRED by MR England & Wales) is huge.

Globally, the market for search and rescue drones is worth around \$4 billion, according to Lucintel, a market research firm. But despite their product’s myriad possible uses in mountainous regions around the world, Binks and Roach have zero interest in commercializing it. In the UK, Binks has always made MR Maps free for anyone involved in search and rescue. This includes the police, and several forces have started experimenting with the drone add-on. “It’s going to be used for search, so I’m quite happy with that,” Binks says.

“I’ve never really been interested in monetizing it,” he says. Instead, his motivation is simple. “I just quite enjoy the problem-solving aspects.” And in the end, he points out, the only real development cost was his, Roach’s, and Parsons’ time—which is something they, like thousands of other MR volunteers across the UK, are happy to give to help those in need.

David Binks’ MR Maps software originally let rescue team members track “pings” from their radios.

Photograph: Tom McNally

When two uniformed police officers knocked on Emer Kennedy’s door in late October 2023, they simply said, “You know why we’re here,” she remembers. She’d been hoping against hope that the outcome would be different. But after six weeks, she says, he “main panic was are they going to find him before winter comes in?” And if not, would they ever find him?

People traveled from far and wide for Charlie Kelly’s funeral. Professional associates from across the country. University friends from around the world. The Pogues played as his coffin was carried out, and a collection was taken for charity—with the proceeds going to the Glencoe MR team.

“Even though they do it on a voluntary basis, they’re incredible professionals,” says Kennedy. “If that Mountain Rescue team hadn’t come up with that software and hadn’t been willing to test it out there ...” She leaves the thought hanging. In the end, she says, “I’m just glad we have closure. It means his kids can have a life. And you know, we got to say goodbye—his friends and family got to say goodbye.”

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*Updated 10-8-2024 11:00 am BST: A previous headline on this piece incorrectly stated that the drone software used AI.*

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[Alex Christian](#)  
[Science](#)

Oct 4, 2024 5:00 AM

# The Secret Alchemy of Making Ice Cream

Ice cream is deceptively simple, but that sweet burst of flavor and soft melt on the tongue is a finicky, frozen science of water, fat, and air delicately held together.

Photograph: Tuala Hjarnø

To make the perfect scoop of ice cream, you first need a dairy base—its natural proteins, fat, and sugar provide the rich, distinct mouthfeel. Heavy cream is added, further smoothing the texture. The introduction of sugar isn't just for sweetness: Like scattering salt on snow, it lowers the freezing point, minimizing ice formation. Flavoring can now be brought to the mix, from the quintessential (chocolate chips or vanilla pods) to the more daring (spices, salt, or booze).

This recipe takes you just under halfway to the ideal dollop. Next is the 0.5 percent of emulsifiers and stabilizers added to the liquid, helping the water content and fats stick together. The mix is homogenized, then cooled and aged for 24 hours at 5 degrees Celsius (40 Fahrenheit), for an even richer, smoother taste before it's frozen.

The cooling system inside a continuous freezer, where the ice cream is scraped inside a large cylinder.

Photograph: Tuala Hjarnø

Then comes the secret ingredient. “We sell air,” says Elsebeth Baungaard Andersen, product manager at Swedish multinational food packaging and processing company Tetra Pak. “Half the volume of your favorite tub of ice

cream is air. But it's those air bubbles and whipped texture that provide the special mouthfeel as it melts in your mouth, releasing the delicious flavor."

At Tetra Pak's Product Development Center in Aarhus, Denmark—a lab for the biggest and smallest ice-cream brands to test and taste their latest experiments—air is a precious, invisible commodity. During the freezing stage, in which the mix is cooled to -5 degrees Celsius (23 Fahrenheit) inside a rotating cylinder, the dasher's scraper knives not only scoop out frozen batches of the good stuff, they also whip in air. Stabilized by fat globules and proteins, air bubbles create that soft, familiar, luxurious feel. "We have to be so precise with our dosing," says Baungaard. "Ice cream is a science: Too much air and it's frothy; too little air and it's hard to scoop and eat."

### **The perfect scoop, step-by-step:**

1. Designing an ice cream involves more than just the taste and texture. Product drawings, with precise measurements, fine-tune its final shape.
2. Unless a customer wants a last-minute tweak to ingredients, the mix is typically made a day before they arrive, then processed and shaped in the freezer.
3. Once out of the freezer, the ice cream is like toothpaste in viscosity—so it can still be shaped. It's then hardened for 30 minutes at -45° C (-49° F, creating a stable finished form.

The exact dosage depends on the recipe: The lower the overrun—that is, the percentage by which the air increases the mixture's volume—the more premium the product. An artisanal gelato has a denser texture—its overrun may be just 20 percent. Budget supermarket ice-cream may have an overrun even exceeding 100 percent.

This is just some of the complex chemistry involved in making the world's favorite dessert. Tetra Pak may be more famous for its packaging, but it takes a sizable scoop of the estimated [\\$113 billion ice cream industry](#): Each of its continuous freezers pumps out 4,000 liters every hour, typically for small producers looking to scale. Besides tubs, its production lines churn out 2 million ice-cream sticks every day. Major clients also use its Aarhus

facility to trial new concepts. (“We’re in the Silicon Valley of ice cream,” says Andersen.)

Tetra Pak ice cream engineers have indeed innovated the industry: In the late 1980s, its technology meant ice cream could be extruded on a stick at a cooler temperature, meaning more air bubbles, creating a more premium taste. The product became the Magnum Classic. Today, collaborative robots (or cobots) ensure there’s no generous overfilling of portions on the factory floor—and that each scoop has an equal amount of sauce. Their human colleagues, meanwhile, test new prototypes via 3D printers.

A breakthrough in the ice cream industry, says Sampson Anankanbil, ingredients application specialist at Tetra Pak, has been the development of heat-shock-resistant ice cream, ideal for transporting tubs to distribution centers and beyond, particularly in hot climates. Stabilizing solutions create a cryogel, so when ice crystals melt, it mops up excess water—the ice cream melts more slowly, and the eating quality remains.

Ice-cream molds are filled, then dunked in cold brine to solidify the contents.

Photograph: Tuala Hjarnø

The next frontier is about creating a plant-based scoop that’s as good as its dairy counterpart. Lacking the same natural fat, texture, and richness of flavor, it’s the Holy Grail of ice cream. In the name of sustainability, Andersen and Anankanbil believe that “hybrid” ice cream, combining both proteins into a single product, is the future of the industry. Tetra Pak is exploring fava beans (also known as broad beans) as a potential solution. “We don’t want to compromise on indulgence,” says Anankanbil. “But we see that it has a very good profile, flavor, and clean taste compared to other vegan protein sources.”

While Tetra Pak has slowed the melting process, it has no interest in eliminating it altogether. That scoop of chocolate gelato in a cone—steadily dripping down your arm on your summer vacation—is going nowhere. “Ice cream is surprisingly complex,” says Anankanbil. “It has air, fat, and ice

crystals in a frozen state, then all these ingredients come together in your mouth in an unfrozen state—melting is what releases the flavor.”

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[Delle Chan](#)

[Science](#)

Oct 3, 2024 4:00 AM

# These New Biomaterials Can Help Decarbonize Fashion and Construction

Designers are imagining a future where bacteria powers both clothing and cement—and their ideas are coming to a shop near you.

The silk Exploring Jacket’s rosy hues are from microbial dyes. Photograph: Toby Coulson/Faber Futures

The Exploring Jacket isn’t your regular anorak. Its color comes not from dyes, but from a pigment-producing bacteria called *Streptomyces coelicolor*. When applied directly to a fabric and left to incubate, the bacteria cells produce a compound in a spectrum ranging from reds and pinks to blues and purples—in eye-catching patterns that evoke the grain of polished marble.

This jacket is just one of the unusual products for sale on [Normal Phenomena of Life](#) (NPOL), an online platform launched in 2023 by Natsai Audrey Chieza, the founder of London-based R&D studio Faber Futures, and Christina Agapakis, the creative director of Boston-based biotech company Ginkgo Bioworks. Their goal? To harness the power of living organisms to develop materials and objects. This is biodesign.

“Nature has evolved over billions of years to assemble atoms in much smarter and more efficient ways than human beings have been able to achieve. And so, as we look to decarbonize and divest from fossil fuels, it turns out that nature has solutions that biotechnology is enabling us to leverage,” says Chieza, who has a degree in architecture but became

fascinated by biodesign when pursuing a master's degree in material futures at Central Saint Martins in London.

By tapping into naturally occurring living systems, many of the products in NPOL's catalog have a lower carbon footprint than their everyday counterparts. For instance, the bacterial dye used to create the Exploring Jacket uses significantly less water than conventional plant-based dyes, as no farmland is needed.

NPOL's latest product is the Gathering Lamp, which is made from bioconcrete. Grown at ambient temperatures using limestone-producing bacteria, bioconcrete has 95 percent fewer emissions than traditional cement—which is typically manufactured by burning limestone—and is three times as strong. Plus, the Gathering Lamp is designed to be easily repaired, upgraded, or recycled at the end of its useful life. “We’re looking at keeping materials in circulation. After all, we can’t be investing billions of dollars into building new biobased materials, only for them to end up in landfill,” Chieza explains.

Natsai Audrey Chieza, founder of R&D studio Faber Futures.

Toby Coulson

NPOL also works with like-minded brands to help bring their products to market. “We’re trying to speed up how these technologies are created and deployed,” she says. Many biodesigned materials are difficult to scale as they have to be carefully engineered, which often translates into high price points. The Exploring Jacket retails at £4,000 (around \$5,400), which Chieza says is already priced lower than it should be. “It’s really amazing when something happens in the lab, but the question is, do we have the infrastructure to match the scale-up journey?”

While plenty of thought and consideration underpins each NPOL product, this might not be immediately apparent to the consumer, Chieza says. “On one hand, that’s good because it means we’re meeting their expectations of what a product should be,” she says. “Of course, we want them to notice that our product is beautiful and amazing and different, but purchasing

decisions are sometimes made around what feels familiar and dependable. It's a very interesting balance we have to articulate.”

Nevertheless, Chieza hopes NPOL will inspire consumers—and crucially, brands—to embrace the potential of biodesign and explore how it can pave the way for a more sustainable future. “Ultimately, it’s about leveraging things at their source as opposed to having long supply chains to make redundant products that don’t bring meaning,” she says. “What comes out of this is hopefully beautiful products that people are going to learn from.”

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By [Matt Reynolds](#)  
[Science](#)

Oct 2, 2024 3:00 AM

# Eight Scientists, a Billion Dollars, and the Moonshot Agency Trying to Make Britain Great Again

The Advanced Research and Invention Agency—ARIA—is the UK's answer to Darpa. But can it put the country back on the scientific map? Photography: Charlie Clift

In a cramped conference room in Bristol, Ilan Gur is trying to convince a group of plant biologists that they can change the world. The 44-year-old has the patter you'd expect from a Californian startup founder, but he's also one of the UK's most senior civil servants, so what comes next is unexpected.

Close your eyes, he asks the scientists, and imagine pushing past the very edges of your research. The attendees take a beat, shifting slightly on their uncomfortable chairs. Positive visualization is not quite what they had expected from a workshop introducing them to the Advanced Research and Invention Agency (ARIA), the UK government's new high-risk, high-reward science funding agency.

Gur is ARIA's CEO, and if he senses their hesitation, he is unfazed by it. The whole point of ARIA is to push researchers beyond their comfort zones and towards ideas the typically risk-averse British science funding system would deem improbable or downright weird. Today, it's plants with genomes written from scratch to grow foods, materials, and medicines that don't yet exist. Tomorrow it could be ways to cool down the planet or build more dexterous robot bodies. The plan should be just on the edge of impossible, Gur tells the room. Impactful enough that it's worth a shot, but



so ambitious that half of the scientists leave the workshop convinced it'll never work.

ARIA is designed to put Britain back on the scientific map. By the mid 2010s, the birthplace of Isaac Newton and Alexander Fleming had become, in the views of some insiders, sclerotic and backwards looking. Inside Downing Street, government advisers were looking toward the US and wondering why the UK seemed such a laggard when it came to truly transformational scientific breakthroughs: Crispr gene-editing, mRNA vaccines, most major AI research (with the notable exception of DeepMind), all happening outside the UK.

Inspired by ARPA, the US agency that helped birth what became the internet, GPS, and the era of personal computing, ARIA is an attempt to find a new way of funding breakthrough British science. It's designed to be ambitious and nimble, and to take big risks. Its employees have an extraordinary amount of freedom over how and who it will fund: startups, universities, individuals, anything is on the table. Its senior employees are exempt from the ordinary restrictions on civil service pay. (Gur's salary of between £380,000 and £385,000 (\$510,000) makes him one of the highest-paid civil servants in the country.) Other agencies send out departmental press releases. ARIA fires out [Substack updates](#).

“We are looking for things that are controversial and risky in terms of whether or not they might work,” says Angie Burnett, a plant scientist who joined ARIA in October 2023 to lead the agency's work on synthetic plants. Burnett is one of eight program directors with tens of millions of pounds to spend to fund breakthroughs in their own scientific niche. Her colleagues are searching for new ways to safeguard against dangerous AI, measure climate tipping points, and manipulate the human brain. If any one of these bets comes off—and ARIA staff agree that many will fail—then the benefits should massively outweigh the £800 million (\$1 billion) of public money the agency has been allotted for its first four years.

Burnett joined ARIA from the University of Cambridge, where she studied how crops adapt to stressful environments. “I left an organization that was over 800 years old to join an organization that was months old at the time, and that is a huge difference,” she says. In her application she pitched

insect-size drones that could monitor individual plants—a doctor for every plant, she imagined. That idea was a nonstarter, but she eventually settled on the challenge of developing synthetic plants with genomes written by human hands. Soon she will start funding the scientists trying to create fully synthetic chromosomes—a breakthrough that, if successful, would be a leap beyond the current capabilities of plant scientists.

“I’ve always had this desire for impact,” says Burnett, who is 34 and whose love of greenery extends to her wardrobe—she’s wearing a sleeveless top patterned with plants. She talks with the earnest, unfiltered enthusiasm of someone who is genuinely excited about her work, even if its ultimate destination is still somewhat uncertain. Before Cambridge, Burnett worked for the Food and Agriculture Organization of the United Nations in Rome, where she focused on helping smallholder farmers in Asia and Sub-Saharan Africa. But it is at ARIA that Burnett thinks she could end up having the biggest impact of her career. “I think the potential is enormous,” she says.

That is, if anyone can agree on what synthetic plants are actually for. In Bristol, Burnett has split the scientists into smaller groups to discuss her program. One group is throwing out possible ideas for what one might do with a fully synthetic plant. Bus shelters made from crops? Too gimmicky. Edible air-conditioning systems? Weird, but intriguing. At the head of the circle a civil servant takes notes while the scientists careen from one improbable idea to another. Dolphins with lasers ... but plants?

The seed for ARIA was planted during one of the most chaotic periods in modern British history. In mid-2019, the UK was crashing out of the European Union and Boris Johnson was crashing into 10 Downing Street. On Sunday July 21, Johnson—the former London mayor who was the favorite to win the Conservative leadership election and become the next prime minister—entered a home on a quiet north London street to cut a deal. The UK’s departure from the EU had already brought down two Conservative prime ministers, and Johnson was determined not to be the third. To make sure of that, he needed the help of Dominic Cummings.

Cummings was an acerbic political adviser who had spearheaded the 2016 Vote Leave campaign during the EU referendum. He was also a prolific [blogger](#), publishing long essays that railed against what he saw as a turgid,

mostly incompetent civil service that he now calls the “deep state.” But he was also fascinated by organizations that transformed the world: the Manhattan Project, Xerox PARC, Bell Labs, ARPA and early NASA. Mid-century America seemed to buzz with breakthroughs. But since then—in Cummings’ estimation—science funding had become more cautious, more bogged down in bureaucracy, and less creative, particularly in the UK. (Cummings did not respond to WIRED’s interview requests.) In one 237-page-long screed from 2013 he called for a high-risk/high-reward agency focused on energy projects that “operates outside all normal bureaucratic systems,” In the following years he returned to the topic multiple times. If the UK government only cared about science and progress, this inertia could be reversed, Cummings hoped.

Amid the Brexit chaos he’d helped deliver, Cummings saw an opportunity to make that happen. The crux of the deal that Cummings presented to Johnson was this: He would become the prime minister’s chief adviser and help stop Brexit subsuming Johnson’s premiership, and in return Johnson would double the science budget, avoid a second referendum, overhaul Whitehall, and create a breakthrough funding agency modeled on ARPA. Cummings’ reported WhatsApp status during this time hints at his priorities: “Get Brexit done. Then ARPA.”

Curiosity about a better way of funding science extended well beyond the Cummings blogosphere. “There was quite an appetite for thinking around different ways of funding,” says Patrick Vallance, who was the UK’s chief scientific adviser between April 2018 and 2023, and one of the most visible faces of the government’s pandemic response. Vallance would later become a founding member of the ARIA board, before leaving in July 2024 when he was appointed by the new Labour government to be minister of state for science, research, and innovation (he spoke to WIRED before leaving ARIA). By the time Johnson came into government, Vallance says, a lot of people were starting to think hard about how the new funding agency, which still lacked a name, would work. “UK ARPA was the name they called it, which was driving me nuts,” Vallance says. To him, UK ARPA sounded pathetic—the point wasn’t to replicate ARPA, but to do something new.

One of the key disagreements was about what problem the new agency was supposed to solve. Most government-backed science is funded through UK Research and Innovation (UKRI), which was set up in 2018 to simplify a byzantine funding system of seven research councils and numerous other bodies. But UKRI already oversaw the so-called Catapult projects that were supposed to fund ambitious, transformational research that other agencies might miss. Some thought that the new agency should focus on translating scientific breakthroughs into real-world progress says Vallance, while others thought the focus should be entirely on “blue-sky” research.

On January 2, 2020, Dominic Cummings published a [blog](#) calling for “weirdos and misfits” to come and work with him in 10 Downing Street. “I’ll bin you within weeks if you don’t fit—don’t complain later because I made it clear now,” Cummings warned. One of those who responded to his call was James Phillips, then a neuroscience researcher who had met Cummings four years earlier, after sending a response to Cummings’ blog-screeds on the state of UK science, and again in 2018 at the Janelia Research Campus in Virginia. “I walked into Number 10 and that was my first-ever office job. It was my first job in politics, it was my first job in policy,” Phillips says. He joined in April 2020, just as the UK grappled with the first Covid wave. About a week before Phillips entered Number 10, Boris Johnson had been in intensive care with a near-fatal case of Covid-19.

Phillips avoided being binned by Cummings, but his days were consumed by the government’s response to the coronavirus. “Thinking about ARIA was part of the day when it wasn’t dealing with the horrible situation that we faced,” he says. One of the key questions was whether it would be a so-called “mission-driven” agency, with a clear direction from the government to find breakthroughs in specific areas, like medicine or clean energy. A report by the House of Commons Science, Innovation, and Technology Committee published in February 2021 argued that ARIA’s focus should be determined by the government, not the agency.

Phillips and Cummings balked at this idea. “We felt strongly that the government should not be telling ARIA what to focus on,” Phillips says. Even though ARPA eventually limited its remit to defense projects when it first became Darpa in 1972, the agency still took a broad enough approach

that in 2013 it awarded Moderna up to \$25 million to research and develop mRNA [vaccines](#). The team setting up ARIA feared that a narrowly defined agency would end up missing these tangential projects that turn into unprecedented world changers—exactly the kind of research that they wanted to encourage.

The team at Number 10 also wanted to avoid the mistakes of other countries that had tried their own breakthrough agencies. “All the countries that have tried to replicate an ARPA-like model have kept it on too short a leash, and that kills it,” says Vallance. “The tendency in government very often is to get the leash shorter and shorter and shorter [...] because it’s public money, and people feel a responsibility, and it was new and shiny and everyone wanted to be involved.”

The bill setting up ARIA—The Advanced Research and Invention Agency Act—became law in February 2022. The [document](#) is the closest thing the agency has to a sacred text. It’s at the top of the reading list Gur provides to new board members. When I meet ARIA chief financial officer and COO Antonia Jenkinson, she is carrying an annotated copy of the act. It’s all in there, she says. It’s independent, with future CEOs appointed by a board’s chair, not the government. It’s shielded from a formal government review for at least 10 years, giving it room to pursue projects that might not pay off in the short term. It’s exempt from Freedom of Information laws that require other government agencies to provide public access to information. The point of all of this, Phillips says, is to keep ARIA as small and nonbureaucratic as possible.

It’s a remit that—combined with its sheer newness—makes it difficult to put ARIA in a box. ARIA staff often refer to the agency as a startup, albeit a startup funded by British taxpayers and staffed by civil servants. “We were a startup, we had to get the culture into the organization,” says Jenkinson, who joined ARIA in January 2023. “Every system, process, and person that I hire is all about trying to get the right appetite and the right culture into the organization.”

When WIRED visited in the spring of 2024, ARIA’s nerve center was a single room on the fourth floor of the British Library, in London.

Photography: Charlie Clift

When I visited ARIA in spring, the agency was squeezed into a single room on the fourth floor of the British Library, an imposing red brick building a short walk from London's King's Cross station. Staff perched on the heavy windowsills as they listened to a colleague run through a series of milestones for the fledgling organization. Each one was greeted with scattered applause. New workshops! Clap! New trips planned! Clap! New joiners! Clap!

The team had expanded by a quarter in the previous six months, and it was clear the agency was starting to outgrow its single room, on lease from the nearby Alan Turing Institute. On some desks in the hallways, sticky notes reminded staff that they were not for ARIA employees. Securing a meeting room had become something of a dark art. Although ARIA had officially been formed in January 2023, the eight program directors at the heart of the agency had only joined that fall, and the agency had the feel of an organization still finding its cultural feet.

A lot of ARIA's success—cultural and practical—will come down to the program directors, who largely decide who they will fund as they try to coax their vision of the future into reality. Each one will have around £50 million (\$66 million) they can give to startups, individuals, or university researchers, among others. They can set up prizes, give out small seed grants, or fund much larger projects. Suraj Bramhavar, who joined ARIA after cofounding a cloud computing firm spun out from MIT, is running a program that aims to make AI hardware a thousandth of its current cost. Even pulling off a 10th of that headline number would “change the world,” says Matt Clifford, a British entrepreneur who chairs the ARIA board. “The test for any one program, is if only this program succeeded, if everything else failed and this was the only thing we could point out for the first decade of ARIA's life, would it be worth it?”

Before Jacques Carolan joined ARIA, he was on the road to becoming a professor of physics. “That was my dream,” he says. But at MIT he started to talk to people—often former academics—who ran Darpa programs, and who had a certain lore and aura. When he heard that the UK was setting up its own breakthrough science agency, he knew he had to apply.

Now Carolan is the director of a £69 million program to develop more precise ways for us to interact with the human brain—perhaps smarter brain implants or stem-cell-based systems that could help treat disorders like treatment-resistant depression. One idea is to come up with therapies that are less invasive than the deep brain implants used to treat Parkinson’s disease and epilepsy, but are still precise enough to have a profound impact on the brain. “When you think about the potential impact you can have, there are not many times in your life where you have serious resources to realize a scientific vision of your own making. To realize your most ambitious vision,” Carolan says.

Jenny Read used to study praying mantis vision at Newcastle University—one time fitting tiny 3D glasses to the insects to figure out how their vision differed from our own—and whether understanding insect vision could lead us toward more efficient ways of building robotic vision. “I did that for many years and really enjoyed it, but I think I sort of reached a point in my life where you turn 50, kids grow up and leave home,” she says. Read was wondering what to do with the rest of her career when she decided to apply to ARIA. “I kind of felt a hunger in myself for being part of something bigger.”

Every other week the program directors meet in ARIA’s office. On the day I visit, they kick off a meeting with a little game. They are each given a superpower—invisibility, superhuman strength, time manipulation, and so on—and have to convince the others why their power would reign supreme. One program director is assigned telekinesis, which they imagine using to manipulate football games, winning vast sums of money, and increasing ARIA’s budget. (A little later the program directors are contemplating ways their programs might fail when they break for another quick game—a riff on musical chairs. This is an organization that takes ice-breakers extremely seriously).

A little telekinesis may come in handy. ARIA’s £800 million budget is tiny compared to the £25.1 billion budgeted for UKRI between 2022 and 2025. In 2024 alone, Darpa was allotted around \$4 billion, and yet ARIA’s remit is—in theory at least—much wider than the US agency’s. It is a modest budget for a big mission, which, according to Clifford, isn’t just to fund



breakthroughs but to help elevate the status of science in the UK. “I think we’ve done a very poor job of elevating the status of discovery ... And yet when you look at almost everything we value, it’s downstream of scientific progress. Without scientific progress you don’t get it.”

ARIA CEO Ilan Gur joined the agency after founding a platform that helps scientists become entrepreneurs.

PHOTOGRAPHY: CHARLIE CLIFT

Ilan Gur has spent his career figuring out how to make that progress happen. In 2005, he was partway through his physics PhD in Berkeley when he decided he was more interested in the gritty work of turning breakthroughs into impact than a career as a scientist himself. Gur had been working on a way to use nanocrystals to make very cheap solar panels, and one of his papers had just been featured in the prestigious journal [Science](#). He thought these ultra-cheap nanocrystals might change the world—if people could print solar panels the way they did newspapers, abundant green energy could be just around the corner.

And yet Gur realized that his nanocrystals stood no real chance of having an impact. They might be able to create dirt-cheap solar cells, sure, but the crystals didn’t last long, and the cost of reinstalling them every three to five years would be astronomically more expensive than conventional solar panels. “We could give those solar cells away for free, and they would not compete with the cells that you could buy at the time,” he says. “That’s actually a pretty simple analysis to understand the value of the technology that you’re trying to build, which no one in my lab had ever even talked about.”

It wasn’t enough to tinker away in a lab and hope your work would change the world, Gur was realizing. “If what you care about is not simply a scientific breakthrough but a scientific breakthrough that can catalyze world-changing impact in a tangible way, then there is so much in that journey. The breakthrough is necessary but not sufficient.” He would eventually leave academia and work at ARPA-E, a US Department of Energy organization modeled after Darpa to pursue high-risk, high-reward research in energy technology. Later he set up Activate—an organization



that supports early-stage scientists working on potentially groundbreaking research. And then in August 2022, Gur moved from California to take the role of ARIA CEO.

Gur was a natural fit for ARIA, says Stripe CEO Patrick Collison, who is one of the agency's advisers. Collison had only met Gur a couple of times before becoming an ARIA adviser, but he knew that the CEO was no armchair innovator—Gur was focused on actually getting shit done. It's one thing to engage in abstract philosophizing, it's quite another thing to conjure up a functioning institution and make it work, says Collison.

But it's also part of Gur's job to help build the myth of ARIA—to pull in talented scientists from across the world, and achieve the agency's secondary mission of positioning Britain as a scientific leader again. The nuts-and-bolts of progress can become obscured by the narrative-building that surrounds genuine breakthroughs: J. Robert Oppenheimer and his boys in Los Alamos got the Hollywood treatment, but the lion's share of Manhattan project dollars went to the complex in Oak Ridge that enriched the uranium for that first atomic bomb. The myth of Darpa, in particular, looms large over ARIA. "Darpa has done brilliant things and changed the world in a lot of ways, but it's done that in the past," says Gur, who wears the startup-founder uniform of sneakers, comfortable trousers and, each time we met, an ARIA T-shirt.

There are signs—beyond the branded clothing—that ARIA is generating its own myth. In August, it announced that the deep-learning pioneer Yoshua Bengio would join ARIA's program on safeguarded AI as scientific director, working with program director David "davidad" Dalrymple. In Gur's estimation, it was the prospect of working with Dalrymple that pulled Bengio into ARIA's orbit.

Perhaps the very best myths become their own engines of progress. Clifford has a six-year-old son who very much wants to become a racing car designer one day. What if future children aspired to be the kind of person who nudged a new breakthrough into existence? Not scientists in the white-coat-wearing way of the imagination, but conductors of progress—engineering scientific crescendos that otherwise may have petered out into silence. "I kind of want people to say that they want to be an ARIA

program director the same way that they say they want to be a Premier League footballer,” Clifford says. That, in its own way, would be a profound kind of success.

In the Bristol workshop, the scientists are introducing themselves. It’s an eclectic bunch: One person is an amateur flower designer, another is an architect interested in using plants as building materials. Some work in startups, others for big corporations. In the course of coming up with her program, Burnett says, she has spoken to over 100 people in and around the world of plant science. Today a decent proportion of them are in the same room for the first time—and some of them are sizing up whether they might want to get in on Burnett’s synthetic plants plan. As much as Gur and Burnett are angling for ideas, they’re also pitching the very concept of ARIA itself.

One of the plant scientists in attendance is Jane Langdale, who is perhaps the closest thing the field already has to a moonshot chaser. Langdale leads the C4 Rice Project, one of the most ambitious plant science projects ever undertaken. Crops like maize use a photosynthesis pathway that makes them—especially in hot, dry environments—more efficient than rice. The [C4 Rice Project](#) aims to recreate this C4 photosynthesis pathway in rice, supercharging the growth of one of the world’s most important crops. Since 2008 the project has been funded by the Bill & Melinda Gates Foundation.

“It’s great that ARIA exists, and I think it’s great that there is a plants program in it,” says Langdale. “There’s no doubt about that because for far too long, people like Gates have been driving the moonshot projects, and of course they have a very specific focus on what it is they want to achieve.”

Philanthropic foundations like Gates’ also have a higher tolerance for projects that may not hit paydirt. “We’ve been going quite a long time, and we certainly don’t have anything near a product to put in the field,” Langdale says. Government-backed science funding has historically had much less of an appetite for these kinds of projects, because it’s hard to justify spending taxpayer money on projects that might take 30 years to come to fruition.

Even compared to the C4 Rice Project, Burnett's synthetic plants program is a very significant chunk of money, Langdale says. Burnett is aiming to spend £62.4 million (\$82 million) over five years. The program will fund scientists to try to make synthetic chromosomes, the genetic building blocks of plants, and synthetic chloroplasts, which have their own separate genomes. But the program doesn't specify what new features these partly synthetic plants should have. It's a little like designing a new machine without knowing what tools that machine is going to build, says Langdale.

Johnathan Napier, a science director at agricultural institute Rothamsted Research shares these concerns. Building synthetic chromosomes and chloroplasts are clearly defined goals, but he's not sure whether they're going to deliver a tangible benefit. Napier tries to engineer crops to produce omega-3 fish oils, while the C4 Rice Project is attempting to make rice much more productive. But Burnett's program is much wider than either of these. In theory at least, it could one day allow plant scientists to plug in any kind of functionality into a plant.

"If this all worked, you'd be able to design your complex pathway in the computer, build an entire chromosome [...] and just plug that into the plant in a single step," says Saul Purton, another workshop attendee and a professor at University College London who works on synthetic chloroplasts in algae. Purton says that he may apply for an ARIA grant, but that the five-year timeline set out to deliver synthetic chloroplasts in several crop species is extremely tight. "We've been bashing away in terms of developing new synthetic biology tools for engineering the chloroplast of a simple model system for 15 or 20 years now, and we're still learning, we're still making mistakes."

Angie Burnett is funding research into synthetic chromosomes and chloroplasts, and the ethics of synthetic plants.

PHOTOGRAPHY: CHARLIE CLIFT

When I meet Burnett again in early August, she has just had her program approved after a grueling three-hour meeting with Gur, members of ARIA's executive team, and a panel of external experts. "It was a little nerve-racking because it's such a big moment that I've been working towards

for this whole time,” she says. As well as funding projects working to build synthetic chromosomes and chloroplasts, Burnett is also asking for research into the ethics of synthetic plants—anticipating a world where farmers, lawmakers, and the public may have to grapple with the idea of crops fully crafted by human hands. But it’s unlikely she’ll still be with the agency to see those scientific seeds bear fruit. Program directors are typically hired for three-year terms, and the agency is [already hiring](#) its next batch of directors, some of whom will launch entirely new project areas.

Over such short timescales, it can be difficult to gauge the success of such long-term plays: Are mistakes just bumps in the road, or signs that you’ve taken the wrong route altogether? Collison is wary about defining success at all. Give it 15 years, he says, and it should be pretty obvious if ARIA is a good thing or not. The agency has a little breathing room. It cannot be dissolved for at least 10 years, by which point the UK will have had at least one more general election. The new Labour government has indicated its support for ARIA, not least by making Vallance the minister responsible for ARIA. “It is essential to harness the power of science to deliver economic growth, opportunity, and scientific advancements for people across the UK,” said a government spokesperson.

But discerning the arc of progress takes time. In 1958 ARPA might have looked like a desperate attempt to wrest back technological supremacy from the Soviets. That was true in a way, but its ultimate impact reached far, far, beyond that. Is ARIA an attempt by a legacy-obsessed prime minister to reinstate the UK’s relevance in a post-Brexit world? Well, yes, but that may become just the preamble to the agency’s real story.

In 1994, Gordon Moore published an [essay](#) that he called “The Accidental Entrepreneur.” In it, he describes how he seemed destined for a midlevel managerial role until a company psychologist at the chemical giant Dow told him he would never manage anything. Instead, he ended up cofounding Fairchild Semiconductor and then Intel, whose silicon chips underpin the exponential growth in computing power that’s driven much of our technological development over the last half century. In the fullness of time, Moore’s rise seemed as inevitable as the law he lent his name to, but to him that was never the case.

Every breakthrough eventually boils down to brilliant people working on fiendishly tricky problems. For Gur, ARIA is about building a system to lift up people like Moore, rather than leaving them to drown in academic bureaucracy or fizzle out in the startup sector. There was something innate in Moore that allowed him to be who he was, Gur argues, but he needed that accidental moment to make him great. “So what do I hope ARIA can be? It can be this sort of catalyst intervention which takes someone who’s got the latent mindset and spirit to change the world—and it’s the accidental piece of their story. Maybe it’s not so accidental anymore.”

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Sep 30, 2024 4:00 AM

# How a 15-Year-Old Gamer Became the Patron Saint of the Internet

In 2025, Carlo Acutis will officially become the first millennial saint. But will he help the Catholic Church reach a younger audience?

Illustration: Phil Galloway

Like a lot of us, Carlo Acutis spent an ungodly amount of his life staring at screens. Born in London in 1991, he grew up an only child in a newly connected world. He wore sweatshirts and Nike trainers. He played *Halo* and taught himself to code. But that's where the similarities end—because next year, Acutis will officially be named a saint.

As well as the internet, Acutis revered another institution: the Catholic Church. From a young age, he was acutely interested in Eucharistic miracles—extraordinary events which, according to Catholics, see consecrated bread or wine suddenly become the actual body or blood of Christ. “To always be united to Jesus: This is my life plan,” he told his mother after his First Communion.

In 2004, Acutis started to research Eucharistic miracles from around the world, developing a website to document them. His aim was to connect with other young Catholics. “He was personally convinced that the scientific evidence would help people ... come back to Mass,” says Courtney Mares, author of *Blessed Carlo Acutis: A Saint in Sneakers* and Rome correspondent for the Catholic News Agency.

The [online archive](#) was unveiled in October 2006, a simple build with cursive text and religious imagery. But just a few days after it launched, Acutis fell ill. He was diagnosed with leukemia, with little chance of

recovery. “Death has become the passage towards life,” he told his mother, before falling into a coma, suffering a brain hemorrhage, and passing away. He was just 15.

His spirit lived on. The website he’d built helped introduce Eucharistic miracles to a mass audience across the globe and was translated into 17 languages. A physical exhibition linked to Acutis’ work has toured internationally, being shown in thousands of parishes worldwide. It’s still touring now.

Acutis is revered not just for his use of technology, but also his dedication to living virtuously. “I think that prayer was truly the great secret of his saintly life,” Mares says. But the website was key to creating a halo effect, heightening his reputation as a blessed figure.

In 2012, the Archdiocese of Milan—where Acutis’ family had moved when he was a child—started a cause for canonization, paving the way for sainthood. Unbeknown to most secular folk, saints are still made regularly; Pope Francis has recognized a record 912 since 2013. But becoming one, as the cliché goes, requires patience. The original petitioner appoints a postulator to collect evidence of the candidate’s sacred work (the “devil’s advocate” used to be a real antithesis to this occupation, arguing against sainthood).

“The process of identifying someone as a saint is long and careful and quite bureaucratic,” says Tim Hutchings, associate professor of religious ethics at the University of Nottingham. “It starts when some Catholics decide that they really think someone *should* be a saint. They start a campaign to prove to their local bishop that this person lived an incredibly holy life, or died for their faith.”

After being named a “Servant of God” in 2013, Acutis reached the second rung on the ladder to sainthood when he was venerated by Pope Francis in 2018. His body was exhumed and brought to a tomb in Assisi where he still lies today, dressed in his trademark ’90s teenager garb. “It’s a beautiful thing that for the first time in history you can see a saint dressed in jeans, sneakers, and a sweatshirt. That’s a great message,” Father Carlos Acácio

Gonçalves Ferreira, the shrine's rector, said at the time. A Franciscan monk based at the tomb, noted that "many young people" were visiting.

Next, Acutis and his followers needed a literal miracle—one he had performed himself. "It has to be something which can't be scientifically explained, so proving this is difficult. For example, this might require doctors to confirm that they can't explain how a healing has occurred," Hutchings says. In 2013 a woman in Brazil [claimed](#) that praying to Acutis had helped heal her son's pancreatic defect. In 2020 Pope Francis authenticated the miracle and Acutis was beatified, culminating in a ceremony celebrating his virtuous life. "According to Google Trends, more people were searching for information about Carlo Acutis than about the Pope," Mares notes.

Then, in May 2024, a [second miracle](#) was recognized, involving the healing of a 21-year-old girl from Costa Rica injured in a bike accident. In 2022, her mother had knelt at Acutis' grave and prayed for his help. Her daughter then miraculously resumed breathing without support and made a full recovery. The Pope approved Acutis' canonization in [July](#)—with an official ceremony set for 2025.

It's rare for a saint to be so young and unheard of, and still reach this lofty status so soon after their death. "It is remarkable that Carlo Acutis will be canonized so close to the date that he was born. For context, of the 912 saints canonized by Pope Francis, the next most recent birth date was in 1926," Mares says. It makes him the first ever millennial saint and, as some Catholics have put it, "God's influencer" and the "patron saint of the internet."

Meanwhile, the cult of Carlos Acutis is continuing to spread across the world. Relics, including a piece of the sheet that shrouded his corpse, a fragment of one of his sweatshirts, and his actual heart, have toured internationally, recently coming to the UK for the New Dawn Catholic Pilgrimage. Online, you can buy Carlo Acutis figurines, rosary beads, posters, and commemorative keychains. In North Lanarkshire, Scotland, a life-size statue of Acutis has been erected at Carfin Grotto, and there's a stained-glass window in Wiltshire to attract young churchgoers.



There's even a comic book telling his story, and a VR experience offering players a chance to step into Acutis' sneakers. And, for Catholics who are unable to pay their respects in person, his tomb can be visited (and donated to) virtually through an [always-on livestream](#).

The Church doesn't pick saints—campaigns start with the Catholic community—but Acutis' popularity meshes with its desire for a young role model. It also highlights the Church's embrace of tech. "The Pope has been making an annual lecture about communications technology for 58 years," says Hutchings. "It absolutely makes sense for Catholics to look for a saint of the internet who represents the godly and faithful use of technology."

There is, of course, still a stigma surrounding the internet's potential for blasphemous behavior. "The Pope has warned that today's digital age constantly tempts young people to 'self-absorption, isolation, and empty pleasure,'" Mares says. And some devout Catholics are still struggling with temptation. "With technology changing at such a rapid pace today, many Christians are still grappling with how best to live out their faith in the world of laptops, cell phones, and social media," Mares says.

But the Pope also called the internet a "gift from God" in 2014, and he recognizes its potential for spreading the word of Christ—it just depends on how it is applied. And in the case of Acutis, tech was used in a pious way. "Acutis used the new technology in exactly the way that the Church wants to see it used: to promote commitment to Catholic teaching, virtuous living, and devotion to the rituals of the local church," Hutchings explains. The Church will hope that the relatable "saint in sneakers" who watched cartoons and surfed the web will resonate with a community looking for an idol.

*This article first appeared in the November/December 2024 edition of WIRED UK magazine.*

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[Charlie Metcalfe](#)  
[Security](#)

Aug 23, 2024 5:00 AM

# When War Came to Their Country, They Built a Map

The Telegram channel and website Deep State uses public data and insider intelligence to power its live tracker of Ukraine's ever-shifting front line.

PHOTOGRAPHY: Sasha Maslov

Roman Pohorilyi was 22 when he started tracking Russian troop movements near Ukraine's border. It was the fall of 2021, and he and a childhood friend, Ruslan Mykula, had been sharing news about foreign affairs to an audience of about 200 subscribers on a Telegram channel. It was just a hobby for them. Neither imagined that a year later their country would be in a state of absolute war with Russia, and that their hobby, which they called Deep State, would be tracking every aspect of it.

Although Deep State started as a news channel, it has become most famous for [its open access map](#) that charts the shifting front line of Russia's invasion, and which has become a crucial tool for Ukrainians to keep track of the conflict that once threatened to overrun their country. On some days in late 2022, Deep State's map received as many as 3 million views. Mykula showed WIRED a screenshot from the website's dashboard that recorded more than 482 million views between June 2023 and June 2024.

Mykula and Pohorilyi created the map on the first day of the war, after recognizing a demand from their Telegram subscribers for frequent updates about what was happening. Pohorilyi was in the penultimate year of a law degree, and Mykula was working in marketing. But both had been learning open source intelligence skills to help verify videos of military activity that actors on all sides were publishing online.

The basic map itself, which a friend helped to design, is simple but precise. Territories occupied by Russia are shaded in red; those held by Ukraine are shaded in green. Blue marks areas that Ukraine has recently liberated. Known Russian units, airfields, and HQs are marked with small red squares; troop movements with arrows; and railways with black and white lines (Ukrainian positions are not shown). Zooming in, one can see detail down to the level of individual streets, villages, and tree lines. It looks like the board of a computer strategy game.

Over time, Deep State has added more advanced features and quirks to the map. A toolbar in the bottom-left corner offers the option to enable different layers, including weather patterns, fortifications, and gamma radiation levels in case of nuclear disaster. Users can simulate the effect of different weapons, calculating the range and potential damage of everything from self-propelled howitzers and ballistic missiles to Patriot air defense systems and nuclear explosions. A hidden Easter egg summons an animation of Baby Yoda that, when poked, uses the Force to destroy Russian units.

The map soon became too much for Mykula and Pohorilyi to manage alone; they now enlist the help of more than 100 paid employees and volunteers. Their methods have also evolved. They still use open source intelligence to verify new information, but also acquire data directly from frontline military units whom they've developed relationships with. In some cases, the authority of a single source whom they've learned to trust is enough, though Mykula admits there have been occasional errors. In other cases, when multiple sources contradict one another, they wait until definitive evidence emerges. Propaganda is rife on both sides, and Mykula insists that Deep State will take no part in it. "We want to win," he says. "Propaganda will not win."

Mykula and Pohorilyi do, however, oblige when Ukrainian military commanders request delays to map updates that may compromise their activities. They also receive some government funding for an alternate version of the map available only to verified members of the military. The government funding also goes toward other intelligence activities that Ruslan refuses to discuss; most of their funding comes from public donations.

Late in the first year of the war, Mykula and Pohorilyi learned that their map was helping another, unexpected group of users: Russian soldiers. The map's designer had added a function that would display instructions to surrender if a user tried to access from a Russian IP address. Then, in October 2022, in [an interview with a popular Ukrainian blogger](#), a Russian POW testified that he had used Deep State's map for this exact purpose.

The success of Deep State's map has attracted more users to their original Telegram channel, which now has more than 700,000 subscribers. It publishes its own original reports of the war, all available through a free app, which other established Ukrainian media organizations sometimes refer to. But the map remains the most popular product, used by Ukrainians at home and abroad to track the front line that, at the time of writing, creeps further toward their office in Kyiv every day.

Both Mykula and Pohorilyi approach their work with a stern dedication that belies their youth and inexperience. "We don't want to disappoint our audience because our projects have become critical for Ukrainians," Mykula says. "If you compare us to other maps, you will see that Ukrainians don't go to check on them. They come to us."

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[Isabel Fraser](#)

[Science](#)

Aug 15, 2024 6:00 AM

# This Is the Most Detailed Map of Brain Connections Ever Made

In a world first, Harvard biologists worked with Google to diagram a cubic millimeter of human cerebral cortex at the subcellular level, paving the way for the next generation of brain science.

Image: Google Research & Lichtman Lab (Harvard University). Rendered by Daniel Berger (Harvard University)

This image could be hung in a gallery, but it started life as a tiny chunk of a woman's brain. In 2014, a woman undergoing surgery for epilepsy had a tiny chunk of her cerebral cortex removed. This cubic millimeter of tissue has allowed Harvard and Google researchers to produce the most detailed wiring diagram of the human brain that the world has ever seen.

Biologists and machine-learning experts spent 10 years building an [interactive map](#) of the brain tissue, which contains approximately 57,000 cells and 150 million synapses. It shows cells that wrap around themselves, pairs of cells that seem mirrored, and egg-shaped "objects" that, according to the research, defy categorization. This mind-blowingly complex diagram is expected to help drive forward scientific research, from understanding human neural circuits to potential treatments for disorders.

"If we map things at a very high resolution, see all the connections between different neurons, and analyze that at a large scale, we may be able to identify rules of wiring," says Daniel Berger, one of the project's lead researchers and a specialist in connectomics, which is the science of how individual neurons link to form functional networks. "From this, we may be able to make models that mechanistically explain how thinking works or memory is stored."

Jeff Lichtman, a professor in molecular and cellular biology at Harvard, explains that researchers in his lab, led by Alex Shapson-Coe, created the brain map by taking subcellular pictures of the tissue using electron microscopy. The tissue from the 45-year-old woman's brain was stained with heavy metals, which bind to lipid membranes in cells. This was done so that cells would be visible when viewed through an electron microscope, as heavy metals reflect electrons.

The tissue was then embedded in resin so that it could be cut into really thin slices, just 34 nanometers thick (in comparison, the thickness of a typical piece of paper is around 100,000 nanometers). This was done to make the mapping easier, says Berger—to transform a 3D problem into a 2D problem. After this, the team took electron microscope images of each 2D slice, which amounted to a mammoth 1.4 petabytes of data.

Once the Harvard researchers had these images, they did what many of us do when faced with a problem: They turned to Google. A team at the tech giant led by Viren Jain aligned the 2D images using machine-learning algorithms to produce 3D reconstructions with automatic segmentation, which is where components within an image—for example, different cell types—are automatically differentiated and categorized. Some of the segmentation required what Lichtman called “ground-truth data,” which involved Berger (who worked closely with Google's team) manually redrawing some of the tissue by hand to further inform the algorithms.

Digital technology, Berger explains, enabled him to see all the cells in this tissue sample and color them differently depending on their size. Traditional methods of imaging neurons, such as coloring samples with a chemical known as the Golgi stain, which has been used for over a century, leave some elements of nervous tissue hidden.

In the example above, Berger made the smallest cells blue and the biggest cells red, with all other cells between falling on a color spectrum. This helped researchers to identify the brain's six cortical layers and white matter.

While researchers have been able to identify structures from the data, one ongoing difficulty of the project is proofreading the automatic

segmentation. This involves individuals manually sifting through every part of the 3D map to check for segmentation errors. “This is a huge challenge for human beings, because now we’re generating datasets that are larger than a single human can experience,” says Lichtman.

In parts of the data that have been proofread, Berger says that particular cells seem “really interested in contacting.” The researchers have found examples of over 50 synapses to one singular neuron, which, according to Berger, is a phenomenon previously overlooked that could be integral to cortical processing.

On top of identifying structures and connections, researchers have identified abnormal cells. Berger said he came across an unidentifiable egg-shaped “object” (much smaller than a cell body but part of a cell) when attempting to systematically categorize each cell in the dataset. Other ambiguous cells include those seemingly mirrored in shape and “tangled” cells that wrap around themselves; until further research is done, these cells remain mysteries. However, they may not remain so for long.

The brain map has been made open access, which means that these images have opened up boundless possibilities for progress in neuroscience, particularly as this is the first publicly available wiring diagram of the human brain at subcellular level. Both Berger and Lichtman emphasized that they did not go into the project with concrete aims of discovery but rather wanted to create the “possibility to observe,” and from this, they hope (and expect) that “further insights will come” from both the Lichtman lab and external researchers.

Berger anticipates that advancements could be made in understanding and treating mental conditions such as schizophrenia. Potential future discoveries could also expand beyond the mind, as Berger thinks the functions of the biological brain may be used to improve deep-learning AI systems and their structures.

In terms of future projects, the Harvard Lichtman lab plans to continue its collaboration with Google to “factor this rendering up another scale of a thousand” by studying a whole mouse brain. The research lab is also working on more human brain samples, to expand research into other

regions of the brain. This will enhance the already invaluable resource and its ability to inform and expand future discoveries.

*This article appears in the September/October 2024 issue of WIRED UK magazine.*

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[Amit Katwala](#)  
[Science](#)

Aug 15, 2024 5:00 AM

# This Code Breaker Is Using AI to Decode the Heart's Secret Rhythms

Inspired by his expertise in breaking ancient codes, Roeland Decorte built a smartphone app that continuously listens for signs of disease hidden in our pulse.

PHOTOGRAPH: christopher l. proctor

Roeland Decorte grew up in a nursing home in Belgium, where he learned to spot the subtle early signs of mental decline in small changes to how residents walked or talked. When Decorte was 11, his father, who owned and managed the care home, started waking up in the middle of the night with chest pains and an overwhelming sense of impending doom.

He went to two doctors, who briefly listened to his heartbeat through their stethoscopes and diagnosed him with anxiety. But the symptoms persisted, and it was only when he underwent a full set of scans at a private hospital that a third doctor uncovered the source of the problem—a tiny hole between the left and right chambers of his heart. If left unnoticed, it would have killed him—he was 39.

Disaster averted, the young Decorte was able to focus on his studies, and by age 17 he was an undergraduate at the University of Cambridge—the youngest Belgian ever to attend the prestigious college. (This caused some logistical issues: His tutor had to become his legal guardian, and a new payment system had to be put in place at the college bar to prevent him from buying alcohol like his peers.)

He spent the next seven years specializing in ancient codebreaking, and a comfy career in academia (or a more exciting one as an Indiana Jones-style

relic hunter) beckoned. But Decorte never stopped thinking about what had happened to his dad and how he could have been diagnosed much sooner if a doctor, any doctor, had spent more than 30 seconds listening to his heart. So in 2019, lacking medical training but armed with the confidence that only an Oxbridge education can provide, the then 27-year-old Decorte founded a company and turned his attention to cracking a different ancient code: the secret rhythm of the heart.

There's an [AI](#) boom in [health care](#), and the only thing slowing it down is a lack of data. Meanwhile, time-pressured doctors can collect information only sporadically. Wearables such as [smartwatches](#) might be able to measure pulse, but they're bad at more specific diagnoses (partly because the wrist is about as far away from the really vital organs as you can get).

Decorte wanted to develop a piece of technology that could monitor the body continuously and precisely, so that people like his father could get the treatment they need more quickly. He began by trying to build sensors into clothes so people could track their vitals without a doctor's visit. Then he designed an elaborate exoskeleton packed with sensors to measure all kinds of ailments. This attracted some military interest but wouldn't really have helped someone like Decorte's father. "I was very naive," he said when we met recently in the wood-paneled basement of a twee café in Mayfair, London. "There was about two years full-time where I was just working out of the spare room in my house doing nothing else." But the problem he kept running into was noise: Unless you could build a contraption that pressed each sensor right against the skin, there was too much random interference from people moving around in the world to get a good sense of what was actually happening in the body.

But perhaps, Decorte thought, noise could also be the solution. During the pandemic, he met PhD student Erika Bondareva, who had published work on diagnosing [Covid](#) by analyzing audio data collected by people coughing into an app. Her software checked for patterns common to people with the disease, then looked for those same patterns to try to detect it earlier in others. Together, Bondareva and Decorte worked on expanding that idea to other ailments—starting with heart conditions. Eventually, Decorte said, he found himself replacing every sensor on the exoskeleton he'd designed with

an audio sensor. Finally, he realized that the only hardware he needed was a microphone.

Today, his company, Decorte Future Industries, is at the vanguard of an audio-powered revolution in health care. Sophisticated algorithms strip out background noise and focus on interpreting the body's faint signals. There are smart stethoscopes and apps beginning to hit the market that claim to [diagnose Alzheimer's based on speech patterns](#), but Decorte wants to go further: He believes the technology he's developing will be able to diagnose heart problems, stomach cancer, and even blood sugar levels, as well as conditions related to speech and gait. Instead of the mishmash of numerous apps and hardware solutions aimed at different conditions, he sees a single solution: The microphone in your smartphone would always be listening, and once every few weeks you'd get an alert to press it against various parts of your body for more detailed readings.

Decorte has raised millions in funding and is growing a small team in Cambridge. He's running clinical trials in India—one local doctor thought he was being scammed until Decorte's colleague played back the recording and the doctor could hear his own voice on the tape from minutes earlier. Decorte's technology matches up to ECG readings with 99.6 percent accuracy—but with just a microphone, patients can take the readings at home.

It's been a steep learning curve, but one that draws on his experience of ancient codebreaking as much as the new skills of networking and artificial intelligence. "It's all pattern recognition," he says.

*This article appears in the September/October 2024 issue of WIRED UK magazine.*

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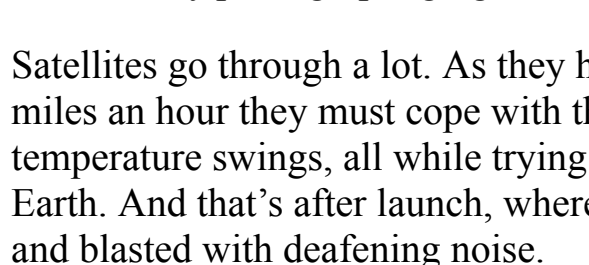
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By [Jonathan O’Callaghan](#)  
[Science](#)

Aug 14, 2024 7:30 AM

# This Gargantuan Lab Simulates Blasting Satellites Into Space

If you spend millions of dollars developing a satellite, you need to know it can handle the rigors of hurtling around the Earth at 17,000 mph. The UK's National Satellite Test Facility is here to help.

Inside the vacuum chamber at the UK’s National Satellite Test Facility.  photograph: greg white

Satellites go through a lot. As they hurtle around our planet at up to 17,000 miles an hour they must cope with the extreme vacuum of space and vast temperature swings, all while trying to precisely train their antennas back to Earth. And that’s after launch, where they’ll be shaken like a can of paint and blasted with deafening noise.

To get them ready for this ordeal, all [satellites](#) are painstakingly tested before dispatch, ensuring every loose bolt is tightened and all the electrics are in exquisite working order. That used to require trips to multiple locations for different tests, but in the UK, the newly opened National Satellite Test Facility in Oxfordshire offers a full satellite health check under one roof.

“The industry said they needed a one-stop-shop where they can do all of their testing for their large complex satellites in one place,” says Sarah Beardsley, the director of the UK government-funded Rutherford Appleton Laboratory Space, which runs the new facility based at the Harwell Science and Innovation Campus. “This is the result of years of hard work.”

Construction began in late 2018, after the UK government announced it would invest £99 million (\$126 million) in the NSTF to develop “a world-

class facility” for testing satellites. Originally set to begin operations in 2020, the project was hit by delays, including [Covid](#), that saw its grand opening pushed back to May 2024. Multiple satellites will be put through their paces every year, with Airbus set to be the first customer to use the facility for its new Skynet 6A communications satellite in July.

There are four testing areas inside the NSTF. The first you come to when you walk in—after donning protective garments to keep the facility as clean as possible—is the huge vacuum test chamber around which the whole building had to be constructed. “There’s no door big enough to fit it through,” says Beardsley. Inside this chamber, pumps can lower the pressure to just 0.00001 millibars, mimicking the vacuum of space, while a nitrogen coolant system can raise and lower the temperature between -180 and 130 degrees Celsius, the extreme range a satellite might experience as it moves in and out of sunlight during orbit.

This calibration model represents a typical size and shape for satellites tested at the NSTF.

photograph: greg white

At seven meters wide and 12 meters deep, this is the largest vacuum test chamber in the UK. It is so large that the immense door needed to close the chamber, constructed in Turkey and Italy before arriving in Britain by boat just days before lockdown in 2020, was at the size limit of what would fit on a UK motorway. Gates at Portsmouth dock had to be widened to get the door off the ship. “We had the largest peacetime convoy going up the A34 to arrive here,” says Beardsley. Satellites will spend weeks or even months inside the test chamber to ensure they can cope with the conditions of outer space: When WIRED visited, a mock satellite called The Iron Chicken—a deep cut to the character who lives in a metal nest orbiting the moon in the cult-classic British children’s animation [The Clangers](#)—took pride of place at the chamber’s entrance.

Antennas are tested in a room lined with 40,000 insulating foam spikes.

photograph: greg white

After the vacuum-chamber test, satellites will then head to the vibration- and acoustic-testing room. Here, it will be shaken violently—horizontally and vertically—on two pads powered by a pair of electromagnetic engines (nicknamed Wallace and Gromit after the beloved stop-motion characters) that simulate the extreme conditions of a launch. The shaking will expose the satellite to 222 kilonewtons of force, equivalent to four times the bite of a T. Rex. If anything is even slightly loose on a satellite, these machines will find out.

During acoustic testing, a giant wall of 48 speakers will blast satellites with up to 146 decibels of white noise. For a human, this would be like standing in the jet engine of a plane. “You would have severe hearing damage,” says Ian Horsfall, dynamics group leader at RAL Space. This test is designed to mimic both the noise of the rocket engines on liftoff and the excruciating volume at the top of the rocket—where satellites are stored on their way into orbit.

In the antenna-testing room, 40,000 foam spikes on the wall absorb all noise and electromagnetic waves from satellites, while the room acts as a Faraday cage to block incoming electromagnetic radiation. A satellite’s antenna can then be focused onto a receiver in the room, to check that its beam can be directed from orbit back down to Earth, despite being hundreds or thousands of kilometers distant and traveling at immense speeds.

The door to the vacuum chamber was built in Italy and Turkey, then brought by boat to the UK.

photograph: greg white

The radio beams used here are so powerful that the room must be almost entirely purged of oxygen to stop the foam spikes from catching on fire, says Michael Shepherd, project manager of the NSTF. Part of the wall is cooled to prevent this possibility, alongside the oxygen reduction. “We can drop the oxygen level down to 14 percent, so they won’t actually burn,” says Shepherd. “It’s like being at 10,000 feet.”

The final test is the dynamics testing suite, a platform that precisely measures the center of mass of a satellite with incredible precision. The goal is to ensure that, when the satellite is on top of a rocket, it won't cause the rocket to suddenly skew off course if the satellite becomes unbalanced. "The other part of that is, once it's separated and in orbit, you need to understand its properties so it doesn't start tumbling," says Shepherd.

Parts for testing are strapped to the platform of the vibration engine.

photograph: greg white

All told, running through a full suite of tests at the NSTF could take upwards of nine months, depending on how stringent a customer wants to be. At first, RAL Space envisages two satellites a year being put through the gauntlet of challenges, but it may eventually expand the facility to create additional clean rooms that can store more satellites between tests, increasing the conveyor belt of machines running through.

It is not just communications satellites that will be tested at the NSTF. After Airbus, the French firm Thales Alenia Space will test its Fluorescence Explorer climate satellite. That will be followed by the European Space Agency's Ariel mission, a telescope designed to study the atmospheres of planets around other stars, set to launch in 2029. "It's brilliant," says Beardsley. "Our first three contracts are looking at communications, Earth, and the farthest reaches of the universe. This facility doesn't care what the satellite is going to do."

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[Vladan Shir](#) [Michal Kučera](#)  
[Science](#)

Aug 5, 2024 7:00 AM

# Jane Goodall Thinks It's Not Too Late to Save the World

The world, the famed primatologist says, isn't what it used to be—but there's still time to save it, if we treat crises like climate change, biodiversity loss, and poverty as one.

Photograph: Jakub Straka

Jane Goodall understands better than most the impact humans have had on the planet. The world, the primatologist says, isn't what it used to be. Having witnessed so much environmental deterioration during her lifetime, today Goodall is as much an activist as a scientist. She warns tirelessly of accelerating environmental devastation, vanishing biodiversity, and rapidly intensifying climate change. “When I began, there weren't such problems,” she says.

At 26, Goodall ventured into the Tanzanian rainforests—where the now-famous Gombe National Park was established a few years later—to study chimpanzees. Her years of meticulous observation deepened our understanding of these animals and their similarities to us. Among her most significant discoveries was that chimpanzees can make and use simple tools, a trait previously thought unique to humans. Goodall also revealed the primates' rich social networks.

Gombe, situated on the shores of Lake Tanganyika, was not large even then—at 35 square kilometers, it is one of Tanzania's smallest parks. However, it was surrounded by dense forest, home to countless wildlife species. Over the decades, deforestation has reduced the forest, and local wildlife has fallen prey to poachers.



“Gombe has become an isolated forest with bare hills all around,” says Goodall. Chimpanzee living conditions have deteriorated not only there but across Africa. There were about a million chimps in the early 20th century; today’s estimates range from 170,000 to 300,000. Countless other animals and regions face similar threats.

The planet’s biodiversity has also rapidly deteriorated over the past few decades, and according to the UN, up to a million species are at risk of extinction, mainly due to their wild habitats being changed to farmland. On top of this, human-induced climate change reduces the living space for many species. The window of time available to halt this trend and to protect ecosystems that both animals and humans rely on is running out, Goodall argues. “I don’t know how big a window it is. The important thing is we’ve got to get together and take action now.”

Addressing both biodiversity loss in specific regions and global climate change is imperative, Goodall stresses. Everything is connected, she says. “You have to do them together—biodiversity loss and climate change.” Focusing solely on climate change could still lead to the loss of species like chimpanzees, she says. “The one advantage of the number of people on the planet, which is too many, is that there are enough people to tackle every single problem. Every one of us makes an impact on the planet every single day. And unless we’re very poor or very young, we can choose what sort of impact we make. Like what do we buy? How was it made? Did it harm the environment? Was it cruel to animals? Is it cheap because of unfair wages?”

The scientist-activist doesn’t merely traverse the globe advocating for conservation. Through her organizations, such as the Jane Goodall Institute, she provides tangible support and guidance, particularly in her adopted home of Gombe, which she still visits twice a year.

While immersed in fieldwork earlier in life, Goodall recognized that lifting people out of poverty was integral to preserving biodiversity in the national park. Hence, she initiated the Tacare program, which offers microloans to kick-start sustainable businesses, scholarships for girls previously deprived of secondary education, and family-planning counseling. Additionally, farmers receive advice on chemical-free, sustainable farming practices, such as permaculture.

“I realized the reason the trees were cut down was because people were struggling to survive,” reflects the scientist. “Their families were growing, and they couldn’t afford to buy food from elsewhere. Their own farmland was infertile with overuse. And so they were cutting down the trees, either to make land, to grow food, or to make money from charcoal or timber.”

It’s only when individuals secure their own livelihoods that they’re inclined to confront the repercussions of their actions and address their environmental impact. This shift in behavior is evident in villages surrounding the national park, where new technologies aid locals. With a simple mobile phone app, villagers can report illegal tree felling by capturing images of fallen trunks. This initiative, initially launched in 12 Gombe villages, now operates in 104 villages across Tanzania and six other African nations.

By stopping deforestation, chimpanzees are no longer forced to live in a confined territory cut off from the outside world. They have created corridors through which they can move freely and interact with other groups, promoting genetic exchange. Today, Gombe’s chimpanzees are connected to their counterparts in neighboring Burundi and are more likely to survive.

A bit further north, in Uganda, Goodall tells us, there is a farmer involved in the Jane Goodall program. His primary livelihood comes from growing sugarcane. However, his farming activities have attracted the attention of chimpanzees, whose habitat and food sources are diminished by agriculture. In response, he decided to allocate a portion of his land near the rainforest surrounding his farm to cultivate crops favored by the chimpanzees. This way, the chimpanzees would have less incentive to raid his sugarcane fields.

“The locals now grasp that conservation benefits both wildlife and their own future,” says the primatologist. Goodall is a staunch believer in the transformative power of grassroots efforts to safeguard our planet’s biodiversity and secure a sustainable future for all.

She shares a cascade of uplifting examples of environmental stewardship. With them, one could paint a picture of human progress in preserving nature. Yet Goodall tempers this optimism with a sobering reality check.

“Take the United States, for example. Biden put back lots of regulations to protect wildlife. Trump has boasted that if he gets back in, he will open up the national parks to logging and mining. I mean, he’s actually boasting about it,” she says.

In Africa, China is increasingly active, investing in rapid road-building, dams, and mineral extraction at the expense of the environment and space for wildlife.

“Funnily enough, within China, they’re ahead in solar power development. They’re now very passionate about protecting their own environment,” says Goodall. “We can always blame China, but what they’re doing is looking after their own environment and getting all the materials they need by harming other environments. But that’s what colonial powers did, and that’s what big business is still doing. America gets its raw materials by going and mining in other countries, the developing countries.”

Nor do all the leaders of African countries themselves often have sustainability in mind. In the more than six decades that Jane Goodall has been going to Tanzania, she has seen six presidents. “The previous president [John Magufuli, in office 2015 to 2021, nicknamed Bulldozer] was a nightmare,” she complains. Most important to him, Goodall says, was the construction of roads and a dam and hydroelectric project on the Rufiji River, a UNESCO World Heritage Site. A wave of resentment rose against the plan, but the government warned that anyone opposing the project would go to jail.

As Goodall looks around the world, she watches with concern as the political pendulum swings towards the far right, which she says means environmental issues are likely to be sidelined. She disagrees with the notion that unlimited economic development can be achieved on a planet with limited natural resources and a growing population, not only of humans, but also of farmed animals. “It doesn’t make sense, it’s not sustainable,” she says.

On the other hand, she doesn’t entirely condemn tourism, a big part of the global economy. To a limited extent, and if well managed, she says, it brings livelihoods to local people and money to national budgets.

Her fascination with chimpanzee research persists, and she closely monitors the next generation of scientists advancing her pioneering work. “I learned just the other day something I never knew before,” she says. In Senegal, amid a parched environment, chimpanzees demonstrate a remarkable adaptation: They frequent watering holes, ingeniously filtering muddy water through hollowed-out holes in roots and vegetation.

“They’ve got a film of it, which I saw last week. I’ve never seen it before. But then think of what we’re learning about other animals. The octopus, so intelligent. Crows, who can solve problems faster than children. You know—there’s so much like that.”

*This interview was originally published by [WIRED Czech Republic and Slovakia](#).*

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[Amit Katwala](#)

[The Big Story](#)

Jul 30, 2024 6:00 AM

# The New Gods of Weather Can Make Rain on Demand—or So They Want You to Believe

In a gold-trimmed command center on the outskirts of Abu Dhabi, scientists are seeking to wring moisture from desert skies. But will all their extravagant cloud-seeding tech—planes that sprinkle nanomaterials, lasers that scramble the atmosphere—really work at scale?

Play/Pause Button



ILLUSTRATIONS: ANA MIMINOSHVILI

In the skies over Al Ain, in the United Arab Emirates, pilot Mark Newman waits for the signal. When it comes, he flicks a few silver switches on a panel by his leg, twists two black dials, then punches a red button labeled FIRE.

A slender canister mounted on the wing of his small propeller plane pops open, releasing a plume of fine white dust. That dust—actually ordinary table salt coated in a nanoscale layer of titanium oxide—will be carried aloft on updrafts of warm air, bearing it into the heart of the fluffy convective [clouds](#) that form in this part of the UAE, where the many-shaded sands of Abu Dhabi meet the mountains on the border with Oman. It will, in theory at least, attract [water](#) molecules, forming small droplets that will collide and coalesce with other droplets until they grow big enough for gravity to pull them out of the sky as rain.

This is cloud seeding. It's one of hundreds of missions that Newman and his fellow pilots will fly this year as part of the UAE's ambitious, decade-long attempt to increase rainfall in its desert lands. Sitting next to him in the copilot's seat, I can see red earth stretching to the horizon. The only water in sight is the swimming pool of a luxury hotel, perched on the side of a mountain below a sheikh's palace, shimmering like a jewel.

More than 50 countries have dabbled in cloud seeding since the 1940s—to slake droughts, refill hydroelectric reservoirs, keep ski slopes snowy, or even use as a weapon of war. In recent years there's been a new surge of interest, partly due to scientific breakthroughs, but also because arid countries are facing down the early impacts of climate change. Like other technologies designed to treat the symptoms of a warming planet (say, pumping sulfur dioxide into the atmosphere to reflect sunlight into space), seeding was once controversial but now looks attractive, perhaps even imperative. Dry spells are getting longer and more severe: In [Spain](#) and southern [Africa](#), crops are withering in the fields, and cities from Bogotá to Cape Town have been forced to ration water. In the past nine months alone, seeding has been touted as a solution to air pollution in Pakistan, as a way to prevent forest fires in [Indonesia](#), and as part of an effort to refill the [Panama Canal](#), which is drying up.

Apart from [China](#), which keeps its extensive seeding operations a closely guarded secret, the UAE has been more ambitious than any other country about advancing the science of making rain. The nation gets around 5 to 7 inches of rain a year—roughly half the amount that falls on Nevada, America's driest state. The UAE started its cloud-seeding program in the early 2000s, and since 2015 it has invested millions of dollars in the Rain Enhancement Program, which is funding global research into new technologies.

This past April, when a storm dumped a year's worth of rain on the UAE in 24 hours, the [widespread flooding in Dubai](#) was quickly blamed on cloud seeding. But the truth is more nebulous. There's a long history of people—tribal chiefs, traveling con artists, military scientists, and most recently VC-backed techies—claiming to be able to make it rain on demand. But cloud seeding can't make clouds appear out of thin air; it can only squeeze more

rain out of what's already in the sky. Scientists still aren't sure they can make it work reliably on a mass scale. The Dubai flood was more likely the result of a region-wide storm system, exacerbated by climate change and the lack of suitable drainage systems in the city.

The Rain Enhancement Program's stated goal is to ensure that future generations, not only in the UAE but in arid regions around the globe, have the water they need to survive. The architects of the program argue that "water security is an essential element of national security" and that their country is "leading the way" in "new technologies" and "resource conservation." But the UAE—synonymous with luxury living and conspicuous consumption—has one of the highest per capita rates of water use on earth. So is it really on a mission to make the hotter, drier future that's coming more livable for everyone? Or is this tiny petro-state, whose outsize wealth and political power came from helping to feed the industrialized world's fossil-fuel addiction, looking to accrue yet more wealth and power by selling the dream of a cure?

I've come here on a mission of my own: to find out whether this new wave of cloud seeding is the first step toward a world where we really can control the weather, or another round of literal vaporware.

The first systematic attempts at rainmaking date back to August 5, 1891, when a train pulled into Midland, Texas, carrying 8 tons of sulfuric acid, 7 tons of cast iron, half a ton of manganese oxide, half a dozen scientists, and several veterans of the US Civil War, including General Edward Powers, a civil engineer from Chicago, and Major Robert George Dyrenforth, a former patent lawyer. Powers had noticed that it seemed to rain more in the days after battles, and had come to believe that the "concussions" of artillery fire during combat caused air currents in the upper atmosphere to mix together and release moisture. Powers figured he could make his own rain on demand with loud noises, either by arranging hundreds of cannons in a circle and pointing them at the sky or by sending up balloons loaded with explosives. His ideas, which he laid out in a book called *War and the Weather* and lobbied for for years, eventually prompted the US federal government to bankroll the experiment in Midland.

Powers and Dyrenforth's team assembled at a local cattle ranch and prepared for an all-out assault on the sky. They made mortars from lengths of pipe, stuffed dynamite into prairie dog holes, and draped bushes in rackarock, an explosive used in the coal-mining industry. They built kites charged with electricity and filled balloons with a combination of hydrogen and oxygen, which Dyrenforth thought would fuse into water when it exploded. (Skeptics pointed out that it would have been easier and cheaper to just tie a jug of water to the balloon.) The group was beset by technical difficulties; at one point, a furnace caught fire and had to be lassoed by a cowboy and dragged to a water tank to be extinguished. By the time they finished setting up their experiment, it had already started raining naturally. Still, they pressed on, unleashing a barrage of explosions on the night of August 17 and claiming victory when rain again fell 12 hours later.

It was questionable how much credit they could take. They had arrived in Texas right at the start of the rainy season, and the precipitation that fell before the experiment had been forecast by the US Weather Bureau. As for Powers' notion that rain came after battles—well, battles tended to start in dry weather, so it was only the natural cycle of things that wet weather often followed.

Despite skepticism from serious scientists and ridicule in parts of the press, the Midland experiments lit the fuse on half a century of rainmaking pseudoscience. The Weather Bureau soon found itself in a running media battle to debunk the efforts of the self-styled rainmakers who started operating across the country.

The most famous of these was Charles Hatfield, nicknamed either the Moisture Accelerator or the Ponzi of the Skies, depending on whom you asked. Originally a sewing machine salesman from California, he reinvented himself as a weather guru and struck dozens of deals with desperate towns. When he arrived in a new place, he'd build a series of wooden towers, mix up a secret blend of 23 cask-aged chemicals, and pour it into vats on top of the towers to evaporate into the sky. Hatfield's methods had the air of witchcraft, but he had a knack for playing the odds. In Los Angeles, he promised 18 inches of rain between mid-December and



late April, when historical rainfall records suggested a 50 percent chance of that happening anyway.

While these showmen and charlatans were filling their pocketbooks, scientists were slowly figuring out what *actually* made it rain—something called cloud condensation nuclei. Even on a clear day, the skies are packed with particles, some no bigger than a grain of pollen or a viral strand. “Every cloud droplet in Earth’s atmosphere formed on a preexisting aerosol particle,” one cloud physicist told me. The types of particles vary by place. In the UAE, they include a complex mix of sulfate-rich sands from the desert of the Empty Quarter, salt spray from the Persian Gulf, chemicals from the oil refineries that dot the region, and organic materials from as far afield as India. Without them there would be no clouds at all—no rain, no snow, no hail.

I’m suddenly very aware that I’m on a military base. Couldn’t this giant movable laser be used as a weapon?

A lot of raindrops start as airborne ice crystals, which melt as they fall to earth. But without cloud condensation nuclei, even ice crystals won’t form until the temperature dips below –40 degrees Fahrenheit. As a result, the atmosphere is full of pockets of supercooled liquid water that’s below freezing but hasn’t actually turned into ice.

In 1938, a meteorologist in Germany suggested that seeding these areas of frigid water with artificial cloud condensation nuclei might encourage the formation of ice crystals, which would quickly grow large enough to fall, first as snowflakes, then as rain. After the Second World War, American scientists at General Electric seized on the idea. One group, led by chemists Vincent Schaefer and Irving Langmuir, found that solid carbon dioxide, also known as dry ice, would do the trick. When Schaefer dropped grains of dry ice into the home freezer he’d been using as a makeshift cloud chamber, he discovered that water readily freezes around the particles’ crystalline structure. When he witnessed the effect a week later, Langmuir jotted down three words in his notebook: “Control of Weather.” Within a few months, they were dropping dry-ice pellets from planes over Mount Greylock in Western Massachusetts, creating a 3-mile-long streak of ice and snow.

Another GE scientist, Bernard Vonnegut, had settled on a different seeding material: silver iodide. It has a structure remarkably similar to an ice crystal and can be used for seeding at a wider range of temperatures. (Vonnegut's brother, Kurt, who was working as a publicist at GE at the time, would go on to write *Cat's Cradle*, a book about a seeding material called ice-nine that causes all the water on earth to freeze at once.)

In the wake of these successes, GE was bombarded with requests: Winter carnivals and movie studios wanted artificial snow; others wanted clear skies for search and rescue. Then, in February 1947, everything went quiet. The company's scientists were ordered to stop talking about cloud seeding publicly and direct their efforts toward a classified US military program called Project Cirrus.

Over the next five years, Project Cirrus conducted more than 250 cloud-seeding experiments as the United States and other countries explored ways to weaponize the weather. Schaefer was part of a team that dropped 80 pounds of dry ice into the heart of Hurricane King, which had torn through Miami in the fall of 1947 and was heading out to sea. Following the operation, the storm made a sharp turn back toward land and smashed into the coast of Georgia, where it caused one death and millions of dollars in damages. In 1963, Fidel Castro reportedly accused the Americans of seeding Hurricane Flora, which hung over Cuba for four days, resulting in thousands of deaths. During the Vietnam War, the US Army used cloud seeding to try to soften the ground and make it impassable for enemy soldiers.

A couple of years after that war ended, more than 30 countries, including the US and the USSR, signed the Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques. By then, interest in cloud seeding had started to melt away anyway, first among militaries, then in the civilian sector. "We didn't really have the tools—the numerical models and also the observations—to really prove it," says Katja Friedrich, who researches cloud physics at the University of Colorado. (This didn't stop the USSR from seeding clouds near the site of the nuclear meltdown at Chernobyl in hopes that they would dump their radioactive contents over Belarus rather than Moscow.)

More than 50 countries have dabbled in cloud seeding since the 1940s—to combat droughts, refill hydroelectric reservoirs, keep ski slopes snowy, or even use them as a weapon of war.

To really put seeding on a sound scientific footing, they needed to get a better understanding of rain at all scales, from the microphysical science of nucleation right up to the global movement of air currents. At the time, scientists couldn't do the three things that were required to make the technology viable: identify target areas of supercooled liquid in clouds, deliver the seeding material into those clouds, and verify that it was actually doing what they thought. How could you tell whether a cloud dropped snow because of seeding, or if it would have snowed anyway?

By 2017, armed with new, more powerful computers running the latest generation of simulation software, researchers in the US were finally ready to answer that question, via the Snowie project. Like the GE chemists years earlier, these experimenters dropped silver iodide from planes. The experiments took place in the Rocky Mountains, where prevailing winter winds blow moisture up the slopes, leading to clouds reliably forming at the same time each day. The results were impressive: The researchers could draw an extra 100 to 300 acre-feet of snow from each storm they seeded. But the most compelling evidence was anecdotal. As the plane flew back and forth at an angle to the prevailing wind, it sprayed a zigzag pattern of seeding material across the sky. That was echoed by a zigzag pattern of snow on the weather radar. “Mother Nature does not produce zigzag patterns,” says one scientist who worked on Snowie.

In almost a century of cloud seeding, it was the first time anyone had actually shown the full chain of events from seeding through to precipitation reaching the ground.

The UAE's national Center of Meteorology is a glass cube rising out of featureless scrubland, ringed by a tangle of dusty highways on the edge of Abu Dhabi. Inside, I meet Ahmad Al Kamali, the facility's rain operations executor—a trim young man with a neat beard and dark-framed glasses. He studied at the University of Reading in the UK and worked as a forecaster before specializing in cloud-seeding operations. Like all the Emirati men I

meet on this trip, he's wearing a *kandura*—a loose white robe with a headpiece secured by a loop of thick black cord.

We take the elevator to the third floor, where I find cloud-seeding mission control. With gold detailing and a marble floor, it feels like a luxury hotel lobby, except for the giant radar map of the Gulf that fills one wall.

Forecasters—men in white, women in black—sit at banks of desks and scour satellite images and radar data looking for clouds to seed. Near the entrance there's a small glass pyramid on a pedestal, about a foot wide at its base. It's a holographic projector. When Al Kamali switches it on, a tiny animated cloud appears inside. A plane circles it, and rain begins to fall. I start to wonder: How much of this is theater?

The impetus for cloud seeding in the UAE came in the early 2000s, when the country was in the middle of a construction boom. Dubai and Abu Dhabi were a sea of cranes; the population had more than doubled in the previous decade as expats flocked there to take advantage of the good weather and low income taxes. Sheikh Mansour bin Zayed Al Nahyan, a member of Abu Dhabi's royal family—currently both vice president and deputy prime minister of the UAE—thought cloud seeding, along with desalination of seawater, could help replenish the country's groundwater and refill its reservoirs. (Globally, Mansour is perhaps best known as the owner of the soccer club Manchester City.) As the Emiratis were setting up their program, they called in some experts from another arid country for help.

Back in 1989, a team of researchers in South Africa were studying how to enhance the formation of raindrops. They were taking cloud measurements in the east of the country when they spotted a cumulus cloud that was raining when all the other clouds in the area were dry. When they sent a plane into the cloud to get samples, they found a much wider range of droplet sizes than in the other clouds—some as big as half a centimeter in diameter.

The finding underscored that it's not only the number of droplets in a cloud that matters but also the size. A cloud of droplets that are all the same size won't mix together because they're all falling at the same speed. But if you can introduce larger drops, they'll plummet to earth faster, colliding and

coalescing with other droplets, forming even bigger drops that have enough mass to leave the cloud and become rain. The South African researchers discovered that although clouds in semiarid areas of the country contain hundreds of water droplets in every cubic centimeter of air, they're less efficient at creating rain than maritime clouds, which have about a sixth as many droplets but more variation in droplet size.

So why did this one cloud have bigger droplets? It turned out that the chimney of a nearby paper mill was pumping out particles of debris that attracted water. Over the next few years, the South African researchers ran long-term studies looking for the best way to re-create the effect of the paper mill on demand. They settled on ordinary salt—the most hygroscopic substance they could find. Then they developed flares that would release a steady stream of salt crystals when ignited.

Those flares were the progenitors of what the Emiratis use today, made locally at the Weather Modification Technology Factory. Al Kamali shows me a couple: They're foot-long tubes a couple of inches in diameter, each holding a kilogram of seeding material. One type of flare holds a mixture of salts. The other type holds salts coated in a nano layer of titanium dioxide, which attracts more water in drier climates. The Emiratis call them Ghaith 1 and Ghaith 2, *ghaith* being one of the Arabic words for "rain." Although the language has another near synonym, *matar*, it has negative connotations—rain as punishment, torment, the rain that breaks the banks and floods the fields. *Ghaith*, on the other hand, is rain as mercy and prosperity, the deluge that ends the drought.

The morning after my visit to the National Center of Meteorology, I take a taxi to Al Ain to go on that cloud-seeding flight. But there's a problem. When I leave Abu Dhabi that morning there's a low fog settled across the country, but by the time I arrive at Al Ain's small airport—about 100 miles inland from the cities on the coast—it has burned away, leaving clear blue skies. There are no clouds to seed.

Once I've cleared the tight security cordon and reached the gold-painted hangar (the airport is also used for military training flights), I meet Newman, who agrees to take me up anyway so he can demonstrate what *would* happen on a real mission. He's wearing a blue cap with the UAE

Rain Enhancement Program logo on it. Before moving to the UAE with his family 11 years ago, Newman worked as a commercial airline pilot on passenger jets and split his time between the UK and his native South Africa. He has exactly the kind of firmly reassuring presence you want from someone you're about to climb into a small plane with.

Every cloud-seeding mission starts with a weather forecast. A team of six operators at the meteorology center scour satellite images and data from the UAE's network of radars and weather stations and identify areas where clouds are likely to form. Often, that's in the area around Al Ain, where the mountains on the border with Oman act as a natural barrier to moisture coming in from the sea.

If it's looking like rain, the cloud-seeding operators radio the hangar and put some of the nine pilots on standby mode—either at home, on what Newman calls “villa standby,” or at the airport or in a holding pattern in the air. As clouds start to form, they begin to appear on the weather radar, changing color from green through blue to yellow and then red as the droplets get bigger and the reflectivity of the clouds increases.

Once a mission is approved, the pilot scribbles out a flight plan while the ground crew preps one of the four modified Beechcraft King Air C90 planes. There are 24 flares attached to each wing—half Ghaith 1, half Ghaith 2—for a total of 48 kilograms of seeding material on each flight. Timing is important, Newman tells me as we taxi toward the runway. The pilots need to reach the cloud at the optimal moment.

Once we're airborne, Newman climbs to 6,000 feet. Then, like a falcon riding the thermals, he goes hunting for updrafts. Cloud seeding is a mentally challenging and sometimes dangerous job, he says through the headset, over the roar of the engines. Real missions last up to three hours and can get pretty bumpy as the plane moves between clouds. Pilots generally try to avoid turbulence. Seeding missions seek it out.

When we get to the right altitude, Newman radios the ground for permission to set off the flares. There are no hard rules for how many flares to put into each cloud, one seeding operator told me. It depends on the

strength of the updraft reported by the pilots, how things look on the radar. It sounds more like art than science.

Newman triggers one of the salt flares, and I twist in my seat to watch: It burns with a white-gray smoke. He lets me set off one of the nano-flares. It's slightly anticlimactic: The green lid of the tube pops open and the material spills out. I'm reminded of someone sprinkling grated cheese on spaghetti.

There's an evangelical zeal to the way some of the pilots and seeding operators talk about this stuff—the rush of hitting a button on an instrument panel and seeing the clouds burst before their eyes. Like gods. Newman shows me a video on his phone of a cloud that he'd just seeded hurling fat drops of rain onto the plane's front windows. Operators swear they can see clouds changing on the radar.

But the jury is out on how effective hygroscopic seeding actually is. The UAE has invested millions in developing new technologies for enhancing rainfall—and surprisingly little in actually verifying the impact of the seeding it's doing right now. After initial feasibility work in the early 2000s, the next long-term analysis of the program's effectiveness didn't come until 2021. It found a 23 percent increase in annual rainfall in seeded areas, as compared with historical averages, but cautioned that “anomalies associated with climate variability” might affect this figure in unforeseen ways. As Friedrich notes, you can't necessarily assume that rainfall measurements from, say, 1989 are directly comparable with those from 2019, given that climatic conditions can vary widely from year to year or decade to decade.

The best evidence for hygroscopic seeding, experts say, comes from India, where for the past 15 years the Indian Institute of Tropical Meteorology has been conducting a slow, patient study. Unlike the UAE, India uses one plane to seed and another to take measurements of the effect that has on the cloud. In hundreds of seeding missions, researchers found an 18 percent uptick in raindrop formation inside the cloud. But the thing is, every time you want to try to make it rain in a new place, you need to prove that it works in that area, in those particular conditions, with whatever unique mix of aerosol particles might be present. What succeeds in, say, the Western

Ghats mountain range is not even applicable to other areas of India, the lead researcher tells me, let alone other parts of the world.

If the UAE wanted to reliably increase the amount of fresh water in the country, committing to more desalination would be the safer bet. In theory, cloud seeding is cheaper: According to a 2023 paper by researchers at the National Center of Meteorology, the average cost of harvestable rainfall generated by cloud seeding is between 1 and 4 cents per cubic meter, compared with around 31 cents per cubic meter of water from desalination at the Hassyan Seawater Reverse Osmosis plant. But each mission costs as much as \$8,000, and there's no guarantee that the water that falls as rain will actually end up where it's needed.

One researcher I spoke to, who has worked on cloud-seeding research in the UAE and asked to speak on background because they still work in the industry, was critical of the quality of the UAE's science. There was, they said, a tendency for "white lies" to proliferate; officials tell their superiors what they want to hear despite the lack of evidence. The country's rulers already think that cloud seeding is working, this person argued, so for an official to admit otherwise now would be problematic. (The National Center of Meteorology did not comment on these claims.)

By the time I leave Al Ain, I'm starting to suspect that what goes on there is as much about optics as it is about actually enhancing rainfall. The UAE has a history of making flashy announcements about cutting-edge technology—from flying cars to 3D-printed buildings to robotic police officers—with little end product.

For the UAE, it's almost irrelevant whether cloud seeding works. There's soft power in being seen to be able to bend the weather to your will.

Now, as the world transitions away from the fossil fuels that have been the country's lifeblood for the past 50 years, the UAE is trying to position itself as a leader on climate. Last year it hosted the annual United Nations Climate Change Conference, and the head of its National Center of Meteorology was chosen to lead the World Meteorological Organization, where he'll help shape the global consensus that forms around cloud



seeding and other forms of mass-scale climate modification. (He could not be reached for an interview.)

The UAE has even started exporting its cloud-seeding expertise. One of the pilots I spoke to had just returned from a trip to Lahore, where the Pakistani government had asked the UAE's cloud seeders to bring rain to clear the polluted skies. It rained—but they couldn't really take credit. "We knew it was going to rain, and we just went and seeded the rain that was going to come anyway," he said.

From the steps of the Emirates Palace Mandarin Oriental in Abu Dhabi, the UAE certainly doesn't seem like a country that's running out of water. As I roll up the hotel's long driveway on my second day in town, I can see water features and lush green grass. The sprinklers are running. I'm here for a ceremony for the fifth round of research grants being awarded by the UAE Research Program for Rain Enhancement Science. Since 2015, the program has awarded \$21 million to 14 projects developing and testing ways of enhancing rainfall, and it's about to announce the next set of recipients.

In the ornate ballroom, local officials have loosely segregated themselves by gender. I sip watermelon juice and work the room, speaking to previous award winners. There's Linda Zou, a Chinese researcher based at Khalifa University in Abu Dhabi who developed the nano-coated seeding particles in the Ghaith 2 flares. There's Ali Abshaev, who comes from a cloud-seeding dynasty (his father directs Russia's Hail Suppression Research Center) and who has built a machine to spray hygroscopic material into the sky from the ground. It's like "an upside-down jet engine," one researcher explains.

Other projects have been looking at "terrain modification"—whether planting trees or building earthen barriers in certain locations could encourage clouds to form. Giles Harrison, from the University of Reading, is exploring whether electrical currents released into clouds can encourage raindrops to stick together. There's also a lot of work on computer simulation. Youssef Wehbe, a UAE program officer, gives me a cagey interview about the future vision: pairs of drones, powered by artificial intelligence, one taking cloud measurements and the other printing seeding material specifically tailored for that particular cloud—on the fly, as it were.

I'm particularly taken by one of this year's grant winners. Guillaume Matras, who worked at the French defense contractor Thales before moving to the UAE, is hoping to make it rain by shooting a giant laser into the sky. Wehbe describes this approach as "high risk." I think he means "it may not work," not "it could set the whole atmosphere on fire." Either way, I'm sold.

So after my cloud-seeding flight, I get a lift to Zayed Military City, an army base between Al Ain and Abu Dhabi, to visit the secretive government-funded research lab where Matras works. They take my passport at the gate to the compound, and before I can go into the lab itself I'm asked to secure my phone in a locker that's also a Faraday cage—completely sealed to signals going in and out.

After I put on a hairnet, a lab coat, and tinted safety goggles, Matras shows me into a lab, where I watch a remarkable thing. Inside a broad, black box the size of a small television sits an immensely powerful laser. A tech switches it on. Nothing happens. Then Matras leans forward and opens a lens, focusing the laser beam.

There's a high-pitched but very loud buzz, like the whine of an electric motor. It is the sound of the air being ripped apart. A very fine filament, maybe half a centimeter across, appears in midair. It looks like a strand of spider's silk, but it's bright blue. It's plasma—the fourth state of matter. Scale up the size of the laser and the power, and you can actually set a small part of the atmosphere on fire. Man-made lightning. Obviously my first question is to ask what would happen if I put my hand in it. "Your hand would turn into plasma," another researcher says, entirely deadpan. I put my hand back in my pocket.

Matras says these laser beams will be able to enhance rainfall in three ways. First, acoustically—like the concussion theory of old, it's thought that the sound of atoms in the air being ripped apart might shake adjacent raindrops so that they coalesce, get bigger, and fall to earth. Second: convection—the beam will create heat, generating updrafts that will force droplets to mix. (I'm reminded of a never-realized 1840s plan to create rain by setting fire to large chunks of the Appalachian Mountains.) Finally: ionization. When the beam is switched off, the plasma will reform—the nitrogen, hydrogen, and

oxygen molecules inside will clump back together into random configurations, creating new particles for water to settle around.

The plan is to scale this technology up to something the size of a shipping container that can be put on the back of a truck and driven to where it's needed. It seems insane—I'm suddenly very aware that I'm on a military base. Couldn't this giant movable laser be used as a weapon? "Yes," Matras says. He picks up a pencil, the nib honed to a sharp point. "But anything could be a weapon."

These words hang over me as I ride back into the city, past lush golf courses and hotel fountains and workmen swigging from plastic bottles. Once again, there's not a cloud in the sky. But maybe that doesn't matter. For the UAE, so keen to project its technological prowess around the region and the world, it's almost irrelevant whether cloud seeding works. There's soft power in being seen to be able to bend the weather to your will—in 2018, an Iranian general accused the UAE and Israel of stealing his country's rain.

Anything could be a weapon, Matras had said. But there are military weapons, and economic weapons, and cultural and political weapons too. Anything could be a weapon—even the idea of one.

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By [Lauren Smiley](#)

[The Big Story](#)

Jul 10, 2024 6:00 AM

# Priscila, Queen of the Rideshare Mafia

She came to the US with a dream. Using platforms like Uber, Instacart, and DoorDash, she built a business empire up from nothing. There was just one problem.

Photograph: Tony Luong

To understand Priscila Barbosa—the pluck, the ambition, the sheer balls—we should start at the airport. We should start at the precise moment on April 24, 2018, when she concluded, *I'm fucked*.

Barbosa was just outside customs at New York's JFK International Airport, 5-foot-1, archetypally pretty even without her favorite Instagram filter. She was flanked by two rolling suitcases stuffed with clothes and Brazilian bikinis and not much else. The acquaintance who had invited her to come from Brazil on a tourist visa, who was going to drive her to Boston? The one who promised to help her get settled, saying that she could make good money like he did, driving for Uber and Lyft?

He's not answering her texts.

Barbosa was stranded. She cried. She took stock of her belongings: the suitcases, her iPhone, 117 bucks not just in her wallet, but total. She called her mom back in Brazil, but she already knew that her family couldn't pay for a ticket home. No way was she asking her friends, who had doubted this plan all along; one said she was too old to start over in a new country and, with a whiff of class judgment, insinuated that immigrating was not something their social circle really *did*.

What now?

Well, Barbosa has a phoenix tattooed on her back. She radiates a game sense of *What can I say yes to today?* The type of person who, when she and a pal don't want to splurge on a fancy hotel during a girls trip, swipes right on every guy on Tinder until one joins their bar-crawl and invites them to sleep on his boat. (Says a friend: "Priscila is craaaazy.") The US government would one day put it more grandly, speaking of Barbosa's "unique social talents," calling her "hard-working," "productive," and "very organized."

She knew there was no going back to Brazil but also, deep down, that she didn't want to, that opportunity was *here*. "I loved this place"—the US—from nearly the moment she stepped off the plane, she declares. She was 32 years old, college educated, and spoke decent English. She had no choice but to work her way out of this mess.

Barbosa couldn't have predicted where her striving would end: that she'd become the heavy in a web of fraud. That she'd expose the [gig economy's](#) embarrassing blind spot. That, one day, multibillion-dollar companies like [Uber](#) and [DoorDash](#) would cry victim. *Her* victim. Or that she'd fall so far, or that her relationship with Uncle Sam would grow so deeply twisted and codependent.

She did know, that day at JFK Airport, that her doubters back in Brazil would only see one plotline on Instagram: Priscila's march to victory. Taking a \$10 Lyft to a bus station, eyes still puffy from her airport cry, Barbosa aimed her iPhone at the traffic speeding across the Throgs Neck Bridge on a clear spring day. She labeled the video "New York, New York," and uploaded it onto her Story, ripe with the promise that she was heading somewhere big.

In real life, Barbosa is candid ("I'm a bad liar"). She drops self-deprecating jokes and lets loose big, jagged laughs that sound like a car trying to start. She grew up in Sorocaba, an industrial city of 723,000 people about two hours west of São Paulo. Her dad was an electrician, mom a postal worker. They set their eldest daughter on a path "to be a very educated and polite person"—English lessons and ballet classes. Barbosa loved to mess around

on computers. As a teen, she kitted out her home PC with a terabyte of storage and an Nvidia processor so she could play *Counter-Strike* and *World of Warcraft*. She also hung out at a local cyber café, where she and a few other gamers formed a tournament team called the BR Girls (“BR” for Brazil). Offscreen, high school was miserable. She was bullied for being a teacher’s pet, for being “chunky,” for being terrible at sports. When a few boys showed romantic interest in her, she turned them down for fear it was a prank.

Barbosa studied IT at a local college, taught computer skills at elementary schools, and digitized records at the city health department. She also became a gym rat (“I’ve had to fight for the perfect body my whole life”) and started cooking healthy recipes. In 2013, she spun this hobby into a part-time hustle, a delivery service for her ready-made meals. When orders exploded, Barbosa ramped up to full-time in 2015, calling her business Fit Express. She hired nine employees and was featured in the local press. She was making enough to travel to Walt Disney World, party at music festivals, and buy and trade bitcoin. She happily imagined opening franchises and gaining a solid footing in the upper-middle class.

But Brazil was in the middle of a recession, and after a few years, her customers started disappearing. Trying to stay afloat, Barbosa cashed out her bitcoin and, when that wasn’t enough, took out high-interest loans (“What a stupid idea, by the way”). She closed Fit Express. Her younger sister had just graduated from college, and her parents had lost their bakery, their retirement gig. Barbosa felt it was up to her to pull everyone out.

She texted that Boston-area acquaintance about her desperation, and he answered: *Why didn’t she move to the US and drive for Uber and Lyft?* He sent her screenshots of what he was making—\$250 a day, better than attorney-level money in Brazil. He said undocumented people could live like normal citizens. She already had a tourist visa. With her family broke and her job search going nowhere, “I couldn’t see any other option,” she says.

The first night at the flophouse, Barbosa slept on the floor. The second, a Walmart air mattress.

A one-way ticket to JFK cost nearly \$900. She sold a ring from her grandpa for \$1,000. At the airport, her father tried to cut through the family's gloom, saying, "Rock out, and get a Mustang for Dad!"

A flight across the equator later, and the momentary meltdown at JFK shaken off, Barbosa hurtled north from New York City to Boston on a Peter Pan bus, fervidly scrolling through Facebook groups dedicated to Massachusetts' large Brazilian community, tapping out DMs and dialing numbers. A Brazilian pizzeria owner told her to come in for a try-out the next day. A Brazilian landlord, who had a tiny room in a flophouse in the western burb of Framingham, said he would take the \$400 rent once Barbosa got paid. A shot-in-the-dark call: a Brazilian guy from Boston whom she'd met years before on vacation in Miami. Miraculously, he not only answered but met her at South Station, let her stay the night, and ferried her the next morning to the pizzeria, where she aced the cooking test.

The first night at the flophouse, Barbosa slept on the floor. The second, a Walmart air mattress. She shoved magazines below the door to keep out the rats ("Disgusting!"). Without a car, she walked an hour to the pizza joint, past strip malls and Brazilian bakeries. On the way, she'd stop at Planet Fitness to lift weights and use the shower. (She welcomed the side effect of all the survival schlepping: "The most skinny I ever got!")

Barbosa was earning about \$800 in cash a week at the pizzeria. Aiming to pay down her debts and build her new life quickly, she looked for a second part-time job. One restaurant manager said he needed her to have a Social Security number, and handed her the number of a guy who could make her fake work documents, but Barbosa didn't dare call. "When you first get here," she explains, "you think ICE is going to be waiting for you on every single corner." She tried cleaning houses but lasted exactly two days, loathing every second. Then the pizzeria got slow for the summer and laid her off. Scrolling Facebook in bed one morning, she saw a post in a Brazilian group asking: *Do you want to work for Uber/ Lyft and be your own boss?*

Barbosa quite enjoyed being her own boss. Working for other people since arriving in the States had felt like a necessary but major downgrade. She

also finally had a car, having financed a used Jeep Liberty after a couple months of work. When she called the listed number in the ad, the guy who answered told her that, for \$250 a week, she could rent an Uber driver account. It would have Barbosa's photo, her car, and her bank account, but would use another name. Barbosa didn't ask any questions. She says she didn't know exactly how she was skipping right over the app's onboarding requirements: a US driver's license, a year of driving experience in the US, a Social Security number, and a background check. She did know that she cleared \$2,000 in her first week, enough to stop worrying about another job.

Illustration: Michelle Mildenberg

Not long after she started, Uber deactivated Barbosa's account out of the blue. So she switched to renting one on Lyft from the same guy. Now she drove as "Shakira." When the Lyft app prompted Barbosa to confirm her identity by scanning her license, she texted the guy she was renting from: *What now?* He sent back a photo of Shakira's ID. *Oh. She was real.* He paid Shakira a fee each week.

Driving without a license, under the table on a tourist visa, loaded Barbosa with stress. One night, Barbosa picked up a passenger at 2 am and he tried to kiss her. She had to fight him off and left him one star on the app; she didn't want to risk calling the cops. Another time, she was pulled over for having her lights off. Barbosa froze as the officer strode up to her window, worried she might get her car towed and end up in jail, or even—who knows?—deported. She showed the cop her Brazilian driver's license, and said she'd left her American one at home. He let her go.

In WhatsApp groups, and while waiting for riders at Logan Airport, Barbosa chatted up other Brazilian drivers also renting accounts. They traded tips about driving without papers, the nuances of the fuzzy don't-ask-don't-tell status quo in a country that hasn't passed comprehensive immigration reforms in more than three decades. Far from an ICE officer on every corner, she heard, if you kept your head down, didn't drink and drive or pick fights, you could manage.

In October, Barbosa posted a humblebrag on Instagram to mark six months in the US: "Thankful every day that I had such courage and audacity." She



had reasons to be proud: From being stranded with \$117 at JFK, she'd moved into a better apartment and had already sent enough money back to Brazil to pay her parents' bills and nearly clear her own debts. She was buying clothes at TJ Maxx, perfume at Macy's, restarting her regimen of technicolor manicures and wrinkle-busting Botox ("a priority"). In another Instagram photo, she was holding her cocktail aloft and dancing with a giant furry bear at a club, kissing toward the camera. The post quoted the iconic Apple ad: "Here's to the crazy ones, the misfits, the rebels ..."

The six-month anniversary also meant Barbosa was officially overstaying her tourist visa. The grind continued. She was clocking 14-hour days on Uber. She was also still paying a middleman just to use an account. Then, that fall, Barbosa stumbled on a way out.

One of her customers left their wallet in her car. She followed the woman's convoluted instructions to return it, driving to two far-flung locations over two hours. Miffed, at one point Barbosa opened the wallet. She looked at the woman's license, blonde with blue eyes. Barbosa snapped a picture. She thought the woman might tip her or at least say "thank you" for having wasted two hours, unpaid, to do her a favor. Instead, the woman was rude and short, giving Barbosa the push she'd been looking for. "I said, yeah, now I'm going to use this."

Over the next few weeks, she would click through the driver onboarding process on both Uber and Lyft, reading over the steps to create her own account, mulling the risk. Finally, lying in bed on Christmas night, the first one she'd spent without her family, it was time: She opened her phone and scrolled to the blonde woman's license. Barbosa uploaded the license to the Uber app. She used the woman's name but her own insurance and registration. She entered her own iCloud email and phone number and set her own picture—brown hair, brown eyes—on the driver profile. She made up a Social Security number, submitted the application, and went to sleep.

The next day, Uber approved the account. Like that, Barbosa was in business for herself.

"I looove to party," Barbosa once wrote me during the year and a half that we talked and emailed. For her, going out is less a dalliance than a

birthright, Barbosa's wildly extroverted brand of self-care. "I'm a human being, too," she says, "I deserve to have fun."

On Fridays, as other drivers shared their earnings in the WhatsApp group, she'd post a pic of her fresh pineapple vodka cocktail and invite them to join her at happy hour. Barbosa headed to bars and clubs several nights a week—the Grand, Scorpion Bar, the Harp, Ned Devine's, Royale—and threw parties at her apartment. She thrived on meeting other Brazilians ("I hate to be alone"), plugging their numbers into her phone, asking what they did for work.

A few incident-free weeks after Barbosa started driving with the Uber account she'd made, a new business opportunity arose. An acquaintance asked Barbosa to find a renter for his Uber and Lyft accounts, which he wasn't using. (Some undocumented drivers traveled to states like Maryland and California, which would issue licenses to residents regardless of immigration status. Barbosa would soon get her own license, using a friend's address in California.) She scouted a candidate, and the acquaintance gave her a cut of the rent, \$50 a week. She soon did the same for a few other people she knew who also wanted to rent out their accounts—a popular side hustle among expats, she quickly realized. Voilà, \$300 in passive income a week.

Barbosa readily admits she enjoyed the ego boost of beating powerful Silicon Valley companies on their own platforms. "I feel pride in breaking their stupid systems," she wrote me.

One day, while chatting over barbecue and Mike's Hard Lemonade at one of her house parties, a friend mentioned that for whatever reason, the onboarding process for ride-sharing accounts seemingly couldn't verify Social Security numbers issued after June 2011, when the Social Security Administration changed the way it assigned the numbers.

After the party, Barbosa couldn't resist; she plugged a few random sequences into [ssn-verify.com](http://ssn-verify.com), a website that shows when a number was issued. She tried one that started 776-94. *Bingo*. Maybe assigned after 2011. She entered the combination while making a new driver account. When Checkr, a company that does background checks for Uber, emailed asking

for her to verify the number, Barbosa says she simply plugged it in again. Then Checkr sent whatever information it gathered to Uber, and Uber approved the account. (A source close to Checkr insists that the company could, in fact, do background checks using numbers assigned after 2011, and Social Security numbers are just one data point they use to find information. All Barbosa knows is, in that era, her trick worked.)

Barbosa also met people with pictures of real licenses to sell, and she spotted another opportunity: By buying a license and adding in her simple Social Security trick, Barbosa could create new driver accounts on Uber and Lyft en masse. She set rent at the price she'd previously paid, \$250 a week. Business took off. Word got around; more people pinged her WhatsApp, wanting their own profiles. By late summer, with some eight renters bringing her \$2,000 a week, Barbosa stopped driving. Now she spent her days at her dining table on her laptop, concocting accounts.

"It never, never crossed my mind that I was, like, being a criminal," Barbosa says.

Photograph: Tony Luong

Barbosa figured she had gotten lucky on her own slapdash Uber account that she'd hatched on Christmas. Now, when she found a client, she registered a burner phone number on TextNow and an encrypted email with Proton Mail. Uber seemed to have gotten more discerning, so if her customer looked nothing like the person on the driver's license, she photoshopped the customer's face in place of the original. That way, when the app prompted them to take a selfie as a security spot check, they would pass. She also photoshopped the name from the license onto the customer's insurance documents. Ever organized, Barbosa kept an Excel spreadsheet with each account's details. In her Apple Notes, she checked off clients once they Venmoed or Zelled her the weekly rent.

"It never, never crossed my mind that I was, like, being a criminal," Barbosa says. Sure, she would learn that her suppliers were getting the driver's license photos on the dodgy down-low. One guy was sneaking pictures of customer's IDs from his job at a car dealership. Other pictures were bought off the dark web. Some people in the underground driver's

license economy in Maryland or California would snap a photo of the licenses before mailing them to their out-of-state immigrant clients, and then rent or sell those photos to people like Barbosa. Somehow (“my naive concept,” she says), uploading doctored documents onto an online platform seemed a lesser transgression than buying fake work documents IRL.

Barbosa rationalized that she wasn’t stealing money, and she had certain standards. She didn’t buy licenses off a guy who reportedly dinged his car into people’s bumpers and photographed the victim’s ID in the post-crash exchange. To Barbosa, that seemed truly beyond the pale.

Mostly, she felt like an entrepreneur, supplying the demand. Undocumented immigrants wanted to drive in the gig economy, and with the system that existed, they legally could not. People like Barbosa—with no family in the States to sponsor them for green cards and their undocumented status precluding them from applying for many other types of visas—were short on options. “If the US gave more opportunities for immigrants to be able to work legally and honestly here,” she says, “nobody would look for something like this.”

It wasn’t just about business, though. Barbosa readily admits she enjoyed not just the challenge but the ego boost of beating powerful Silicon Valley companies on their own platforms. “I feel pride in breaking their stupid systems,” she wrote me. “These companies are all about money. They don’t care for the drivers (we are just numbers for them).” So she held open yawning security loopholes and waved undocumented drivers in. “I never had evil intentions,” she explains. “I always thought I was helping my people.”

The good faith Barbosa showed to her customers paid off. Soon she was raking in about \$10,000 a month

Of course, Barbosa was poking the rideshare industry’s weak spot: The companies sometimes had no idea who was driving. Uber and Lyft, vying for supremacy and scale, competed to add drivers as fast as possible. Onboarding was optimized for ease and speed, done remotely, via the app. Both companies outsourced criminal background checks, but they didn’t catch everything. (That led to a torrent of lawsuits, regulator spats, and bad

press about Uber– and Lyft–approved drivers who’d committed robbery, sex offenses, and assault.) A year before Barbosa arrived in Massachusetts, the state had tried to wrangle the chaos with its own background check for drivers, the toughest oversight in the country at the time. An audit later found that program severely lacking, too.

Background checks, of course, are useless if the person being vetted is not actually the driver. As Barbosa was finding, in that era, *verifying* the driver’s identity was a Swiss cheese of flaws to exploit. In 2019, London regulators reported 43 unauthorized drivers who had simply uploaded their photo to another Uber worker’s account to give some 14,000 rides. Officers at San Francisco International Airport were ticketing Lyft and Uber drivers after discovering people who didn’t match their app profiles. Industry observers called the issue of drivers sharing or renting accounts an open secret. (The companies claim to have ramped up security since, but the American Immigration Council says that, in its analysis of 2022 census data, undocumented workers are very much still a part of this sector.)

Barbosa tried to do her own vetting of drivers, for safety and business. She texted the potential customers: *Did they have a driver’s license in Brazil? Did they have a car? How often do they plan to work?* Dilettantes, she learned, tended to stop paying rent, wasting an account.

She started to become well known in Boston’s Brazilian community (“famous,” she calls it) as, paradoxically, an honest broker. All over social media were warnings about scammers preying on undocumented drivers, taking advantage of the fact they wouldn’t go to police or the courts. Some vendors charged exorbitant rent or would take money upfront and never give someone an account. Others siphoned the drivers’ earnings to their own wallets.

The good faith Barbosa showed to her customers paid off. Soon she was raking in about \$10,000 a month and was pairing up with business partners to help make and manage some accounts. In the summer of 2019, she bought a used black Mustang. (She posted on Instagram, “Dad, this is for you.”) She shared her #route66roadtrip, the Grand Canyon, a crowded Vegas pool party. From Epcot, she and a friend posted cocktail toasts from a whirlwind of Disneyfied countries. She posed in front of a Beverly Hills

sign and on Rodeo Drive. Her followers were paying attention. On a picture of Barbosa wearing a faux fur coat in New York City, one person commented, “She’s Hollywood now!” In phone calls, her mom asked, “What do you do for work, Priscila?” She answered vaguely, “Making accounts.”

Then, the fall brought a nearly existential blow: Uber asked drivers on profiles with fake Social Security numbers—about 35 of Barbosa’s clients at that point, she estimates—to present their documents in person. (“We’re committed to constantly improving our detection capabilities to protect against fraudsters’ ever-evolving schemes,” said Heather Childs, chief trust and security officer at Uber.) Barbosa and her drivers had no choice but to walk away: a loss, she says, of around \$30,000 a month in rent. Until this point, she recalls, account deactivation had been rare.

DoorDash incentivized drivers to invite new workers to the app by dangling a referral bonus. The setup was ripe for exploitation.

Now Barbosa knew that if she wanted to keep making lucrative Uber accounts, she’d need real Social Security numbers. She searched the dark web for the numbers belonging to the people on the licenses she bought, but struck out. So Barbosa started purchasing stolen numbers from a contact, \$100 a pop. She nervously created a few new accounts with the real numbers, but didn’t feel comfortable repeating that at scale; it felt, she says, like she’d “crossed the line.”

Barbosa was wondering whether she’d need to leave her Uber business altogether, when one of her customers gave her an idea. Alessandro Da Fonseca was an amiable guy in his twenties who’d recently emigrated from a shantytown district of Rio de Janeiro. He rented one of Barbosa’s cars for a pizza delivery job and a Lyft gig, where he could get along with just a few words of English and an animated “Yeah!” as customers chatted him up. He’d also started driving for DoorDash. (“I prefer food, because food doesn’t talk,” he told me.) DoorDash incentivized drivers to invite new workers to the app by dangling a referral bonus, which would be paid out after the first-time driver made a set number of deliveries. The setup was ripe for exploitation.

At the time, DoorDash required a driver's license number but no picture of the actual card. Barbosa tried making an account, reusing a number from a license she had on hand. Success. Fonseca started driving—as her “new” referral—on this account. She offered him a 50-50 split of the bonus. Barbosa and Fonseca got into a routine: She created new accounts to refer, and he typically cleared enough deliveries to earn the bonus on two accounts he worked under simultaneously (also against the rules) every two weeks.

While waiting for orders at McDonalds, Chipotle, or Burger King, Fonseca would chat up other Brazilian delivery workers. Some were getting kicked only 20 percent of the referral bonus from their account maker. Fonseca pitched his contact and her 50-50 split.

Thanks to her previous business, Barbosa was sitting on a stack of IDs, and her old Uber customers who'd lost their accounts now wanted in. She could push out a DoorDash account in five minutes. Pretty soon, she says, she had 10 customers. Fonseca found Barbosa to be a showboat on Instagram, sure, but also unfailingly polite and generous. She invited him to her house parties and dispensed recommendations on anything from a good car dealer to a Japanese restaurant. In business, she was demanding, prodding him when his referrals were dallying in reaching the bonus. Sometimes she'd give Fonseca a laggard's login, and he would ask the driver whether he could finish the jobs himself. (A spokesperson for DoorDash said, “We've made huge strides on tackling fraud, and the fact is, what we did five years ago is not what we do today.”)

Barbosa started making Instacart accounts, too, and soon she was again minting money, to the tune of some \$12,000 a month. The week before Christmas 2019, Barbosa posted on Instagram a picture of her in New York City, grabbing the charging Wall Street bull by its enormous bronze balls.

Illustration: Michelle Mildenberg; Getty Images

Distracted by her burgeoning delivery app business, Barbosa mostly stopped thinking about Uber and Social Security numbers. Then Covid struck and cratered ride-sharing overnight.

A mother lode of food delivery surged in its place. DoorDash and Instacart cranked up their referral bonuses to lure more drivers to the road. At one point, she recalls, it was \$2,000 on DoorDash, \$2,500 on Instacart. Immigrants ineligible for unemployment or Covid relief texted Barbosa with a new level of desperation. They needed to make rent, to feed their kids. Now she was hearing from Brazilians all over the United States. Spanish-speaking immigrants too. Even some US citizens who couldn't drive because of DUIs or reckless driving tickets.

Barbosa went into overdrive, churning out accounts "as fast as I could." For friends, or people whose situations sounded especially grim, she'd sometimes make them for free.

On Instacart, she'd scan the front of her own California license, so she could then take a selfie to pass the platform's face-recognition test. She says she did this on hundreds of accounts. For the license's backside, she photoshopped on a barcode that she generated with software, using the identity information from her existing stockpile of drivers' IDs. When she needed more licenses, she bought fresh ones off Instacart workers who were using a new harvesting technique: While scanning the back of a customer's ID into the app during alcohol deliveries, the worker would sneak a photo of the front.

On DoorDash, a few zealous drivers were nabbing the referral bonus in a single day and coming back the next day for another account. Sometimes, Barbosa had up to 20 new accounts on various platforms going through background checks; at her Covid apex, she says, she raked in about \$15,000 in one week.

Barbosa—always a "materialist," she concedes—catapulted to a new realm of buying power. She flaunted her acquisitions on Instagram: a Sea-Doo (\$7,000, used), Louboutin heels, Gucci sunglasses, a Louis Vuitton purse. She upgraded her cross necklace to a 24k gold one with 18 inset diamonds (not religious, just superstitious), and her bed to a California king. With most clubs shuttered, Barbosa outfitted her latest rental upgrade, a three-story townhome in Saugus, with a karaoke machine and a keg tap, plus a hot tub and a firepit in the backyard. She adopted a Yorkie named Bailey, for whom she bought so many toys that house visitors asked whether she



had kids (no, and no thanks). She posted an Instagram Story that someone had filmed of her standing out of the sunroof of her gleaming white Porsche Macan, hair whipping. (For extra money, she rented out the Porsche and her Mustang on Turo.) She dropped \$13,000 to rent an event hall in the Boston burbs for her 35th birthday bash, with a band and 50 guests. The next day, she was awed but not stressed by an additional \$12,000 charge on her credit card for the open bar. She bought a plot of land outside of Fort Myers, Florida, that she saw advertised on Facebook for \$5,000. (“I’m like, that’s so cheap!”) She planned to someday build a house there and move in with her boyfriend, a Brazilian house painter whom she hoped to marry.

Uber seemed to be wising up. Then Barbosa would noodle a workaround, and the cat-and-mouse game would continue.

Barbosa also had enough money to solve what she thought was her biggest problem: She couldn’t go home to see her family, because she needed a green card to leave and reenter the US. So a couple of months into Covid, she flew to LA and flipped through a binder full of pictures of potential husbands in an office on Wilshire Boulevard. A sham marriage would cost some \$28,000—\$18,000 to the agency and \$10,000 to the husband, paid out in \$350 monthly chunks to keep him cooperative throughout the process. She felt zero guilt: At least she wasn’t feigning romance with a citizen. Cleaner for it to be a business transaction.

Barbosa bought a white sundress at a boutique and a crown of white flowers and drove to a park, where a Covid-masked officiant married her and a man named Mario by a flowering jacaranda tree. An agency staffer snapped pics for evidence, and Mario’s real girlfriend looked on. Barbosa’s family, who knew the drill, FaceTimed in on her phone. Her Instagram post from the day doesn’t mention what was really happening; it shows her alone in her sundress on the beach. Caption: “The sky is the limit!”

Throughout the pandemic, Barbosa was a digital nomad tending her accounts mill. From a water park, she’d call DoorDash customer service to clear up a flubbed delivery from one of her workers who didn’t speak English. Poolside in Vegas, she’d log in to a client’s Instacart to snap a selfie for a face recognition spot-check. (Some customers kept a printout of Barbosa’s photo on hand for the checks. Instacart says those tricks would

not work today.) When Instacart deactivated some 85 percent of her accounts—a particularly dire crisis—she ignored her boyfriend’s protests and hunkered down in a Florida hotel room for days to remake each one.

Over time, Barbosa invited a small group of compatriots in the business into a WhatsApp group that she cheekily named Mafia. (An unfortunate choice, in hindsight: “I should have put ‘People From Church.’”) The Mafia shared tips and problems and agreed on account prices, with plenty of banter to enliven the drudgery of the digital assembly line.

By the fall of 2020, drivers were asking for Uber Eats accounts. If Barbosa wanted their business, she would again have to face the Social Security number dilemma. She mulled it over. It had been months since she’d queasily made her first accounts using the real numbers, which she’d bought off a contact. Nothing bad had happened. She’d since found the right dark-web site to purchase them directly. Why ease off now? “I was already so involved in this,” she wrote me.

So Barbosa decided to wade back into the Uber biz. She bought a batch of Social Security numbers off the dark web with bitcoin.

By then, Uber seemed to be wising up. Accounts would be deactivated after a week, a month at most. Then Barbosa would noodle a workaround, and the cat-and-mouse game would continue. But in late 2020, after a wallop of new deactivations, the Mafia seemed to finally hit a wall. For days, then weeks, they tried to figure out a new method that would get an account approved. No luck. Barbosa recalls someone texting, chagrined, “The Titanic is sinking.”

Then, one Mafia member mentioned that Uber kept metadata on the accounts. Barbosa noticed that all of her axed accounts had, in fact, been created on her phone—*iPhone de Priscila Barbosa*. What if she made her computer look like a different device each time? She restarted her laptop, accessed the web through a VPN, changed her computer’s address, and set up a virtual machine, inside which she accessed another VPN. She opened a web browser to create an Uber account with a real Social Security number bought from the dark web. It worked. Barbosa delivered a few orders herself. The account held.

She texted the Mafia, “Guys, this is working.”

They exploded in texts of relief and joy: “If Priscila can’t figure it out, no one can!” Barbosa felt a pride she had only known back in Brazil when her meal business was booming. She felt smart, and needed: She’d kept scores of immigrants working during the pandemic; she’d helped get people food as a deadly virus menaced. If she blurred the details, she could feel good about all of it.

The glow was short-lived. As the year wound down, a vague rumor hit one of her WhatsApp groups: Police might be investigating the fake accounts biz. Already uneasy about buying Social Security numbers, Barbosa says she didn’t want to be caught flat-footed if the rumor turned out to be true. She hustled around her apartment, grabbing Instacart, DoorDash, and Grubhub bags, logo stickers, and app-issued debit cards. Outside, she placed several phones under her Porsche’s wheels and drove over them. She threw all the evidence into garbage bags and, that night, chucked them into several dumpsters in various parking lots.

She’d long taken comfort that WhatsApp and Proton Mail, the email service she’d used for the apps, were encrypted. She used an alias, Carol, on her work phone so clients couldn’t easily snitch on her. Now the physical evidence was gone too. (“Sweet illusion,” she wrote me.) For a couple of weeks after the purge, Barbosa forced herself to stop making accounts.

She spent New Year’s in Miami Beach, where she posted a photo of herself wearing Gucci sunglasses and holding a frozen mai tai the size of her head. She shared the pic with the Mafia.

Someone quipped back, “Find me, FBI.”

“I had so many chances to stop, but I didn’t,” she wrote me. “It looked like an addiction you know.”

As 2020 turned to 2021 and Barbosa continued making accounts, a low hum of dread invaded her idle moments. She started to ponder an exit.

She confided to a Mafia pal that she was scared of losing everything. News in February didn't help: A 30-year-old Brazilian named Douglas Goncalves had been arrested for working under a stolen identity on Instacart. It was the first time Barbosa had heard of criminal consequences for a fake profile, and she recognized the suspect's name: Goncalves, she says, had texted her a couple of weeks earlier about getting an account. His long-winded answers to her usual vetting questions annoyed her, and she ghosted him, she recalls. But the texts might still be sitting on his phone.

Fonseca, Barbosa's DoorDash partner, also started to worry. Too many people were hawking accounts, licenses, and Social Security numbers in his WhatsApp groups. "Everybody knew this bomb would explode someday," he said. "People are stupid and don't take care."

Barbosa thought about going legit, getting back into the food business, opening a Brazilian steakhouse. She figured startup costs at about \$50,000; she had that amount many times over. She googled around to see what kind of permits she'd need.

Still, her frauds kept compounding. Uber was now rejecting the doctored ID photos; she bought a printer to create physical fake licenses. She had more than 50 customer accounts active on various platforms, and new people kept texting her, often with a woeful tale. To calm her fraying nerves, she told herself that with so many people in the accounts trade, some doing more audacious things than she was, why would *she* get in trouble? One Mafia member, she says, was running a team that spoofed DoorDash deliveries for food that, in reality, was never picked up or delivered.

"I had so many chances to stop, but I didn't," she wrote me. "It looked like an addiction you know."

In April 2021, while Barbosa was cooking dinner, a text pinged her phone. Her green card had been approved. Barbosa screamed; she called her parents in tears. Then she threw together a party for the next night to celebrate. When Fonseca arrived, he squeezed through the loud, packed house and grabbed some Brazilian barbecue. Outside on the back porch, he found Barbosa, in cut-off shorts and a halter top, swigging overflowing champagne from the bottle.

If you ask Barbosa when she was happiest, she'll say it was that moment: "Everything was perfect." She had a green card. She had the house and the (real) boyfriend and the Porsche that she wanted. She booked a round-trip ticket—first class—to visit her family in Brazil for two weeks in late May. She bought Versace sneakers, because why not. She was going to open her steakhouse, marry her boyfriend, and, down the line, move into the house she'd build in Florida. Just three years after landing at JFK, she had risen to the top of a shadow Silicon Valley gig economy. She'd hacked her way to the American Dream.

On May 6, 2021, a new Instagram Story. Among the vacation bacchanalia and designer haul videos, this one stood out. Barbosa filmed ahead, over handlebars as she pedaled a bike through her sunny townhouse complex. No humblebrag, or even brag-brag. Carefree.

The next morning, she woke up at dawn to her Yorkie barking. A banging on the front door. A booming voice, ordering her to come downstairs.

*Find me, FBI.* They did.

Illustration: Michelle Mildenberg; Getty Images

Later that day, crying in the back seat of an unmarked car en route to a Rhode Island prison, Barbosa recalls an FBI agent trying to calm her down. He complimented her apartment, which she admits, even given the circumstances, pleased her just a little.

As it turns out, in late 2019, right about the time Barbosa was grabbing the Wall Street bull by the balls, Uber did know something was off. The company detected a ring of people bypassing its background checks in Massachusetts and California, and tipped off the FBI in Boston. Investigators served a warrant to Apple; they wanted to see the iCloud account of a Brazilian guy named Wemerson Dutra Aguiar who, after getting hurt at his job in construction, started driving for apps and later dealing fake accounts. Barbosa didn't know Aguiar, but a Mafia member had once asked her to email him a Connecticut driver's license template. She did. By February 2021, law enforcement had circled in on her, and served Apple a search warrant for her iCloud too. In early April, the FBI

had tracked Barbosa's location via her T-Mobile cell number. Investigators staked out her apartment and watched her come and go.

All this time, Barbosa had worried that getting caught could mean the government would seize her money and property—to her, disaster enough. She was shocked that the FBI raided her house, “like arresting a murderer.” *All this for me?* Then she was locked in a prison cell and charged, along with 18 other Brazilian nationals, with conspiracy to commit wire fraud and aggravated identity theft, for making and renting fake accounts over the prior two-plus years.

Barbosa was accused of being a heavy in the case: The government said she pushed out some 2,000 accounts, using hundreds of driver's licenses, and profited more than \$780,000. Barbosa says about half of that was her actual take. The rest she either split with her business partners or sent along to the immigrants who didn't have their own bank accounts and used hers. (The government conceded in court filings that Barbosa did let other people use her bank account.)

For the next two weeks, Barbosa says, she sat alone in her jail cell for 23 hours a day—for a mandated Covid-era quarantine—suffering from panic attacks and spiraling self-loathing. “I was feeling that my life was over,” she wrote me. “I fucked up everything.” Her attorney mailed her a flash drive of the government's evidence: her bank statements, the contents of her iCloud account, her Excel spreadsheet, some Mafia WhatsApp chats. Barbosa cringed upon reading “Find me, FBI.” (“I bet the FBI agent's face, when they read that, they said hahaha, like, stupid woman!”)

While Barbosa was in jail, her sister traveled to Boston and packed four suitcases full of Versace and Louboutin shoes and LV purses, then took them back to Brazil. Barbosa had a contact transfer \$30,000 back to Brazil before it could be seized. (The feds did later grab approximately \$55,000 in bitcoin.) On a video call, her sister showed her stories in the Brazilian press. “My name was in everyone's mouth in my city,” she says. The former teacher's pet from Sorocaba who taught computers to kids, now an alleged felon with some Mafia texting group in the US. Her mom was devastated. For months and months, the legal process dragged on.

Barbosa holds onto the shoes and gray sweats she wore in prison.

Photograph: Tony Luong

She took up crochet, among other hobbies, while incarcerated.

Photograph: Tony Luong

So, question: Did you think Priscila Barbosa, queen of accounts, was going to sit idle in jail? At the Gloria McDonald Women's Facility in Rhode Island, she morphed into Barbosa, Star Inmate. She cooked for more than 100 prisoners in the cafeteria and shared Brazilian recipes with fellow kitchen staff. That earned her \$3 a day. ("Ridiculous," she says, but she enjoyed the work.) She joined inmates in planting an organic vegetable garden in the yard. She aced law clerk and English composition classes. She picked up crochet, writing down pages of instructions that her sister had emailed: a headband, glittery unicorn slippers, a Christmas tree, stockings, and snowmen to deck out the unit for the holidays. She conquered a 2,000-piece puzzle of jellyfish and whales, then a 5,000-piece world map. She did daily squats and jumping jacks. She watched *Orange Is the New Black* and declared it somewhat accurate. She watched a TV commercial for WhatsApp's "private" texting and declared it a lie. When she entered a room, she says that some inmates, resentful, would snipe, "Here comes the princess." Upon hearing about her crime, one woman called her "Brazilian Robin Hood."

The name was snappy, but an awkward fit. Barbosa hadn't stolen money from the rich as much as identities from ordinary people. Now sitting in jail, she says, she finally thought about them. "This is going to sound awful," she warns, but here goes: "I feel bad that I caused some emotional distress to people. But at the same time, I did it in peace, because I never took money from any of those people. It wasn't victimless, because I used people's identity. But nobody really got damaged."

None of the three identity-theft victims who spoke to me—a Harvard professor and two tech workers—knew how or when their identity had been stolen. None had experienced financial harm. They felt unnerved because their information was exposed, but they were also curious about, and even

showed a degree of empathy for, the thieves. One victim mused to me, “It’s kind of a sad crime in a way, isn’t it? Obviously, it’s a crime and they shouldn’t have done it, but sad that people have to do stuff like this to get by.”

In prison, the crime was regarded as rather pathetic. Alessandro Da Fonseca, Barbosa’s DoorDash ally (arrested on the same day), was waiting out the legal process with many other defendants in a Rhode Island detention center, and found that more serious fraudsters were baffled. With all the personal information the ring had access to—enough to open bank accounts, credit cards—their only con was to ... create Uber profiles? Fonseca shrugged it off. “We are not criminals, with a criminal mind,” he told me in a jail call. “We just want to work.”

Uber disagreed. During the legal wranglings, the company accused the ring of stealing money and tallied its losses: some \$250,000 spent investigating the ring, around \$93,000 to onboard the fraudulent drivers, plus safety risks and damage to its reputation. Defense attorneys shot back that no one lost money at all: The jobs were done. The food was delivered. People got their rides. The gig companies, in fact, profited off the undocumented drivers, taking their typical hefty cut—money that, once the fraud was discovered, there was no evidence they’d refunded to customers.

As the rush of freedom subsided, Barbosa faced the sobering task of another new start. At least she had more than \$117, and her family had shipped back her designer clothes.

In February 2022, Barbosa sat in her Rhode Island prison cell, reading two packets of papers: one agreement to plead guilty to felony identity theft and conspiracy to commit wire fraud, another to cooperate with the US government. She had already done the latter in two hours-long interviews, in hopes of a lighter recommended sentence. She signed both agreements with a star in the P of Priscila (a sort of watermark, she says, in case the government tried to use her signature elsewhere).

A year later, in June 2023, Barbosa walked into her sentencing inside the red-brick federal courthouse along Boston’s waterfront. It felt nice to be back in civilian clothes—a white flouncy blouse and black pants—but she



was still afraid. The government was recommending three years for her, given her cooperation. Other defendants, whose alleged profits were lower, had been sentenced to that or more.

In court, assistant US attorney David Holcomb told the judge that Barbosa was the “most prolific creator” of the accounts, a “central figure” in the network, “highly effective” at this kind of fraud, with “unique social talents” bringing together ex-boyfriends, social contacts, and competitors. Barbosa’s attorney argued that her intentions were mostly good. “She is a very intelligent woman,” he said, who “put her intelligence to use in an extraordinary way,” helping immigrants work. (Barbosa enjoyed that part.) The judge wasn’t convinced. Her intelligence was all aimed at defrauding people, he said, and he had to set an example: “I hope those chat rooms are now filled with chats about ‘Did you hear about what happened to Priscila Barbosa?’” Her use of technology—the dark web, bitcoin, Photoshop—constituted “sophisticated means,” a sentencing enhancement, he added.

When Barbosa spoke, she cried. She said she was ashamed. She apologized “from the bottom of my heart” to the people whose identities she used. Then the judge read out her sentence: three years, just what the assistant US attorney recommended. Barbosa exhaled. With the two years she’d already served in prison, and with time shaved off for good behavior, she’d be released within a few months. For that last stretch, she was shipped off to Aliceville federal prison in Alabama.

Then, late in the hot summer, she got a visit from federal immigration officers. After she finished her sentence, they told her, she’d be taken to deportation proceedings. (“It looks like this nightmare never ends,” she wrote me.) As the months ticked by, Barbosa’s hopes of being able to stay in the US had grown. Now, crestfallen, she slipped into depression. She also decided that she would not fight it. She’d pay for her own ticket to Brazil so she’d be free as soon as possible. With the weeks dwindling, she typed me a very un-Barbosa message:

*“Too bad they got me too, it is what it is.”*

Sitting in her quiet living room in January, she said, “Maybe this is me adjusting to the world again.”

That, you might have guessed, was never how the story of Priscila Inc. was going to end.

Remember Barbosa's sham marriage in LA? The government found out about it too, while raiding her apartment. Along with her laptops and phones and driver's license printer, investigators took an album of wedding photos and a receipt for the \$28,000 "Package Plan." They asked her about it during those interviews while she was in jail.

In October, as Barbosa's deportation drew nearer, she heard from her attorney. Thanks in part to the intel from the apartment raid and her interviews, the government had busted the 11-person ring. Now she was being subpoenaed to testify at one person's trial.

Barbosa didn't want to take the stand, but given her cooperation agreement, she had little choice. So on November 15, 2023, the day before she had been scheduled to be taken into ICE custody, Barbosa was on a commercial plane, flying back to Boston with two US Marshals, hiding her handcuffs from other passengers inside her hoodie's kangaroo pocket. At the federal courthouse, she was (technically) rearrested, this time as a material witness. A magistrate judge released her with an ankle monitor to await the trial.

To understand Priscila Barbosa—the pluck, the sheer balls—consider that as other fraudsters were counting the days until their deportations or still living on the lam, she was walking out of a Boston courthouse's front door.

Barbosa was 37 years old. Fluent in English. Still wearing her gray Alabama prison sweatsuit. A bulky GPS cinched on her ankle. She breathed in the autumn air, along with a surreal feeling of once again being in charge of her own day. "I don't have even a toothbrush!" she told me over the phone the next day, giddy. "It is incredible to feel free again."

Two weeks later, she'd stride into the trial and recount the meeting at the marriage agency's office on Wilshire, the binder of potential spouses, the wedding by the jacaranda tree. The defendant's attorney, while cross-examining Barbosa, would rub in just how much she was benefiting from testifying: that she'd helped herself by telling the government about others

("I was just being truthful," she retorted), that her prison sentence had been shorter ("Who wants to be in jail?" she replied).

Her deportation had been temporarily halted for her testimony, but she would still need a permanent immigration remedy to stay long-term. Barbosa says she applied for asylum late last year, claiming that she fears retribution from the associates of the wedding agency and some people in the Uber case.

Illustration: Michelle Mildenberg

As the rush of freedom subsided, Barbosa faced the sobering task of another new start. At least she had more than \$117 this time, and her family had shipped back her designer clothes. Solving one immediate problem, she could get a legitimate driver's license now; Massachusetts had started issuing them regardless of immigration status. She could also work while her asylum application was pending, and her English skills, burnished by constant use in prison, got her part-time gigs translating medical appointments and home-renovation sales pitches. But frankly, neither felt like Barbosa-sized jobs. Her boyfriend had moved on while she was in prison, so she moved into a studio apartment alone. She hit the old clubs and parties with a smaller circle of friends—her closest one had been deported, others distanced themselves. At times, depression sank in.

Sitting in her quiet living room in January, she said, "Maybe this is me adjusting to the world again." As she spoke, she wobbled between the versions of herself. The Barbosa who meant well but, yes, did bad ... but had been quite good at it, hadn't she? The Barbosa vowing to never go anywhere near a gig app ever again, then the one who could still, when asked, recount every fraudulent keystroke. The repentant Barbosa who was glad getting caught forced her to quit. The pragmatic Barbosa who knew she would never have made a single fake profile had she just been legally allowed to work. With her future suspended between two countries, she wondered what was next.

So that's it. Barbosa wanted you to know the full story, "the real Priscila," the complex one. For the easy plot with a clean ending, there's Instagram.

In December, Barbosa put up her first after-prison post, picking up her victory march where she'd left off. She stood in front of a suburban Boston ballroom's Christmas tree in pleather bell bottoms, forehead newly Botox-smoothed, Louis Vuitton purse dangling from her wrist. She typed out a fresh bio: "Brazilian Living in USA ... Grateful for Life. Paralegal. MasterChef. IT Professional."

All of it more or less true.

*Updated: 7/22/2024, 11 am EDT: Wired clarified aspects of Priscila Barbosa's home computing set-up.*

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**Hair and makeup by Rose Fortuna**

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