

WIRE

G O E S W I L D

Mountain lion
Kodiak bear

Red fox
Marmot

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By [Hemal Jhaveri](#)

[Backchannel](#)

Nov 28, 2023 6:00 AM

***Rebel Moon* Director Zack Snyder on Violence, Loss, and Extreme Fandom**

The director manages to game the system and keep his soul while doing pretty much whatever he wants. Right now that means trying to make his *Rebel Moon* space opera into a Netflix mega-franchise.

Photograph: Dan Winters

more taxidermied animals live in Zack Snyder's office than seems normal. A lioness. A beaver. A duck. Also a wide collection of axes, swords, and guns—the weapons used to fell the wild beasts, maybe? The effect should be unsettling, but it isn't, because Snyder himself is warm, chatty, accommodating. And the space, tucked into a mountainside in Pasadena, California, turns out to be less a man cave than a fan cave: Snyder's shrine to his creative life. The swords and guns are merely props from his movies, like Babydoll's katanas from *Sucker Punch*. The photo of Wonder Woman above the sofa, where she's holding a few severed heads? Huge and sepia-toned, it's oddly alluring.

The Big Interview

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Being in Snyder's office, in fact, is a bit like watching one of his many stylized shockfests: The violence is so exaggerated it ends up feeling not only harmless, but fun. That is, of course, why his legions of fans show up.

Think of the *300*-style bloodbaths, the discomfiting opening of *Watchmen*. Or any number of scenes from the [director's cut of Justice League](#)—which, at [four hours long](#) and wrapped up in tragedy both personal and professional, ranks among the most authentic, auteurist comic book movies to date.

Now, Snyder is adding to his canon of large-scale sci-fi with [Rebel Moon](#), a galaxy-spanning space opera about a band of misfit outlaws. His first franchise movie as a director since *Justice League*, the film marks the start of a new era for Snyder. Well, newish: It'll still be big, bloody, and violent. With comic book sagas no longer the assured juggernauts they once were, Snyder has an opportunity to move unencumbered by the chains of existing IP. *Rebel Moon* will launch on Netflix with a two-hour PG-13 version, to be followed at a later date by, yes, a three-hour, hard-R director's cut. This is the sweet spot, Snyder tells me. He's happy to play the studio game if it means he also gets what he wants.

It's a vision for his career he's happy to dig into, and we do, but as much as Snyder likes looking ahead, he also has a habit of flicking back to the past. As we talk, he jumps up repeatedly to show me one piece of memorabilia after another. We flip through the sleeves of a rare vinyl *Justice League* soundtrack (\$400 on eBay). We page through Snyder's carefully bound, unproduced screenplay for *The Fountainhead*. (We talk about Ayn Rand way more than expected.) Then it's on to the original storyboards for *Watchmen*, which are crisp, artfully clean. When we get to the scene where Rorschach fights the guys in the hallway, Snyder does a little *pink-pink-pink* sound as he mimes shooting a gun.

The longer we talk, the more old themes resurface, and by the time Snyder comes across his high school yearbook (“Never forget who you are and never neglect to express it,” writes Mr. Brown, his algebra teacher), I am deep into a Snyder nostalgia tour—even as he insists he's not the nostalgic type. Somehow, I know what he means. Snyder is reflective about his career, but he's not weighed down by it. There's no Martin Scorsese-style hand-wringing about the old days of cinema or the sanctity of movie theaters. He just makes cool shit and wants to talk about it. Snyder is a

businessman as much as he's an auteur, clear-eyed, calm. If there's violence in him, it's artfully buried.

Hemal Jhaveri: I want to take a minute to acknowledge that, for a lot of people, I am in the inner sanctum. [*Points to Wonder Woman photo on the wall.*] Holy moly. That is gorgeous.

Zack Snyder: That's the original. My friend Steve Berkman took this before we hired Patty [Patty Jenkins, who directed the [two Wonder Woman films](#)].

Wow, do people know this exists?

The dorks know it exists. When I started it, I wanted a Wonder Woman that was not necessarily naive. Not necessarily, like, a virgin. Actually, there's one line in the *Wonder Woman* movie that I originally wrote. When they're on the boat and talking about, like, the treatises on sexual pleasure, she says [*to Steve Trevor*], "You wouldn't like it because it concludes that men, though important for reproduction, are not necessary for pleasure." That was my contribution.

Zack Snyder at his home in Pasadena, California. Photograph: Dan Winters

***Rebel Moon* also has a strong female lead—Kora, this former soldier. Who is she, to you?**

The movie is not a naive fantasy. She's a soldier. The trauma of being a soldier is a big part of who she is, and the trauma is really a lot of what shapes her. She's a powerful female character, but she does have a lot of flaws. In this case, she's got a lot to discover about herself. She's powerful, she's savvy in the universe. But emotionally, that's where she needs to grow.

Does she grow?

There is this whole thing of her feeling unworthy of redemption, but she has a taste of it, and she gets to this place where she can live a life.

What was crucial here about taking *Rebel Moon* to Netflix?

They understood from the beginning, “Oh, you’re gonna want to do a director’s cut.” The director’s cut was a prerequisite for making the movie for the first time ever, so my joy at making the two-hour PG-13 version was much greater.

Is there maybe even an advantage to having that separate PG-13 version?

It allowed the R-rated version to be more out there. It’s an interesting, mythological sort of place that I have found for myself. The way I make the movies now is that I have this concept of the director’s cut. I think nearly every movie I’ve made, except for *Man of Steel*, has a director’s cut, maybe two director’s cuts. Unlike my friends who make movies—

Name names.

Well, like [Chris \[Nolan\]](#) and, I don’t know, maybe Todd Phillips. These are the people that I run into. Chris, as a filmmaker, is probably the person I would be closest to, as far as like, you know, calling them up.

Is it because you both make really long movies?

He produced *Man of Steel*. I worked with him closely through that process, and that kind of just bonded us.

Sure, but how is it that you get to make two versions of your films while Christopher Nolan never gets to put out his extended cut of *Oppenheimer*?

Well, and Chris doesn’t need to. I have cultivated this other system where I, in a lot of ways with the director’s cut, asked for more than I have any business asking for. I realized that there was a commodity in just, “You know what I really wanted to do?” Then I do that. It’s been my experience that all the director’s cuts I’ve ever done are considered better movies than the theatrical versions. Critics or whoever, they’re just like, “Well, the director’s cut is better.”

That was certainly the case with *Justice League*.

To be honest, I have never seen the theatrical Warner Bros. cut of *Justice League*. I've heard a lot about it. My wife [*the movie's producer, Deborah Snyder*] was forced to watch it.

Has streaming changed how you make films, then?

It's a different sort of vibe. On the streamer, though, you have to be careful with the opening of the movies because the barrier for entry is really easy. But also the barrier for leaving is very easy. The balance is a lot more difficult on a streamer than in a theater. I normally open the movies with a very hard opening, right? I want to break the barrier. All those movies, *Watchmen*, *Dawn of the Dead*, have very intense openings.

You're clearly trying to unsettle people with your work.

I am and I love it. I believe the most satisfying sort of cinematic journey is the one that you don't expect. It's the turn you didn't see coming. It's being a little uncomfortable or being taken to a place that you wouldn't normally get to.

A common complaint about your movies is that they're always so dark and violent. Is that valid?

Maybe, but it's just because that's the art I like, I guess? The things that make me excited or interested, it tends to be a little bit more hard-hitting. My favorite movies, you know, really kind of fucked me up.

Speaking of, I see a lot of katanas and axes on the wall. There's also, like, a bearskin over there.

That's a lion.

Oh my God.

[*Snyder gets up and we walk over to it.*] I pulled her out of a dumpster. We found her, and she was behind this woodshop.

So you didn't skin her yourself.

I didn't, no. They had thrown it away. And I was like, wow, this is so rude. You put a lioness in the trash? I pulled it out and I found another taxidermist, had it cleaned and washed and refelted and everything. So she has a second life.

You also have a lot of guns.

Those are fake. That's a prop. This musket is real. My wife got me this brown Bess, it's from the Revolutionary War.

Do you think filmmaking has become too sanitized?

I do. I do.

You think we're getting a little too conservative?

I do. But you know, movies cost a lot of money. It's hard to do.

You're such a realist.

The whole thing to me is like, how do I trick the system?

So you're just gaming it.

You have to game it. If you don't, you end up with nothing. You end up really having to bury your soul, you just rip your heart out. Then you put it on the auction block. You put the movie out, it becomes a consumer product. You yourself become a consumer product. That's the thing that I think can be really difficult for filmmakers. That's the price of the transaction. That can be painful.

Photograph: Dan Winters

You had such a strong hold on the DC Extended Universe, you had your whole plan, and it didn't really work out the way you wanted it to —they've handed the keys over to James Gunn. How do you process letting something that was so meaningful to you go?

The big, the most cathartic thing was *Justice League*. My *Justice League* experience was the hardest in what was happening with me personally and what was happening professionally. All of it was really painful and difficult and made me wonder about the why of the whole thing. Like, what's the end game?

There was a real crisis. Like, I was trying to make something as best I can. I was called upon for a skill set, but in the end there was all that second-guessing. Also in my personal life, I'm confronted with, you know, probably the most painful thing I can think of.

Your daughter Autumn's death by suicide. Which happened at the tail end of *Justice League*, right?

Yeah, during postproduction, and I found no solace in the work. The life I created for myself was of no comfort to this other experience. You know, if we're honest with ourselves, in what we pursue, we hope that pursuit will have some catharsis for us in the struggles that we have in our lives. And I just think that was the darkest time, because I felt like I turned to the thing that I love and it turned its back on me as well.

Do you mean the work wasn't giving you solace? Or are you referring to your relationship with the studio?

I think it might have been the studio, but also it was the work itself. Where I was with the project, and my relationship with the studio, that experience offered me nothing. Any kind of healing was impossible, and so therefore I had no interest in continuing with it.

That was a real break for me. You live under this illusion that your art, and the way you express yourself, is a kind of therapy that you can always rely on. And then when the rubber hits the road, you're like, oh, no, it's not helpful at all.

Grief is deeply debilitating. What actually brought you back to moviemaking?

The fan movement of wanting to know what *Justice League* was supposed to be, that was cathartic. Because [the making of *Justice League*] was that exact same thing that had betrayed me. And then being able to dedicate the movie to Autumn.

Let me pull at that thread, because your name now is associated with the downsides of extreme fandom. These days, internet shorthand for aggressive bullying in fandom is, like, “Snyder Cut fans”—many of whom actually were harassing people and posting vitriol online.

Look, there's tons of toxic fans, and I don't condone that behavior. But for every toxic fan, there were legitimate and ridiculous and really, incredibly dark attacks on me, my family. I'm not justifying any bad behavior, but also, I'm in this conversation with this fandom, where I have tried to make the work as best I can.

On top of everything, your work is so polarizing. Nearly every article about you says something to the effect of, “whether you love or hate his movies.” How do you make sense of that?

It's weird that people care that much. That they would hate the movies. I'm more interested in the analysis of what draws that kind of ire. The fandom has emerged in this strong way. They're not casual. I make movies with the motivation to create something for the fans where they get to care about it as much as possible. That's the sort of bargain that I've struck.

Are you somebody who's hopeful about the future?

Very much so. Yeah, very, very hopeful. I try to live for the moment as much as I can, but I really—I'm always excited.

It sounds like you've figured out how to exist as an artist while still understanding the commercial nature of what it is you do.

I think that a lot of people don't realize that there's kind of two worlds that exist for us. It really has taken a while for me to really understand that. You can have it both ways and not compromise one way or the other. You know what I mean?

I think so, yeah ...

Do you see *The Fountainhead* over there? My way is not the Howard Roark-ian way of doing it. [Snyder gets back up and grabs a beautiful custom-bound copy of his unproduced *Fountainhead* screenplay. It looks very, very long.] Do you know the Ayn Rand novel?

I know it.

Howard Roark would never have built two buildings. One for you, one for me. He's about no compromises. To make a studio movie is a compromise. But I've gotten to this place where I can, wide-eyed, create a bespoke experience for two different markets at the same time. I don't know of any other filmmaker who can do it. I can do both.

Zack Snyder at his home in Pasadena, California. Photograph: Dan Winters

Are you still interested in theatrical releases?

I am. I don't know that having a movie in the theaters necessarily serves a streaming release. I think the verdict is out on that.

What's your verdict?

I don't think it does. But I do think, obviously, if you make a movie for the theaters, that's an incredible experience. I saw *Barbie* in the theater. I saw *Oppenheimer*. Those were great. I want to do that. I like that.

You seem to have no work-life balance.

There is no work-life balance. Absolutely you're right. Deb and I don't try for it.

Don't you ever feel the need to tap out for a little while?

I haven't yet.

Your wife said that she nudged you in the direction of pottery.

Yeah, I was playing too much *Fortnite*. I'm pretty good at *Fortnite*, actually. But it was also, you know, 3 in the morning, and my wife is like, "Are you seriously playing *Fortnite* at 3 in the morning against some 12-year-olds?"

Do they know that you're Zack Snyder?

No, I don't think so. My skin is Mr. Meeseeks, from *Rick and Morty*. Anyway, if you've been killed by Meeseeks, that could have been Zack Snyder.

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[Andy Greenberg](#)

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Nov 14, 2023 6:00 AM

The Mirai Confessions: Three Young Hackers Who Built a Web-Killing Monster Finally Tell Their Story

Netflix, Spotify, Twitter, PayPal, Slack. All down for millions of people. How a group of teen friends plunged into an underworld of cybercrime and broke the internet—then went to work for the FBI.

ILLUSTRATION: JAMES JUNK, MATTHEW MILLER; GETTY IMAGES

Early in the morning on October 21, 2016, Scott Shapiro got out of bed, opened his Dell laptop to read the day's news, and found that the internet was broken.

Not *his* internet, though at first it struck Shapiro that way as he checked and double-checked his computer's Wi-Fi connection and his router. *The internet.*

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The *New York Times* website was offline, as was Twitter. So too were the websites of *The Guardian*, *The Wall Street Journal*, CNN, the BBC, and Fox News. (And WIRED.) When Twitter intermittently sputtered back online, users cataloged an alarming, untold number of other digital services

that were also victims of the outage. [Amazon](#), [Spotify](#), [Reddit](#), [PayPal](#), [Airbnb](#), [Slack](#), SoundCloud, [HBO](#), and [Netflix](#) were all, to varying degrees, crippled for most of the East Coast of the United States and other patches of the country.

Shapiro, a very online professor at Yale Law School who was teaching a new class on cyber conflict that year, found the blackout deeply disorienting and isolating. A presidential election unlike any other in US history loomed in just under three weeks. “October surprises” seemed to be piling up: Earlier that month, US intelligence agencies had jointly announced that hacker breaches of the Democratic National Committee and Hillary Clinton’s presidential campaign had in fact been carried out by the Russian government. Meanwhile, Julian Assange’s [WikiLeaks](#) had been publishing the leaked emails from those hacks, pounding out a drumbeat of scandalous headlines. Spooked cybersecurity analysts feared that a more climactic cyberattack might strike on Election Day itself, throwing the country into chaos.

Those anxieties had been acutely primed just a month earlier by a [blog post](#) written by the famed cryptographer and security guru Bruce Schneier. It was titled “Someone Is Learning How to Take Down the Internet.”

“Over the past year or two, someone has been probing the defenses of the companies that run critical pieces of the internet,” Schneier, one of the most highly respected voices in the cybersecurity community, had warned. He described how an unknown force appeared to be repeatedly barraging this key infrastructure with relentless waves of malicious traffic at a scale that had never been seen before. “These probes take the form of precisely calibrated attacks designed to determine exactly how well these companies can defend themselves, and what would be required to take them down. We don’t know who is doing this, but it feels like a large nation-state. China or Russia would be my first guesses.”

Now it seemed to Shapiro that Schneier’s warning was coming to fruition, right on schedule. “This is *the attack*,” he remembers thinking. Was it “the big one?” he asked himself. Or was it perhaps a test for the true “big one” that would hit on November 8? “Obviously, it has to be a nation-state,” Shapiro thought. “It has to be the Russians.”

For Shapiro, the internet outage was a kind of turning point: In the months and years that followed, he would become obsessed with trying to understand how someone could simply stamp out such a large swath of digital connectivity across the world, who would do such a thing, and why. But meanwhile, a little less than 500 miles west of Shapiro's Connecticut home, in the town of Washington, Pennsylvania, another sort of observer was watching the attack unfold.

After a typical sleepless night at his keyboard, 19-year-old Josiah White sat staring at the three flatscreen monitors he'd set up on a workbench in a messy basement storage area connected to the bedroom he shared with his brother in their parents' house. He was surrounded by computer equipment —old hard drives and a friend's desktop machine he had offered to fix—and boxes of his family's toys and Christmas tree ornaments.

For weeks, a cyber weapon that he'd built with two of his young friends, Paras Jha and Dalton Norman, had wreaked havoc across the internet, blasting victims offline in one unprecedented attack after another. As the damage mounted, Josiah had grown accustomed to the thrills, the anxiety, the guilt, the sense that it had all gotten so absurdly out of hand—and the thought that he was now probably being hunted by law enforcement agencies around the world.

He'd reached a state of numbness, compartmentalizing his dread even as he read Bruce Schneier's doomsday post and understood that it was describing his own work—and now, even as a White House press secretary assured reporters in a streamed press conference that the Department of Homeland Security was investigating the mass outage that had resulted directly from his actions.

But what Josiah remembers feeling above all else was simply awe—awe at the scale and chaotic power of the Frankenstein's monster that he and his friends had unleashed. Awe at how thoroughly it had now escaped their control. Awe that the internet itself was being shaken to its foundations by this thing that three young hackers had built in a flurry of adolescent emotions, whims, rivalries, rationalizations, and mistakes. A thing called Mirai.

Part One

Illustration: Joonho Ko

None of the three young men who built Mirai fit the profile of a cybercriminal, least of all Josiah White, who could lay perhaps the most direct claim to being its inventor. Josiah had grown up in a rural county an hour south of Pittsburgh. He was the youngest of four children in a close-knit Christian family, all homeschooled, as his mom put it, to better “find out how God had created them and what he had created them to pursue.” She describes the thin, dark-haired baby of the family as a stubborn and independent but unusually kind child, who would sit beside the new kid in Sunday school to make them feel welcome.

Josiah’s father was an engineer turned insurance salesman, and the family lived in a fixer-upper surrounded by woods and farmland. As early as he can remember, Josiah followed his father around the house while he tinkered and made repairs. In 2002, when he was 5, Josiah was delighted to receive for Christmas the components of an electrical socket. Later his parents gave him a book called *101 Electronics Projects*, and he would beg his mother to drive him to RadioShack, arriving with a shopping list of breadboard componentry. Before he was 10, he was advising his father on how to wire three-way switches.

Josiah’s father would take him along to their church’s “car ministry,” where they’d repair congregants’ cars for free and refurbish donated vehicles for missionaries. Josiah would stand in the corner of the shop, waiting for the foreman to give him a task, like reassembling a car’s broken water pump.

Josiah reveled in impressing the adults with his technical abilities. But he was always drawn to computers, cleaner and more logical than any car component. “You give it an input, you get an output,” he says. “It’s something that gave me more control.” After years of vying for time on his family’s computer, he got his own PC when he was close to his 13th birthday, a tower with a Pentium III processor.

Around the same time, Josiah's brother, seven years older than him, figured out how to reprogram cell phones so they could be transferred from one telephone carrier to another. Josiah's brother started to perform this kind of unlocking as a service, and soon it was so in demand that their father used it to launch a computer repair business.

By the time he was 15, Josiah would work in the family's shop after school, setting up Windows for customers and installing antivirus software on their machines. From there, he got curious about how HTML worked, then began teaching himself to program, then started exploring web-hosting and network protocols and learning Visual Basic.

As wholesome as Josiah's childhood was, he felt at times that he was being raised "on rails," as he puts it, shepherded from homeschooling to church to the family computer shop. But the only rules he really chafed against were those set by his mother to limit his computer time or force him to earn internet access through schoolwork and household chores. Eventually, on these points, she gave up. "I sort of wore her out," he says. She relented in part because a hands-on understanding of the minutiae of computing was quickly becoming essential to the family business. Josiah, now with near-unlimited computer time, dreamed of a day when he'd use his skills to start a business of his own, just as his brother had.

In fact, like most kids his age, much of Josiah's time at the keyboard was spent on games. One of them was called *Uplink*. In it, the protagonist is a freelance hacker who can choose between two warring online movements, each of which has built a powerful piece of self-spreading code. One hacker group is bent on using its creation to destroy the internet. The other on stopping them. Josiah, not the sort of kid to do things in half measures, played through the game on both sides.

Illustrations: Joonho Ko

immersing himself in that cyberpunk simulation—and learning about famous hackers like Apple cofounder Steve Wozniak and Kevin Mitnick, who had evaded the FBI in a cat-and-mouse pursuit in the 1990s—cultivated in Josiah's teenage mind a notion of hacking as a kind of secret, countercultural craft. The challenge of understanding technical systems

better than even their designers appealed to him. So did the subversive, exploratory freedom it offered to a teenager with strict Christian parents. When he googled a few hacking terms to learn more, he ended up on a site called Hack Forums, a free-for-all of young digital misfits: innocent explorers, wannabes, and full-blown delinquents, all vying for clout and money.

On the internet of 2011, the most basic trick in the playbook of every unskilled hacker was the denial-of-service attack, a brute-force technique that exploits a kind of eternal, fundamental limitation of the internet: Write a program that can send enough junk data at an internet-connected computer, and you can knock it offline.

The previous year, for instance, the hacker group Anonymous had responded to the refusal by Visa, Mastercard, PayPal, and Bank of America to allow donations to WikiLeaks by urging its plebes to bombard the companies' servers with data requests, creating so-called distributed denial-of-service attacks that briefly took down the companies' online services. But most DDoS attacks were less principled: the constant AK-47 cross fire of the cybercriminal internet's internecine wars and vandalism.

On Hack Forums, many hackers ran their own “booter” services that, for a few dollars a month, would launch denial-of-service attacks against anyone a customer chose—often online gaming services, to troll or sabotage rival players. Users and admins of booters talked casually of “hitting off” targets, or worse, “holding off” a service or a single user’s connection, repeatedly bombarding it to prevent it from coming back online.

Some booters launched attacks from botnets, collections of thousands of unwitting users’ PCs, hijacked with hidden malware to form a lemming-like swarm of machines pummeling a target with data. Other booters used “reflection” or “amplification” attacks: If a hacker could find an online service that would respond to a query by sending back a larger chunk of data than the request itself, they could spoof the origin of their question so the service would send its answer to a victim. By bouncing a stream of thousands of questions off a server, the hacker could bombard the victim with its responses and vastly multiply their attack’s firepower.

Josiah, fascinated by the cleverness of those tricks, was naturally determined to understand them at their deepest level. He stumbled upon a blog post from a cybersecurity blogger describing a reflection attack that used the servers of the online first-person-shooter game *Quake III Arena*. Ping them with a simple “getinfo” or “getstatus” request, and the servers would send back information that included the usernames of the players on the server and the map of the level they were playing on—an answer that was nearly 10 times as big as the question and could be directed at any spoofed IP address a hacker chose.

The post was intended as a warning. It cautioned that this kind of attack could be used to take down a service with as much as 23 megabits per second of bandwidth, a pipe that seemed enormous to Josiah on his 1.5-megabits-per-second home DSL connection. A competent programmer exploiting the problem, the blog post’s author wrote, “can easily create a full-fledged attack suite in a lazy afternoon.”

Josiah took this as a challenge. He cobbled together a simple script to perform the attack and posted it to Hack Forums under his handle, “Ohnoes1479.” He asked only for anyone who used it to give him an upvote “if its good ¶” to increase the prestige of his forum profile.

Josiah didn’t think too much about the morality of his creation. After all, it took a computer offline only temporarily, right? More of a mischievous hiccup than a crime, he figured. He couldn’t use it himself anyway, because his home internet connection didn’t allow the IP spoofing the attack required. Still, as other hackers on the forum—some of whom he suspected ran their own booter services—asked questions about how to use the program and even requested feature updates, he was happy to help.

Mostly, like the technical wunderkind he’d once been in his church’s auto shop, he aimed to impress. “I wanted to make something cool,” he says. “And I wanted respect.”

in that anarchic Hack Forums scene, Josiah soon found a kindred spirit, a user who called himself “moldjelly.” In the offline world, his name was Dalton Norman. He was a teenage hacker just a year older than Josiah who was far more in touch with his rebellious side.

Like Josiah, Dalton had grown up with an engineer for a father. His dad led the maintenance team for a skyscraper in New Orleans, where the family lived. And like Josiah, Dalton had a natural technical talent. As a preteen, he wrote cheating mods for video games that he presented on his own YouTube channel in a squeaky voice. He and his father would work in their spare time on his dad's souped-up Chevrolet Monte Carlo, which had so much horsepower that Dalton remembers the feeling of its exterior twisting as it accelerated. He says he inherited that same drive to push technology to its limits.

But far more than Josiah's, Dalton's childhood was tinged with adversity. As a small child, he had struggled with a stutter that deeply scarred him. He remembers his family laughing at him at the dinner table as he labored in vain to pronounce his younger sister's name. "It was awful and kind of contributed to me just being in my room and having low self-esteem and trying to raise it by being super good at something," Dalton says.

By the end of elementary school, to Dalton's relief, the stutter had faded away. But just as it seemed like he might enjoy a normal adolescence, his life was disrupted by misfortune on a far larger scale: Hurricane Katrina. Dalton's family evacuated to Mississippi and didn't return for more than five years. In exile one state over, Dalton found himself at a "culty" Christian private school, where students prayed before class and, as he remembers it, a math teacher assured him that Barack Obama was the Antichrist. "When I wouldn't pray or do any of that," he says, "I would get shit for it."

Dalton wrote his first program when he was 12. It was a spam tool that he used to torture a teacher he disliked, wrecking her inbox. He says he carried out his first denial-of-service attack not long after, targeting his school's network from within.

While connected to the school's Wi-Fi, he flooded its router with junk requests until the entire intranet collapsed. "It's easy to take down a network when you're inside of it," he says. Ironically, as Dalton describes it, he had gotten enough of a reputation for IT know-how that school staff asked for his help fixing the problem. He stopped his attack script, unplugged the router, plugged it back in, and showed the school

administrators that it magically worked again. During another attack, however, he says he overheated the router so badly in its poorly ventilated closet that it was fried.

In his early teens, he remembers watching *The Social Network* and taking exactly the wrong message from the movie: Rather than feeling cautioned by the film's fictionalized origin story of an icily amoral Mark Zuckerberg, Dalton was profoundly inspired. "That movie basically changed how I viewed the world," he says. "It's like, with a laptop and a great idea, you can take control of your life and build something cool."

After a failed attempt to launch his own social network—he had no idea how to gain users and no budget to advertise it—he returned to hacking: He wrote a keylogger program, designed to snoop on a victim's keystrokes after infecting their PC via thumb drive. He also found his way onto Hack Forums. Soon he was running his own booter service, hiring other hackers to handle customer service so he could focus on finding new methods to amplify his attack traffic.

It was around this time that Dalton encountered Josiah, who was, he says, the smartest hacker he'd ever met. The two teens soon moved off Hack Forums to talk regularly on Skype and then later TeamSpeak, another internet conferencing service. In those conversations, Dalton eventually used his real name, while Josiah went by "Joey," a thin veneer of a pseudonym. They enjoyed competing with each other to find new denial-of-service amplification tricks. In a friendly rivalry, they'd stay up into the early morning hours, plumbing the internet for eclectic servers that they could use to multiply their attack traffic dozens and eventually hundreds of times over.

In those late-night cyberattack sessions, the two hackers say, they would typically set up their own website for target practice, or use a friend's, so that they could measure the size of the traffic they were blasting at it. At times they would clock attacks of more than 100 gigabits a second, they say—more than 4,000 times as big as the 23-megabit attack that had initially amazed Josiah. Very often they would knock their target website offline, along with the server of the hosting service it ran on, causing downtime for an untold number of other websites too.

By this time, Josiah admits, he'd become mildly intoxicated by the power of the tools they'd learned to wield, though he still considered himself a kind of innocent, exploratory hacker. "I was stupid, and I was just angry sometimes, and I wanted to see damage, at points," he says. "But it wasn't my primary motivator—for a while."

Dalton, who was already running a for-profit attack service, had no such illusions of innocence and admits—a little proudly—to using his growing arsenal of booter artillery on any Hack Forums rival who sufficiently annoyed him. In some cases, he boasts, he would "hit people off so hard" that their internet service providers would cut the victim's connection for 24 hours to avoid further collateral damage. "It was a lot of power," he says. "If someone was bullying or being an asshole, then yeah, they went offline for a while."

Illustration: James Junk, Matthew Miller

both teenagers managed to hide these dalliances with illegal hacking from their families. But for Dalton, the consequences soon spilled violently into his physical world.

It began when he discovered that someone who worked for his booter service, an older kid to whom he'd foolishly given his real name, had been stealing their profits. He fired the guy. A few days later, Dalton and his family were sitting around the dinner table when a team of police officers in bulletproof vests burst through the door, screaming at everyone to get on the ground. The cops pointed shotguns at Dalton and his terrified parents and siblings, barking orders and questions.

It turned out that the police had received a spoofed 911 call. The caller had warned that Dalton had shot his mother and was now holding the rest of the family hostage. Dalton had been "swatted," targeted with the most dangerous retaliatory measure in the toolkit of nihilist teen hackers. When the police realized there was no hostage crisis, Dalton explained to the cops and his parents that an angry kid online had inflicted this situation on them —leaving out the part about his booter service. As a measure of the skewed risk assessments of his teenager's brain, his biggest fear during the entire incident was how his furious parents would punish him. He was grounded.

Dalton says the real lesson he drew from the incident was to tighten his operational security, no longer telling anyone in the hacking world his real name—except Josiah. “I trusted no one except for Joey,” he says.

In the midst of all this, when Dalton was 15, another kind of calamity struck: His stutter came back. He says it happened when he met another stutterer at his high school. Somehow, the event triggered his brain to start tripping up his speech all over again. And the change seemed to be permanent. All the difficulty he’d had speaking as a small child, along with all the anxiety and shame that came with it, flooded back. It was, he says, “a nightmare.”

Like many stutterers, Dalton found workarounds for the arbitrary lexicon of words that would halt his speech, substituting others to hide his disability. But names, which allowed no substitutions, were particularly tough. At one point, to get out of gym class, he volunteered with his high school’s tech office and found that the job included delivering laptops to students. He remembers standing in front of a classroom trying to say a student’s name as the entire class laughed at him. Even his own name was often impossible to get out. “It broke me,” he says. “But afterward, I was just like, ‘I don’t care what other people think. Fuck it.’”

Dalton’s stutter, he says, drove him into cybercrime with a renewed fervor. He cut ties with real-world friends, retreated to his computer, and focused his energy on hacking. His skewed teenage logic kicked in again, telling him to abandon any hope of a normal life or legitimate career. “I thought, ‘No one’s gonna hire me because I can’t talk. How am I going to get past an interview when I can barely say my name?’” Dalton remembers.

He had, he told himself, no other option. “I have to find a way to make this blackhat thing work out.”

Of the Three young hackers who would go on, together, to be responsible for the biggest DDoS attacks in history, Paras Jha came to that path from the most innocent and childlike place of all: a love of *Minecraft*.

Born in Mumbai, Paras was less than a year old when his family emigrated to the US, where they eventually settled near central New Jersey. His

parents demanded academic perfection, and Paras was gifted enough to easily deliver. Too easily, in fact: For years of elementary and middle school, he would read entire textbooks as soon as he got them, he says, then never study them again and ace every test.

At the same time, Paras was aware that he had a paradoxical problem with focus. He remembers being in third grade and disassociating as a teacher spoke to him, tracing out her face in the air with his finger. That teacher later suggested to Paras' parents that he be tested for attention deficit disorder. Coming from a culture that stigmatized such a diagnosis, Paras says, his family was skeptical of the teacher's warning. His mother and father filled out the school's evaluation for learning disabilities; it came back negative, and he was never treated.

Over Skype, Josiah told the others that he was launching the attack. Across the internet, Paras could hear the tap of the Enter key on Josiah's keyboard. And the world stopped.

As Paras grew older, his scattered mental state meant he often forgot school assignments, and his strict parents would respond by grounding him. To pass the time, he gravitated to computers. His beloved video games were forbidden on weekdays, so he would spend hours playing with Microsoft's Visual Studio, teaching himself to program.

By his early years of high school, Paras had become obsessed with *Minecraft*, an immersive online world that essentially presents a blocky, lores, nearly infinite metaverse. More than playing the game, however, Paras was drawn to the possibilities of running his own *Minecraft* world on an online server. He would host mini-games of tag or capture the flag, endlessly tinkering with his server's code to modify the rules. He loved to join his own world, turn himself invisible, and then observe how players responded within the universe he controlled and changed at will. It was like watching 8-bit ants with human intelligence move around his very own ant farm.

Paras soon discovered he could make thousands of dollars using his coding skills to build modifications and mini-games for other *Minecraft* administrators. In fact, it turned out that the *Minecraft* ecosystem supported

its own surprisingly high-stakes industry. Players paid small fees for access to perks and upgrades on their favorite servers, and administrators of the most popular worlds within that decentralized metaverse made as much as six figures a year in revenue. All of that money meant this innocent-seeming industry had developed a surprisingly ruthless dark side. *Minecraft* servers came under constant barrage from booters' DDoS attacks, launched by aggrieved players, competitors, and trolls. Many paid thousands of dollars a month to DDoS protection firms that promised to filter or absorb the attack traffic.

One day, Paras found himself in a Skype group chat with an acquaintance who also ran a *Minecraft* server. This person was determined, for reasons Paras can no longer remember, to take down a particular rival's world. Paras read along as the acquaintance asked another member of the chat for help—a figure by the name of LiteSpeed, who had attained a certain infamy for his denial-of-service wizardry.

Josiah had changed his handle on Hack Forums from Ohnoes1479 to this less-cute moniker about nine months after he'd joined the site, and these days he carried himself online with significantly more swagger. He was happy to oblige.

Josiah, Paras, and a few friends all entered the target *Minecraft* world, apparating into its blocky landscape full of hundreds of other players' lo-res figures. Then, over Skype, now in a voice chat, Josiah told the others that he was launching the attack. Across the internet, Paras could hear the tap of the Enter key on Josiah's keyboard. And the world stopped.

Instead of going dark or returning an error message, the universe hosted on the server that Josiah had knocked offline simply froze, as each player was suddenly disconnected and confined to their own computer's splintered version of it. Paras marveled at how he could move through that world and see other players paralyzed where they stood, or floating in midair.

That frozen state lasted for 30 seconds before the world crashed entirely. To Paras, it was a hilarious magic trick. "It felt like a secret superpower almost," he says. "Even though it wasn't me who did it, it was cool to just be in the know about what's going on."

He became friendly with Josiah and found that this talented hacker was happy to take down practically any target server that Paras asked him to, mostly just for sheer amusement. Josiah also seemed to be surprisingly open to sharing his knowledge. Having moved on from the amplification attacks he and Dalton had experimented with early on, Josiah now carried out his attacks with a botnet of thousands of computers around the internet that he'd infected with his own malware, exploiting a security flaw in the web-hosting software phpMyAdmin to turn the underlying servers into his personal army.

Later Josiah would switch to wielding an even more powerful collection of Supermicro servers that he'd hacked via a vulnerability in their baseboard management controllers, chips meant to allow an administrator to remotely connect to a server and monitor its performance. The attacks he was triggering were soon so powerful that he and his friends had difficulty even gauging their strength: Everything they'd hit with it—the best-protected *Minecraft* servers, even their own measurement tools—would immediately fall offline.

Paras wanted this superpower too. Josiah was happy to help him troubleshoot his DDoS attack code and even offered thousands of computers from his own botnet for Paras to test it on. "Instead of just pressing the button, I wanted to say I had *made* the button," says Paras. Soon he was a relatively sophisticated botnet herder with his own DDoS zombie horde.

By 10th grade, to his parents' dismay, Paras had begun to struggle in school as subjects became more complex and his disaffected-prodigy tactics reached their limits. But online, where he went by the handle "dreadiscool," he embraced his new godlike capabilities with roguish abandon, knocking off targets on the slightest whim. He and another friend would even sometimes find the phone number for a company that hosted certain *Minecraft* servers, call their business line from a burner number, and verbally taunt them as Paras launched a DDoS attack that ripped their machines offline.

Somehow, the rule-following, high-achieving kid from a strict immigrant household had become a rampant online vandal. But at that point, Paras

says, it was never quite clear to him—or Josiah, or Dalton—how serious the consequences of their attacks might be. They were, after all, still just taking some computers off the internet, right? “Like, the servers come back online,” Paras says. “You wake up the next day and you go to school.”

At other times he would almost check himself, coming to grips with his spiraling behavior. He remembers sitting in the bathroom of his parents’ house just after taking down one of the biggest *Minecraft* servers, Hypixel, and realizing that if he kept going, he was bound, sooner or later, to get arrested. “Don’t get sucked into it,” he told himself. “Don’t get sucked into it.”

Illustration: Joonho Ko

paras got sucked into it. They all did. In particular, Josiah, the Christian homeschooled who’d once kidded himself that he was a harmless hacker-explorer or a Wozniak-style prankster, had taken a rapid, step-by-step slide into moneymaking cybercrime. Under his LiteSpeed handle, he’d begun selling his amplification techniques to known booter service operators for a few hundred dollars a customer, spending most of the money to rent servers in remote data centers to further his hacking. He reverse engineered Skype’s code to find ways of extracting users’ IP addresses, the identifiers for their home internet connections that could allow them to be directly DDoSed. Soon he was selling this IP-extraction tool on a per-use basis to his fellow hackers and booters.

When one of his friend’s would-be victims bragged that he couldn’t be hit offline because he had a dynamic IP address that changed every time he rebooted his home router, Josiah figured out he could use a traceroute command to see the IP address of every router between that target and his internet service provider. So he and the friend started hitting the computers farther upstream in that network, going after the bigger arteries that fed data to and from his computer instead of the capillaries that linked to his home machine, until all of those routers were unresponsive too. This indiscriminate tactic, as far as they could tell, took out the internet service for the target’s entire town, all just to prevent him from dodging their attack.

Each step, Josiah says, felt small enough that, like the mythical boiling frog, he barely noticed the change in moral temperature. He'd found something he was very good at—better than perhaps anyone he knew. And he wasn't, he told himself, carrying out hardcore cybercrime like breaching networks or stealing credit card data. Another Hack Forums user reassured him that the FBI cared only about botnets bigger than 10,000 computers, a story he naively accepted. "I rationalized a lot of it away," Josiah says. "The pot was boiling."

in early 2014, when Josiah was still 16 years old, he dialed the temperature up another fateful degree with the creation of a powerful new form of botnet. It began when a friend pointed out to him that home routers, aside from making good targets for DDoS attacks, could themselves be hacked and potentially turned into botnets' zombie conscripts. In fact, many routers still used an old protocol called telnet that allowed administrators to remotely configure them, sometimes without the need for any authentication or else requiring only default credentials, like the password "admin." All those routers represented countless thousands of hackable devices, in other words, waiting to be taken over and added into Josiah's army.

The catch was that the routers were small, simple gadgets that used cheap, low-performance embedded-device chips—not the kind of system that most hackers were accustomed to exploiting. But Josiah was never one to be daunted by the task of learning the arcane details of a new machine. He started from scratch, learned to write the native language of routers' ARM chips, and built a compact piece of malware that could be installed over telnet onto the relatively dumb devices to make them obey his attack commands.

The routers' operating systems didn't normally allow software to be installed on them. But Josiah figured out that they did have an "echo" command that could write out any line of text that you typed into a new file. He used that command to copy his code, line by line, into a file small enough to fit into the routers' few megabytes of memory. The feat was the equivalent of assembling a model ship inside a 12-ounce bottle. He called the code Qbot.

Qbot was Josiah's first foray into hacking the so-called internet of things, the vast universe of internet-connected devices beyond traditional computers, from security camera systems to smart appliances, that would turn out to be ripe for exploitation. Even in this first, crude attempt, it was immediately clear that Qbot was a potent new weapon.

Josiah could see the power he'd stumbled into: There seemed to be many thousands of vulnerable routers online that Qbot could commandeer. He was initially more careful with this creation than he'd been with his previous coding projects, keeping Qbot's code private and sharing it only with his friends: Dalton, Paras, and a few other young hackers who had formed a loose network and hung out on Skype and TeamSpeak. But Josiah made the mistake of also giving the code to one other contact. The guy went by the name "vypor" and, Josiah says, had a reputation for trading in other hackers' secrets as a means of impressing more talented acquaintances. Vypor immediately began trading Qbot for favors and clout with, it soon seemed, his entire contact list.

When that betrayal became clear, Dalton retaliated on Josiah's behalf by hiring a rapper through the gig-work service Fiverr to record a profanity-laden track brutally mocking vypor's lack of coding skills. The diss track was uploaded to YouTube. Vypor immediately responded by threatening to swat all of them: Dalton, Josiah, even Paras, who had only recently joined the group.

All three of the young hackers were terrified of being swatted—or swatted again, in Dalton's case. They agreed that their best bet to protect themselves was to knock vypor offline and hold him off as long as possible. If he couldn't reach a VoIP service to spoof a call to the police, their short-term reasoning told them, he couldn't swat anyone. Maybe they could at least enjoy the weekend before he brought armed police to their doorsteps.

So all of them, together, bombed vypor with every DDoS tool they had. For days, they repeatedly hit not only his home connection but also routers two and three steps upstream, using Qbot and every other botnet and amplification technique they'd learned to wield. The three believe they probably blasted vypor's entire town off the internet, though they never got

confirmation aside from seeing the entire chain of network devices stop responding to their pings.

Regardless, the attack seemed to serve its purpose. Vypor disappeared from the scene and never bothered them again.

Illustration: Joonho Ko

allison nixon, who would become one of the first security researchers in the world to fully understand the dangers posed by weaponized routers and internet-of-things appliances, had no idea who Josiah White was. But she knew LiteSpeed.

At the beginning of her career in New York a few years earlier, Nixon had worked the night shift in the Security Operations Center of Dell's SecureWorks subsidiary, essentially as the cybersecurity equivalent of a patrolling night watchman. A petite, hoodie-wearing security analyst in her early twenties, she monitored the company's clients' networks for attacks in real time and investigated them just enough to know whether to escalate to someone more senior. "Kind of a grind," she remembers.

But she was curious about where all these daily, wide-ranging hacking attempts were coming from. So in the long stretches of downtime between alerts, she started googling and was amazed to discover Hack Forums, a platform on the open web where young digital deviants were bragging about their attacks and brazenly selling their toolkits. She found boomer services especially shocking: how publicly, and cheaply, these miscreants sold a kind of cyberattack that could cost companies millions of dollars a year and often made her and her colleagues' lives hell. Many of the young hackers doing this damage could even be identified, thanks to their rash public posting, sloppy operational security, and the frequent "doxing" of rivals—digging up and outing another hacker's real identity. But no one seemed to be doing anything to stop them.

As Nixon lurked longer on the forum, she could see that most hackers on the site weren't actually developing their own techniques. Instead, almost all of their tools seemed to trickle down from just a few skilled individuals. LiteSpeed was one of them. His attack amplification tricks and bot infection

tools had established him as a kind of Hack Forums alpha, an unmistakable standout in the scrum. “Sometimes you kind of get a gut feeling when you’re tracking someone that they’re going to blow up in one way or another,” she says. “I knew I wanted to keep an eye on him.”

Nixon says the more senior researchers on SecureWorks’ counterthreat team had little interest in DDoS attacks, which were considered primitive compared to the cutting-edge intrusion methods that they focused on. But Nixon was fascinated by the anarchic *Lord of the Flies* world of young hackers building an entire cyberattack industry, seemingly with no repercussions or even notice from law enforcement.

Nixon partnered with a university researcher and began testing out booter services on Hack Forums, barraging a guinea-pig target server with waves of junk traffic. Some of the attacks topped 30 gigabits a second, easily enough to knock someone offline or cripple a website.

By 2014, Nixon had quit the security operations center and taken a job hunting hackers full time, but she couldn’t let go of her DDoS obsession. At a meeting in Pittsburgh of cybercrime fighters, called the National Cyber-Forensics and Training Alliance, she stood before a room of several dozen researchers, academics, and law enforcement officials. With the participation of an internet service provider that had just presented its DDoS protection plan, she demonstrated that she could click a button on a booter website and launch a cyberattack at will—a daring move in front of a crowd of federal agents and prosecutors.

One agent from the FBI’s Pittsburgh field office, named Elliott Peterson—a former Marine from Alaska who’d recently led the landmark takedown of a Russian-origin cybercriminal malware and botnet known as GameOver ZeuS—was particularly impressed. He and Nixon talked about the booter problem. She pointed out how freely the services operated, how many of the culprits were identifiable, and how powerful any intervention in that world might be. And she shared her growing sense that, if the larger problem were left unchecked, it would pose a serious threat to the operation of the internet.

for Josiah, the conflict with Vypor was a wake-up call. He felt he'd narrowly avoided watching his secret hacking hobby burst into his peaceful family life. For more than a year, he backed away from Hack Forums and let his LiteSpeed handle go dormant. But he continued to chat with his friends Paras and Dalton, and the three of them began sharing a rented server for coding experiments and internet scanning, which they referred to as the Fun Box.

Paras, meanwhile, continued his free fall into hacker nihilism. In the fall of 2014, he started college at Rutgers and found himself alone and unmoored. He had looked forward to delving into the study of computer science and was appalled to learn that he would have to enroll in other kinds of courses that, to him, seemed like months of wasted time and tuition. Even the computer science exams, to his horror, had to be taken with pencil and paper. "I absolutely hate college," he texted a friend. "There is absolutely nothing for me here."

He sank into a malaise and gained weight, sometimes eating a large Papa Johns pizza in one sitting. He couldn't sleep at night and often couldn't find the motivation to get out of bed, much less go to class. Aside from his roommate, he had little social contact in the real world—certainly nothing that could compare to the rich, battle-tested friendships he'd built online.

"We'll do it a few times," Josiah remembers thinking. "We'll cause trouble for a little bit, and then we'll just forget about it. We'll stop."

Paras was particularly frustrated to find he couldn't even get into some of the computer science courses he wanted to register for: Third- and fourth-years got first dibs, and only once their registration round was over did second- and first-years get a chance to choose from the leftovers.

But Paras soon realized he had just the superpower to right this injustice: He could use one of his botnets, built mostly of vulnerable home routers, to blast the entire registration system offline until it was his turn.

He took a trollish delight in tormenting the institution that he felt was tormenting him. Under the Twitter handle @ogexfocus, accompanied by a picture of a ghostly mask, Paras publicly taunted his target. "Rutgers IT

department is a joke,” he wrote in a public manifesto, bragging, after three attacks in succession, about crushing the university’s network “like a tin can under the heel of my boot … I’m fairly certain I could run circles around all of you with my eyes closed and one leg amputated.”

When dreaded exams rolled around, he tore down Rutgers’ network again to delay them, buying himself a few more days of miserable procrastination. Later, he took the network down to prevent his parents from seeing his increasingly horrendous grades. “I was feeling very frustrated—I guess with myself—and lashing out,” he says.

On one occasion in the spring of 2015, Paras totaled the Rutgers network so thoroughly that he had to text Josiah to ask him to continue the attacks on his behalf. “Admiral can you execute my command?” he wrote in the jokey, naval-themed slang they’d developed. The outages persisted long enough that some Rutgers students later demanded a tuition refund.

Paras enjoyed the sense of control the attacks gave him, watching their cascading effects on the university the same way he’d invisibly watched players respond to his tweaks of *Minecraft* worlds years earlier. But when the attacks were over, his problems were still there. By his second year, it was clear to Paras that college wasn’t working for him.

Around the same time, he had started batting around an idea with Josiah that seemed like a way out: What if they founded their own startup offering DDoS protection, to defend paying customers from exactly the sort of attacks that they had become so expert at launching?

To Josiah, it made perfect sense. He understood DDoS attacks on a deep technical level—he had, in fact, built or at least used many of the attack tools that other DDoS protection firms were combating daily—and Paras had built a reputation as a skilled programmer, particularly among *Minecraft* server administrators, who might be a good initial customer base.

Paras borrowed \$10,000 from his father, and he and Josiah used it to cofound a company: ProTraf Solutions, short for “protected traffic.” They had seen other firms struggle to defend customers from new forms of DDoS, and they were sure they could do better.

It wasn't so simple. After launching ProTraf, they realized their potential customers didn't often shop around for DDoS protection. Typically, they didn't feel the need to switch providers unless the one they already had was failing to shield them from an attack, which occurred only rarely.

Meanwhile, the bandwidth Josiah and Paras had rented on servers around the world—the cushion they would use to absorb attack traffic aimed at customers—was quickly eating through their capital.

Soon they came to an idea. Only when customers were actually knocked offline would they consider switching to ProTraf. Maybe the two young partners just needed to hurry this process along. "We could wait for one of these outages," Josiah says, "or we could *cause* one of these outages."

They agreed: They would use their own DDoS attacks to hit off their competitors' customers—just enough to get their own fully legitimate business on its feet, of course. "We'll do it a few times," Josiah remembers thinking. "We'll cause trouble for a little bit, and then we'll just forget about it. We'll stop."

Illustration: James Junk, Matthew Miller

Josiah and Paras began building the new attack botnet they'd use in what would become—whatever story they told themselves—a kind of DDoS protection racket.

The two teenagers used Josiah's old Qbot code to reinfect a new army of thousands of routers and started wielding it to target their rivals' clients—all *Minecraft* servers—easily obliterating their protections. For a while, this veiled extortion scheme actually worked. More than a dozen *Minecraft* administrators, desperate to get back online, did switch to ProTraf, paying \$150 or \$200 a month each.

It still wasn't enough. They'd expanded too quickly, buying infrastructure that was eating up their capital faster than their revenue could replenish it. And they found that when their attacks stopped, some customers switched back to their competitors—perhaps because they sensed that the attacks, timed so closely to the launch of this new startup, had been a little too convenient. "People had their suspicions," Josiah says.

Josiah was still working at his family's computer repair business as he struggled to get ProTraf on its feet. When he wasn't helping customers there, he resorted to making phone calls to drum up sales. He figured if his father and brother could pitch customers and build a business, so could he. But no one who picked up the phone wanted to listen to this fast-talking teenager selling a mission-critical security service. The calls were dead ends, and Josiah came to loathe making them.

Just around a year after launching, in the late spring of 2016, ProTraf was flaming out. For Josiah in particular, the company's looming death was hard to accept. His parents had been so proud of his business ambitions: He seemed to be making good on his enormous potential, following in his family's entrepreneurial footsteps. Was he really going to admit that he'd already failed? He felt trapped and ashamed.

So Josiah began to consider other sources of cash flow. A friend from the hacker scene had been impressed with his rebuilt collection of Qbot-infected routers. He asked whether Josiah might be willing to build a new DDoS botnet. If so, he would have customers lined up to pay thousands of dollars in bitcoin for access to it.

Josiah suggested to Paras that they could accept the offer and build a new, even bigger botnet, renting slices of its attack power to the highest bidder in a last-ditch attempt to keep ProTraf alive. It would essentially mean turning the company from a protection racket into a front for their new, real business: selling cyberattacks as a service.

"Sounds ill ey gahl," Paras joked. *Sounds illegal.*

"Eh," Josiah wrote back. "Kinda."

Illustration: Joonho Ko

to build the chief weapon of their secret DDoS-for-hire sideline, Josiah and Paras started from scratch. A few years had passed since Qbot's creation, and they both had a few new ideas of how to infect and commandeer a vastly larger collection of internet-of-things devices.

In the time since Josiah's original Qbot code had leaked—thanks to Josiah's old friend vypor—the hacker community had been steadily upgrading it. Some versions had now been redesigned into “worms”: Infected routers would automatically scan for other vulnerable devices and try to hack and infect them, too, in a self-spreading cycle. But when Josiah and Paras examined those newer botnet systems, they seemed inefficient and unreliable. Someone else's hacked router was an unwieldy vantage point from which to find vulnerabilities in new machines. Plus, that decentralized setup made it slow and difficult to upgrade their bot software.

So instead, they designed a more centralized, three-step structure. Their infected machines would scan for other hackable devices—using a new system they say was as much as a hundred times faster than the bootleg Qbot worms they'd previously seen—and then report the vulnerable gadgets they found to a “loader” server, which would hack the machines via telnet to install their malware. Then a separate command-and-control server would shepherd those malware-infected bots, periodically sending new commands for which targets to attack.

Paras and Josiah were surprised to discover just how powerful this new automated zombie recruitment process turned out to be. Josiah remembers leaving the system running overnight and waking up to find 160,000 freshly brainwashed routers ready to do his bidding—far more than he'd ever controlled before.

When he saw the scale of what they were building, Josiah's plan—raise some money with a few cyberattacks, then return to ProTraf and go straight—began to seem like a wasted opportunity, a waste of his talents. “This is cool,” he remembers thinking. “This is innovative. No one else is doing this.”

As their botnet's size exploded, Josiah suggested to Paras that they would be able to rent even small fractions of their firepower to attackers for \$2,000 or \$3,000 a month, easily topping \$10,000 in monthly revenue.

“Lol,” Paras wrote back. “And how big does the armada have to be.”

“That won't be a problem,” Josiah responded.

seeing their botnet grow so deliriously large so quickly had now triggered in Josiah an old impulse, purer than any profit motive. “What are the limits here?” he began to ask himself. “How far can we spread this thing?”

Naturally, he turned to his old friend Dalton, who had always shared that urge to push the technological envelope. Josiah and Paras agreed to cut Dalton in on shared control of their growing creation, letting him sell access to a part of it through his own booter service. In return, Dalton would contribute his hacking skills to finding new populations of devices to add to their horde.

To maximize their malware’s footprint, Dalton began to plumb the teeming vulnerabilities of the internet of things. He dug up tens of thousands more gadgets across the world with unpatched flaws, machines that went far beyond home routers: Smart appliances such as online fridges, toasters, and light bulbs all became part of their agglomerated mass of raw computing power. All these eclectic digital objects had the advantage of being relatively greenfield territory. While countless hackers vied for control of traditional computing devices, like PCs and even routers, many of these newer devices remained untouched by malware and uncontested.

Surveillance cameras’ digital video recorder systems, with hardware capable of processing large video files, turned out to be especially strong new recruits. Some scans even turned up more exotic hackable devices, like internet-connected industrial cement mixers and municipal water utilities’ control systems. (The three hackers say they did avoid hacking those industrial devices for fear of being mistaken for cyberterrorists.)

They settled into a workflow. Dalton would scan for new species of exploitable devices and write code to infect them. Josiah would refine Dalton’s code and create software to take control of new additions to their menagerie of networked gadgets.

Paras, meanwhile, focused on the administration software that ran on their command-and-control server—its own complex programming task as their botnet grew to nearly 650,000 devices. He sensed that the scale of their creation would soon draw attention, and he took it upon himself to create a trail of misdirection to hide their identities from public scrutiny. To

advertise the botnet, Paras created new sock-puppet accounts with names like OGMemes and Ristorini on Hack Forums, Skype, Reddit, and Jabber. He then created a collection of fake “dox” linked to those handles—the posts that hackers typically use to out rivals’ real identities, but in this case all pointing at people whom Paras had chosen as patsies.

To make their connection to the botnet’s command-and-control server harder to trace, Josiah found a vulnerable server in France that they could hack and use as a jump point, connecting to that hacked machine only through the anonymity software Tor, which made it look like that computer’s owner was the real mastermind. The machine was actually a “seed box,” a server left online to continuously trade in pirated movies over the BitTorrent protocol.

The French server, in fact, was filled with anime videos, a subject Paras knew something about. He was a fan of the psychedelic animated Japanese show *Mirai Nikki*, in which a teenage outcast discovers he’s part of a battle royal among 12 owners of magical cell phones, and eventually—spoiler alert—uses his phone’s powers to become the god of all space and time. The show, Paras had texted a friend, “literally defines the genre of psychological thrillers.”

Paras knew that the file name for their program, now running on an ever-increasing base of hundreds of thousands of devices worldwide, would soon be a subject of notoriety. So in keeping with their work to pin the botnet’s creation on a random anime collector, he chose a suitable name. All the better that it also evoked a cyberpunk superweapon brought back to the present by a time-traveler, an instrument for which the world was wholly unprepared: *Mirai*. In Japanese, it meant “the future.”

to allison nixon and any other security researcher observing it from the outside, the advent of Mirai initially looked less like the rise of a new superpower than the start of a world war—one where the battlefield was the internet’s multitudes of insecure gadgets.

In 2014 and 2015, the years leading up to what she would call “the battle of the botnets,” Nixon began noticing that groups of nihilistic young blackhats with names like Lizard Squad and vDOS were picking up LiteSpeed’s

leaked Qbot code and then selling access to their own hordes of zombie devices, or using them to terrorize and extort online gaming services. So Nixon, who around this time started working at the security firm Flashpoint, created “honeypots”—internet-connected simulations of vulnerable devices designed to be infected by the hackers’ bot software, acting as her own spies amid the botnets’ ranks. The result was a real-time intelligence feed revealing the booters’ commands and intended targets.

It was in early September 2016, while monitoring those botnet honeypots, that Nixon and some colleagues spotted an intriguing new sample of code that was infecting routers and internet-of-things gadgets: the one the world would come to know as Mirai.

This new code seemed capable of detecting when it was running on a honeypot instead of a real device and would immediately terminate itself when it did. So Nixon and her coworker ordered a cheap DVR machine off of eBay, connected it to the internet, and watched the device—they nicknamed it the “sad DVR” due to its life of victimization—get infected over and over again by Mirai and its competitors.

In fact, unbeknownst to Nixon, Mirai’s creators were by then locked in an escalating turf war with vDOS, a competing botnet crew, which had built an especially large army of hacked machines using an updated version of Qbot. Both the Mirai and vDOS teams had designed their bot software to identify and kill any program that appeared to be their rivals’, and the two botnets began vying for control of hundreds of thousands of vulnerable machines, like warlords repeatedly conquering and reconquering the same strip of no-man’s-land.

Soon the Mirai crew and vDOS resorted to anonymously filing abuse complaints with the companies hosting each other’s command-and-control servers, forcing them to build new infrastructure. At one point, a company called BackConnect, which had been hosting Mirai’s server and was run by acquaintances of the Mirai team, came under a DDoS attack from the vDOS crew. To Nixon’s shock, BackConnect responded by using a so-called BGP hijack—the highly controversial tactic of essentially lying to other internet service providers to misdirect a wide swath of traffic—to effectively pull vDOS’s command-and-control server offline.

Soon, Paras, Josiah, and Dalton got tired of the endless tit for tat. They reprogrammed Mirai, allowing it to sever the telnet connections on the victim devices—thus making them harder to update but shutting out vDOS and any other rival from easily reinfecting those machines. That seemed to do the trick: To the Mirai team, it appeared vDOS had given up. (In reality, their adversaries had been questioned by law enforcement and later arrested.)

Nixon remembers the feeling she and her team of researchers had as they watched Mirai win that war and come to dominate the internet’s mass of vulnerable devices. Once, that messy landscape had been infected with a rich diversity of malware species. Now, for the first time she had ever witnessed, all of that malevolent code seemed to go quiet as Mirai’s superior infection techniques took hold of hundreds of thousands of networked devices across the globe. “From our perspective, it was like this new apex predator was prowling the savanna, and all of the other animals had disappeared,” says Nixon. “From that point forward, we were on the hunt for this monster.”

For much of the cybersecurity research community, the purpose of this gargantuan botnet still remained unclear. They couldn’t know that Josiah, Dalton, and Paras had opened Mirai for business and put its services up for sale—that the monster Nixon was hunting was, itself, on the hunt for its first victims.

From left to right: Bruce Schneier, Elliott Peterson, Allison Nixon, Brian Krebs, and Scott Shapiro.

Illustration: James Junk, Matthew Miller

Part Two

Illustration: Joonho Ko

For brian krebs, September 22, 2016, was an inconvenient day to become the target of the most powerful DDoS botnet in history.

A construction crew had been replacing the siding on Krebs' rural house in Northern Virginia all morning. The incessant hammering was freaking out his dog, who responded as if barbarians were laying siege to their home. Krebs worked as an independent investigative reporter and security researcher—one of the best known in the cybersecurity industry. He had no workplace to escape to. “I was already losing my mind,” Krebs says.

It was only a little later that day, Krebs says, that it started to become clear that his dog was not wrong. He was, in fact, under siege. And the barbarians were winning.

Two nights before, Prolexic, the service that provided his DDoS protection, had warned him that something was amiss. His website, KrebsOnSecurity, had been hit with an attack that peaked at a mind-boggling 623 gigabits a second, according to Prolexic’s measurements. The company had never seen an attack even half that big. But it had heroically managed to absorb the traffic, the Prolexic rep told Krebs, and his site had stayed online.

“Holy moly. Prolexic reports my site was just hit with the largest DDOS the internet has ever seen,” Krebs tweeted that night. “Site’s still up. #FAIL.”

Krebs prided himself on his work hunting cybercriminals, a role in which he was nearly peerless in the world of journalism and one that had made him plenty of enemies. He’d been swatted by a target of his investigations and once had someone ship dark-web heroin to his house in an attempt to frame him. DDoS attacks from aggrieved subjects of his reporting were nothing new. But taunting the source of this particular attack, he now realized, had perhaps been ill-advised.

For two days, he continued to get notices from Prolexic that the massive DDoS was still going. In fact, whoever was barraging his server had

persistently switched tactics throughout that time, firing new forms of data designed to be harder for Prolexic to filter out, or targeting machines further upstream. “These guys were real bastards,” Krebs says. “They were throwing the kitchen sink.”

Amid all this, more than 36 hours after the attack had begun, a member of the work crew at Krebs’ house managed to kick his satellite dish, knocking out his home’s internet connection. He tried to tether his computer to his cell phone, but its bandwidth was too spotty. And the attack kept coming, an overwhelming, sustained tsunami of malicious ones and zeros.

Krebs was still struggling to get online on the afternoon of the 22nd when he got another call from Prolexic. This time the company told him, in polite but clear terms, that he’d better find a new source of DDoS protection. They were dropping him. One of the biggest DDoS defense firms in the world could no longer handle the scale of the data torrent barraging his site.

Krebs got in his car and drove to a local business’s parking lot to try to find a stable Wi-Fi connection for his laptop. From there, he called his web-hosting provider to warn that, without Prolexic’s layer of defense, it was about to get hit with an unfathomable wall of digital pain. He suggested that rather than allow all its customers to be taken offline, it should instead configure his website to point to a nonexistent IP address, essentially routing the attack traffic—and anyone trying to visit his site—into “a hole in the ground.”

The hosting company took his advice. KrebsOnSecurity.com instantly dropped offline. It would remain that way for days to come, as Mirai loomed, seemingly ready to obliterate the site again the moment it resurfaced.

For Krebs, being successfully censored by cybercriminals was a wholly new experience. “Someone just took my site offline,” Krebs remembers marveling. “And there’s nothing I can do about it.”

Josiah, Dalton, and Paras had unlocked their superweapon, and already it seemed there was almost nothing on the internet that could withstand it.

When Krebs tweeted that his website had been hit with “the largest DDoS the internet has ever seen,” he was almost right. Mirai had actually struck the French internet provider OVH around the same time with an attack that had reached the even more shocking volume of a terabit per second. The botnet’s hundreds of thousands of hacked devices had also quietly KO’d a web-hosting firm and a *Minecraft* service in August with attacks that were nearly as large but had gone mostly unnoticed by the security world.

Within just a few months of launching their fully operational Death Star and making it available for hire, the three hackers—all still too young to legally drink alcohol—had assembled a small but devoted collection of clients. A fellow hacker who went by the handle “Drake” allegedly acted as a kind of sales rep: He would periodically hit off arbitrary targets as a form of marketing, to demonstrate Mirai’s bristling firepower to potential paying customers. One such patron, who claimed to be in Russia, had rented Mirai to launch attacks against rivals in the cybercriminal web-hosting world, knocking out his adversaries’ sites. Their most frequent user seemed to be a hacker in Brazil, who repeatedly and inexplicably rented access to Mirai to fire off attacks at the network of the Rio Olympics, at one point bombing it with more than a half-terabit per second of traffic.

Paras himself used Mirai a couple of times against his old whipping boy, the Rutgers IT department, mostly just for vengeful fun. On another occasion he briefly tried using it for straightforward extortion against one of their former ProTraf customers, slamming a *Minecraft* server with a Mirai attack and then demanding a bitcoin payment. In an attempt to make the connection to ProTraf less suspect, he even copied his own ProTraf email address as a recipient of the ransom note. The company didn’t pay. Josiah disapproved of Paras’ extortion attempt, and they never tried it again.

It was their Brazilian customer, Paras says, who had decided to DDoS Krebs into oblivion. Paras woke up that day, read news stories about the monumental attack on Krebs—by far the most high-profile Mirai victim to date—and instantly felt a mix of excitement and dread in the pit of his stomach. “This had better not have been our botnet,” he remembers thinking. He checked their user logs. “It was our freaking botnet.”

After the Brazilian's earlier attacks on the Olympics, Paras and Josiah had decided this user was perhaps a little too reckless in his targeting. They'd attempted to limit his access to Mirai, ending his sessions after just 10 minutes. But Paras saw that the nihilistic Brazilian had simply manually restarted the attack on Krebs' site again and again throughout the night—and he was still going.

Paras messaged Josiah and Dalton, and they jumped onto an emergency call on a private, encrypted VoIP server. They all agreed: Annihilating the website of a very well-known journalist had crossed the line beyond helpful marketing into a kind of attention they didn't need—the kind that got you arrested. "You don't want to poke the bear," says Josiah. "This was a pretty big poke."

By this point, too, they were all 19 or older. They were adults, carrying out an extremely visible criminal conspiracy. The heat Mirai was now bringing them, they began to realize, wasn't worth it. And despite all the chaos it had caused in its early months of life, Mirai had made only a small fraction of the money Josiah hoped it would: about \$14,000 worth of cryptocurrency in total. Even the biggest DDoS attacks in the world were, for their perpetrators, a relatively cheap commodity.

They had only just launched this world-shaking creation. Now they already needed an exit strategy. It was Paras who, a day or two later, suggested a new idea. Their "Russian" customer had, despite renting occasional access to Mirai, suggested to him that DDoS was a bad business. Not enough money. Far too noisy. He'd advised they instead consider partnering with him to use their botnet-building skills for a much stealthier and more lucrative opportunity: click fraud.

Put all those hijacked machines to use quietly clicking on pay-per-click web ads instead of pummeling victims, Paras explained, and they could make tens of thousands of dollars a month by invisibly defrauding advertisers, a far less disruptive form of cybercrime. Josiah and Dalton agreed they should start to transition away from the cyberattack-for-hire industry and into this more respectable black-market business.

But they couldn't quite bring themselves to kill their monster just yet. Instead, Paras and Josiah, who held more control of Mirai's targeting than Dalton, attempted to add the IP address for KrebsOnSecurity.com to a block list that would at least end the attack—though they'd find in the days to come that their efforts to restrain their least predictable customer had failed again.

Regardless, by that point it was too late. Josiah was right. They had poked the bear. Now it was wide awake.

Elliott Peterson was sitting thousands of miles to the northwest in the FBI's Anchorage, Alaska, office when he read the news that Brian Krebs, a journalist whose work he knew well, had been wiped off the face of the web.

He was shocked to learn that an attack could hit Prolexic—a firm owned by the internet giant Akamai, whose entire business model depended on handling giant flows of traffic—so hard that it could essentially jam one of the biggest digital conduits in the world. And all to silence a journalist. Peterson knew that he'd just witnessed the start of a new era. "All of a sudden, the world woke up to the fact that someone's throwing around a terabit of traffic," he says. "No one was ready for that."

Two years had passed since Peterson had seen Allison Nixon's live booter demonstration at a Pittsburgh cybercrime conference. He'd since returned to his native Alaska, taken up an assignment at the FBI's smallest field office, and turned it into an unlikely hub for takedowns of botnet and booter operations. Just days earlier, he'd learned of the detainment in Israel of vDOS's two administrators, the rival hackers with whom the Mirai crew had recently been at war. Peterson had been involved in the investigation of vDOS for months. The resulting bust was, in fact, the real reason that Mirai had definitively won that rivalry.

Now Peterson was disturbed to see that the takedown had only cleared the field for someone wielding an even bigger weapon. He knew he would need to take on this case, too.

Working from his cubicle in the “cyber atrium”—a glass-roofed enclosure that houses the handful of FBI agents focused on cybercrime inside Anchorage’s brutalist, red-brick federal building—he started digging. He and Nixon had helped create an industry working group called [Big Pipes](#) that dealt with DDoS attacks, and he immediately learned from contacts there that Akamai had been hit by a mysterious new botnet called Mirai.

Even in the midst of Krebs’ unfolding crisis, Peterson understood that for the Anchorage office to take on this new monster, he’d first have to get over a legalistic hurdle: He needed to prove that either its victims or creators were in Alaska. Krebs and Akamai were thousands of miles away. So he realized that he would have to somehow find Mirai-infected devices in his own state. Luckily, by this point, there were hundreds of thousands of those infected devices online, a digital pandemic that reached nearly every country in the world.

Meanwhile, Peterson could only watch helplessly as Krebs’ website was held offline by Mirai for more than 48 hours. Only then did Krebs finally manage to get it back up with the help of a new DDoS defender: Google. The web giant had recently expanded a pro bono DDoS protection service called Project Shield to a wider array of users, and it was eager to prove that it could withstand the internet’s biggest attacks.

Within two hours of KrebsOnSecurity coming back up, it received another blast from Mirai. The site’s IP address had changed, Paras says, so his and Josiah’s block list didn’t prevent their Brazilian customer from relaunching his attack. But this time the site stayed online.

Google reached out to the FBI, and with Krebs’ permission, the company eventually shared a list of IPs that had been the sources of the Mirai attack traffic. Peterson and his four-person team began to comb through it. Sure enough, he could see in the data that Mirai had infected devices across Alaska, along with practically every other state in the country. He started tracking down the Alaskan device owners, trying to explain to them in phone calls that their routers and security camera systems had been unwittingly turned into cannon fodder. Finally, Peterson got a break: He managed to persuade the owner of a hunting lodge in the town of Ketchikan

to unplug its malware-infected security camera DVR and ship it to Anchorage to be dissected and used as evidence.

Peterson had found his Alaska victim. He launched an investigation to hunt for the hackers behind Mirai.

Illustration: Joonho Ko

after serving in the Marines but before joining the FBI, Elliott Peterson had served as a “dean of men” at a college in Michigan. In that job, he had helped kids with emotional problems and substance abuse issues, essentially acting as a guidance counselor and mentor. It was an unusual role for a future federal agent, but the two jobs reflected Peterson’s strange hybrid personality: half by-the-book, buzz-cut G-man, and half well-meaning, friendly Midwestern youth pastor.

Peterson brought that same peculiar cordiality into his Mirai manhunt. He began politely asking around among the Hack Forums crowd and their ilk, a scene he’d become familiar with over his years of tracking botnet services: Who might know any of the pseudonymous hackers selling access to Mirai?

Not long after starting the investigation, his team in the Anchorage office got a lead on one good source. They’d managed to obtain a complete sample of the Mirai code from an infected device and found that it phoned home to a command-and-control server hosted by the DDoS mitigation firm BackConnect. Peterson knew that name. He’d been hunting the vDOS crew when BackConnect came under attack from Mirai’s rival; in an apparent act of self-defense, the company had used a BGP hijack to pull vDOS’s infrastructure offline—a rogue move that had nearly derailed Peterson’s vDOS investigation.

So he made a few calls to BackConnect’s management to ask about the company’s BGP hijack and the Mirai server they were hosting—which had since moved elsewhere—and whether they had any contact with whoever controlled it. BackConnect’s staff said they didn’t, but suggested someone who might: One of their acquaintances from a company called ProTraf Solutions, Paras Jha, seemed to have had contact with whoever was behind Mirai.

After all, Paras had received an extortion email from someone launching the Mirai attacks—neither Peterson nor BackConnect knew that Paras had sent that email himself—and they’d heard he’d chatted with a Mirai handler known as Ristorini.

So Peterson called ProTraf’s phone number and left a voicemail. Paras called him back. Peterson remembers that Paras matched his polite, friendly tone and calmly explained that yes, he had been in touch with Ristorini in online chats. But he had no idea of the real identity of the person who’d tried extorting one of his former customers.

Paras kept the conversation short but said he’d be sure to keep asking around and would be in touch soon to help in any way he could when he’d learned more. Then he hung up and immediately called Dalton and Josiah to tell them the FBI was on their trail.

this time, their emergency meeting was steeped in panic: They needed to ditch Mirai, *now*.

Dalton suggested they simply take down Mirai’s infrastructure, wipe the command-and-control and loader servers, and destroy the hard drive of every computer they’d ever used to manage it. “Lay as low as possible, kill the whole thing, shred our drives,” as he put it. Then they could quietly move on to their more promising click fraud business.

Paras had another idea: How about they release the Mirai source code into the wild? If they posted it publicly on Hack Forums, it would be adopted by every DDoS-happy hacker in the world, just as Qbot had once been. They could disappear into that crowd, making it vastly harder for this nosy Alaskan FBI agent or anyone else to identify the original Mirai amid the flood of copycat attacks.

Dalton vehemently disagreed. He argued that releasing the source code would only draw more attention to Mirai, cause more damage, and make law enforcement all the more intent on finding the botnet’s original creators.

The call devolved into a full-blown shouting match, the first the three friends had ever really had. Dalton screamed at Paras not to release the code. Paras remained unmoved. Josiah, meanwhile, listened impassively, stuck between his friends, unable to break the tie.

When they hung up, they had agreed that their Mirai adventure was over. But they remained split on what to do with its source code.

So Paras acted on his own. A couple of months earlier, he had created a new sock-puppet account on Hack Forums as another potential profile for Mirai's mastermind: He'd called this one Anna-Senpai, named after the villain of the Japanese animated show *Shimoneta*, or "Dirty Joke," in keeping with Mirai's anime-loving cover persona.

Now, in late September, he logged in again as Anna-Senpai to post a stunning announcement. "I made my money, there's lots of eyes looking at IOT now, so it's time to GTFO," he wrote. "So today, I have an amazing release for you." The post then linked to download pages for Mirai's source code, along with a tutorial detailing how anyone could use it to create their own massive, self-spreading, internet-of-things attack tool. He added in a separate post that Anna-Senpai was now on the run, fleeing their home in France for a non-extradition country.

Someone was using a copycat botnet to troll a video game company—and the collateral damage was the worst internet outage the world had ever seen.

Paras had just dumped the recipe for a superweapon into a mosh pit. Beyond throwing up a smoke screen to ward off the FBI, it was also a final, epic troll: a way to shake the internet ant farm, this time on a global scale, and watch the ants scramble.

The Hack Forums community responded accordingly, showering him with praise and admiring Mirai's polished programming. Several users wrote that it had to be the work of professionals, not the forum's typical teenage wannabes. "Your a fucking legend," one user wrote. "Leak of the year," wrote another.

Within days, one user responded that they'd successfully used the source code to create their own Mirai botnet of 30,000 devices. Another chimed in to say theirs had reached 86,000 machines. "The glorious copy paste will happen," wrote another appreciative hacker. "IoT botnets will spread like wildfire."

"Best haxoring tool of all time! Gonna take down eribody!" wrote another Hack Forums fan, summing up the gleeful mood. "I've always wanted a botnet that can DDoS de planet!"

Peterson was deeply dismayed to see the Mirai code dumped online, a move he saw as appallingly reckless. But rather than be thrown off, as Paras had intended, Peterson had the immediate thought: Had his poking around inspired this? Did his conversation with Paras have something to do with it?

Not long after Anna-Senpai's Mirai release, Peterson got another break in the case: Some university researchers working with the anti-DDoS group Big Pipes told him they'd found a clue in the logs of their honeypot machines, designed to monitor internet scanning. Two months earlier, on August 1, they'd been able to see that a kind of proto-Mirai scanning tool, perhaps the earliest version of the botnet's reconnaissance code, had probed their devices from a US-based IP address.

Peterson contacted the IP's hosting company to request the identity behind it and got a subscriber name: Josiah White. The other cofounder of ProTraf solutions.

The FBI agent called ProTraf again and this time spoke to Josiah on the phone, projecting his same friendly tone. Josiah, trying to sound professional but caught off guard by Peterson's discovery, nervously admitted that yes, he'd "done some scanning." Scanning the internet, after all, isn't a crime. Then he begged off answering any more questions and hung up the phone.

Peterson had been fascinated and even impressed by the Mirai team's operational security: the careful layering of proxies, the dead ends he reached as he traced those connections, the "doxes" he found for Mirai's handler accounts, all of which seemed to lead him astray. But now, just

weeks into his investigation, he knew that Josiah’s early scanning slipup had allowed him to sidestep all of that obfuscation and misdirection. His team began sending a flurry of legal requests to the email and internet service providers for every account associated with the throwaway profiles Paras had created for Mirai, as well as those of Paras and Josiah themselves and ProTraf Solutions.

As Peterson dug through Hack Forums, he noticed, too, that there was another interesting account that sometimes chimed in on Anna-Senpai’s posts—someone called Fireswap. Often they seemed to be defending Mirai’s creators and taking shots at critics of their source code. So Peterson sent a legal request to Hack Forums for Fireswap’s email address—fireswap1337@gmail.com—and then asked Google for that user’s subscriber metadata.

Looking through logins on Fireswap’s Google account, registered to someone named Bob Jenkins, he could see they came from the same VPN or proxy server IP address that had carefully been used to create the fake Mirai doxes—sometimes just minutes apart. But then, in some cases, “Jenkins” had a different IP: the same one that Paras had used to connect to his ProTraf email account.

Paras had never suspected that an investigator would think to look into the burner account he’d created solely to cheerlead for himself on Hack Forums and take swipes at detractors. Now it had become the missing link tying him to Mirai.

Peterson still hadn’t heard of Dalton Norman. But he now believed he’d found Mirai’s two creators. The end of their cybercriminal careers was already in sight. But the chaos they’d invited onto the internet was just beginning.

Illustration: James Junk, Matthew Miller

once it was fully unleashed and reproducing in the wild, Mirai didn’t immediately break the internet. It took three weeks.

On the morning of October 21, 2016, Allison Nixon was just getting down to work in Flashpoint’s office, an old garment factory on the desolate western edge of Midtown Manhattan, when a colleague pointed out to her that something was seriously wrong with the internet.

Specifically, its phone book was broken. The domain name system is the mechanism that translates human readable domain names into the IP addresses that actually route internet traffic to the computers where services are hosted. DNS is what allows you to remember “Google.com” instead of 2001:4860:4000:0:0:0:0, for instance, as the way to tell your browser to load up a search engine.

On that morning, the DNS of dozens of websites seemed to be crippled. Internet users across the US were typing names into browsers that needed to be translated into numbers, and the translators had been knocked out cold. “Something big is happening,” Nixon remembers a colleague saying to her. “We need to figure out what’s going on.”

As Nixon’s team tried sending DNS requests to some of the affected sites—the same sprawling collection of news sites, social media, streaming services, banking sites, and dozens of other major services that Scott Shapiro and millions of other users were trying in vain to reach—they saw that all the sites used the same New Hampshire-based DNS provider, [a firm called Dyn](#). Although it wasn’t yet clear to Nixon at the time, no fewer than 175,000 websites were offline.

Searching for a root cause for this unfolding internet collapse, she checked the attack logs generated by her “sad” DVRs—by now her team had several of them serving as bait. Sure enough, she could see that a Mirai variant, one of the many copycats that had sprouted in the weeks since Paras leaked the source code, had been relentlessly bombarding the Dyn DNS server for Sony’s PlayStation gaming network. The attack’s effects had apparently spilled over to take down Dyn’s entire DNS system. Someone was using their copycat botnet to troll a video game company—typical Hack Forums behavior—and the collateral damage was the worst internet outage the world had ever seen.

The nihilistic, teen-angst-fueled, mega-DDoS that Nixon had always warned about had finally arrived. “We had worked for such a long time in preparation for that day that it was kind of vindicating,” Nixon says. “On another level, it was super, *super* stressful.”

Shortly after the attack on Dyn started, Nixon managed to reach someone at Dyn and share the evidence pointing to Mirai, a suspect Dyn only had an inkling of until that point. Dyn staffers, at that moment, were anxious but still confident that they could handle the problem and get their servers back online.

It was around the same time, still before 9 am eastern, that Dyn truly began to implode.

DNS records are designed to work like a kind of hierarchical phone tree. Major services like Google and Comcast have their own DNS servers ready to answer computers requesting the IP address of a domain, and they only periodically check in with an “authoritative” DNS provider—in this case, Dyn—to make sure the addresses they’re handing out haven’t changed. Some services check in multiple times a minute, while others refer to their last update of DNS data for hours before refreshing it.

Within minutes of the Mirai attack striking, Dyn was already in trouble, as DNS servers set to check in every 15, 30, or 60 seconds for new DNS records pounded the company’s overwhelmed authoritative servers. When they didn’t get an answer, they’d ask again—and again and again. They were designed to *expect* answers, after all: An authoritative DNS provider as large as Dyn had never gone down before.

But as time passed and Dyn’s servers stayed down, the chorus of DNS requests began to include major services that check in only every hour. And then the ones that check in every two hours. And three. All now joining the mob incessantly hammering on Dyn’s doors. Some internet services had even designed their DNS systems to automatically spin up new DNS servers to ask for answers when their existing ones didn’t get a response, multiplying the barrage of queries.

“Once the cascading failure started, that’s when everyone got very, very nervous,” says one person who was working at Dyn on the day of the attack. “Before that, the graphs looked awkward, but they didn’t look catastrophic. But then they tipped over an edge as major services couldn’t get responses, and the numbers started shooting up to the right.”

The Mirai attack, in other words, had set off a chain reaction. The internet’s IP address directory system was DDoSing itself.

At the same time, Dyn began to experience a kind of parallel, human DDoS attack, as people began demanding answers in almost the same cascading structure. Angry corporate customers with comatose websites started bombarding Dyn’s phone lines. When management couldn’t answer their questions, they echoed them down the org chart to engineers who were already entirely overwhelmed. “When the ratio of management and client services people looking for answers versus the number of people who can provide any answers starts to explode,” the Dyn staffer remembers, “that’s when it really starts to feel like chaos.”

Compounding the problem was a coincidence of almost comic timing: A team of Dyn staffers was, on that very day, waiting for Oracle to sign the paperwork to close a deal to acquire their company, reportedly for more than \$600 million. No one wanted to be remembered as the middle manager who failed to keep the internet online on this momentous occasion—the first day that the new bosses were watching. And through all of this corporate panic ran an undercurrent of rumors that China or Russia was responsible, that they were up against an all-powerful state-sponsored hacking operation.

Josiah was walking through a dark hallway, still trying to get a shirt over his head, when he found a flashlight—and a gun—pointing at his face.

Those rumors were short-lived. So, by some measures, was the outage. By that afternoon, Dyn had managed to get the attack under control and had started sending DNS responses piecemeal to its clients, quieting the different networks clamoring for answers from its servers, one by one.

But the damage left in the wake of the Dyn outage lasted longer. The total economic cost of a major fraction of the global internet falling offline for half a day is difficult to measure. Sony, whose PlayStation Network was the attack's original target, reported an estimated net revenue loss of \$2.7 million. Following the attack, there were projections that, for a time, Dyn lost roughly 8 percent of its contracted web domains—more than 14,000 total—and millions in future revenue.

As Paras, Dalton, and Josiah watched a botnet built with their code break the internet's backbone, they had an array of reactions. Paras remembers being shocked that it was so easy: The Mirai clone that had carried out the attack had hit Dyn with fewer than 100,000 devices, just a fraction of the size of their original botnet. Dalton felt a grim "I told you so" sense of confirmation that he'd been right about the hazards of releasing the source code, along with the stress of knowing it was sure to draw more heat—but he also noted, with a hint of pride, that whoever carried out this internet-shaking attack hadn't even updated their code. "There was no innovation at all," he says.

Josiah, who had already had the closest brush with the FBI among the three young men, was perhaps the most troubled. By then, his family had moved out of the Pennsylvania countryside into a three-story house in the nearby town of Washington. That's where, from the basement-level storage room he now used as his work area, he read about the Dyn disaster, silent with dread and amazement.

As for Elliott Peterson, he spent the day in the FBI's Anchorage office, fielding calls from every agency and official imaginable. Over the course of a month, his case had grown from a cybersecurity industry curiosity into an international clusterfuck, a subject of urgent interest for the Department of Homeland Security and for reporters asking questions in a White House press conference.

No one yet knew who had made the copycat Mirai that had attacked Dyn. But Peterson was confident he already knew who had created Mirai and handed the code to those attackers. It was time to pay Josiah and Paras a visit.

it was just before 6 am, long before the sun would rise on that mid-January morning, when Josiah heard the banging on his front door.

For two months, he had been waiting for the raid. He was now keeping a nocturnal schedule, working at his computer with Paras and Dalton until 3 or 4 in the morning before sleeping until 8 am and then heading into his father's computer repair shop. But that night, having finally gone to bed after 4 am, he still lay awake, his mind racing with anxiety.

As the banging started and his older brother hurried upstairs from their shared basement-level bedroom, Josiah went into the storage room and quickly switched off his computers. All three of the Mirai creators had been careful to do their hacking on remote servers and to connect to them only from ephemeral virtual machines that ran on their own PCs. So he figured that switching the computers off would erase any lingering data in memory. Then, before turning off his phone, he sent a message to Paras using the encrypted messaging app Signal: “911.”

Josiah slipped on a pair of sweatpants and grabbed a T-shirt. He climbed the stairs and was walking through a dark hallway, still trying to get the shirt over his head, when he found a flashlight—or rather, he'd later learn, a gun with a flashlight attached to it—pointing at his face. “Drop the shirt,” he remembers an agent saying.

Josiah was herded onto his front porch, still shirtless, in the cold Western Pennsylvania winter air, where the rest of his family was already being held. Black Suburbans filled the street. And there was Elliott Peterson, on the porch, greeting Josiah in his weirdly gregarious tone. “Oh hi, Josiah. I was hoping we wouldn’t meet under these circumstances,” Josiah remembers him saying. “But here I am.”

After leaving Josiah’s flabbergasted family shivering in the cold for several long minutes, the agents brought them all back inside. As they searched the house, Josiah managed to get fully dressed and sat in the living room. But even once he’d warmed up, he still couldn’t stop shaking. As his secret life finally came crashing into his family life, he remembers feeling especially embarrassed that he’d left the storage room the FBI was searching so untidy.

Aside from Peterson, Josiah could see that local Pittsburgh FBI officials had joined the raid—as had French special intelligence officers. He’d later learn that French law enforcement had also raided the home of a certain innocent patsy in France with a server filled with anime.

After a couple hours of searching, the agents hauled away Josiah’s computers, hard drives, and phone, and Peterson asked Josiah and his parents to come into the dining room to talk. “You probably know why I’m here,” Peterson said. Josiah responded that he could guess.

The conversation lasted about half an hour. Peterson brought up the Mirai scanning server, and Josiah deflected again, confessing to nothing. The FBI agent warned Josiah not to tell anyone about the search—not knowing that Josiah had already sent his “911” warning to Paras. Then he left.

In the silence that followed, Josiah’s parents told him it was time to come clean. During an excruciating 30-minute car ride to their computer repair shop to start the workday, Josiah confessed everything. His parents listened, stone-faced, too scared for their son’s future to even be angry.

Finally, his father responded: They would have to entrust Josiah’s fate to God.

Illustration: Joonho Ko

the raid on Paras’ home came the next day. Peterson had hoped for simultaneous searches but decided he should be present at both, so he spent the hours after leaving Josiah’s house driving more than 350 miles across Pennsylvania into New Jersey.

At 6 am, Paras heard the same banging on the front door of his family’s house, where he was home from Rutgers for winter break. Thanks to Josiah’s warning, this second raid had far less of an intimidating effect than the first: Paras had carefully cleaned up any evidence on his computers and turned them off long before the FBI agents arrived. In an attempt to find any storage devices Paras had hidden, the agents brought along an electronics-sniffing dog—trained to smell the glue used in computer

hardware components. Paras remembers it wanted to play with his family's dog, a comical moment that helped dispel any shock and awe.

When Paras saw Peterson in person, his first response was annoyance that this chipper FBI agent had come all the way from Alaska to turn his home upside down. Peterson asked Paras whether Josiah had told him about his search of Josiah's house the previous day. Peterson assumed Josiah had stayed silent, as instructed, and he hoped to plant a sense of betrayal in Paras that his friend hadn't given him a heads-up.

But Paras instead smiled and said that yes, Josiah had warned him, surprising Peterson. And like his friend the day before, Paras refused to confess to anything related to Mirai.

Paras' family was deeply shaken by the intrusion. But when the agents left, he assured his parents that it was all a misunderstanding, that he had no idea why this Alaskan FBI agent seemed so fixated on him. He hadn't done anything wrong.

paras, josiah, and Dalton discussed the raids, and they came to an extremely optimistic conclusion: that the feds didn't seem to have anything on them. The searches had been a scare tactic, they agreed, and they had failed.

On the same day the FBI searched Paras' home, Brian Krebs had published a [bombshell article](#) suggesting that Paras, potentially with Josiah's help, was the most likely identity behind Anna-Senpai. Krebs was working his own sources to piece together many of the same connections the FBI had drawn. But Paras had denied the accusation in a response to Krebs, and the three hackers, armed with the incredible hubris of youth, blew off the article as circumstantial evidence. After all, the FBI had already taken their shot and seemed to have gotten nothing that could prove their guilt.

As the months passed and they remained free, they made a brazen decision: They would continue their pivot into the click fraud scheme.

This new venture was turning out to be far more lucrative than Mirai, to a degree that even they had never imagined. To avoid ties to their overexposed botnet, they had begun building a new one, this time focused

on devices primarily in the US, given that they could make the most money selling access to American computers to generate clicks on American ads. By the spring of 2017, they were quietly pulling in \$50,000 a month in revenue, paid out in cryptocurrency by a business partner who seemed to be Eastern European.

Paras and Josiah mostly socked away the money, waiting for an opportunity to try to launder it through a legitimate business—though by then they'd finally given up and killed ProTraf. Dalton was less careful. He spent tens of thousands of dollars on splurges like a 70-inch flatscreen TV for his parents—he told them he'd made the money trading crypto—and upgrades to his home computer, a gaming desktop surrounded by transparent tubes of red coolant to prevent it from overheating as he supercharged its performance.

Even as the three hackers left Mirai behind, their code continued to plague the global internet. Mirai attacks hit the UK banks Lloyds Banking Group and Barclays, intermittently tearing Lloyds offline while Barclays repelled the onslaught. Another [struck the primary mobile telecom provider for Liberia](#) with about 500 gigabits a second of traffic, taking down much of the West African country's connectivity.

But Mirai, and its many malicious progeny, were no longer its creators' problem. The three young men had now, finally, hit their stride with a truly profitable and stealthy form of cybercrime. Dalton made a prediction to himself: "In a year, we'll either be rich," he thought, "or we'll be in jail."

Illustration: Joonho Ko

only months later did Josiah hear from Elliott Peterson again. The FBI agent asked him to come to Anchorage to talk. Prosecutors were suggesting a reverse proffer session, where they would lay out the evidence against him. By this point Josiah had a lawyer, who recommended that he take the meeting—and not tell his friends. This time he didn't.

In the summer of 2017, Josiah and his mother flew to Anchorage. The 10-hour flight was only the second time he'd ever been on a plane. On the morning of the meeting with prosecutors, he arrived at the Anchorage

Department of Justice building in a suit, his mind nearly paralyzed with anxiety. Peterson was there, and he greeted Josiah and his mother, suggesting fun activities they should check out while they were in town, as if this were a family vacation.

The Alaskan assistant US attorney who had taken on the Mirai case, a young prosecutor named Adam Alexander with a background in charging violent crimes and child exploitation, launched into a PowerPoint presentation projected on a screen in the front of the conference room. He began by displaying the sentencing guidelines for violations of the Computer Fraud and Abuse Act, showing how the prison time scaled up based on the amount of damage caused.

For the millions of dollars in damage Josiah might be held responsible for, Alexander suggested, he was facing as much as six or seven years in prison for his first offense.

Alexander began to detail the evidence they had against him. First, they had his connection to the early Mirai scanning server. Then it went further: On occasion, it turned out, Josiah had let his guard down in small but revealing ways, checking on the IP address of another Mirai server directly from his home computer rather than using a remote virtual machine that would leave no trace on his PC.

And then there were text messages he and Paras had exchanged during his pre-Mirai DDoS takedowns of Rutgers' network.

"Were you still smashing?" Josiah had written to Paras at one point.

"No. Phone is insecure," Paras had wisely responded. But then, minutes later, he had asked for Josiah's help in launching another attack: the barely coded "Admiral can you execute my command?" message.

After more than an hour, they took a break. Josiah's lawyer told him and his mother that he strongly advised they seek a plea deal and that Josiah cooperate with the FBI—that he "shouldn't push his luck." Josiah, terrified by the looming threat of years in prison that had been slowly materializing since his first call with Peterson, immediately agreed.

When they reconvened in a different, much smaller conference room, Josiah told Peterson and Alexander he was ready to negotiate a deal. They responded that he'd first need to tell them the full, true story of his crimes. To their relief, he began to detail the entire Mirai conspiracy. The FBI agent and prosecutor were intrigued to learn more about the key role played by Dalton, who hadn't until then been a target of their investigation. And they were amazed to hear that the Mirai crew was now, even after their raids, engaged in an entirely new click fraud botnet scheme. They had known nothing about it.

Peterson and Alexander told Josiah that if he wanted any chance of a plea deal—still without any promise of avoiding prison—he'd have to fully cooperate. That meant helping to collect evidence on his friends.

Josiah, now in survival mode, was ready to do what it took to stay out of prison. By the time he flew back to Pennsylvania, he was a federal informant.

Dalton and Paras could tell Josiah was acting strangely. He'd never been aloof or a step behind on any technical questions before. Now, on their group calls, he was quieter and would inexplicably ask them to break down how their criminal enterprise worked in unusual detail.

They had their suspicions and did their best to discuss their conspiracy using only convoluted code words and hypotheticals. But they couldn't bring themselves to violate the unspoken terms of their friendship by confronting Josiah or cutting him out of their deal. "We both knew something was up," Dalton says. "But we didn't have any proof. I didn't want to fuck him over just because I was sketched out." After all, this was their old friend, the legendary LiteSpeed, the one to whom they owed so much for advancing their careers as botnet masters.

As for Josiah, he says his years of working in his family's computer repair shop had helped prepare him for his new role as a double agent. "When you work in retail, you're used to putting on a face," he says, "talking to people how they want to be talked to."

When the feds finally arrived before dawn, Dalton was relieved. They found him in his boxer shorts, wrapped in a pink blanket on a beanbag, watching Star Wars.

A few weeks later, Paras got his own call from Peterson, with his own offer of a meeting in Anchorage. Paras told Dalton about the invitation—but not Josiah, whom he'd begun to distrust. They agreed that it made sense for Paras to meet with this FBI agent and see exactly what the feds had on them.

Over the six months since the raid of his home, Paras had remained in denial, putting on a defiant face but quietly living in a state of latent terror. His family had never again discussed the traumatic violation of their home by federal agents, instead pretending it had never happened. They were “going through the motions of being a family,” as Paras puts it, “but there’s this cloud hanging over everyone’s head.”

The cloud of silence remained in place as Paras and his father flew to Anchorage. Along with Paras’ lawyer, they met with Peterson and Alexander in the same Department of Justice conference room and got the same cheery hiking tips from Peterson. Paras tried to maintain an implacable expression as the prosecutor threw one damning piece of evidence after another onto the screen, laying out his crimes in front of his father. They showed Paras’ connections to the Mirai handles and to Anna-Senpai, and his Fireswap burner account.

Still, Paras told himself that the case was far from clear-cut. Then Alexander played for the room a series of audio recordings of the three hackers explicitly discussing their new click fraud venture. One conversation, from a night when Paras and Dalton had been drinking and let down their guard, was particularly incriminating. For Paras, it was the first confirmation of Josiah’s betrayal.

Just as with Josiah, the meeting paused for a break after an hour. Paras, his father, and his lawyer walked across the street from the prosecutor’s office into a small park of paper birch trees in front of the Anchorage Museum. It was a dismally cold, cloudy day, though Paras says his anxiety had reached a degree where he was disassociating, barely aware of his surroundings.

Paras' lawyer leveled with him: It sounded very much like he was guilty of the crimes that he had, until then, denied even to his own attorney. Standing there in the park, Paras finally broke. Huddling with his father and lawyer, he confessed, tears flowing as he unlocked the shame, guilt, and fear that he'd kept bottled for months.

He asked his father to cut ties with him, begged him to let him face whatever punishment he had brought on himself alone. His father responded in a voice as broken as Paras' own: He could never do that.

Instead, he and the lawyer both told Paras that there was no other way out now. His only chance to save himself was to do whatever the FBI and the prosecutors asked of him.

Unbeknownst to them, Peterson and Alexander had watched the three men speaking from the window across the street. From Paras' body language, they could tell they'd made a breakthrough.

When Paras came back inside, he was a different person, his defenses down. "You're in a hole, Paras," Peterson told him. "It's time to stop digging." He was ready to cooperate.

Alexander asked him whether he had told anyone that he was coming to Alaska, and he admitted that he'd told Dalton. So Alexander and Peterson asked Paras to call Dalton now, on the spot, on speakerphone, and tell him that he had nothing to worry about.

Paras did as he was told. Dalton picked up the call. And as the FBI and prosecutors sat around the table intently listening, Paras assured Dalton that it was just as they'd thought: The feds had nothing on them.

when it was Dalton's turn to be raided, Peterson practically scheduled it with him. A few weeks before the bang on the door, Yahoo had mistakenly sent Dalton a letter stating that his old email address had been the subject of a legal request. For more information, it read, he should contact FBI special agent Elliott Peterson.

So Dalton preemptively called the FBI agent who'd now been stalking them for nearly a year. Josiah and Paras, playing their roles as supportive friends, listened in. Peterson picked up the phone, said hello, and immediately apologized. "I wasn't planning on us talking for a couple weeks," he explained.

When Dalton claimed not to know who Peterson was or why his emails were being read, the FBI agent laughed out loud. "We're going to have a great opportunity to have a chat," he said in the most aggressive version of his usual genial tone. He ended the call by confirming with Dalton that he was still living at home, despite having now started college, implying he didn't want to search Dalton's parents' house if he had moved into a dormitory. "We try to be minimally invasive."

Dalton hung up with Peterson. "What the fuck was that?" he said to Josiah and Paras, who were still on the group call.

"Your ass," Paras responded.

For the next three weeks, Dalton was stricken with nausea-inducing anxiety and a sense of "impending doom." When the feds finally arrived before dawn, he says, he was actually relieved. They found him in his boxer shorts, wrapped in a pink blanket on a beanbag, watching *Star Wars*.

During the search, Dalton says, his anxiety evaporated—thanks to his early swatting experience, it wasn't his first time having law enforcement point a gun at him—and he did his best to show the feds that he wasn't impressed. He napped on a couch during the FBI's search. When Peterson tried to interview him, he gave him nothing.

In fact, with plenty of time to prepare before they arrived, Dalton had physically destroyed all his most sensitive hard drives. The agents found his beloved water-cooled PC torn apart, its red coolant spilled across his bedroom floor like blood. He'd carefully cached another drive that stored all the bitcoins earned from their click fraud scheme inside a cat food container, fully hidden by kibble. Since the container was transparent, the searching agents didn't think to look inside.

Just as with Paras and Josiah, Peterson told Dalton not to tell anyone about the search. But Dalton, loyal to the end, tried to send a coded message to Paras that he'd been raided, too: He repeatedly toggled the status of his account on the Steam video game network on and off in Morse code, spelling "FBI."

Paras saw Dalton's account blinking. But he never got the message. Of course, even if he had, he'd already been working with the FBI for months to collect evidence on his friend.

Dalton soon took his own trip to Anchorage, where he and his parents sat through Peterson and Alexander's third and final Mirai reverse proffer presentation. Through an hour of damning chat logs and audio recordings, Dalton showed no emotion. But when it was over, he knew there was no use resisting. They had everything.

When Dalton reluctantly agreed to cooperate, Peterson didn't ask him to keep their arrangement secret from Josiah and Paras. This time, he phoned the other two. All four of them joined the call.

After months of paranoia, Peterson wanted to clear the air, to tell them that they were no longer cooperating against one another. They would now all be working together. Josiah remembers it almost like a reunion: meeting each other again now that they were all on the other side.

In the call, Josiah and Paras seemed relieved to finally be able to speak honestly to each other and Dalton after months of subterfuge. Dalton agreed, in a defeated tone, that yes, he was on board. They would give up all their hacking tools and dismantle the click fraud botnet, and Dalton would forfeit the hidden hard drive full of their bitcoins. But Peterson remembers that Dalton remained quiet and formal, seemingly still processing his anger and shame at having been cornered by the FBI and surveilled by his friends.

It was only late one night, a few days after Dalton got home to New Orleans, that he allowed the full reality of his situation to catch up with him. He was facing a felony conviction. He was going to have to work as a

federal informant. And he was still likely to end up in prison. It felt hopeless.

The person he chose to call to talk this over with, strangely, wasn't Josiah or Paras, but Peterson. He was trapped, he told the FBI agent in tears. His life was over.

For the next hour, Peterson, sitting in his living room in Anchorage, found himself back in his "dean of men" role, comforting and counseling the young cybercriminal who'd so recently been the target of his investigation.

Peterson asked Dalton about his hopes for the future—the "where do you see yourself in five years" question of every guidance counselor. Dalton confessed that beneath his old, secret belief that cybercrime could be his only path in life, he still hoped that someday he might be able to have a normal, successful job in technology. Peterson told him that was still possible.

"He was super nice," Dalton says. "Far nicer than he ever needed to be."

Peterson said he couldn't promise Dalton that it would all be OK. There was still the possibility of spending years in prison. Regardless, Peterson reassured Dalton, he could still go to college. He could still do something rewarding with his talents. His life was not over.

the young men's lawyers had each warned them that, to have any hope of avoiding prison, they would need to go above and beyond in their cooperation with the FBI and prosecutors. So once they found themselves on the same team again, Josiah, Dalton, and Paras threw themselves into working with law enforcement with the same obsessive energy that they'd once put into conquering the internet of things.

All three were still deeply embedded in the cybercriminal community—in fact, Mirai had turned the personae that Paras had created into celebrities. So to start, they began helping the FBI target their old associates. It was Paras, the Mirai creator who had opened Pandora's box by publishing the botnet's source code, who found himself most actively working undercover to take down Mirai's copycats.

Because he still controlled the Anna-Senpai handle, Paras was tasked with reaching out to the creator of one especially prolific Mirai knockoff. The copycat botnet was controlled by a hacker who lived near Portland, Oregon. He'd been brash enough to reveal his location to Anna-Senpai in their chats, and even to invite Mirai's creator to hang out if he were ever in town. Paras took him up on the offer.

At that point, Peterson and Alexander had been tracking the suspect and believed they knew his identity. But he appeared to have no fixed address—he seemed to have developed a serious drug problem and had admitted to using meth in his chats with Anna-Senpai—and instead roamed around the city from house to house with little more than a backpack and the laptop he used to manage his botnet.

After Paras flew to Portland, he suggested to the target of their sting that they meet at his hotel. Sure enough, the hacker turned up, and the two botnet admins spent a few hours in Paras' room there, swapping stories and hacking tricks, and even inviting other hacker associates to join the conversation via Skype. Meanwhile, Peterson and other FBI agents recorded the meeting—with eavesdropping techniques they declined to describe—from another room across the hallway.

Eventually the young Portland hacker suggested they head to a nearby Little Caesars to eat. When he and Paras walked out of the room, he carelessly left his laptop open and didn't even bother to close the video chat session with his hacker friends. Those friends were still watching through the laptop's webcam when Peterson and another agent came into the room and seized the computer as evidence. Less than an hour later, the agents stepped out of a black van in the hotel parking lot and arrested their target as he and Paras returned from their lunch.

After that Portland sting, some of the hackers who had just watched the accidental livestream of the hotel raid accused Paras of acting as the FBI's snitch. But Paras pointed out that it hadn't been his idea to meet up—or even to conveniently go out for pizza—arguing that maybe *he* was in fact the one who had been set up.

The explanation was convincing enough that Paras managed to pull off subsequent undercover operations against multiple other cybercriminal suspects across the country. He says he hardly relished his role in those stings. But nor did he feel much guilt. “I mean, honestly, it was exhilarating,” he says. “It felt like something out of a movie.”

The FBI and the Justice Department declined to share all of the details of the investigations that Paras and the other two Mirai creators helped them pursue. But Peterson summarizes them: “We arrested people, and we worked other cases against IoT botnets, and we shut down other botnets where arrests weren’t feasible,” he says. “We just did really interesting work.”

Illustration: Joonho Ko

after a few months, when they had run out of undercover cases, Peterson began to give the team different kinds of tasks, many of them with no direct relationship to Mirai or their old contacts. They were grateful to find they were no longer acting as informants, so much as Peterson’s new group of technical analysts.

They started helping the FBI agent with jobs like reverse engineering malware and analyzing logs to identify botnet victims. They built a software tool that parsed the blockchain to trace cybercriminal cryptocurrency. In early 2018, when hackers began to exploit server software known as Memcached to amplify their DDoS attacks, the Mirai team figured out how to scan for vulnerable servers that enabled those attacks so that the FBI could warn the servers’ owners and help remove a new kind of DDoS ammunition from the internet.

Josiah says that, in this new role, he couldn’t help but apply the same technical perfectionism he had always prided himself on. “I enjoy being the best at this sort of stuff,” he says. “I thought, ‘If we’re going to work on this, it damn well better work right.’”

Paras says that, at first, he had immersed himself in Peterson’s assignments —even the harrowing undercover ones—mostly on his lawyer’s advice and as a distraction from his lingering guilt and shame. “To prevent myself from

feeling things,” as Paras puts it. But over time, he found that he was able to look at the work more squarely—and to even get some gratification from the good he felt he was now doing. Peterson’s comment to him in Alaska, that he should stop digging the hole he was in, had stuck. The work for Peterson felt like “the opposite of digging,” as he puts it. “I wanted to put as much distance as possible between who I am now and who I was then,” he says.

Eventually, when the Mirai crew talked among themselves about their motivation to work with Peterson, Paras says, it went beyond self-interested survival to a sense of actual atonement for the harm they’d done. “It was like, OK, what is our path to redemption?” he says. “Maybe this is the start.”

The FBI, of course, has a long, unsavory record of exploiting informants and cooperating defendants—many of whom are put in dangerous situations, made to entrap innocent associates, or end up feeling abandoned or used by their handlers. The three Mirai hackers felt they were an exception.

As the months passed, they say, they came to see Peterson as a kind of mentor. He seemed to show real concern for their futures. The strange friendliness he’d displayed while hunting them, they felt, was not an aggressive front but an actual expression of his humanity. “We were very lucky that we got Elliott,” says Dalton. “He literally saved my life.”

the us criminal justice system has a history of notoriously harsh sentences for hackers. In 2010, Albert Gonzalez was sentenced to 20 years in prison for stealing tens of millions of debit and credit card numbers from retailer networks when he was in his mid-twenties. In 2017, Russian cybercriminal Roman Seleznev, arrested on vacation at the Maldives airport, was sentenced to 27 years for his own massive theft of credit card data. Even Hector Monsegur, a front man for the rampaging hacktivist group LulzSec who flipped on his friends and served as a federal informant for more than two years, was jailed for seven months—longer than some other members of LulzSec in the United Kingdom he had informed on.

So it was almost a radical act when the prosecutors in the case of Mirai, the botnet behind several of the biggest cyberattacks in history, asked the judge to sentence its creators to a total of zero days in prison.

Adam Alexander, the Alaskan assistant US attorney who had flipped each of the three hackers with PowerPoint presentations full of evidence against them, explains that his decision was based in part on the fact that none of them had prior criminal history or substance abuse problems that might have led them to fall back into old habits. Unlike many defendants, they had strong family support networks holding them accountable. Most importantly, by the time their sentencing was approaching in the fall of 2018, they had done more than a thousand hours of work for Peterson, what Alexander described in a letter to the judge as “extensive and exceptional” cooperation. “They were kind of gleefully willing to break the internet,” Alexander says. “But would putting any of the three of these young men in prison for 18 to 36 months, and then wiping our hands of them, have more meaningfully assured that we could prevent future criminal conduct? I didn’t actually think so then, and I still don’t think so today.”

Instead, he asked the court to sentence Josiah, Dalton, and Paras to 2,500 hours of community service each over the following five years. They would carry out that work with the same FBI agent who had supervised their presentence cooperation period: Elliott Peterson.

In an Anchorage courtroom roughly two years after Mirai had obliterated Brian Krebs’ website, a judge handed down that sentence—community service, no prison time—to the three 21- and 22-year-olds, along with debts of between \$115,000 and \$127,000 each in restitution. “You’re young, you have a lot to give to society … and you have a lot of talent and skill,” a judge told the three men in his Anchorage courtroom that fall day. “I hope you use it for good.” (Paras would face separate charges in New Jersey for his attacks on Rutgers, where prosecutors vehemently argued that he deserved prison time. Alexander intervened, countering that Paras’ cooperation with prosecutors and the FBI in Alaska should be factored into his sentencing in that case, too. The New Jersey judge ultimately agreed, sentencing Paras to nearly \$9 million more in restitution and six months of confinement at his parents’ home, but no jail time.)

On this visit to Alaska, when Peterson again suggested local activities, the Mirai crew actually took him up on it. That evening they ate together at a local indie theater restaurant, the Bear Tooth Grill, where they also caught a screening of a documentary about Google’s Go-playing AI—just some notorious hackers and the FBI agent who hunted them down, out for dinner and a movie.

Illustration: James Junk, Matthew Miller

not long into their five-year community service stint, Peterson says he began to sense that his three unlikely protégés were beginning to outgrow him—that he couldn’t find enough technical tasks worthy of their talents. So he asked the Big Pipes anti-DDoS group he’d helped create with Allison Nixon if anyone there had work for them to do. Nixon raised her hand.

When Peterson had first started overseeing “the kids”—as they came to be known within Big Pipes—Nixon had wanted nothing to do with them. She’d spent long enough lurking in the Hack Forums cesspool to be familiar with the toxicity that flowed freely there and had even been personally harassed by some of the Mirai team’s old associates. “They’re not nice people,” she says of that scene. “You don’t want them to know your name.”

But after seeing that Peterson had worked with Paras, Josiah, and Dalton for more than a year and was still willing to vouch for them, she decided to take a chance and met them on a video call. She found the three young hackers—including the notorious Josiah “LiteSpeed” White, whom she’d tracked for nearly his entire career—polite and eager to please.

She did, in fact, need their programming help: She had an idea for a new kind of honeypot that would be far more versatile than her “sad DVR.” She wanted to create a system where security researchers or analysts could load up any internet-of-thing device’s firmware in a virtual environment to catch new malware variants.

The tool they built together was called Watchtower. It used a newer technology called QEMU containerization to spin up quarantined, full-fledged simulations of DVRs, waiting to be infected. The Mirai team had

designed their internet-of-things malware to detect when it loaded on a software simulation of a gadget rather than the real thing and to kill its processes rather than give a researcher any information. But WatchTower's honeypot was designed to look like a real device in every way that malware could check—a seamless, virtual panopticon in which to observe malware and intercept its master's commands.

"It was brilliantly done," says Larry Cashdollar, a security researcher at Akamai who says the company used Watchtower to obtain and analyze countless new samples of IoT malware. Eventually Nixon and her Mirai team added in data contributed from other researchers and members of her Big Pipes DDoS working group, including machines that acted as honeypots for reflection attacks and DNS data to identify targeted domains, integrating it all into a real-time DDoS analysis dashboard. By 2020, they had added a list of domain keywords to identify attacks on political or voting system targets, and the tool's results were used to monitor for DDoS attacks throughout that year's election—helping them prepare for any democracy-disrupting "big one" that many in the security community still feared.

As for Brian Krebs, when he found out that the three Mirai creators had escaped jail time and were now essentially working as whitehat security researchers, he was initially perturbed by what he saw as a lack of accountability.

"Trust the process," he remembers Nixon telling him.

"What process?" Krebs says he responded. "This doesn't look like justice to me."

But as time passed and he continued to learn from Nixon and others about the good work Paras, Josiah, and Dalton were doing, he says he slowly changed his mind. "When I was able to hear about some of the things they came up with, it was encouraging," he says. "I guess that it's the best of all possible outcomes."

When Nixon moved from Flashpoint to a job at a new security firm, Unit 221B, she lobbied the company to hire her Watchtower team. By that time,

Paras had gotten a job writing code for a semiconductor company. But Josiah and Dalton both began working for Nixon full time as security researchers on contract, on top of their community service work.

Of course, even as the Mirai crew joined the legitimate security industry, many of the new botnets that they were now monitoring with Watchtower were, in fact, variants of their own monstrous creation. Like Josiah's Qbot code before it, Mirai had become the best, cleanest code base for anyone trying to build their own massive collection of hacked machines, and all manner of digital miscreants proceeded to pick it apart, repurposing its components to wreak havoc. "There are pieces of Mirai everywhere now," says Chad Seaman, a security researcher at Akamai and an early member of the Big Pipes working group.

Companies still face near-constant attacks from Mirai descendants, Seaman says. Because those botnets are generally still fighting over the same vast but splintered collection of vulnerable internet-of-things devices, none of them is nearly as big as the original Mirai. Nor has any of Mirai's progeny ever again managed to surprise defenders to the degree Mirai did.

But their attacks still plague the internet, adding to the millions of dollars a year that companies pay in DDoS protection. "The arsonists have turned over a new leaf," Akamai's Seaman summarizes. "The wildfires continue to rage."

Epilogue

in the years after he sat in his Connecticut home and watched his digital life implode, Scott Shapiro became a kind of Mirai fanatic. The Yale Law professor eventually read the source code that Paras published on Hack Forums, printing it out, poring over its mechanics, and marveling at its well-polished design. Years later, he would write a case study of Mirai in his book *Fancy Bear Goes Phishing*, which tells a history of the internet through a series of extraordinary hacking events.

Among other things, Shapiro now sees the Mirai case as a rare model of actual restorative justice in cybercriminal law. It shows, he argues, a positive alternative to putting young hackers in prison when, in many cases, their online behavior contrasts so sharply with their real-world selves. Yes, the internet can seduce good people into doing bad things. But perhaps the split personalities it creates also leaves more room for redemption in the offline world. Perhaps it even means more cybercriminals like the Mirai crew can be reformed and put to work fixing the problems they caused. “This was an experiment. It worked out really well,” Shapiro says. “I would like to see more of it.”

One afternoon in early December of 2021, three years into the Mirai creators’ five years of probation, Shapiro invited Josiah, Paras, Dalton, and Elliott Peterson to speak to his Yale cybersecurity law class over Zoom. It would be the first time the four of them had appeared together in a semipublic setting other than a courtroom.

At first, Peterson did most of the talking, telling the story of the case and his investigation in a 45-minute presentation. Then he finished and the group took questions from the students.

One asked how this group of young adults with no criminal records had justified to themselves carrying out such epic acts of digital disruption. Paras answered for all of them, explaining how incremental it had all felt, how easy it had been to graduate from commandeering hundreds of hacked computers to thousands to hundreds of thousands, with no one to tell them

where to draw the line. “There was never a leap,” he says. “Just one step after another.”

Another student asked how they had kept going for so long—how they believed they could evade the FBI even after they had been raided. This time it was Dalton who answered, overcoming his anxiety at speaking in front of crowds, in part thanks to better treatments that have helped to alleviate his stutter. He explained to the class that they had simply never faced an obstacle to their hacking careers that they hadn’t been able to surmount—that, like teenagers who have no experience of aging or death and therefore believe they’ll live forever, they had come to feel almost invincible.

Throughout the presentation, Shapiro says, he was struck by the youthful nervousness of the three Mirai creators and the fact that, even as they spoke, they never turned on their webcams. The hacker threat that he’d once been sure must be the Russians, that had felt so large and powerful, was just these “young boys,” he realized. “Young boys who don’t want to show their faces.”

Paras would later explain to me that he wasn’t exactly trying to hide. He just doesn’t want to associate his face with Mirai anymore. He’s since lost more than 30 pounds, ditched his glasses, grown a trim beard; he’d prefer to let his old image, the pudgy bespectacled kid pictured in Brian Krebs’ story about Anna-Senpai, be the one tied to Mirai.

As of the end of October, all three of the Mirai hackers’ periods of probation have ended. Paras Jha and Josiah White work together for a high-frequency financial trading company. Dalton Norman still holds his job working for Allison Nixon at Unit 221B. But they all plan to continue maintaining and updating Watchtower, perhaps their most lasting contribution to undoing some of the damage they’ve done.

“I’m grateful for the chance to try to put the genie back in the bottle,” Josiah says.

He also admits that’s probably impossible. Even now, he and Dalton and Paras know that fragments of the monster they built still haunt the internet.

Mirai no longer comes from the future. Instead, it stubbornly hangs on from the past. Someday, they hope to leave it there.

Collage Source Images: Getty Images

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Nov 9, 2023 6:00 AM

Robotic Putting Greens. Mixed Reality. Loud Spectators. This Is Golf?!

Tiger Woods and Rory McIlroy are backing a new sports league that's reinventing golf as high-energy, made-for-TV entertainment.

Photograph: Andrew Hetherington

Cameron Young slides a driver from his bag. He stares at a hole referred to as Texas Hill Country. It's new to him—a par 4 with sand hazards and rough to avoid. The 26-year-old is in the top 20 in the [Official World Golf Ranking](#), but he's not sure how to proceed. He turns to his companion, former pro Roberto Castro. "What's going on here?" Young asks.

Castro consults with their caddie and reports, "It's 312 to that bunker there."

Young makes clean contact. The ball lofts skyward.

But there's no sky above him. On this steamy day in late October, Young is in an air-conditioned soundstage on the back lot of Universal Studios in Orlando, Florida. The building once hosted Nickelodeon TV shows. The "caddie" Castro consulted is virtual—it lives on a 15-inch tablet. The tee is on a patch of natural grass the width of a large mattress. It sits atop wooden pallets on a concrete floor.

This article appears in the December 2023/January 2024 issue. [Subscribe to WIRED](#). Illustration: James Junk and Matthew Miller

Young's golf ball hits a billboard-sized screen 35 yards away. The dimpled sphere falls meekly to the ground, while up on the giant display its virtual successor continues its flight. A phalanx of supersensitive radar trackers and hi-res cameras sends data to a bank of computer servers that calculate velocity and spin to show how the ball will bounce and where it will ultimately settle on the vista of the screen.

Young's ball lands in the digital rough. He walks over to a tray of 2-inch-high Bermuda grass mixed with rye. The screen now shows him closer to his goal, an 8-iron away. He swings, the ball thuds against the display again, and seconds later his virtual ball lands just outside the green. For his next shot, Young ambles to the back of the soundstage, where an artificial putting surface and fringe awaits him. An official places a ball precisely on the ground. Young successfully chips over a rise to land within 5 feet of the cup. Not good enough. Castro has already sunk his third shot and wins the hole.

Many pro golfers practice using room-sized simulators in their personal gym, and weekend warriors commonly visit golf centers with plenty of tech. That's not what Young is up to. He's testing a system for real competition that will be aired on prime time, with \$20 million of prize money at stake. He's one of 24 pros, including golf legends Tiger Woods and Rory McIlroy, who are involved in the most ambitious effort yet to merge e-gaming and actual pro sports. It's called [TGL](#), allegedly *not* an acronym for The Golf League, but three TV-friendly letters that don't mean anything.

TGL's first event will take place in early 2025 inside a \$50 million-plus, custom-built arena with an inflatable dome in Palm Beach Gardens, Florida. A 200,000-pound turntable will support an 800,000-pound green that will shape-shift to give each hole its character. A 4K screen will rival the goliath displays of Taylor Swift concerts. The stands will accommodate around 1,600 live spectators, who are encouraged to boisterously violate golf's finicky silence rule. Players themselves will be mic'd up, in hopes that their trash talk might go viral online.

Woods, McIlroy, and TGL's other backers are betting that a hipper version of the sport will draw in new fans, especially on TV. Enough with the onscreen whisper-thons that lull boomers in recliners into light slumber. This new version of golf will rock, at least in the yacht sense. (It is, after all,

golf.) Driving the whole effort is tech. TGL is riding the arc of one of the century's most profound trends: mixing physical and digital reality.

Young's visit to the Orlando test lab marks the first time an elite active pro has tested the system. About a dozen TGL people are watching his every move, terrified that he might fling his wedge down and say that this won't do. No worries. He's clearly upbeat. "It's really cool," he says. "And a very different take on golf."

Cameron Young, currently ranked 17th in the world, tests out the new parameters for a TGL game.

Photograph: Andrew Hetherington

strolling into a low-key seafood bistro in Winter Park, Florida, for a late lunch, Mike McCarley has the confidence of someone at equal ease among bankers in a boardroom and blue-collar partisans at a Chickie's and Pete's. In his career as an NBC sports media executive he worked on marketing the Olympics and *Sunday Night Football*. But golf is his specialty. He headed the Golf Channel for a decade and had a deep relationship with its revered cofounder Arnold Palmer.

At that job McCarley had tons of airtime to fill. There are only so many times you can rerun tournaments, and instructional shows ate up a lot of the hours. They were dull, pretaped segments that dispensed the same tired wisdom. McCarley wanted to beam in live coaching from a studio outfitted with cameras and displays to mimic being on a golf course. He tried out a lot of equipment companies and soon started airing more spontaneous instruction.

McCarley began to get restless in that corporate role. In early 2019, he wondered whether the virtual style of golf he had introduced in the instructional studio might have a place in pro tournaments. You could never get him to say golf was broken, but he knew the sport needed change. Production-wise the game is horribly inefficient. It costs at least a million dollars to wire a golf course for TV, just for the few days of a tournament. The number of players is unwieldy. A couple bolts of lightning brings everything to a halt, and suddenly you're running a tape of the 2014 John

Deere Classic. Also, when the sun goes down, everyone goes inside. No live action during prime time.

This new version of golf will rock, at least in the yacht sense. (It is, after all, golf.) Driving the whole effort is tech.

He began to imagine what it might look like to add a virtual layer to gameplay. Golfers, like lizards, cluster in warm climes—Southern California; Jupiter, Florida; Las Vegas; Scottsdale, Arizona. If he built a sort of super-studio in one of those places, maybe the pros would be tempted to try it out. They could play a match on Monday or Tuesday—their slow days between tournaments. To help the sport take off with fans, he pictured teams of elite golfers playing together. Instead of TV producers having to choose which golfers to show live, and cutting back and forth between players on different holes, head-to-head play between two teams would create a single flow of action. Viewers would have an easier time following the game, and the pros’ personalities could come through. “This scenario approaches golf like other sports, where you can see everything happening in front of you in a stadium-like environment,” McCarley says.

Mike McCarley, the founder and CEO at TMRW Sports, is incorporating new data into the league’s matches so fans can obsess over the details of every swing.

Photograph: Andrew Hetherington

McCarley was still pondering how to condense a course’s 200 acres and 18 holes down to a single arena when, in January 2020, he attended a big golf industry trade event. One evening he sat down with Ryan Dotters, CEO of Full Swing, a maker of golf simulators. Full Swing had bought a company that made interactive, customizable indoor putting greens. “We were the only ones who had a green that could come alive,” Dotters says. On an old-school cocktail napkin, they sketched out plans to make a hybrid game of golf—one foot each in the digital and physical worlds.

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After the show, McCarley began talking about the idea with his other connections in the golf equipment world. One day, Andrew Macaulay, then an executive at the tech-centric golf entertainment company Topgolf, told McCarley he needed to go check out a driving range in Sweden. He immediately hopped on a plane. “I was so jet-lagged, I couldn’t make a coherent sentence,” McCarley says. “They had set up this giant screen at a facility. That was the first time I actually saw a screen that big, with shots that long being hit to it. Technology would actually allow the players to see the movement on the ball.” The experience convinced McCarley he had to keep going.

He’d been brainstorming away when the pandemic locked everything down. By virtue of proximity, his wife became his main collaborator. For months they went back and forth, even clashing on what font to use on the presentation deck. Still, in the pandemic haze it seemed like a dream—just another option to consider when Covid went away.

In January 2021 he went to Jupiter, Florida, to share the idea with the one person whose buy-in was live or die: Tiger Woods. For 90 minutes, McCarley went through his PowerPoint. Finally, Woods spoke. “Look, I completely understand the technology,” McCarley recalled him saying. “If I commit to doing this, will you commit to doing it too?”

Of course he would. McCarley had been working on this for over a year.

The next visit was with Rory McIlroy. “I loved it. I’ve always said that golf must try to embrace the 21st century,” McIlroy says. By that time, McCarley was edging out of his job at NBC, which had recently moved Golf Channel’s studio operations from sunny Florida to chilly Connecticut. McCarley left to start his own company, called TMRW Sports Group (pronounced “tomorrow”). Woods and McIlroy signed on as partners, and McCarley began collecting an all-star roster of investors, including Steph Curry and Justin Bieber. Dotters’ company, Full Swing, became the official greens provider. McCarley was ready to make TGL come to life.

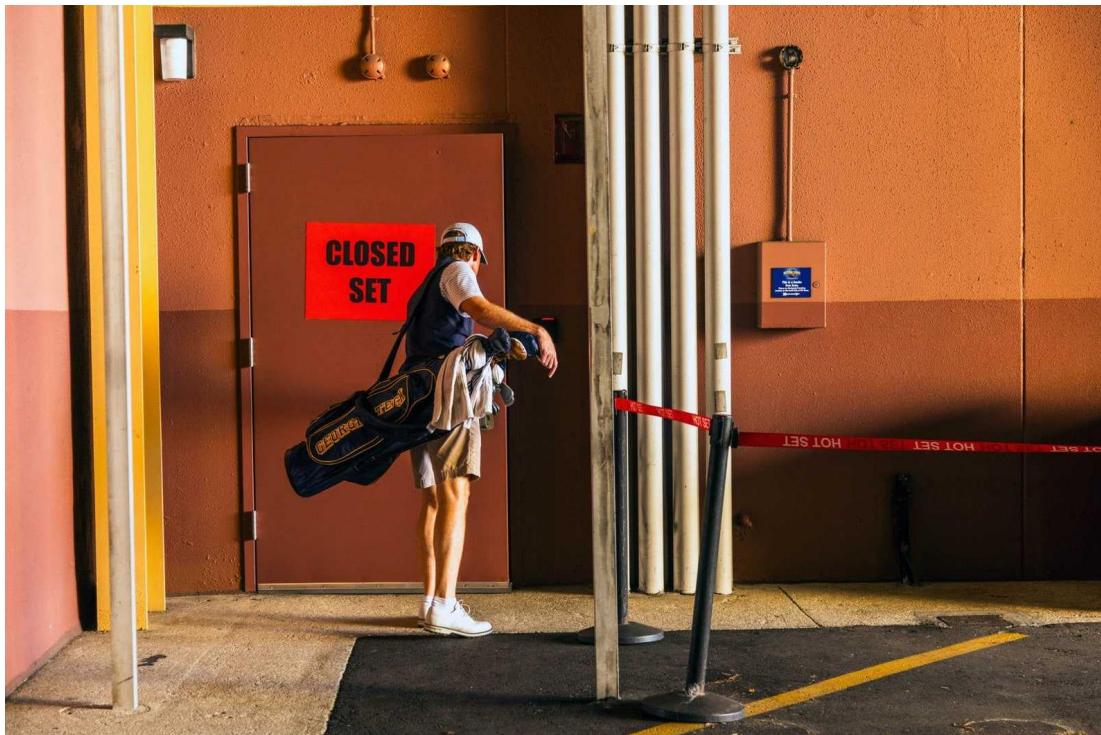
But first, he needed to win over the PGA Tour. Perhaps a clinching factor was that Woods was going to play. Injuries from an almost fatal car crash in 2021 had severely limited his ability to traverse long distances. TGL’s

version of golf—a game famously described as a “good walk spoiled”—had no walk to spoil. The PGA Tour quickly endorsed TGL and took an 18 percent ownership stake in exchange. (Unlike the rogue Saudi-backed LIV Golf league, which was also in its early days, TGL was never viewed as a rival.) The team owners together get an additional 18 percent, and 10 percent goes to the players, who get equity in addition to prize money. McCarley’s TMRW Sports has a majority stake of 54 percent.

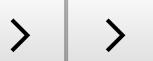
McCarley and his crew still hadn’t worked out what the format would be. That’s where Roberto Castro came in. After a decade without a win on the PGA Tour (he was twice runner-up), Castro became an industry consultant and is now helping TGL design its gameplay. “Basically building a new sport from scratch,” he says. There was one constraint that ruled them all: The entire match had to fit into the two-hour window ideal for prime-time TV watching.

“This is a TV show—we’re making no bones about it,” McCarley says. “If you’re creating sports in 2024, you’re doing it through the lens of the audience at home, whether they’re watching on the box on the wall or watching on their phone, or they’re just getting the data.”





1 / 9



Photograph: Andrew Hetherington
Taking a shot from the rough.

They introduced a shot clock, like the ones in basketball and baseball. No more dreamy pantomimes where players line up a putt, consult with a caddie, walk to the hole, dust away nano-clumps of grass, line up the putt again, stand over the ball, pull back, and start the whole thing over ... *I'm falling asleep just writing this!* In McCarley Ball, if you don't slam the drive or hit the putt in 40 seconds, your team will be penalized a stroke. With the help of some professional and amateur golfers, Castro did some test matches. They found that 18 holes was too many to jam into two hours, so they ditched three of them. The first nine holes will feature team play, with teams alternating turns and working through a three-player lineup (one player sits out each week). The final six holes will be one-on-one square-offs between individual opponents. The season will run 15 matches, after which a two-week playoff will determine a champion. So far TGL has announced five owners, including the New York franchise's Steve Cohen (billionaire, owns the Mets), Atlanta's Arthur Blank (owns the Falcons), the Fenway Sports Group (Boston Red Sox), a San Francisco group with Steph Curry, and in LA, Reddit cofounder Alexis Ohanian, his wife Serena Williams, and Venus Williams.

There's always been an artificiality to sports, where local fans cheer for mercenary athletes solely because of the jerseys they wear. TGL stretches that to the edge of credulity. With only a single stadium, there's no such thing as a home game. Ohanian says the key will be building "connective tissue" in the local community to the distant warriors—promoting golf to young people and organizing watch parties for the game. He compares it to the IRL meetups in the early days of Reddit. "Geography is a weird hangover from back when sports teams existed before mass communications," he says. Esports, he insists, has changed the dynamic. (Tell that to the millions of people who attend rowdy parades to hail Super Bowl heroes.)

Ohanian says he has never blasted a drive in his life, but the tech behind TGL instantly excited him. "This sport has never spoken to me, and a lot of people also feel that way," he says. Here, "all that negative energy becomes an advantage, because we're delighting people in a way they never expected."

There was one constraint that ruled them all: The entire match had to fit into the two-hour window ideal for prime-time TV watching.

is this golf? McCarley insists it is, and that it's not an esport—he blanches at the word. “The golfers are making the exact same physical moves with the same clubs, the same balls, in basically the same environment,” he says.

Well, not exactly. As viewers will see when play begins in 2025, TGL is venturing well into the video game realm.

The screen. At 64 by 46 feet, TGL’s screen is “ridiculously bigger” than what’s in ordinary simulators, McCarley says. “Closer to an Imax screen than anything else.” The size makes it possible for golfers to take their shots from much farther away than a simulator would normally allow. “Hitting a ball into a screen right in front of you is a very, very muted experience,” Cameron Young says. By the time you look up from your swing, your physical ball has already hit the ground. “But with this, you can really hit shots, especially given that you get to see a little bit of ball flight.”

The ball. It looks and plays the same as ever, but special materials make it easier for the radar to track the ball’s spin.

The software. The longer ball flight produces more real-world data, which means the virtual ball’s location and bounce are more accurate. Spectators at home get more dramatic video too—vistas that could never be captured by cameras in Pebble Beach or Troon. “If you wanted a camera right in the middle of that fairway facing right back at the golfer, we could put it there,” says Andrew Macaulay, the guy who sent McCarley to Sweden and is now the CTO of TGL. “The coolest angle would probably be flying with the ball, getting a ball’s-eye view of where it’s coming from and how it’s coming down. *Is it going to enter the bunker? Oh, just missed it and kicked left into the fairway! That lucky bastard!*”

The course design. Normally, golf designers have to accommodate budgets, nature, pricey residences next to the course, pesky physics. Agustín Pizá, one of the world-class course architects hired by TGL, doesn’t have to worry about all that. “If you want five more acres, here they are,” says Pizá, almost crooning with delight. “We can create extra sets of grasses, more ample

here, a little bit more stretched out there. In the real world that would require more irrigation or you would have to sacrifice housing development. The artistry becomes even greater, because what you see when you're standing on that tee box is our intention—a grass sculpture that's inviting you to take it on."

Of course, a breathtaking course design isn't much fun to watch unless it gives the golfers a chance to show off their artistry too. "The easy way out is just to say, let's do this crazy thing and make it fabulous and majestic and fantagious," Pizá says. "The point is, how do you stretch the boundary but still respect the integrity of the game?" One of Pizá's holes is called the Scorpion. It has two fairways that resemble claws. Golfers can play it safe by choosing either side, but they *might* reach the green in two strokes by playing the narrow, risky middle. As he puts it, "I wanted to dig deep into their brain thoughts."

The green. TGL teams will play the short game in a space about half the length of a soccer pitch, with a round—and rotating—green. Underneath the putting surface, Macaulay explains, three concentric circles of steel are held up by more than 500 beams and 49 steel supports bolted to the concrete floor. "Stonehenge comes to mind," he says. When nothing's happening, the turntable just sits there. When it's time to change the green setup to conform to the course architect's plan, a commercial compressor blows into airbags in the support structure, lifting and rotating the turntable. When Cameron Young tested the system in Orlando, the TGL team demonstrated how to tilt the green surface—changing the direction that a putt breaks—with the push of a button.

The conditions. Playing inside a dome shelters the golfers from the vicissitudes of weather. How boring. So the TGL team concocted something called digital wind. "We don't have actual fans blowing in the stadium for the players, but a graphic on the screen could tell the player, 'It's gusting between 8 and 10 miles an hour off your right shoulder,'" Macaulay says.

Video: Andrew Hetherington
Video: Andrew Hetherington

The PGA Tour is watching all of this closely, to see whether any of the innovations might find their way into its tournaments. “Everybody needs to innovate,” says Norb Gambuzza, the PGA Tour’s senior vice president of media and gaming. “We may find some new competitive elements. That shot clock is a cool thing.”

“There’s so much technology in golf that people probably don’t know,” McIlroy says, listing the Moneyball-style data that golf insiders follow, such as ball speed and launch angle. “There’s a way to engage a different audience here by not just, obviously, showcasing the talent but also everything else that goes around this. The biometric feedback, players’ heart rates.”

Wait a minute … you want to air *live heart rates*?

“We could do it!” he says, “Full disclosure—I’m an investor in [fitness tracker company] Whoop. So I monitor my heart rate a lot.”

So basically, Rory, you’re saying that golfers are geeks?

“Most of us are, yeah,” says the champion who won four majors before his 26th birthday. “If we weren’t we’d probably be playing a different sport.”

And soon they will be.

Photograph: Andrew Hetherington

as i visited the test facility and spoke with the TGL team about the weird hybrid they’re launching, I wondered whether TGL might fall into a sports uncanny valley—not enough pure golf to satisfy the geezers who wear blazers in the clubhouse, and not enough virtual reality to delight the gamers in backward baseball caps. No simulation can precisely duplicate a classic golf course. So why not stop trying, and let things run wild? Have players tee off in the streets of Manhattan or through the gates of Casterly Rock? Putt during an avalanche? Hit an 8-iron while avoiding TIE fighters?

The TGL team told me they don’t want to venture too far into the virtual world—for now. Because it’s all controlled by software, they can try jacking up the distances or wind strength anytime they like. Would the players be on

board with that? “Maybe not in the regular season,” McIlroy says. “But maybe on the weekend leading into the playoffs, we could have something like baseball’s or the NBA’s all-star weekend, where they have skills challenges.”

That might put golf traditionalists over the top. The precariousness of the enterprise became apparent in early November, when current Masters champ Jon Rahm, citing the commitment TGL would require, pulled out of the league.

As it stands now, to those with shrines to Bobby Jones in their locker room, TGL is already flirting with heresy. McCarley was famously close with the golf legend Arnold Palmer, probably the sport’s best ambassador before Tiger Woods. For years Palmer was also the connection to the sport’s history and traditions. It’s hard if not impossible to imagine Arnie teeing up to a display screen.

Late in our lunch, I ask McCarley what Palmer would think of TGL. He considers the question for a while as if assessing a minefield. “I would say that the lights, the music … not for him,” he finally says. “But this is a way to open up golf to a new group of fans and a new group of players. Ultimately he would love it.”

Especially if Palmer had lived to become a partner in TMRW and joined the bet on making a nearly 600-year-old sport into a rollicking video game.

Updated 11-20-23, 12:50 pm ET: An earlier version of this story said that TGL’s inaugural season would begin in January 2024. According to a statement from TMRW Sports Group, on November 14 a failure of temporary power systems caused the Palm Beach venue’s dome to deflate and damaged parts of the structure. The start of play is postponed until early 2025.

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By [Lauren Smiley](#)

[Backchannel](#)

Nov 7, 2023 6:00 AM

How Citizen Surveillance Ate San Francisco

When a homeless man attacked a former city official, footage of the onslaught became a rallying cry. Then came another video, and another—and the story turned inside out.

A security camera at a laundromat (left) at Laguna and Magnolia streets in the Marina District in San Francisco. Magnolia Street in the Marina District in San Francisco on October 22, 2023. Photograph: Ian Bates

Just when the people of San Francisco thought they'd seen every video—the sidewalk drug runners, the Louis Vuitton mob heisters, the men selling stolen laptops, the smash-and-grabbers snatching a camera from a Prius in traffic, the *porch pirates porch pirates porch pirates* into infinity, all indexed in the “Lawless [San Francisco](#)” section of the great internet video store—yes, just then: Stig Strombeck took out his cell phone camera on April 5 and hit Record.

This article appears in the December 2023/January 2024 issue. [Subscribe to WIRED](#). Illustration: James Junk and Matthew Miller

It was around 7 pm, and Strombeck was on his way to his second job. He'd parked on Lombard Street. Not the famously crooked section up over the hill, but the wide gauntlet that jets toward the Golden Gate Bridge through the Marina district: the preppy hood of woo girls and boat guys and early-career Gavin Newsom and largely law-and-order Democrats. (“Everyone likes to shit on San Francisco, and San Franciscans like to shit on the Marina,” one resident told me. “It’s a victimless crime.”) But lately, even in

the Marina, there was no escaping the rest of the city's problems. The previous November, in a manicured playground just two blocks from where Strombeck was walking, a father said his 10-month-old baby had [ingested fentanyl](#) and had to be revived by Narcan—a San Francisco nadir that, to the presumable relief of civic boosters, hasn't surfaced on film.

On the Lombard sidewalk, Strombeck pulled headphones from his ears and trained his camera on a disturbing scene playing out in the lot of a Shell gas station. Here's the video: A bear of a middle-aged guy, 5'11", 230 pounds, faces a rakish, apparently homeless man in his twenties who is wielding a 3-foot-long pole. The older bear of a guy holds his arms up like a boxer as the younger one jockeys with the pole, falls backward off a curb, then lithely spins back to his feet. The older guy blots his eyes and yells, "You're going to jail, motherfucker." The younger one, who wears a bright red stocking cap, whacks the bear of a guy across his face, sending him careening to the side. A male voice off camera says "Dude!"—the unmistakable Greek chorus of *Wtf, this is insane*. The younger guy looks toward the camera. The video stops.

⚠ *WARNING: GRAPHIC CONTENT*

The following videos contain graphic content, which some readers may find disturbing.

Strombeck stowed his phone, but the action kept spilling into other frames. A daycare's security cam showed the red-capped figure maniacally chasing the now bloodied man down the Lombard sidewalk before bashing him again. A neighbor pointed his camera down from his third-floor window as the younger guy strode below with the pole in one hand and what looks like the older man's baseball cap in the other, pumping his arm, looking amped. Another video of the attacker that appears to be shot from a passing vehicle was uploaded to the crime-alert app [Citizen](#), which pinged a software engineer sitting on his couch a few blocks away, who ventured over and filmed the crimson drips and Rorschach splotches of blood leading down the sidewalk. (Strombeck would later testify that by the end of the attack, the big guy was covered in "the most blood I've ever seen.")

The following day, a Marina local named Joan wrote on Nextdoor that she was the mother of Don Carmignani, the man who'd been bludgeoned by the

pole: “I want to thank all the neighbors that videoed what was happening & got involved to stop it. If they were not there my son would be dead!” Don was in the hospital, she wrote, with a skull fracture and a broken jaw. City politicians tweeted prayers and a call for more cops. Local news identified Carmignani as a former city fire commissioner, a lifelong San Franciscan and father of two. The assailant: 24-year-old Garret Doty, a recent arrival from Louisiana.

Reports said the attack kicked off when Carmignani asked some homeless people to move away from his elderly parents’ door, which they were blocking. In one TV newscast, a reporter mentions an allegation, from one of Doty’s companions, that Carmignani used “bear spray” during the altercation. The segment then cuts to a close-up interview of Doty’s homeless friend—a striking, red-bearded man named Nate Roye, speaking from under a filthy shearling hood—saying that Doty attacked because Carmignani had been “disrespectful.”

“Is that enough to beat him up?” the journalist asks, incredulously.

“Yeah, sometimes,” Roye replies, with a decisive nod.

San Franciscans know the larger drama that this episode advances, and you probably do too: Tech’s glittering citadel, fallen, with the footage to show it. Within some 40 hours of the Marina attack, in another swank part of the city, a widely admired tech executive named Bob Lee, the former CTO of Square and a founder of Cash App, had staggered past surveillance cameras while bleeding from several stab wounds and later died at the hospital. The two maulings—a beaten fire commissioner, a slain tech executive—upcycled to the national news, putting San Francisco under the national surveillance to which it’s become accustomed, with particularly lip-licking schadenfreude on the right. Here again was Newsom’s and Nancy Pelosi’s [doom-looping dystopia](#), where remote-working techies and fleeing billionaires have ceded the city to IRL *Grand Theft Auto*.

Carmignani, his family, his attorney, and some witnesses provided images that flickered through the reports and social media: Strombeck’s video from the gas station. A laundromat’s street cam view of Doty grabbing the metal bar out of a trash bin and taking a practice swing. The daycare cam. In the

neighborhood itself, the vigorous uptake of these images inspired a kind of hope. Marina residents—forever wary of being pegged as pearl-clutching Karens—thought they finally had their irrefutable proof of how clearly things had gotten out of hand. “Somebody got beat up. It was on camera multiple, multiple places,” one told me. “Like, the best evidence!”

But within days, the clarity crumbled. In the case of tech executive Bob Lee, police arrested not a person off the street but a tech entrepreneur whose sister had been [hanging out with Lee](#). And in private, within the police department, the Carmignani attack was veering off narrative too. A police sergeant, sorting through the symphony of surveillance clips that captured the face-off, played the bodycam footage from a cop who had been interviewing Carmignani’s girlfriend after the attack. The officer asks whether she’d been inside when Carmignani went out to “confront” the guy. She says yes. Then from the ambulance, Carmignani interrupts her, barking a command through his broken jaw, seeming to thicken the plot:

“Don’t say nothing to nobody. Don’t say nothing to any cop, no one.”

In San Francisco there’s always another video. New York and London are known for being blanketed with government-run CCTV coverage, but surveillance here is different: It is as privatized as it is pervasive, a culture of Hitchcock’s *Rear Window*, at scale.

In the city where Nextdoor’s offices sit right in the gritty Tenderloin, sharing [Ring cam](#) footage of porch thieves is a bonding exercise between neighbors who’ve never met. All over town, local nonprofits oversee neighborhood-wide networks of cameras funded in part by donations from crypto entrepreneur Chris Larsen. (“That’s the winning formula,” Larsen told *The New York Times* in 2020. “Pure coverage.”) Platoons of Waymo [self-driving cars](#) circulate the streets like *Pac-Man* ghosts, gathering up videofeeds that cops snag for evidence. You can watch a resident’s live cam to see who’s on the corner of Hyde and Ellis, right now.

True-crime video has become San Francisco’s civic language, the common vocabulary of local TV news broadcasts, the acid punch line to a million social media posts. The feeds intensified during the pandemic, when commuterless streets erupted with synthetic opioid use and property crime.

Since then, the city has found itself hobbled through successive breakdowns—a police shortage, a 34 percent office vacancy rate, a federal injunction severely limiting the city from clearing homeless camps. No one seems to be solving San Francisco’s problems, the feeling goes, so by God, people are going to film the dysfunction and post the footage.

A guy who goes by the handle JJ Smith is probably the most vivid personification of this drive. A longtime resident of the Tenderloin whose brother died of a fentanyl overdose in 2022, Smith—not his real name—films unhoused people as he tries to cajole them into considering treatment. Then he posts the footage on X, where he has about 19,000 followers.

In happier cases, he’ll document when people check into a program and come out clean on the other side. But much of Smith’s footage is far grimmer: coroners rolling sheet-draped corpses out of residential hotels; a cold open on a woman’s face as she OD’s on a sidewalk. Smith explains that he’s just given the woman Narcan, pulling you into morbid suspense combined with an awful feeling of *Are we really supposed to be seeing this?* Other times, Smith dispenses a tough love that edges into trolling, like the time he snatched away a coat draped over a woman’s head so he could scold her for smoking drugs next to a park where his kids play.

People shrug off statistics, Smith says, but “when you’re actually seeing it, it really gets to you.” Supporters credit him with recording a humanitarian crisis. Critics tweet at him, even chide him on camera: He’s exploiting people who have no privacy with footage they haven’t consented to. (Hey, he says, it’s a public sidewalk.)

An encampment on a beach near the Marina District in San Francisco.

Photograph: Ian Bates

Some of the discomfort with Smith, who says he knows many of the people he films, stems from the simple fact that, by now, he’s part of a social media bandwagon. Even presidential hopeful Ron DeSantis once stopped by the Tenderloin to shoot a video. Today, Smith is joined by other accounts like FriscoLive415 and Tenderloin Tube—a cadre that lives somewhere on the border between citizen journalists and dystopic paparazzi. Consider the live

birth video. Last spring, a Twitter account that typically posts store-looting vids showed something else: an infant, just born and naked, on a Tenderloin sidewalk, its dazed mother trying to pick the baby up. The event is morally excruciating, but so is its existence here, on X, overlaid with the account's watermark as the video travels the internet to 1.5 million views, churned into headlines like "Caught on Video: Homeless Woman Gives Birth in Broad Daylight on Tenderloin District Sidewalk."

X content

This content can also be viewed on the site it [originates](#) from.

Which is to say: Anything "caught" on camera is actually, on some level, set loose—often into realms scarcely envisioned by whoever filmed it. In Carmignani's neighborhood, several hills and a couple of miles away from the Tenderloin, a distinct culture of surveillance holds sway: more genteel and hyper-local, less engineered for maximal algorithmic consumption, but just as aggressive. It is herded by a ubiquitous seventy-something retiree named Patricia Vaughey, a woman who has little presence on social media outside of Nextdoor. But even in the Marina, the rule holds: Video may seem like a means of control, but it can just as easily unleash chaos.

Officially, Patricia Vaughey is the long-running president of a Marina merchants and neighbors association. Unofficially, she is the Marina's self-appointed minder. Vaughey doesn't like the term "Karen"; she prefers an older title: "the curmudgeon." A transplant from Mississippi who arrived in 1969, she radiates mirth and deep worry from her blue eyes and speaks with the heft of a steamroller.

For decades, Vaughey says, she felt compassionate toward the few homeless people shuffling by the chic stores and restaurants on Chestnut Street, where she once kept a gift shop. She'd ask if they wanted social services or a job; if they didn't cause trouble, she didn't call the cops. "You've gotta be fair," she says.

Then came Covid. Like others in the Marina, Vaughey started counting many more people living on the streets, seemingly using harder drugs. The

Marina had theories: They were drifting over from the Lombard Street motels where the city moved unhoused people during the pandemic. They were escaping from the Tenderloin, which had descended into such tent-and-fentanyl anarchy that the mayor declared a state of emergency. Maybe they were even being dropped off from other cities. (Several people I spoke with are convinced this is happening; Vaughey muses about setting up her own camera sting.)

Emails pummeled the inbox of Catherine Stefani, the Marina's supervisor in City Hall. Messages about drug dealers, a guy with a knife, instances of public indecency. Carmignani wrote requesting a call about "a homeless person and a sexual act." Naturally, the Marina started taking pictures: tents pitched in a row behind Safeway. A person smoking drugs on the baseball bleachers at Moscone Park. Campers parked illegally on Marina Boulevard. Men passed out in outdoor dining areas, burnt drug foils in one's lap.

Vaughey emailed the police: "WE NEED A STRATEGY!!!!!!" She spun up an ad hoc network of neighbors who walked different areas of the Marina, some during their daily dog walks or exercise routines, doing recon on the unhoused. And the network persists to this day. If a member spots someone breaking a specific law (blocking sidewalks in violation of disability codes is a big one), they call the cops. If a homeless person looks "mental," as Vaughey puts it, a volunteer can call the police nonemergency line for someone to check on them—or Vaughey makes the call herself. Some volunteers make a practice of asking homeless people if they're open to moving into a shelter or accepting medical help, then try to make it happen if they say yes.

Always, above all: Vaughey wants photos and videos. "You have to show that you have a problem," she says. (Plus the group tries to keep track of who's been approached.) If a neighbor texts her but fails to send pics, or someone mentions bad behavior on Nextdoor without evidence, Vaughey pads down the 48 steps from her fourth-floor apartment to collect the visuals herself from the driver's seat of her Chevy Spark.

Where do all the images go? Not far, generally. Vaughey says she often sends them to a security patrolman who many neighbors pay to watch their houses. Sometimes to the cops. (Vaughey to the district police in 2020: "30

of our group have spent more than a month taking pictures documenting the activities of the drug dealers and their suppliers and their paths of moving. Our group has documented most of the homeless.”) At the very least, she keeps them on file for future reference and writes occasional updates on her favorite social network. “I am a public figure,” one man living in a tent off Lombard told me. “I’m pretty well known over the Nextdoor app.”

But the indisputable stars of the Marina’s surveillance archive are a couple named Nate Roye—the guy with the shearling hood—and Ashley Buck. Or as Vaughey calls them: “the worst we’ve ever had.”

Roye and Buck arrived in the neighborhood around 2019, after Roye took a Greyhound in from North Carolina and hooked up with Buck somewhere along the way. They set up camp outside the Walgreens on Lombard, where, according to an employee, in court filings, they smoked meth, antagonized customers, and yelled at each other. Buck would allegedly go into the store and steal things—ice cream, Red Bull, cookies—sometimes every 30 minutes, and once made off with \$205 worth of makeup, hurling vitriol. (She was never formally charged with shoplifting from the store.)

More complaints about the couple’s alleged misdeeds piled into Supervisor Stefani’s inbox: that Roye had swung a metal object at pedestrians; that he had “exposed himself” around kids on Halloween; that he had smacked with a tree branch a guy who threatened to call the cops on him. The duo had each been involved in local criminal cases—Buck was charged with shoplifting from a boutique, but the case was dropped; Roye pleaded no contest to vandalism charges, did quick stints in jail, was put on probation. But they always ended up back on the street.

I walked up to talk with Roye on a couple of occasions. He downplayed his disputes with neighbors. “They just don’t like company. That’s just some people, sometimes.” When he messes with people, he said, “It’s just for fun, really,” and he said he smokes crystal meth “all day, every day.” Buck, for her part, didn’t want to talk: The first time I approached her for an interview, she asked me to wait “around the corner” for a chat that never came; later she told me, “I think you’re looking for the other one … She’s around somewhere; we can schedule something soon.”

While most of the Marina's Covid-era surge of homeless people had dissipated by about 2022, Vaughey's network kept tracking the holdouts. Specifically, Vaughey patrolled at least once a day in her Spark to shoot photos of Buck and Roye's whereabouts. (Sitting in a Marina pizzeria this summer, I asked Vaughey where the duo was. On the spot, she texted a woman in her network, who called with the answer.) Beyond surveillance, Vaughey also worked other angles: In late 2022, at her urging, a Walgreens employee filed for a restraining order against Buck and Roye. When Vaughey posted the news on Nextdoor, Marina people were exuberant: "Thank you for everything you do." "Finally!"

As the restraining order made its way through the court, Buck and Roye simply drifted to the area around Magnolia Street near Carmignani's house, where a new set of Marina residents had to contend with their ever-expanding gyre of scavenged items and their operatic scenes.

A neighbor whom I'll call Dana—a manager at a tech company who works from her rent-controlled apartment of 13 years—was particularly bothered by Roye's tendency to berate Buck gratuitously. One day, after Dana watched the cops arrest Roye, she walked up to Buck on the sidewalk: "If there's any time for you to get out," Dana told her—to escape this cycle—"it's now." It was the rare olive branch: One day, the couple's yelling sent Dana into such tears of frustration that she felt like a hostage in her own house. The couple was stuck in some sort of dead-end loop that, from a distance, might inspire pathos, but the lived reality of it, just outside her window, turned Dana's empathy sideways. "Fuck Nate and Ashley! They are pure chaos, with complete impunity and disregard," she says. Dana hates that she's gotten jaded: "I hate them for making me hate them."

The duo wasn't without companions, though. Earlier this year, some neighbors around Carmignani's block noted a new guy with long hair who started hanging around the couple—quieter, often on a bike: Garret Doty.

Doty declined to speak with me (through his lawyer), but his odyssey to Magnolia Street can be partially reconstructed with video. On November 9, 2022, he drove a stolen utilities truck with Texas plates up to a border patrol checkpoint in New Mexico and was detained for questioning. In a taped interview with a state trooper, an upbeat Doty says he's headed to Route 66,

to Tucson, eventually to San Francisco. “That’s home,” he says, though he doesn’t have an address there. “You ever heard that song by that woman: She ain’t never looking back with her rearview mirror torn out, and her left foot on the gas?” he says. “That’s about how I feel.”

The agents pulled up his arrest history in Acadia Parish, Louisiana. He had been charged with domestic violence and strangulation when he was 20 and with obstructing a public passage and resisting arrest when he was 22, though all the charges had been dismissed.

An agent noticed that Doty had lesions on his face and suspected him of being high, though Doty said he wasn’t on any drugs. Doty gave vague answers as to how he got the truck—his mood zigzagging from jolly to agitated. The state trooper eventually told his coworkers, bodycam running, that Doty might need a mental health check at a hospital before they booked him into jail. (Doty pleaded not guilty to a charge of attempting to possess a stolen vehicle, which was later dismissed.)

Police bodycam footage of a New Mexico state trooper interviewing Doty while he was detained in November 2022. (Note: The audio delay was present in the video released to WIRED in a records request.)

The video trail goes cold soon after that; somehow Doty made it to the Marina. Last winter, he approached a man named Richard who lives in a tent off Lombard. Richard says Doty asked questions about his camping setup—“I thought he was just some lost kid. He referred to home, home, home, home, home.” It was chilly, and Richard offered Doty one of the caps that he crochets to sell. Doty popped on a bright red one. “He brightened up and did a dance in the rain.”

Soon, Richard saw that Doty had befriended Roye and Buck—almost becoming “the third partner.” Doty and Roye seemed to urge each other on to be “more macho, more daring,” once dancing around in a sword fight with PVC pipes for kicks. It also meant that Doty had walked right into the frame of the ongoing drama that so many Marina residents were surveilling.

On the afternoon of April 5, Vaughay was driving down Carmignani’s street, out on her daily photo-snapping patrol to track Roye and Buck. She

saw the duo sitting on the sidewalk with Doty, clogging the public right-of-way with their possessions. Vaughey says she called the disability violation in to the cops. Later, when she got news of the Carmignani attack, her first thought was: “Shouldn’t have happened.” The cops ought to have cleared the sidewalk, she felt, before Carmignani ever got to the scene. A nearby surveillance cam filmed what happened instead: The police came, talked to the unhoused, then left.

When a San Francisco deputy public defender named Kleigh Hathaway started watching the bodycam footage from the Doty case—and got to the part where Carmignani barks, “Don’t say nothing to nobody” to his girlfriend—she didn’t initially understand what was going on. She thought it was just his personality coming through.

Through his lawyer, Carmignani declined to speak with me. But the way he paints himself in a 2022 radio interview, he’s a back-slapping city kid, the third-generation son of an Italian family that settled into the Marina in the early 1900s, a guy whose home is next door to the house his grandpa built in the ’40s, where his parents still live. He cofounded a startup in the dotcom boom, then invested money from the company’s 2010 acquisition in a cannabis emporium in the financial district. He also had a business selling jukeboxes and pool tables. He’s well known in his part of San Francisco: His family owns the building that houses the iconic Balboa Cafe, run by a hospitality company founded by now California governor Gavin Newsom. Over the years, Carmignani joined community boards and the Elks Club, got a purple belt in jiu jitsu, donated to city campaigns. That daycare whose security cam picked up a few moments of Doty’s onslaught? Carmignani owns the building. “The city is crashing and burning right now, with all the people with fentanyl and all the people OD’ing. I wish we could stop that, and I know we can,” he said on the radio last year, sounding every bit the concerned pillar of the community.

This laundromat’s security cam caught part of the altercation between Doty and Carmignani.

Photograph: IAN BATES

But when Hathaway took on Doty's case, she quickly learned some other things about Carmignani. A decade ago, he had been arrested for domestic violence involving his then wife, forcing him to resign from the fire commission after just a few months. (He pleaded no contest to a misdemeanor assault.) So when Hathaway saw Carmignani demand silence from his girlfriend, she thought, "Yeah, this guy maybe has something to hide."

Doty pleaded not guilty to felony battery and assault charges. Then, in late April, on the eve of his preliminary hearing, prosecutors sent Hathaway a new batch of evidence, including a continuous stretch of footage from the laundromat cam. For the first time, Hathaway watched Carmignani's initial approach to Doty, which occurred nine minutes before the start time of the clip Carmignani's attorney had released.

That old clip had begun with Doty plucking a pole from a trash bin. In the new footage, Carmignani, wearing a Covid face mask, walks past a jumble of items on the sidewalk and pulls a tall black canister from his pocket, thumb trigger on top. Seconds later, Doty, with his red hat, scrambles into the frame with a jacket pulled over his head. As they face each other, Carmignani steps toward Doty, who quickly turns his back and moves away. Carmignani walks after him. There's no audio, but the body language is telling: Doty's on the defensive.

Courtesy of San Francisco Public Defender's Office

The next surprise Hathaway came upon in the new batch of evidence was a bundle of police reports, detailing eight crimes from the prior year and a half. On all occasions, a male suspect had approached homeless people on Marina sidewalks and pepper-sprayed them. In the first case, in November 2021, there was even video evidence—from a Ring camera, right on Magnolia Street. When Hathaway played the clip, she saw a bulky guy stride up to a man lying on the sidewalk and spray him for a full five seconds, studiously aiming the chemical agent—designed to cause pain, burning, and temporary blindness—into the victim's face and head as he rolls over and stands up. "I was like *what? What?!*" Hathaway recalls. "He focuses on the victim's face. It's just so gross."

Courtesy of San Francisco Public Defender's Office

Hathaway looked at the 2021 sprayer—sure-footed, bulky, Covid face mask, baseball cap. Then she looked at Carmignani as he approached Doty on April 5—sure-footed, bulky, face mask, baseball cap. “I was like, Jesus, that’s Carmignani. Like that’s exactly how he walks.” (In the press, Carmignani’s attorney denied it was him.)

In some of the other sprayings, witness statements bent toward a roughly similar script. A goateed white guy in his fifties, riding a bike, asked if an unhoused guy needed help before pepper-spraying, kicking, and punching him. A white guy, 6'1" and some 220 pounds, with short, light brown hair, wearing a gray beanie, unzipped a man’s tent and maced him with a 10-inch canister, warning, “Get out of my town.” A white male, 40 to 50 years old, grayish hair, sprayed Ashley Buck and an unhoused man. In other spray attacks, suspect descriptions skewed younger: One involved a white or Hispanic male in his thirties riding a gray bicycle. Another was a white thirtysomething male on a skateboard.

(Still other incidents didn’t make it into those police reports. In my reporting, a Marina man told me he’d seen someone—not Carmignani, he said—spray a homeless person in the face in August 2021, but he told the 911 dispatcher he didn’t want to get further involved by talking to the cops. Roye told me he’s been sprayed on three different occasions by different people: “It just makes you very mad, but you can still see. It just burns.”)

The same day that Hathaway saw the new evidence, the district attorney’s office told Carmignani’s lawyer that they intended to drop the charges against Doty and might prosecute Carmignani instead, for pepper-spraying.

That night, Carmignani appeared on the local news. Sitting in a kitchen, his words rolled out slowly. He described his night terrors and his wounds, sometimes closing his eyes, seeming overwhelmed with pain. At times, his voice flecked with anger. “My city—*my* city—is in chaos.” He called the prospect of his own prosecution “sad,” explaining, “When you have animals in the street saying they’re going to rape your daughter and kill your mother, and you have nothing to do or help. When you call for help,

911”—Carmignani narrowed his eyes—“and they don’t show up,” he weighted each word, “*What do you do?*”

The next day, the public defender’s office demanded that the charges against Doty be dropped, detailing the prior spray attacks and publicly releasing the 2021 Ring cam footage alongside the new videoclip of Carmignani’s advance on Doty. Carmignani’s attorney denied that his client had been involved in any prior spray attacks and blasted the accusations as “victim blaming.”

The district attorney ended up going through with the charges against Doty after all, and didn’t charge Carmignani in any spray attacks. But the fresh chaos of facts churned through the culture war, needling its obsession with who, on San Francisco’s symbolic turf in 2023, was the real victim. In Carmignani, some now saw a vigilante, a bully who got a brutal comeuppance for picking on the city’s underclass. Others focused on the violent transient who’d horrendously beaten a former official—and said if there was any fault on Carmignani’s side, it was that San Francisco’s failings had pushed him over the edge.

As much as citizen surveillance culture has put an eye on unhoused people, it has also captured a steady, years-long ticker of those harming them, all across the city. In 2018 a Tenderloin camera filmed a man wearing a suit and carrying a briefcase as he kicked a person lying on the sidewalk in the head; the police identified and arrested the man, who later pleaded guilty to felony assault. In January, a septuagenarian named Collier Gwin trained a water hose on the face of a woman on the sidewalk in front of his art gallery. A chef waiting at a stoplight filmed the attack and posted it on TikTok. (Gwin avoided battery charges by doing community service.) And police are still offering a reward for information about an attack that wasn’t filmed: In 2021 someone set fire to a Guatemalan immigrant’s sleeping bag, leading to the man’s death from burn injuries.

None of the spray attacks in the Marina had made the news until they were linked to the sensational Doty case.

Carmignani’s nearby neighbor, Dana, had actually been a witness to one of the sprayings. One afternoon in January 2023, as she was working from

home, she heard screaming from Magnolia Street. Having dealt with Roye and Buck for months, she hesitated—“Once you engage, it becomes this whole thing”—but when she popped her head outside, she saw that it was a different homeless duo. The two told her that they and their Chihuahua had been pepper-sprayed. They asked Dana to call the cops and help their dog. Dana brought them a wet washcloth and lugged the salivating Chihuahua up to her bathtub while she dialed 911.

Then she heard the couple scream *again*, and she rushed to the window: They were being sprayed a second time. Not, apparently, by the same guy. Unbeknownst to Dana, another neighbor had witnessed the initial attack and caught a short cell phone video of the first purported sprayer: middle-aged, gray goatee, gray beanie, gray jacket. But the guy Dana now saw was a lanky white guy, twenties or thirties, “tweaker-ish,” basic gray sweat suit, who slowly bicycled past the couple as he sprayed them in the eyes. She’s since seen the photo of the first suspect, and this wasn’t him, Dana says.

With the dog in one arm, Dana fumbled with her iPhone to record the second sprayer as he biked down the block, but she couldn’t get it cued in time. As the police and ambulance descended, Dana handed the two victims some swag T-shirts from her tech company to change into.

That day, Dana was one of four witnesses who gave a statement to the cops. The event marked the eighth spray attack on unhoused people in the Marina area within 14 months. Now, police were treating all the suspected vigilante incidents as related. They sent out a department-wide email with the middle-aged January suspect’s photo. Vaughey told me some officers texted the photo of the suspect to her, but she didn’t recognize the guy.

Now, after the Doty ordeal, the Marina was as infamous for its pepper-spray vigilantes as it was for the attack on Carmignani. Meanwhile, Roye and Buck and Doty were blowing up on Nextdoor and Twitter—hashtag #TransientTrio—and still getting photographed in the blocks around Carmignani’s house. During a spell when he wasn’t in jail, Doty was filmed smoking on a mattress nearby, flashing a mellow peace sign at the camera. Then, over the summer, JJ Smith, San Francisco’s preeminent chronicler of street desperation, noticed all the Twitter hubbub and drove his beat-up

Chevy van out from the Tenderloin for his first on-camera intervention in the Marina.

“I’ve come out here to see if I can help y’all or offer y’all any services,” Smith starts up in a warm voice. Roye stands amid a stew of objects—a papasan chair, blankets, bags—that expands over most of the sidewalk, a block and a half from Carmignani’s house. Smith urges Roye to move some things to the curb so they can be hauled away. Blasé and unfazed, Roye says he’d rather sell the stuff. Buck ignores him. After some small talk, Smith gently asks Roye if he’d like to try detox or a shelter rather than sleeping out on the street. “I’d rather stick with it,” Roye replies. “I like the freedom out here.”

garret doty strode into a Hall of Justice courtroom one Monday in June wearing an orange jumpsuit and walking with a light step, his stringy locks wafting behind him. Carmignani pushed a walker up the aisle with a lumbering limp. At a prior hearing, Carmignani had said that the painkillers he was taking were strong and his brain processing had slowed and had gaps. He stuttered a few times.

The hearing stretched on for several sessions over three months. The prosecution and the defense both entered videos as evidence. Much of it had already played on the news. But the hearing also filled in a crucial hole: No audio existed to reveal the early minutes of Carmignani and Doty’s interaction—key to determining whether Doty had acted in legal self-defense. In its place, there was old-fashioned eyewitness testimony.

From the stand, Carmignani said that on the morning of April 5, his mom told him that she couldn’t leave her house because three people—Doty among them—were posted up against her front gate, “smoking crack” and screaming. Carmignani said that he went to the window and asked them to leave and they just yelled back at him. He snapped a photo, called 911, and left for work. When he returned that evening, the group had moved across the street to the laundromat, but his parents were still too nervous to go out; they’d stayed inside all day. Hearing this, Carmignani testified, he walked out and asked, “Can you please get your stuff and move.” Doty started yelling and screaming, Carmignani said, and was holding some kind of weapon—a kitchen knife, a metal object, maybe a screwdriver—in his right

hand. “I brought my hands up, and then he jumped up, and he circled me.” At some point, Carmignani said, his spray “went off accidentally, I guess, and went in my eyes, and then I was blinded.”

All the commotion had drawn a neighbor to her window, who saw and heard the interaction differently. Taking the stand, Kristin Onorato, an executive assistant who has worked for a string of tech companies, said Carmignani’s request did not sound like “Can you please get your stuff and move.” Instead, she testified, Carmignani was “aggressively yelling” at the homeless trio: “Get the fuck out of my neighborhood. I own this block. I don’t want to see you here tonight. If you come back, I will stab you.” Onorato said that Carmignani told the group “he would kill them. He said, ‘You have two hours to get out of here. I don’t want to see you tonight.’”

After that, Onorato said, Carmignani left, Buck wandered off, and Doty, now holding the metal pole, started pacing the street. Within about 15 minutes, Carmignani was back, yelling at Doty and Roye. Carmignani was standing with his back against a wall, Onorato said, “almost as if he’s baiting them to come closer to him.” At some point, she said, Carmignani called Doty a “white [N-word].” When Doty came within 10 feet, Carmignani sprayed at him—“willfully,” she said—but the wind blew the spray into Carmignani’s own face, causing him to wipe his eyes and continue to spray “haphazardly.” That’s when Doty struck Carmignani with the pole two or three times. Carmignani continued to spray as he backed down the sidewalk toward the gas station, out of her view, at which point Stig Strombeck, the guy who’d gotten out of his car on Lombard, filmed the encounter. Strombeck testified that Doty continued to follow and hit Carmignani for a full block down Lombard, repeatedly yelling, “Don’t fuck with my family. No one fucks with my family.”

The Shell station where Stig Strombeck filmed Doty and Carmignani's encounter.

Photograph: IAN BATES

When it came time to cross-examine Carmignani, Kleigh Hathaway, the public defender, suggested that he knew the block and its surveillance well. “You hid yourself in this area where there weren’t any videos, and you

baited Mr. Doty to get close enough so you could then spray him, correct?" (Carmignani: "I do not recall that at all.")

And the prior sprayings? Carmignani's attorney, who sat feet away in the otherwise empty jury box, instructed him not to answer most of the questions. An exception was when Hathaway brought up a November 2022 spraying. Carmignani checked his phone, then told the court he was flying to a wedding in New Jersey that day. Hathaway pointed out the inconsistency: He'd answered questions about that one day while pleading the Fifth on others: "And that is because, sir, you believe you have an alibi, is that right?" And the January 2023 suspect—the middle-aged guy in a gray beanie who sprayed the couple with the Chihuahua on Magnolia? Carmignani denied "100 percent" that it was him. The lead police investigator on the Doty case testified that he hadn't done much to look into the prior reports of pepper-spray attacks.

At the end of the hearing in July, Judge Linda Colfax spoke from the bench. She said she was "troubled, and that's a somewhat generous word," that the police hadn't followed up on any of the previous sprayings. She also didn't find Carmignani to be credible: He easily recalled details during direct testimony, she said, but then got fuzzy during cross-examination. The video belied what Carmignani claimed happened when he first approached, she said—the purported weapon in Doty's hand, the circling face-off—and she didn't believe Carmignani set off the pepper spray accidentally.

Then Colfax turned her attention to Doty: She was troubled that once Carmignani began to run, Doty pursued and kept hitting him on the head. The felony assault and battery charges against Doty would go on to trial, though Colfax called Carmignani "the initial aggressor."

In the Marina, neighbors around Magnolia were used to keeping a close eye on Roye and Buck. At least one neighbor now considered Carmignani someone to keep an eye on too. In early June, within a few days of Carmignani pushing his walker into the courthouse, the neighbor held up a cell phone and filmed him limping out his door with a cane to a waiting black pickup.

One Friday evening at quitting time, I followed Dana from her Magnolia Street house across a field of golden retrievers and poodles at Moscone Park to a weekly event at the dog run called Yappy Hour. Dana's typical crew sipped rosé from plastic cups and Yeti thermoses. One mutt wore a hot-dog costume. An owner ran to scoop an errant poop from the artificial turf with the intensity of a US Open ball boy. ("You're going to get shamed on Nextdoor if you don't," Dana said.) One exasperated 70-year-old who described herself as third-generation Italian San Franciscan emphasized to me, with hearty smacks to my shoulder, that San Francisco can't become the next Detroit. She said she wasn't sure whether Carmignani had committed any of the prior sprayings: "He could have maybe, who knows? But they can't prove it, so fuck them. He's protecting his family, he's protecting his mother, and we are not going to stand for this anarchy in our city!"

In Vaughey's circle, many people seemed less worried about the harm pepper-sprayers might do to their victims than about the damage they might do to the reputation of people like the Marina photo squad. Vaughey herself disavows vigilantism, but has, on at least one occasion, inadvertently invited associations with it. Last year, she convened a neighborhood meeting about public safety and set off some worry at City Hall when she said—in front of a police captain, someone from the supervisor's office, and about 100 attendees—that the community needed to "militarize against the homeless." She chalks the misunderstanding up to semantics: "You say 'militarize' and this generation thinks pull out guns. It's join together, speak up, and be strong." Their only weapons are phone calls and images.

I asked Dana (who is not part of Vaughey's group): Did she think the first sprayer caught on the Ring cam on Magnolia looked like Carmignani? Her answer was a verbal shrug. "I mean, sure." Her frustrations lay elsewhere. With the Doty attack, the neighborhood had gotten what seemed like unimpeachable proof that its problems were real. "A lot of us were like, 'finally, we have something on camera of these assholes!'" But Carmignani's actions ruined it, nullified their case. It was now just the story of a sprayer.

One day in July, I spotted a camera on the front of a tidy house on Magnolia—the place whose driveway had been the site of the 2021 attack where a man was sprayed in the face for five seconds. I walked up to the open garage and asked the man inside if I could talk to him about the Ring cam footage that had emerged of the incident. He said he'd rather not, that he was thinking he would be subpoenaed. Doty's trial was coming up—it's now set for mid-November—and the man said he had to get an attorney himself. He hadn't authorized the release of his footage to the media, he explained, and he wasn't happy that it wound up on national TV.

The next day, I drove into the Chevron lot across from the Shell where Doty and Carmignani had fought. Then I looked up, and as surprising as any celebrity sighting, there was Nate Roye. Right on Carmignani's corner, under those laundromat cameras, he was balancing a bulky Whirlpool appliance atop a narrow scooter. It was a feat so on-brand that I pulled out my cell phone, hit Record, and kept filming as Roye, in a set of Care Bears-print pajama pants, glided his humongous cargo across six lanes of Lombard crosswalk to the pile where Buck was waiting.

As I became yet another Marina surveillant, I thought of what one regular chronicler of the homeless in the neighborhood had told me—that he doubted all the careful surveillance had added up to much other than “On my phone I have a bunch of stupid photos now.” San Francisco’s police chief has called the city’s bonanza of surveillance footage a “golden” tool for solving crimes, but it can just as easily set people free: The public defender’s office is one of the main requesters of footage from the Tenderloin’s camera network. One defense attorney in the city, Elizabeth Hilton, told me that in many of her cases the trove of San Francisco video evidence ends up helping the accused, contradicting victims’ and witnesses’ accounts of what went down.

Vaughey, for her part, is convinced the Marina’s surveillance and activism have made a difference. “I’m proud of my neighbors,” she told me, again and again. In late summer, Walgreens was granted another restraining order against Roye and Buck, this one good for three years. The couple have since moved to the periphery of the neighborhood where, Roye told me, it’s “calmer.” But problems in the Marina persist. In September, Dana texted

me from Moscone Park, where firefighters were attending to a guy who had apparently just been pepper-sprayed. I arrived in time to find a shirt and an Oakland A's cap soaked in orangish liquid, lying in the grass. Then, in October, another unhoused regular on Vaughey's radar, Zavein Wright, was charged with assaulting an 80-year-old man. Vaughey told me she was trying to figure out whether anyone had seen or filmed it.

As I kept my eye on the Marina, I couldn't stop thinking about the guy I'd met in his garage that day in July, bewildered that his Ring footage had ended up on the national news, that this little piece of hardware had unleashed something bigger than he'd ever intended. His reaction struck me as genuine and understandable—what *most* people would feel in his position. Yet it also seemed quaintly naive, a reminder that those engaged in citizen surveillance in 2023 still don't totally get what it means to have a camera watching the street.

Photograph: Ian Bates

A camera offers the illusion of a private sentry, serving you and your castle. Control your tiny corner of a flailing city. Yet once you capture something you didn't expect, say, a neighborhood vigilante mystery unfurling on your doorstep, the control is breached. Your cam blasts up and away into the stratosphere of attention. The cops get it, the footage gets passed to the prosecutor, who hands it to the defense attorney, who tosses it like chum to the ravenous media, and before you know it, your house cam is on CNN, it's playing on *All In with Chris Hayes*, it's making rhetorical points against Tucker Carlson, it's basically a live birth on a San Francisco sidewalk, boomeranging the eyes right back on you, threatening to put you on the witness stand, sending a WIRED reporter marching up to your garage on a Friday afternoon, hoping to talk.

You wanted to surveil. You end up surveilled.

And right there, under the little security camera that kicked it off, our garage meeting completed the surveillance media ouroboros. You and I are variations on a theme, our distinctions flattened, our outputs—your footage, my story on all the footage—sucked into the same grasping, greedy, ever-

expanding gyre of internet, the “Lawless San Francisco” section, competing for eyes and for clicks. Watching and watched, all true-crime-casting now.

This article appears in the December/January issue. [Subscribe now](#).

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Oct 19, 2023 6:00 AM

Watch This Guy Work, and You'll Finally Understand the TikTok Era

The creator economy is fragmented and chaotic. Talent manager Ursus Magana can (almost) make sense of it, with a frenetic formula for gaming the algorithms.

Photograph: SINNA NASSERI

We were on the patio of a middling Los Angeles taqueria when Ursus Magana tried to talk me out of writing this story. A hirsute fireplug of a man with a slew of anime tattoos, Magana wasn't worried that I'd spill any awful secrets. In the months since I'd first messaged him on [Instagram](#), he'd been endlessly candid about his life as a talent manager for emo rappers, goth [TikTokkers](#), and [OnlyFans](#) creators. He just thought I was wasting my time on a project that seemed unlikely to excite the social media algorithms that mean everything in his world. "Do you know how hard it is for an article to go viral?" he warned. "I mean, articles never go viral."

Perhaps fearing he'd bummed me out by implying that my career was pointless, Magana put off eating his last brisket taco to whip up a blueprint for how he would guide me to stardom. It started with me ditching journalism to focus on churning out daily TikToks in which I'd offer tips about storytelling. Magana's talent management startup, [25/7 Media](#), would ensure eyeballs for this content by enlisting its 60-plus clients to drive traffic my way. Once I'd built a decent fan base, 25/7 would produce a weekly podcast featuring my candid conversations with up-and-coming digital creators. I'd then parlay that success into a "big swing": a how-to

book or Netflix series that would land me a spot on *The Tonight Show* and a lucrative endorsement deal with, say, a manufacturer of ballpoint pens.

I'm enough of a realist to know Magana was flattering me and that I'm much too boring to pull off any of what he proposed. But he delivered his pitch with such confidence, such zeal, that a dreamy little piece of me couldn't help but see myself telling witty anecdotes on Jimmy Fallon's couch. And when I caught myself flirting with that fantasy, I grasped how a genuinely talented young artist must feel when Magana lays out his plan for making them the richest person in their family by the age of 19.

Magana and his colleagues at 25/7 have made good on that grandiose promise enough times to prove that, despite any semi-delusional schemes for my future, they know what they're talking about. In an entertainment industry still dazed by the chaos of digital platforms, Magana has emerged as a fairly reliable rainmaker.

The creator economy is projected to be worth \$480 billion by 2027. In many ways, that figure represents an enormous redistribution of wealth: a tide of ad dollars and other revenue ebbing away from established studios and publishers, and flooding toward individual creators and the technology giants that host their work. But the corporations are the only ones on a secure footing in this arrangement. If individual creators want to stay afloat for longer than a brief moment, they still need managers to help them navigate the algorithmic churn.

The old-guard talent agencies—the Creative Artists and United Talents and Gershes of the world—ventured into this terrain years ago, forming their own digital divisions to court influencers. They face stiff competition from massive newer firms like Viral Nation and Underscore Talent, which boast that the creator economy is woven into their corporate DNA. In this scrum, the upstart 25/7 Media has fashioned a niche for itself prospecting for viral talent in areas that its larger rivals often ignore—the misfit subcultures of the young, which can often cross-pollinate with other online communities to yield colossal audiences.

Like other self-styled social media gurus, Magana hustles to sign clients by touting his ability to game the platforms that shape our tastes. (“Influence

the algorithm, not the audience” is 25/7 Media’s slogan.) But part of his pitch, and his gift, is that he’s an authentic product of the subcultures in which he operates. An ardent metalhead and community college dropout who was shaped by a turbulent immigrant experience, the 29-year-old Magana has built his company around supporting artists who are often isolated by their creativity, and by their oddness. “We understand how they feel at home when they’re doing something kind of weird, something that isn’t easily explainable,” he says. “That’s our competitive advantage.” And that is no small edge. Doing something weird at home has never offered such a wormhole to fame.

25/7 clients outside an Airbnb in Los Angeles.

Photograph: Sinna Nasseri

the closest thing 25/7 Media has to a headquarters is a WeWork in Playa Vista, a former nowheresville in West Los Angeles that now teems with boxy glass-and-steel office buildings and absurdly pricey condos. On my first day there earlier this year, Magana was joined by his two cofounders: Andrew Alvarado, who oversees finances, and Rafail Luzi, the head of the music division, who’d flown in the night before from his home in northern Connecticut. Rather than spring for a private office, the three men were camped out at a countertop by the common kitchen, amid other entrepreneurs chattering into MacBooks about their drop-shipping ventures.

My tutorial in how 25/7 Media operates began during the founders’ late-morning Google Meet with an executive from the digital music distributor Vydia. The executive was keen to strike a deal involving a 25/7 client named YoungX777, a guttural, nihilistic trap-metal musician with long curly locks that veil his face.

This article appears in the November 2023 issue. [Subscribe to WIRED](#)
Photograph: Sinna Nasseri

YoungX777 had been discovered by 25/7 in late October 2022, after Luzi and his two full-time music scouts had glimpsed promise in the data for his song “Toxic.” A sludgy sonic wallop about suicidal ideation, the song hadn’t racked up many streams. But its five-second intro, a post-toke cough

followed by a throaty scream, had popped up in a few [TikToks of MMA fighters](#) pummeling each other and [weightlifters](#) grunting beneath squat bars. Experience had taught 25/7 Media that when brief “recreates” of these kinds of songs bubble up in those particular TikTok communities, virality can soon follow.

When the number of recreates climbs into the tens or hundreds of thousands, Magana told me, two of 25/7’s core tenets become germane. The first: Once a social media user hears an audio snippet nine times, it gets stuck in their head to some degree. The second, which Magana has dubbed the Ten Percent Rule, is that 10 percent of those earwormed users will end up tracking down the snippet’s original source.

Confident in the algorithmic potential of the “Toxic” intro, 25/7 Media had rushed to sign YoungX777 even though he had less than 30,000 monthly listeners on Spotify. Taking such risks is an essential part of the strategy: The firm has to snag clients before they appear on the radars of well-heeled competitors. “We’re the ones who hit you up before you blow up, so we can say we believed in you before you got big,” Magana told me. “These artists, a lot of times the only sign they have of their success is some kids sending them videos of themselves dancing to their song. We’re often the first ones who aren’t their friends telling them, ‘Hey, you’re good.’”

Once YoungX777 was on board, 25/7 Media ran its standard campaign to juice a new client’s recreates. Rather than pay one or two famous influencers to use the “Toxic” intro in the hopes of producing a trickle-down effect, the firm appealed to scores of MMA and weightlifting TikTokkers whose followings rarely top more than a few hundred. (Some were given small payments to push the song, but others were happy to do it for free.) Flooding the zone this way caused TikTok’s algorithm to funnel posts featuring “Toxic” into the feeds of users who consume gym-centric content. Inevitably, some of those users were creators themselves, and they began to weave YoungX777’s clip into videos targeting related subcultures —like the region of TikTok obsessed with [highlights of soccer players](#) bursting past hapless defenders.

“When you drop one song,” Magana told one artist, “there needs to be four other versions of the song right away.”

The “Toxic” intro became a TikTok and Instagram Reels sensation in mid-January, at which point the Ten Percent Rule kicked in. By month’s end, the full song was zooming toward more than a million plays on Spotify. Now, Vydia was pitching 25/7 Media on letting it take charge of distributing YoungX777’s catalog around the globe. It would use its proprietary technology to collect royalties from disparate platforms and stamp out copyright violators in exchange for a cut of YoungX777’s revenue. After much hemming and hawing, the Vydia executive ballparked his offer at around \$200,000, a seemingly vast sum for YoungX777, who’d been eking out a living as a solar panel salesman.

Magana and Luzi seemed underwhelmed. Luzi responded that he was certain a major record label would offer a quarter-million for YoungX777’s next album without a second thought. “If I tell one of my artists that I turned down a quarter-million dollars, I might not have that relationship any longer,” Luzi said. The call ended with the Vydia executive promising to talk to his team about increasing their offer. (Vydia did eventually reach an agreement with YoungX777, who now has more than 1.9 million monthly listeners on Spotify—a figure that translates into annual revenue that can top \$450,000. Soon after the deal was inked, Vydia was sold to a new media company founded by the former creative director of Apple Music.)

I gleaned more about 25/7’s way of doing business during an afternoon call with Ovrthro, a 22-year-old Canadian musician and TikTokker whom Magana was eager to sign. Much of Magana’s pitch centered on how, if hired, he would promote an Ovrthro song called “Death,” which is based on a sample of the villain’s whistle from the animated film *Puss in Boots* 2. He talked a lot, of course, about the tactics 25/7 Media uses to “ride the algorithmic wave,” but he also stressed that the ride can be short unless a client is committed to constantly pumping out fresh content. The algorithms are designed to highlight new material, even if its quality is subpar. “When you drop one song,” he told Ovrthro, “there needs to be four other versions of the song right away.”

The volume of work required to stay in the algorithms’ good graces can certainly be daunting. A 25/7 Media creator named Nixxi, who derives most of her revenue from her OnlyFans subscription fees, told me she is urged to

post across multiple platforms every day, and that she uploads three folders' worth of content to her manager's server every Sunday so that posts can be scheduled in advance. Another client, an Oregon-based musician who goes by 93feetofsmoke, said that he was aiming to release around 50 solo songs this year and produce as many as 70 for other artists. "You can't take weekends off," he told me. "Like, I don't take the weekends off, ever."

Toward the end of his call with Ovrthro, Magana talked about how 25/7 presses its clients to help one another in commandeering the algorithms. His example involved a social media starlet named Emma Langevin, a thickly accented New Jerseyite known for her darkly comic confessional posts about makeup, food, and mental health. An object of untold thousands of crushes, Langevin let a fellow 25/7 Media client named SyKo use her photo as the digital cover for a song of his entitled "[#BrooklynBloodPop!](#)"

Magana credits that photo—Langevin's de facto seal of approval—with giving "[#BrooklynBloodPop!](#)" its initial launch into the stratosphere. Few songs were more omnipresent on TikTok in 2021, when SyKo's bright "hyperpop" beat became the backdrop for a million videos of teens doing the [10-second dance](#) that had virally attached itself to the track. (The song now has more than 250 million plays on Spotify and 120 million views on YouTube.)

When the Ovrthro call was done, I half-jokingly noted to Magana that the collaboration between Langevin and SyKo sounded like a prime example of synergy. He said he'd never heard that word before but that he loved it and would be incorporating it into his recruitment spiels from now on. He also encouraged me to post a TikTok explaining the concept. (I later texted Magana a vintage GIF from *The Simpsons* to show that "synergy" has been lampooned as corporate jargon for nearly as long as he's been alive.)

The musician Syko shows off a gold grill given to him by an LA jeweler.

Photograph: Sinna Nasseri

Though Magana was excited about the prospect of adding Ovrthro to the 25/7 Media family, he was clearly more passionate about another artist he'd recently unearthed: a 17-year-old musician and TikTokker named Lumi Athena, whose social media profile lists his interests as "sushi, emo girls,

and shiny stars.” Magana sensed enormous potential in Lumi’s signature style. His songs were inspired by the same hyperpop genre that SyKo had capitalized on, but they had a spacier, more haunted edge. A sample from his catchiest track, a singsong ode to debauchery entitled “[Smoke It Off!](#)” was beginning to get recreates on TikToks celebrating the weirder strains of anime.

Magana had first contacted Lumi via Instagram last December, and on their subsequent phone call, they’d instantly clicked. “I’m Mexican, he’s Mexican, we start cracking jokes,” recalled Magana, who teased Lumi for having pale skin. (Magana, who proudly claims that an ocean of Aztec blood courses through his veins, has a much darker complexion.) Lumi felt comfortable enough to reveal that a few record labels had already approached him with offers of \$10,000 for an album—an attempt, in Magana’s eyes, to exploit an undereducated teen’s naivete about how the industry really works.

magana traces his love for music back to an experience in utero: In the spring of 1993, his pregnant mother attended a Guns N’ Roses show at Mexico City’s Palacio de los Deportes. Both she and Magana’s father served in the Mexican army, but they were much hipper than most of their military peers. Once a year, for example, they’d make the long drive to Southern California to buy flashy clothes that they’d then resell to Mexican entertainers. (When he was a toddler, Magana had his picture taken with Alejandra Guzmán, a famous singer who’d bought sequined outfits from his parents.)

But for reasons that Magana is hesitant to discuss, his parents came to believe their lives in Mexico were untenable. On an early summer day in 2000, Magana’s parents told him they were taking a surprise trip to Disneyland; he remembers being ecstatic as they passed through the border checkpoint. But instead of heading to the park, the family drove to an apartment in a shabby part of Long Beach. For weeks, Magana’s parents told him they were playing a game of make-believe, which the 7-year-old boy took to mean they’d soon return to Mexico City. “And then they signed me up for school,” Magana recalls. “And that’s when I realized like, oh, yeah, we ain’t going back home.”

Clockwise from left: Magana with the musicians Jnhygs and Syko.

Photograph: Sinna Nasser

Long Beach proved to be a hostile environment for a chubby kid whose poor English marked him as an outsider. Magana was frequently taunted and beaten up by packs of older boys. He remembers being chased by gang members because his school's bus stop was on a street they controlled. The harassment only got worse as Magana began to develop a taste for bands like Van Halen and Kiss, whose music and fashion were reviled in his rap-obsessed neighborhood.

When he wasn't busy coping with bullies, Magana could often be found in the company of his entrepreneurial ex--military mother. While her husband toiled on construction sites, she sold counterfeit perfumes and sneakers on the streets of Long Beach. Tagging along with her is an experience that Magana credits with nurturing his gift for salesmanship. "That made me so fucking fearless," he says. "Like, you know, walking around LA with a bunch of boxes with shoes, and then going into the projects, literally the projects, and convincing these, like, fucking gangsters to buy these knockoff shoes."

The Maganas eventually saved enough to buy a small home in Pomona, 30 miles east of Los Angeles. Ursus enrolled at an artsy charter high school where he was no longer considered an outcast for his music, his increasingly shaggy hair, or his burgeoning love for the anime series *Naruto*. "Every time you saw him, he had a guitar in his hand," says Ken Smith, one of Magana's high school teachers and a close confidant. "And he always had multiple bands he was in or he was forming." Magana had his heart set on someday making millions by fronting a metal group, a goal that became especially urgent after his family lost their house in the subprime mortgage crisis. He found more immediate success as a promoter of backyard metal shows, scrappy \$10-a-head affairs where sweaty teens smashed one another in the face while dancing to songs about Norse gods and serial killers.

As graduation neared in 2011, Magana realized his future looked bleak. He was an undocumented immigrant, so he wasn't eligible for federal financial

aid to attend a university; he couldn't join the military despite having been in his high school's Junior ROTC program; and decent jobs were off-limits because he didn't have a Social Security number or a driver's license.

Magana had also come to terms with the fact that he wasn't quite talented enough to play music for a living. He was fated to be, as he puts it, "a metal kid who never made it." Unable to see a path toward any life he desired, he heeded his guidance counselor's advice to enroll at Pasadena City College.

An introductory film class there altered his wayward trajectory. Instantly fascinated by the craft of stitching images together to tell a story, Magana talked his way into an unpaid internship with a photography studio that had been branching out into video production. Some nights he would work there until 3 am, editing footage for ad campaigns, then crash at his girlfriend's dorm at Cal State Los Angeles before catching the Metro to Pasadena for a 9 am class. En route, he'd earn pocket change by busking for commuters.

His reprieve from that exhausting routine came in 2013, when he applied to the new federal immigration program known as Deferred Action for Childhood Arrivals. For the first time, Magana was able to obtain a work permit without fear of being deported. He soon dropped out of college to accept a paid, full-time position at the photography studio. He also married his American-born girlfriend, a step that allowed him to start inching along the long journey toward US citizenship.

After settling into married life, Magana felt obligated to pull in a higher salary and wound up selling solar panels door-to-door, making upwards of \$80,000 a year. But he missed the buzz of spending his days surrounded by music, the art form he associated with his warmest childhood memories.

"The only time I saw my parents loosen up completely and not give a fuck, not give a fuck about anything, is when they were dancing," he says.

"When my mom was head-banging to Metallica while cleaning the house on a Sunday, when my dad was dancing salsa."

Yet Magana had no clue how to gain a foothold in the notoriously shady music industry. He tried to manage a few small-time rappers, but they kept ghosting him after he'd shelled out thousands of dollars to produce

their videos. “So I’m wasting all this money,” he says. “I get really fucking sad, really fucking depressed.”

Then, in 2016, an increasingly desperate Magana created a LinkedIn profile. That profile attracted an inquiry from Fullscreen, one of the first companies to specialize in connecting digital creators with major brands. Fullscreen was looking for a native Spanish speaker, and Magana assumed the job would involve day-to-day interactions with celebrities. “They had, like, Steve Aoki on their website,” he recalls.

Instead, Magana was handed a far less glamorous assignment: doing search engine optimization for Telemundo’s YouTube videos. Through trial and error, he mastered the tricks necessary to inflate a video’s views and thus maneuver YouTube’s algorithm into pushing Fullscreen’s clients to the fore. He figured out how to frame the most alluring thumbnail teasers, for example, and the best place to drop the clickable “end cards” that nudge viewers to watch another video. He also analyzed Telemundo’s traffic data and realized that a lot of viewers were using the channel’s English-subtitled telenovela recaps to learn Spanish. He also knew that those subtitles were automatically generated and often garbled to the point that many users gave up. So Magana persuaded Telemundo to write accurate captions and embed them in its videos, a move that he says boosted the channel’s viewership by hundreds of thousands.

Magana thrust himself into his Fullscreen work, especially as his marriage began to disintegrate: He took to sleeping in his car outside the office so he could put in extra hours. His portfolio expanded as he honed his SEO chops—he was assigned to the Ubisoft account to help launch an *Assassin’s Creed* title, for example, and he produced YouTube content for Telemundo during the 2018 World Cup. But he still pined to carve out a place for himself in art and music. He often talked about that ambition with Andrew Alvarado, a friend and fellow college dropout who managed a stable of YouTubers for Fullscreen. They kicked around some ideas for doing their own thing, like moonlighting as music video producers, but they never followed through.

One night in early 2019, Magana and Alvarado went to a party at a gaudy, largely unfurnished Los Angeles mansion, the sort of place rented by packs

of influencers to use as content mills. Magana prides himself on his knowledge of pop music, so he was surprised when the DJ made the dance floor shake with a song he'd never heard. Everyone belted out the brief chorus at the top of their lungs, but they didn't seem to know any other lyrics.

Magana couldn't believe he was unfamiliar with such an obvious hit, and he asked a fellow partygoer what it was. "Old Town Road," by Lil Nas X, she said, adding that it was currently the biggest hit on TikTok—or, perhaps more accurately, its chorus was a hit, having been woven into countless bite-size videos. That was why the crowd knew only two lines' worth of lyrics.

In that instant, Magana's next move revealed itself to him. "Like a dog, I ran to look for Andrew," he says. "Shoulder-grabbed him. Said, 'We're gonna start a new company! And it's gonna be based on TikTok.'"

25/7 media clients from across the US and Mexico congregate in L.A.

Photograph: Sinna Nasser

magana and alvarado's first stab at managing digital talent was a failure, albeit an instructive one. In the fall of 2019, they signed a popular TikTokker named Reagan Yorke, who'd attracted millions of followers by posting videos of herself lip-syncing and playing juvenile pranks. The two aspiring managers thought they could extend her presence onto other platforms, and thereby increase her revenue, by adding music to her creative arsenal. "We created a song from scratch, brought in producers and writers that we knew from the music industry, created this song, coached her how to sing rap, all that stuff," Alvarado says. But the resulting video, starring Yorke's influential friends, was a dud on YouTube.

Chastened, Magana and Alvarado got in touch with Rafail Luzi, a music promoter they knew through Instagram, to help them figure out what had gone wrong. (Luzi was yet another college dropout; his Albanian parents had hoped he'd become a plastic surgeon.) Their conversations led them to conclude that even their clients' finest content would flop unless 25/7 figured out how to game the platform's algorithms and heed the data's cues.

Now a three-person startup, 25/7 Media put its revamped vision into action to support Curly J, a New York-based rapper they'd signed. When they dug into the data on Curly J's YouTube videos, they saw that more than a quarter of the comments mentioned video games—specifically the battle royale phenomenon *Fortnite*. So Magana and his colleagues set about finding ways to have Curly J's music inserted into the *Fortnite* montage videos that were doing huge numbers during the early weeks of the Covid-19 pandemic. Because Curly J was verified on Instagram, they had him reach out to the teenaged creators of those montages, many of whom were thrilled to hear from someone who'd been blessed with a blue check mark.

"It was personalized messages to each person," Curly J told me. "Like, to literally over 1,000 different creators." The ones who agreed to promote Curly J's work weren't always reliable; many vanished with the \$100 or so that 25/7 Media paid them. But hundreds of honorable creators inserted songs like "No Hoodie" into their montages, then added a link to Curly J's social media in the description box. What would soon be known as the Ten Percent Rule kicked in as thousands of *Fortnite* aficionados checked out Curly J's music. This, in turn, compelled YouTube's algorithm to push Curly J content into gamers' recommendations.

Curly J (foreground) and Cade Clair at a recording console.

Photograph: Sinna Nasseri

Curly J's connection to the hottest game of the pandemic did not go unnoticed in the corporate realm. In June 2020, Warner Records signed him to a \$4.8 million deal. Shortly after, 25/7 Media hammered out an arrangement with Twitch that guaranteed Curly J thousands of dollars per month if he streamed himself gaming for a few hours each week. Those triumphs became 25/7 Media's calling cards when courting other potential clients—proof that the fledgling firm's approach to manipulating the algorithms could provide a path toward life-changing money.

As 25/7 Media expanded throughout late 2020 and early 2021, brand sponsorships became another handsome source of revenue. One of the firm's biggest deals involved Emma Langevin, the TikTokker who would become the face of "#BrooklynBloodPop!" Langevin first caught Magana's

attention with a post in which she joked about the tribulations of being a girl who wears a Nirvana T-shirt, a sartorial choice that inevitably causes men to question how well she really knows the band's discography. Given Langevin's combination of beauty and self-deprecating nerdiness, Magana thought she could develop a huge following among male gamers. "She didn't really play video games," he says. "But I'm telling you, she's every gamer guy's dream girl." Langevin soon began streaming herself playing games on Twitch, sometimes in the company of a masked, gravel-voiced musician named Corpse Husband, who has nearly 3 million subscribers on YouTube. (Langevin would become both the inspiration and the cover girl for Corpse Husband's most popular song, "E-Girls Are Ruining My Life.") Those streaming sessions earned Langevin a sponsorship deal with the energy drink G Fuel, which bills itself as a performance enhancer for gamers.

He confessed that he had several boxes of silicone vaginas in his trunk, remainders from a failed effort to create branded merchandise for one of his OnlyFans creators.

It was harder, though, for Magana to arrange sponsorship deals for the many 25/7 Media clients whose primary platform is OnlyFans, since brands are wary of sexually explicit content. To increase those clients' subscription numbers, Magana helped them establish Instagram and TikTok accounts where they could post erotically charged recreates of trending memes and songs—including those generated by artists within the 25/7 Media fold. Every Monday, Magana sends his OnlyFans clients a memo detailing the audio bits they should be re-creating to maximize their odds of jacking into the algorithms—for example, an out-of-context *SpongeBob SquarePants* clip that prompts the reveal of an alluring outfit. Such posts persuade only a minuscule percentage of viewers to sign up for an OnlyFans subscription, but that's sufficient to generate fantastic revenue. Magana showed me data for one creator—an Amazonian goth with head-to-toe tattoos and an affection for autopsy simulators—who earns more than \$70,000 per month. (25/7 Media also provides its OnlyFans clients with "chat specialists," contractors who pretend to be the creators when responding to messages from paid subscribers.)

By the time I first spoke to Magana in late 2022, 25/7 Media's success had given him some measure of financial security. "The truth is that I just retired my parents," he told me two days after Christmas. "Let's just leave it at that." He owns a comfortable suburban home with his fiancée, a popular OnlyFans creator with whom he has a 2-year-old daughter. His parents have stayed busy by teaching their granddaughter Aztec dances.

Photograph: Sinna Nasseri

Magana also acknowledged that, like so many startups without outside investors, 25/7 Media remains just a few blunders away from the abyss: "If 50 percent of my talent or 50 percent of my staff doesn't work out, my daughter doesn't eat," he said.

In the weeks following that initial conversation, Magana came to view Lumi Athena as the client most likely to get 25/7 Media out of its classic startup bind. Recreates of "Smoke It Off!" were sprouting up in more and more TikTok communities, and it seemed only a matter of time before the Ten Percent Rule guaranteed Lumi more than a million monthly listeners on Spotify. But Magana told me that Lumi's future lay not in creating his own music, but in producing other artists. He saw Lumi as the central figure in a new musical genre called "krushklub," the occult-themed successor to the now-outdated hyperpop. And 25/7 Media was now planning to corner the market on krushklub talent.

as i sped north along the Hollywood Freeway one February night in Los Angeles, a jubilant Magana called to share some news. He and his partners had just gotten out of a meeting with Mike Caren, a former producer for Beyoncé and Kanye West who is now CEO of his own record label, Artist Partner Group. (Caren famously bought Jeff Bezos' Beverly Hills estate for \$37 million.) The 25/7 team was stunned when, toward the end of the conversation, Caren brought up the idea of creating a joint venture with the startup. The exact parameters of the proposed collaboration were fuzzy, but it was Magana's understanding that 25/7 Media would receive millions in funding in exchange for recruiting and developing talent exclusively for APG.

Magana was elated in the moment. A joint venture would guarantee enough capital to cement 25/7 Media's long-term viability. But in the days that followed, he became more measured in his assessment. He was worried about ceding some amount of independence, and maybe even equity, to APG, a company that would clearly be the alpha in their relationship. But he also feared that if he passed up the opportunity, he'd never learn the skills necessary to take his clients to the next level. "You know, I won't know how to get an artist to the Grammys," he told me. "I won't know how to get an artist in, like, you know, Nickelodeon Splash events—like, all the mainstream levers."

Ravengriim, a content creator, cosplayer, makeup artist, and 25/7 client.

Photograph: Sinna Nasser

Magana thinks he needs that expertise because so many of his clients—even some with roots in the most subversive subcultures—aspire to conventional forms of validation and fame. Artists who cut their teeth on digital platforms often idealize the careers of their childhood idols, who didn't have to stress about the exhausting churn of TikTok trends. "I mean, I would love to be in acting and movies and things like that," Curly J told me. "I would love to have, like, major sponsorships, whether it's commercials, you know, that you see around, whether they're from Sprite or Gatorade."

As 25/7's lawyers hashed out terms with APG throughout the early spring, Magana and his partners moved to scoop up the artists in Lumi Athena's immediate orbit—specifically Cade Clair and Jnhygs, the two vocalists on "Smoke It Off!," both of whom had met Lumi on Instagram. Clair, a 21-year-old Detroit native who worships Prince, was an easy get. He was desperate for any sort of career boost, since he had just 12 monthly listeners on Spotify. Jnhygs was trickier because she turned out to be shockingly young: The Metallica-loving Alabaman with a honeyed voice was just a 16-year-old high school sophomore. That meant the 25/7 Media crew had to arrange a Zoom call with her parents, who had no clue their daughter was an artist with a rapidly growing audience. "I didn't even realize that she was making music," Jnhygs' mother told me. "Hearing music coming from a room, I'd think it's just radio or something. I didn't realize that she was actually doing it herself."

Magana walked Jnhygs' parents through the minutiae of how art gets distributed these days and how their daughter's talent could alter their family's fortunes in a spectacular way. "You explain to them that, somehow, that noise their daughter has been making in her room has been picked up on TikTok," Magana says. "And now we're here talking to you about never having to work another day in your life."

Jnhygs, a 16-year-old high school sophomore, needed parental permission to shoot content for 25/7 media.

Photograph: Sinna Nasser

Jnhygs' parents were receptive to that message, but they made Magana jump through another hoop, insisting that he also meet with their family's Baptist pastor, who was willing to fly to Los Angeles for the occasion. Magana and Luzi met him at the airport and cued up a playlist of Christian music for the ride to the hotel. But the pastor, who showed up wearing a jewel-encrusted grill on his teeth, demanded that the duo instead blast classics by Young Jeezy. "I see no devil in these boys," he told Jnhygs' parents, thus granting final approval for their daughter to become 25/7 Media's youngest client.

To celebrate its krushklub recruiting coup, 25/7 Media flew Lumi Athena, Cade Clair, and Jnhygs to Los Angeles so they could spend a few days creating music and TikToks in a space-age Airbnb high in Beverly Hills. (The three artists had never met in person.) Keeping his young clients focused on the tasks at hand proved to be a challenge for Magana. "These are kids," he told me. "Really, we're just trying to stop them from smoking weed all the time."

Lumi Athena, a central figure in a new musical genre called "krushklub," shoots content.

Photograph: Sinna Nasser

artists have a reputation for struggling with the mundane aspects of life, which is partly why managers exist. One evening at the Playa Vista WeWork, for example, I listened in as Magana and Alvarado tried to

explain the basics of personal finance to an important client in Texas. One of six siblings who'd been raised by a single mother, the client had earned a windfall of around \$400,000 after going viral in 2021. Absolutely bewildered by the concept of taxes, he'd brought his 1099s to the nearest outpost of a national accounting chain to seek help. The advice he received there had cost him tens of thousands of dollars. Alvarado, the most financially prudent of the 25/7 founders, promised to set up the client with a limited liability corporation and automatically deduct taxes from his revenue-sharing and royalty payments.

The client was also about to fly for the first time ever, to perform at a club in Los Angeles, and he had no idea how to handle the logistics of air travel. Magana assured him that he'd be allowed to check his massive canvas duffel bag, and that he could safely stow his carry-on in the overhead bin.

Many of 25/7 Media's clients are ill at ease in the world for poignant reasons. As reflected in the inward-looking content they produce, these young artists see themselves as largely defined by their battles with anxiety and depression. "I am going to stop hyper-fixating on my mental illness," Emma Langevin intones in one of her most moving TikToks. "And I will not make jokes about it that make the normal people I hang out with uncomfortable." These mental health issues were compounded by the chaos of the pandemic, an event that Magana refers to, perhaps a bit curiously, as "our generation's Korean War."

"Due to the internet and social media culture and everything these kids grew up in, they don't go outside, they don't interact, they don't want to talk to people," Alvarado says. "They're scared to hop on a call, they have all this social anxiety. And so, you know, the only way to get through to these types of people is to be relatable. And the only way to be relatable is to know what's actually going on in their lives."

Relating to clients can become more difficult after they discover that the fame they crave can't fix their deeper problems. "For a lot of people that become successful, they become successful because of doubt and revenge," Luzi says. "When that's kind of out the window and you already did it, what are you looking forward to next? And you have to look at yourself in

the mirror and you gotta say to yourself, ‘Do I actually like myself?’ And for a lot of people, they really don’t.”

That realization is too often followed by self-destructive behavior. “I’ve broken people out of hotel rooms,” Magana says. “Peeled them off of balconies, gotten their parents on the line looking for them.” A teetotaler himself, Magana believes he was well prepared for the demands of fatherhood because he’d already grown accustomed to making sacrifices to protect his troubled artists.

Thankfully, the krushklub crew got up to only mild hijinks during their time in Los Angeles. In between In-N-Out burger runs, they managed to shoot a black-and-white, frenetically edited video for “Smoke It Off!,” which Magana sent to me a few days after it hit YouTube in July. As the central refrain oozed out of my laptop speakers—“Too much / too much / oh yeah ...”—I clicked over to Lumi Athena’s Spotify account to check on his progress. He now had more than 3.8 million monthly listeners.

The following month, Lumi returned to LA to pursue a fresh musical direction. “TikTok kinda, like, stole my sound,” he told me shortly after he woke up one afternoon in late August. “Like, after ‘Smoke It Off!’ popped off, they just run off with my shit.” When 25/7 Media told him that his songs were getting surprisingly high traffic from users in Chile, Lumi decided to invent a new genre he dubbed “Latinklub”—essentially krushklub leavened with strains of reggaeton. His time in LA was thus being spent writing and recording new tracks, a process that involves hanging out in an Airbnb Jacuzzi until inspiration strikes, then retreating to the studio until 4 am.

“Like, dude, I already made it in the fucking US,” Lumi said. “But if I managed to figure out how to crack the Latin space, shit, it’s gonna be a way, way bigger impact.”

after weeks of internal debate, 25/7 Media’s founders decided to pass on the joint venture opportunity with APG. Alvarado had lobbied for the deal, contending that it would address all of the startup’s financial anxieties. Magana countered that the rapid success of Lumi Athena, whose flagship song “Smoke It Off!” has now been played more than 235 million times on

TikTok, proved that 25/7 Media wasn't yet at the point where it needed to surrender any independence. As is usually the case, Magana won the argument through force of personality. "I'm the Napoleon of the group," he told me with a laugh.

Magana's faith in 25/7 Media's prospects is rooted in his belief that bigger competitors are too stuck in their ways to emulate what the startup does best. "It's going to take CAA 20 years to have enough agents who look like me," Magana says. It is certainly a bit hard to picture someone with his résumé and mosh-pit style climbing the ladder at one of Hollywood's institutional powers. But the status quo always becomes less important to decisionmakers when they realize they're missing out on piles of money.

To keep 25/7 growing as a fully independent enterprise, Magana is seeking new ways to drum up revenue. When I was in Los Angeles, for example, he confessed that he had several boxes of silicone vaginas in his trunk, the remainders from a failed effort to create branded merchandise for one of his OnlyFans creators. "He'll come up with some crazy ideas," Alvarado says. "And some of them I don't even know where to start. But I really appreciate him always just saying what's on his mind, because out of the 10 crazy ideas he has, at least one of them's gonna end up working."

Ravengriim shooting content

Photograph: Sinna Nasser

I patiently listened to Magana talk through a lot of brainstorms, and many were indeed as half-baked as his plan for reinventing me as a TikTokker. But there were also moments like the time on Google Meet when he showed me an electrician's Instagram page. As I perused various photos and Reels of an attractive young woman installing circuit breakers and wiring light fixtures, Magana outlined one of the next phases in 25/7's evolution: managing creators who specialize in performing blue-collar jobs.

"She is basically glamorizing the freedom of being a self-sufficient woman in an industry that is not female dominant," Magana said. What if he could wheedle the Instagram algorithm into pushing the electrician's Reels onto the feeds of 18-year-olds disillusioned with the idea of going into debt for

college, who fantasized about finding another way to achieve their dreams? Or maybe their 45-year-old parents, who are prone to doomscrolling through Reels about lazy teens? Then 25/7 Media would cut deals to do recreates of music on the account, so that a new song could make inroads with people in the building trades.

“What do you do when you work construction?” Magana said. “I know—because I worked construction when I’d work with my dad—you listen to music. So why the fuck wouldn’t you pay her to just use that song?”

It was only in hindsight that I had questions about all the specifics Magana conveniently elided. While he was stringing together one enthusiastic sentence after another, I was sold on his vision. And if the algorithms truly want me to pick up carpentry rather than type these words, maybe I’m being a fool to resist.

Magana’s shirt design by Eva Garcia.

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Nov 13, 2023 7:00 AM

Will Life Be Better in the Metaverse?

WIRED's spiritual advice columnist on the lure of augmented reality and what may get left behind here on earth.

Illustration: Nico Ito

“I kind of want to live in the metaverse. There will be all the same stuff as my regular universe—friends, work, shopping, entertainment—but it will somehow be more thrilling. When I move, will I still be myself?”

—Virtual Horizons

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Spiritual Troubleshooting for the Digital Age

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Dear Virtual,

It's hard to believe that only two years have passed since we were promised the new dispensation—the digital universe where, as [Mark Zuckerberg](#) put it, we would “be able to express ourselves in new, joyful, completely immersive ways.” In the [metaverse](#), brain surgeons in Scotland would operate on patients in New Zealand, and friends would gather in simulated space stations, luxurious alpine retreats, and enchanted forests. The soaring

promo video at 2021’s Meta Connect suggested that the metaverse would remain untainted by the limitations of the real world—even, perhaps, the laws of physics. (One clip showed the novelist Octavia Butler saying, “There are no closed doors, no walls.”) It certainly was, as you say, thrilling. Amid the global pandemic’s alternating waves of fear and monotony, I don’t think anyone could have been faulted for wanting to decamp for something new. World without end, amen.

Since then, as you probably know, this dream has undergone the steady erosion of technological disenchantment. The fluid virtual bodies we were promised turned out to be boxy cartoon avatars. The Oculus headsets were awkward and, because the nondigital world is still one of doors and walls, its most enthusiastic users kept injuring themselves. Meta’s [Horizon Worlds](#) platform failed to hit its user targets, and several companies that had set up shop there, including Disney and Microsoft, pulled out.

But despite the many eulogies for the metaverse, the promise has not died and the technologies seem to be improving.

At the most recent Connect, in September, Zuckerberg spoke of the metaverse as less a destination than a process, one that is well underway. The world we currently occupy is already somewhat “meta,” he stressed, because it’s a blend of the physical and the digital, and the boundary between these realms will slowly blur into “this idea that we call the metaverse.” Screens will morph into headsets, physical objects will gradually be augmented by interactive holograms, and the mundane world we live in will mutate into something more glorious, almost without us noticing. Or we might already be in the metaverse? It’s hard to say. The concept has become a bit vague and tautological. As one writer for *The Verge* put it, “whatever Meta does is the metaverse, by definition.”

If I can venture a somewhat grand comparison, Virtual, the evolution of the metaverse recalls the fate of so many religious eschatologies, which the true believers are forced to adapt and reinterpret once their prophecies fail to materialize. When Christ spoke of the glories of the kingdom of God, many of his earliest followers believed he was speaking of an imminent revolution that would transform life on earth.

Once several generations had come and gone and nothing of that sort had happened, other interpretations began to emerge. Maybe Jesus had been speaking about the afterlife and the more ethereal promises of heaven? Maybe the kingdom was merely the steady cumulation of justice and equality that humans were tasked with bringing about?

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When I was growing up in the church, the popular evangelical interpretation was “inaugurated eschatology,” which held that the kingdom is both “now” and “not yet.” All the glories of heaven are still to come, and yet we can already experience a glimpse of them here on earth. It’s a somewhat inelegant interpretation, one that in hindsight feels like an attempt to have (quite literally) the best of both worlds: Believers can enjoy paradise in the present and also later in heaven. It’s this theological framework that comes to mind when I hear Zuckerberg go on about the physical world, AR, VR, and the porous borders between them. When he speaks about existing “mixed reality” technologies as an ontological pit stop on the road to a fully immersive virtual paradise, he sounds (to my ears, at least) an awful lot like the theologian George Eldon Ladd, who once wrote that heaven is “not only an eschatological gift belonging to the Age to Come; it is also a gift to be received in the old aeon.”

All technological aspirations are, when you get down to it, eschatological narratives. We occupants of the modern world believe implicitly that we are enmeshed in a story of progress that’s building toward a blinding transformation (the Singularity, the Omega Point, the descent of the True and Only Metaverse) that promises to radically alter reality as we know it. It’s a story that is as robust and as flexible as any religious prophecy. Any technological failure can be reabsorbed into the narrative, becoming yet another obstacle that technology will one day overcome.

One of the most appealing aspects of the metaverse, for me, is the promise of being delivered from the digital–physical dualism mediated by screens and experiencing, once again, a more seamless relationship with “reality” (whatever that might be).

But maybe we are wrong to look so intently to the future for our salvation. Although I am no longer a believer myself, when I revisit Christ's promises about the kingdom, I can't help thinking that he was widely misunderstood. When the Pharisees asked him, point-blank, when the kingdom would arrive, he replied, "The kingdom of God is within you." It's a riddle that suggests this paradise does not belong to the future at all, but is rather an individual spiritual realm anyone can access, here and now. In his *Confessions*, Saint Augustine, sounding not unlike a Buddhist or Taoist sage, marveled at the fact that the wholeness he'd long sought in the external world was "within me the whole time."

When you describe, Virtual, your longing to live in a digital simulation that resembles reality but is somehow better, I can't help thinking that we have forgotten the original metaverse we already have within us—the human imagination. Reality, as we experience it, is intrinsically augmented—by our hopes and fears, our idle daydreams and our garish nightmares. This inner world, invisible and omnipresent, has given rise to all religious longings and has produced every technological and artistic wonder that has ever appeared among us. Indeed, it is the source and seed of the metaverse itself, which originated, like all inventions, as the vaporous wisp of an idea. Even now, amid the persistent, time-bound entropy of the physical world, you can access this virtual realm whenever you'd like, from anywhere in the world—no \$300 headset required. It will be precisely as thrilling as you want it to be.

Faithfully,

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Oct 12, 2023 7:00 AM

My Kid Wants to Be an Influencer. Is That Bad?

WIRED's spiritual advice columnist advises a parent who's freaking out about their 6-year-old's ambitions to make a life online.

ILLUSTRATION: CÁSSIA RORIZ; Getty Images

“Whenever my 6-year-old daughter gets asked what she wants to be when she grows up, she says, ‘An influencer.’ The thought of it freaks me out. What should I do?”

—Under the Influence

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Spiritual Troubleshooting for the Digital Age

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

Dear Under,

Your question made me think about Diana Christensen, a main character in Paddy Chayefsky's 1976 film *Network*, played by Faye Dunaway. Christensen is a young network news executive who is meant to represent the moral bankruptcy of a generation that was raised on TV (one character calls her “television incarnate”). While charismatic and highly capable, she is also rampantly amoral, viciously competitive, and so obsessed with

ratings that she famously has an orgasm while discussing viewership numbers. The character clearly piqued a pervasive cultural anxiety about TV's corrupting influence, though with a little distance it's hard not to see her depiction in the film as moralizing and heavy-handed. As *The New Yorker*'s Pauline Kael put it in her review, "What Chayefsky is really complaining about is what barroom philosophers have always complained about: the soulless worshippers at false shrines—the younger generation."

I mention the film only to get out of the way the most obvious objection to your freak-out, one I'm sure you've already considered—namely, that every generation fears new forms of media are "false shrines" corrupting the youth, and that these concerns are ultimately myopic, reactionary, and destined to appear in hindsight as so much unfounded hand-wringing. Before Diana Christensen, there were the studio bullies in Norman Mailer's novel *The Deer Park* (1955), who represented the degeneracy of Hollywood, and the ruthless newspaper men in Howard Hawks' film *His Girl Friday* (1940), who are referred to as "inhuman." If you want to go back even further, consider the bewilderment often experienced by modern readers of *Mansfield Park*, Jane Austen's 1814 novel whose dramatic apex rests on a father's outrage at coming home to find that his children have decided to put on a play.

Rest assured, Under, that I am not trying to dismiss your question through appeals to historical relativism. Pointing out that a problem has antecedents does not compromise its validity. It's possible, after all, that humanity is on a steady downhill slide, that each new technological medium, and the professions it spawns, is progressively more soulless than the last. The many journalists who've cited the [2019 poll](#) claiming that 30 percent of US and UK children want to be YouTubers when they grow up have frequently juxtaposed that figure with the dearth of kids who want to be astronauts (11 percent), as though to underscore the declining ambitions of a society that is no longer "reaching for the stars" but aiming instead for the more lowly consolations of stardom.

If I were to guess your [objections to influencing](#) as a future occupation for your daughter, I imagine they might include the fact that the profession, for all its vaunted democratic appeal—*anyone can be famous!*—conceals its

competitive hierarchies; that its spoils are unreliable and largely concentrated at the top; that it requires becoming a vapid mascot for brands; that it fails to demand meaningful contributions to one's community; that it requires a blurring between personal and professional roles; that the mandates of likes, shares, and followers amount to a life of frenetic people-pleasing and social conformity that inevitably destroys one's capacity for independent thinking.

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I'm also willing to bet there is a deeper fear humming beneath those seemingly rational objections—one that is related, incidentally, to the very notion of influence. [Parenting](#) is, at the end of the day, an extended experiment in influencing. You hope to instill your values, politics, and moral and ethical awareness in your children, yet as they make their way into the world, it becomes clear that there are other influences at war with your own. Influence, it has been noted in this era of [epidemics](#), shares a root word with influenza, an etymology that echoes the popular notion that ideas are free-floating pathogens that someone can catch without giving their conscious consent. I think this is how many parents regard the social technologies their children use, as hosts for various contagions that must be staved off with more deliberate moral instruction given at home. To realize the extent to which these digital platforms have fascinated your daughter is to feel that you have failed to inoculate her.

Or maybe your uneasiness goes even deeper than that. If I can turn the problem back on you, perhaps your instinctive aversion to your daughter's aspirations has raised more probing questions about the source and validity of your own values. Any serious attempt to think through the perils and possibilities of new technologies forces you to realize that many of your own beliefs are little more than amorphous, untested assumptions, formed by the era in which you were raised. Are the artists you grew up idolizing—musicians, filmmakers, novelists—any less shallow and narcissistic than the TikTok and YouTube personalities your daughter idolizes? The answer to this question is not a given. But if you consider it honestly and persistently,

I suspect you will discover that you are not an isolated moral agent but porous to the biases and blind spots of the decades in which you came of age.

Such realizations can easily inspire fatalism, but they can also lead to a more expansive and meaningful understanding of your own fears. My intent in reminding you of the anxieties of previous generations—all that collective angst about television, movies, newspapers, and theater—is to help you see your situation as part of a lineage, a rite of passage through which all generations must proceed. (If we are to believe Plato’s *Phaedrus*, even Socrates fell prey to griping about the popularity of writing, a medium he feared would “produce forgetfulness in the minds of those who learn to use it, because they will not practice their memory.”) To see this problem historically might also prompt you to consider, as a parent, what kinds of life lessons transcend the particulars of a given economy.

I would like to believe that alongside all the ephemeral inherited assumptions we absorb in our youth, there are some pearls of enduring wisdom that will remain true and valuable for generations to come. Ideally, it’s these more lasting truths that you want to pass down to your daughter, and that will equip her to have an influence, no matter what she chooses for work.

Faithfully,

Cloud

Be advised that **CLOUD SUPPORT** is experiencing higher than normal wait times and appreciates your patience.

This article was downloaded by **calibre** from <https://www.wired.com/story/my-kid-wants-to-be-an-influencer-is-that-bad/>

By [WIRED Readers](#)

[Culture](#)

Oct 5, 2023 6:18 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.

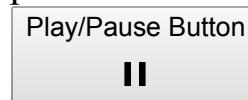


Illustration: Elena Lacey

THIS MONTH'S PROMPT

In six words, write a story about an AI on trial.

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

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

SEPTEMBER 2023

A Story About Teleportation Gone Wrong

ILLUSTRATION: SI PARMEGGIANI/NEPTUNIAN GLITTERBALL

—@NotaForexTrader, via X

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

AUGUST 2023

A Story About the Future of Vegetables

ILLUSTRATION: SI PARMEGGIANI/NEPTUNIAN GLITTERBALL

—Rachel Brigden Haskins, via Facebook

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

JUNE/JULY 2023

A Story About a Sentient Moon

Illustration: SI PARMEGGIANI/NEPTUNIAN GLITTERBALL

—@v1z3n, via Twitter

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

MAY 2023

**An Award-Winning Documentary From the Year
2100**

ILLUSTRATION: VIOLET REED

—Geneviève Goggin, via email

Honorable Mentions:

Grand unification: the first AI marriage. —Daniel Dippel, via email

The great exodus, goodbye Blue Dot. —@viggy.j, via Instagram

Songless seas: a tale without whales. —Christopher Jankoski, via email

Beige planet: Life finds a way. —@danaxon, via Twitter

How the lunar war was won. —Bob Clark, via email

Coping with your AI overlord's demands. —@wwlili, via Twitter

The day the flowers stopped blooming. —@a.c.hachem, via Instagram

Electric sheep: How AI changed us. —@elliottboyd_, via Instagram

After humans: a new cockroach documentary. —@adamrgarcia, via Instagram

APRIL 2023

A Story About the Future of Sleep

ILLUSTRATION: VIOLET REED

—Travis Carraro, via Facebook

Honorable Mentions:

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

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

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

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

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

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

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

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

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

MARCH 2023

A Story About the Future of Personal Hygiene

ILLUSTRATION: VIOLET REED

—David Frank, via Facebook

Honorable Mentions:

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

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

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

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

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

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

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

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

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

FEBRUARY 2023

A Story About a Dramatic Change in Size

ILLUSTRATION: VIOLET REED

—B. Scott Crawford, via email

Honorable Mentions:

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

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

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

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

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

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

Giant wakes up tiny, confused. —ChatGPT

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

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

JANUARY 2023

A Story About a Mad Scientist

ILLUSTRATION: VIOLET REED

—@DaveDyball, via Twitter

Honorable Mentions:

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

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

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

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

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

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

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

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

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

DECEMBER 2022

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

ILLUSTRATION: VIOLET REED

—@JayZheng10, via Twitter

Honorable Mentions:

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

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

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

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

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

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

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

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

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

NOVEMBER 2022

A Story About Living Forever

ILLUSTRATION: VIOLET REED

—J C Thrush, via email

Honorable Mentions:

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

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

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

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

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

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

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

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

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

SPECIAL [RE:WIRED](#) EDITION

A Story About Tackling Climate Change

ILLUSTRATION: VIOLET REED

—@ChuckBaggett, via Twitter

SEPTEMBER 2022

A Story About an Evil Twin

ILLUSTRATION: VIOLET REED

—Andy Walton, via Facebook

Honorable Mentions:

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

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

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

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

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

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

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

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

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

AUGUST 2022

A Story in Six Emoji

ILLUSTRATION: VIOLET REED

Illustration: Violet Reed

—Caleb Bell, via Facebook

Honorable Mentions:

♀♂♂♂♂♀ —@jessbeckah42, via Instagram

□□□□□ —@lgvpart, via Instagram

□□□☠□□ —Ché Graham, via email

□□□♂□□□ —@cmayc414, via Instagram

□□□□□ —@aotrivera, via Instagram

□□□□□ —@marcia_storyteller, via Instagram

□□□△□□ —@PatCattigan, via Twitter

□□□□□□□ —@nadia.bkb, via Instagram

□□□□□ —@cva.maría, via Instagram

JULY 2022

A Story Set in a Galaxy Far, Far Away

ILLUSTRATION: VIOLET REED

—@KuraFire, via Twitter

Honorable Mentions:

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

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

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

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

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

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

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

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

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

JUNE 2022

A Story About a Wormhole Discovered in Your Closet

ILLUSTRATION: VIOLET REED

—Olivia Richardson, via email

Honorable Mentions:

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

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

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

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

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

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

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

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

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

MAY 2022

A Story About a Futuristic Meal Gone Wrong

ILLUSTRATION: VIOLET REED

—Stuart Hodgson, via email

Honorable Mentions:

Waiter, I ordered polynyocominnucloride, not biconvocominleucloride.

—Carolyne Gibson, via Facebook

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

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

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

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

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

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

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

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

APRIL 2022

A Story About Surviving a High-Tech Disaster

ILLUSTRATION: VIOLET REED

—John DeFilippi, via email

Honorable Mentions:

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

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

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

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

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

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

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

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

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

MARCH 2022

A Story About an Extraordinary Coincidence

ILLUSTRATION: VIOLET REED

—Joyce, via email

Honorable Mentions:

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

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

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

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

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

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

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

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

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

FEBRUARY 2022

A Story About a New National Holiday

ILLUSTRATION: VIOLET REED

—@sarahschneiter, via Twitter

Honorable Mentions:

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

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

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

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

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

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

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

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

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

JANUARY 2022

A Story About Your Next-Generation Pet

ILLUSTRATION: VIOLET REED

—Ed Gubbins, via Facebook

Honorable Mentions:

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

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

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

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

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

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

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

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

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

DECEMBER 2021

A Children's Book From the Future

ILLUSTRATION: VIOLET REED

—Jane Turner, via Facebook

Honorable Mentions:

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

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

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

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

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

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

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

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

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

NOVEMBER 2021

A Story About the Future of Psychotherapy

ILLUSTRATION: VIOLET REED

—@oscartkav, via Instagram

Honorable Mentions:

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

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

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

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

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

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

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

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

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

OCTOBER 2021

An Adventure Story Set in the Metaverse

ILLUSTRATION: VIOLET REED

—Evan Skopp, via email

Honorable Mentions:

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

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

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

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

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

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

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

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

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

SEPTEMBER 2021

A Story About a Robot Pop Star

ILLUSTRATION: VIOLET REED

—Randy Cepuch, via email

Honorable Mentions:

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

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

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

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

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

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

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

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

AUGUST 2021

A Story About a Self-Aware Self-Driving Car

ILLUSTRATION: VIOLET REED

—Stephen Clamage, via email

Honorable Mentions:

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

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

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

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

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

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

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

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

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

JULY 2021

A Story About a Casual Encounter With Aliens

ILLUSTRATION: VIOLET REED

—@phorne96, via Twitter

Honorable Mentions:

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

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

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

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

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

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

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

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

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

JUNE 2021

A Story About an International Digital Heist

ILLUSTRATION: VIOLET REED

—@jamesnsmith, via Twitter

Honorable Mentions:

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

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

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

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

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

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

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

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

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

MAY 2021

A Story About a Freaky Discovery in Physics

ILLUSTRATION: VIOLET REED

—Mark Crane, via Facebook

Honorable Mentions:

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

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

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

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

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

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

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

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

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

APRIL 2021

A Review of a Future Work of Art

ILLUSTRATION: VIOLET REED

—Jacky Reif, via Facebook

Honorable Mentions:

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

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

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

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

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

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

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

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

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

MARCH 2021

A Story About a Tech-Centric Religion

ILLUSTRATION: VIOLET REED

—Eduardo Bolívar, via Facebook

Honorable Mentions:

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

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

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

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

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

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

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

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

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

FEBRUARY 2021

A Story About a WFH Office Scandal

ILLUSTRATION: VIOLET REED

—@abhignak, via Instagram

Honorable Mentions:

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

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

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

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

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

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

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

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

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

JANUARY 2021

A Story About a Future American President

ILLUSTRATION: VIOLET REED

—Maayan Brodsky, via Facebook

Honorable Mentions:

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

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

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

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

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

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

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

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

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

DECEMBER 2020

A Story About a Gargantuan Space Creature

ILLUSTRATION: VIOLET REED

Illustration: VIOLET REED

—@threepanelcrimes, via Instagram

Honorable Mentions:

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

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

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

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

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

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

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

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

NOVEMBER 2020

A Story About the Next Big Security Leak

ILLUSTRATION: VIOLET REED

Illustration: VIOLET REED

—@_inflexion_ via Instagram

Honorable Mentions:

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

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

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

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

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

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

OCTOBER 2020

A Story Set in a World Without Paper

ILLUSTRATION: VIOLET REED

ILLUSTRATION: VIOLET REED

—Anna Jaruga, via Facebook

Honorable Mentions:

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

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

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

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

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

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

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

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

SEPTEMBER 2020

A Story About the Upside of Failure

ILLUSTRATION: MAXIME MOUYSSET

ILLUSTRATION: MAXIME MOUYSSET

—@rosiestonies, via Instagram

Honorable Mentions:

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

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

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

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

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

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

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

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

JULY 2020

A Story About an Apocalypse With a Happy Ending

ILLUSTRATION: MAXIME MOUYSSET

ILLUSTRATION: MAXIME MOUYSSET

—@romer6, via Twitter

Honorable Mentions:

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

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

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

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

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

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

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

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

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

JUNE 2020

A Story About Love in the Time of Coronavirus

ILLUSTRATION: MAXIME MOUYSET

ILLUSTRATION: MAXIME MOUYSET

—Hamish Hamish, via Facebook

Honorable Mentions:

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

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

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

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

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

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

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

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

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

MAY 2020

A Story About Digital-Age Autocrats

ILLUSTRATION: MAXIME MOUYSET

ILLUSTRATION: MAXIME MOUYSET

—@needsmuchvalidation, via Instagram

Honorable Mentions:

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

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

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

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

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

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

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

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

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

APRIL 2020

A Story About Saving the Planet

ILLUSTRATION: VIOLET REED

Illustration: Violet Reed

—@johnjohnjungle, via Instagram

Honorable Mentions:

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

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

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

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

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

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

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

MARCH 2020

A Story About the Next Great Crowdsourced Project

ILLUSTRATION: MAXIME MOUYSSET

Illustration: MAXIME MOUYSSET

—@milked_, via Twitter

Honorable Mentions:

Smelt decommissioned weapons into musical instruments. —

@casinclair, via Twitter

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

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

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

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

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

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

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

FEBRUARY 2020

A Story About Rebooting Democracy

ILLUSTRATION: MAXIME MOUYSET

Illustration: Maxime Mouysset

—@dmcdev, via Instagram

Honorable Mentions:

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

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

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

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

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

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

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

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

JANUARY 2020

A Story About a Rosy Future for Facial Recognition

ILLUSTRATION: MAXIME MOUYSET

Illustration: MAXIME MOUYSET

—@henriquegeirinhas, via Instagram

Honorable Mentions:

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

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

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

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

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

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

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

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

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Oct 5, 2023 8:21 AM

In the War Against Russia, Some Ukrainians Carry AK-47s. Andrey Liscovich Carries a Shopping List

Kyiv enlisted a Silicon Valley insider to rush consumer-grade tech onto the battlefield. He's giving a demo of the future of war: the military-retail complex.

Illustration: Lena Weber; Getty Images

In hindsight, zhenya Podtikov realized, he should have known that Ukraine's first Vector [drone](#) was not long for this world. But when it arrived at an army base in Lviv, in April 2022, he couldn't help admiring it. "I was just surprised that drone hardware could look so good," he said. The Vector came in pieces—its sharklike nose, sleek fuselage, and upright tail all polished to a tooth-enamel white. Its manufacturer, a German company called Quantum Systems, had designed the Vector so you could carry it, dismantled, in a backpack. Podtikov needed no tools and just a few minutes to unbox it, put it together, and send it up as a surveillance scout. Entirely on autopilot, it could take off, remain airborne for two hours, and return home, sending back rivers of encrypted video from as far as 20 miles away.

As a test pilot in the [Ukrainian army](#), Podtikov was unaccustomed to such sophistication. He'd been flying drones since 2014—the year [Russia](#) annexed Crimea, the year he turned 18 and joined a unit of volunteers. All of the drones he'd launched were civilian models like the Vector, but they were lesser machines. One had to be propelled by catapult. The army's only military-issue drones, a pair of lumbering aircraft left over from the Soviet

era, didn't even have digital cameras. "You had to have a separate room to develop their film," Podtikov said, sounding as incredulous as any child of the 21st century.

This article appears in the November 2023 issue. [Subscribe to WIRED](#)
Photograph: Sinna Nasseri

On the front lines near Barvinkove, in eastern Ukraine, that first Vector lasted just two full flights; on the third flight, Ukrainian friendly fire took it down because the army's radar units didn't yet have a way to distinguish their own drones from Russia's. Days later, a replacement unit took off toward enemy lines, but the Russians jammed its global navigation satellite system. Then the drone's communications link with its pilot cut out. At this point, it should have abandoned its mission and navigated home, but without GNSS its sense of direction was thoroughly scrambled. The Vector flew north instead of south, right into Russian territory, and was never seen again. Frustrated, Ukraine's drone pilots turned to the man who had helped procure the Vectors in the first place: a [tech](#) executive named Andrey Liscovich.

Liscovich is a strange, liminal figure produced by a novel sort of conflict. He is a civilian neck-deep in military work, a Silicon Valley emissary to battlefields beset by electronic warfare, a Thomas Friedman character cast into a Joseph Heller world. Having grown up in Zaporizhzhia, in eastern Ukraine, Liscovich went on to a PhD at Harvard and then a career in the San Francisco Bay Area. For a while, he was the CEO of Uber Works, an [Uber](#) offshoot that helped companies find on-demand staffing. When Russia invaded Ukraine, he moved back to Zaporizhzhia and, through circumstance more than intent, became a personal shopper for the Ukrainian army. He deals only in nonlethal equipment—merchandise that's available off the shelf to everyone, or at most classified as "dual use," suitable for both military and civilian applications. Generals and brigade commanders tell him what they need, and he roves the global tech souk, meeting manufacturers and inspecting their products. Then he cajoles wealthy friends or friendly nations to foot the bill and arranges for the matériel to be fetched to the front. In the year and a half since Russia invaded, he has wrangled everything from socks to sensors to [Starlink](#) terminals. The two

downed Vectors were among his earliest acquisitions, paid for by a Ukrainian benefactor at more than \$200,000 a pop.

Loosely speaking, Liscovich is an adviser to the general staff of the army, although the most he gets out of that is a military email ID. The army doesn't compensate him for his service. Instead, Liscovich said, he cuts himself a paycheck out of donations from an American billionaire. (He wouldn't say which one, but he assured me it was a household name.) He is one of at least 100 civilians who act as buying agents for Ukraine, an official in the general staff of the army told me. (The official asked to be anonymous: "Our government doesn't like it when military people say something on the record without their permission.") With its defense budget stretched thin, the Ukrainian government isn't always willing to spring for "nonlethal things," the official said. "They're worried that if their partners pay for this, they'll pay for fewer tanks or shells or HIMARS rocket launchers." Civilian fixers are "a way to get around" this problem—and the official described Liscovich as the most effective of the bunch. "He's out there on the front lines, asking questions, taking notes," the official said. "He's always doing his homework." Since the war began, Liscovich has helped the army procure nearly \$100 million in supplies. His is the kind of role that aristocrats played back in the 1800s, when their unelected influence extended to statecraft. Over the past century, as war became a nationalized state function, that species died out. Liscovich is a throwback: a Victorian with an iPhone.

Under the rigors of a live, hot war, commercial products break down. Pickup trucks last a week.

Though Liscovich stays away from lethal technology, his ambit is vast. Never in the history of warfare has commercial technology played as big a role as it has in Ukraine, said Michael Brown, a former director of the US Department of Defense's Defense Innovation Unit. In part, Brown said, this is because Ukraine's army has been innovative and scrappy. ("Of course," he admitted, "they have to be—this is existential for them.") But it's also the culmination of a long, slow-cooked [reversal in the flow of technology](#). A few decades ago, defense researchers built shiny new things—GNSS, for instance, and Arpanet, a precursor of the internet—and eventually

bequeathed them to the general population. Now, Brown said, commercial companies are faster and can develop consumer products so cutting-edge that armies would do well to use them. It isn't just that defense departments move ponderously; the private sector is also awash in far more money. "If you go back to 1960, the military was 36 percent of global R&D spending," Brown said. "Today it's barely more than 3 percent."

Window-shopping is the easy part, though. The wares on the civilian market may be first-rate technology, allowing their users to get close-to-military-grade gear without incurring as much bureaucracy or expense. But they come with a congenital problem: They're designed for peacetime customers—for cops and academics, hobbyists and corporations. Under the rigors of a live, hot war, these products break down. Pickup trucks, of the kind driven around suburban America, last a week to 10 days when they're trying to outrun shelling in areas with no roads, the Ukraine army official said. Portable batteries overheat in the summer sun. The cables and outer shells of Starlink terminals have proven too flimsy for the Ukrainian front, so soldiers have gotten used to swapping them out for more rugged alternatives. It often falls to Liscovich to act as a go-between, shuttling information from soldiers to manufacturers and back again, trying to get them to speak each other's language so the equipment can be hardened for battle. In the summer of 2022, that meant, among other things, figuring out whether Zhenya Podtikov's beloved Vector drones could ever survive in the treacherous, jammed-up airspace above eastern Ukraine.

Liscovich sits on a truck after a delivery of more than 200 drones.

Photograph: Sasha Maslov

To the extent that Liscovich is based anywhere at all right now, it is in a hotel in Zaporizhzhia, where he rents two rooms—one for sleeping and another for working. The building is ugly, he freely admits. He has to use a portable heater in the winter, and summers are so sweltering that he works at night with the windows open, ignoring the gnats and flies that stream in. When Zaporizhzhia was being heavily bombarded last fall, Liscovich moved to a neighboring village, where he slept on hay in the cellar of a house. He still keeps his apartment in San Francisco's Chinatown, although he spends barely two weeks a year there now. Sometimes he flips open an

app and looks at his bedroom through a webcam: the bed made, the blinds drawn, the black-and-white image giving nothing away about whether it is night or day on the other side of the world. He's a man laboring for his homeland without any real home of his own.

Liscovich's duties take him away from Zaporizhzhia for weeks on end as he travels through the US and Europe, either to appraise companies' products or to coax the powerful and wealthy to set aside more money for those products. Getting everyone on the same page, he said, "is like herding cats." He has to be careful about these trips. He turns 40 next year, and under wartime law, no service-age man can leave the country on a business trip for more than 30 days at a time. (At least once he has found himself driving from Poland into Ukraine on day 30.) Fortunately for him, Liscovich appears to be one of nature's born business travelers, built to fold his tall frame into an economy class seat, stride through airports with a wheelie bag that he never checks in, subsist on cold cuts from buffets, and demand Marriott Bonvoy upgrades after arriving at a hotel in the dead of night. He packs a uniform: jeans, sneakers, a number of button-down shirts (rarely tucked), and a blue blazer. The pocket inside his blazer bulges with a mobile hot spot, into which he slips one of several local SIM cards. That enables him to keep his phone on airplane mode and use the hot spot for Wi-Fi, he said. "It's to avoid anyone tracking my location."

In mid-June, I accompanied Liscovich on one of his succinct tours: five cities, four countries, four days. We met up outside Athens in the Greek seaside town of Xylokastro, where a company called Velos Rotors makes drones that look like miniature helicopters. Started by a hobbyist named Aris Kolokythas, Velos occupies the third floor of a short, utterly ordinary building—a space so small it seemed capable of assembling drones at only an artisanal pace. Everywhere we went, in fact, we sat in conference rooms in nondescript office blocks or business parks. The vaunted, hulking might of the military-industrial complex was nowhere in sight.

A few mini-choppers, Velos V3s, had already gone out to Ukrainian brigades on the front lines. But their data links were frequently taken offline by Russian jammers, the scourge of pilots like Podtikov. Most civilian drones flail in the face of such interference; Ukraine loses between 1,000

and 10,000 drones every month, many of them jammed into oblivion. On a schematic map that Liscovich stores as an image on his phone, he showed me how the front is choked with jamming signals. He'd come to Xylokastro to ask how Velos could make its drones less jammable—a particularly tricky proposition in Europe, where companies find it nearly impossible to obtain permits to activate jammers for testing.

Kolokythas, it turned out, was working on a new flight mode. If a drone's GNSS was blocked, he wanted its pilot to be able to fly it home using tools that weren't susceptible to jamming—barometers, gyroscopes, and other parts of an inertial navigation system. "Well, that's excellent," Liscovich replied, sounding cautious. In the army's experience, he said bluntly, nearly every vendor misrepresents the specs of their drone. The two talked some more about antennas manufactured in Turkey and gimbal cameras before Liscovich asked how quickly the company could turn out a big order. That gave the Velos people pause. "If someone goes, 'Hey, here's an order for 500, I need them in nine months,' well, obviously we're not going to do them here, right?" said CEO Michael Seal, gesturing around his spare headquarters. They'd have to outsource production to other firms, which would need six or nine months to ramp up, Seal said.

Scale is one of Liscovich's nagging problems. As a matter of survival, Ukraine's army needs many things very quickly, but startups and other civilian manufacturers are often too puny to meet its urgent demands—or, for that matter, to find solutions to the electronic warfare raging at the front. (According to Podtikov, some firms learned about GNSS-blocking only after their drones failed test flights in Ukraine. Others flat-out denied that their drones could be jammed at all.) On occasion, companies simply walk away, deciding they would rather not retool their gear for a large wartime order that may never come—that they would rather just keep selling drones to the Walmart shoppers seeking crisp aerial shots of their Sunday barbecue.

After an hour in their offices, Kolokythas and Seal drove us out of Xylokastro, up a road that snaked to the top of a scrubby hill. On the red earth, one of their engineers set up a workbench and primed the Velos V3 for a demo—a pretty if pointless exercise, because no one really doubted it could fly, only whether it could fly when Russians were hacking its GNSS.

Below the hill, beyond ranks of lemon and olive trees, the Gulf of Corinth lay ironed flat on a still day. Behind us, Kolokythas said, gesturing vaguely over the horizon, was Sparta. Or, to be precise, the ruins of the Spartan civilization, once the most powerful of all Greek city-states until it fell to Rome. Historians propose several reasons for the Spartans' collapse, including an outdated military. They had once been "craftsmen of war," the historian George Cawkwell wrote, but they'd fallen behind and been swallowed. "New ways of war had outdone them."

Liscovich grew up in Ukraine during the thaw in the Cold War. He remembers the shops being so bare that "you'd see a 3-liter jug of birch tree juice and maybe seaweed preserves, or something else that no one wanted, and nothing else." Perestroika was in the air. The Soviet Union fell apart just as he entered primary school. Among other transformations that eventually took place in Zaporizhzhia, a bomb shelter turned into an internet café. Teenage gamers locked themselves into the shelter overnight for marathon sessions of *StarCraft* and *Counter-Strike*. Liscovich didn't play much. Instead, he set himself up as a vendor of essentials: *StarCraft* maps downloaded in advance, snacks, his grandmother's homemade wine, and other nonlethal supplies for these cyberspace soldiers.

After studying physics and economics for six years in Moscow, Liscovich went to Harvard for a public policy doctorate in 2007. He wrote his thesis on experimental economics—the arduous trials that economists run, in which they set up human subjects in simulated real-world situations and study their behavior and motivations. In one chapter, Liscovich suggested that economists could use ready-made video games to run some of this research. You could buy a mid-list game's source code for not very much money and rewire its internal logic to function as an economics experiment, Liscovich explained to me. "Take a poker game and change the meanings of individual cards," he said. "Or it could be, like, competitive rice-growing." He remembers this as his first brush with the notion of dual use. Why should an economist—or a military, for that matter—reinvent the wheel when perfectly serviceable wheels can be purchased quite cheaply next door? "I just take something from one area and apply it in another," Liscovich said. "Interdisciplinary arbitrage is a very powerful thing."

He speaks like this often, in solemn sentences that could have been plucked from the *Harvard Business Review* or a Silicon Valley pitch deck. Fresh out of his PhD, Liscovich joined Shuddle, a now-defunct “Uber-for-kids” service, before joining the real Uber and rising to become head of Uber Works. It can be easy to mistake him for a dour man with an unyielding sense of corporate purpose, but he is mightily amused by bureaucratic absurdities and has an intermittent, impish sense of humor. As befits a former Uber executive, he hates taking ordinary taxis, regarding them as inefficient and exorbitant. Once, in Munich, we spotted an ad for an app called *Die Taxi* painted on the doors of a city cab. “A very appropriate name for a taxi app,” Liscovich said. “Finally we concur.” He took a photo, then gave himself over to gales of giggles.

After Uber Works shut down, early in the pandemic, Liscovich started planning new startups. He was visiting Nepal toward the end of January 2022 when the rumors of Russia’s impending invasion of Ukraine escalated. Counterintuitively, he flew to Moscow. He wanted to see his friends from university before a war made that impossible. The US had warned that the invasion could start on February 16, so Liscovich spent the night of the 15th in a hotel facing the Ministry of Foreign Affairs on Smolensk Square to see whether the windows were bright with hectic overnight work. They weren’t. Then he moved to a hotel room on the 89th floor of a building overlooking the Kremlin and the Ministry of Defense to see whether they were churning with activity. They weren’t. Eventually he left Moscow, reaching San Francisco on the 22nd. Two days later, Russian forces marched into Ukraine.

Any device that had to work in Ukraine required a system to foil the people and machines bent on destroying it.

Once more, Liscovich swam against the current. As thousands of Ukrainians, including his parents, fled westward, he flew to southeastern Poland. He rode a fire truck to the border, caught a train and a succession of buses, then walked the rest of the way to Zaporizhzhia. He fully intended to enlist, but at the army office he saw a long line of new soldiers wearing jeans, thin sweaters, and sneakers. Beyond giving each man an AK-47 and some spare magazines, the army had run out of gear. If Liscovich wanted to

help, the colonel in charge of the army office said, he could get supplies. “He gave me a van and two soldiers, and they drove me around various military surplus stores,” Liscovich said. He showed me photos of long, itemized receipts of his purchases: winter boots, heavy clothing, tins of food, cell phones and tablets, tires. He swiped his Apple Pay everywhere in those early days, spending either his own money or contributions that friends and acquaintances made to the Ukraine Defense Fund, a nonprofit he’d quickly set up.

During the chaos of the war’s early months, Liscovich had to improvise to get his purchases across the border. The first batch of tech he sourced overseas consisted of Motorola radios—98 of them, bought from a store in London and flown to Kyiv by diplomatic pouch. They took a week to arrive. When Liscovich obtained 10 Starlinks from a warehouse in Warsaw, he had volunteers drive them into Ukraine in their cars, hoping customs authorities wouldn’t check their trunks. Such drivers were hard to find: Europeans refused to go into Ukraine, and younger Ukrainian men were being pressed into service, so Liscovich and his colleagues had to round up senior citizens to make their supply runs. Drivers sometimes spent days in line at border posts and crossed well after dark, when paperwork problems were much harder to solve. “I would often have to do these middle-of-the-night calls or pull strings at customs, asking them to let people through and saying I’d provide paperwork later in the day,” Liscovich said. At checkpoints, “there was a lot of fear that if you carry something quasi-military, like drones, your cargo may be impounded,” he said. Polish authorities started to demand extra paperwork for drones en route to the front: special permits, customs duties, transit declarations. At its peak, the Ukraine Defense Fund had 30 volunteers on Slack micromanaging every step of these supply chains. “It was just a huge mess,” Liscovich said.

Eventually, the broken, brittle links in these supply chains were mended. The devices and software that streamed in from the West have been of undeniable value—because they’re inexpensive, but also because they arrive quickly. “Some war technology is military grade, so it’s limited by export controls, and it can take a long time to get licenses and permissions to bring them over,” Yegor Dubynskyi, Ukraine’s deputy digital minister, told me. “We don’t have that kind of time. We need things right now.” The

Ukrainian army, he added, was cobbled together out of men who may have lacked military training but often had experience with civilian tech—certainly enough to follow a radio or drone manual. “The approach was: If you find something you can use, use it.”

At the same time, these products could rarely be deployed perfectly out of the box. Conditions on the eastern front were so different from those in California or Munich that it may as well have been another planet. In the beginning, Liscovich tried to school himself in the demands of war by reading, but one book after another quoted Sun Tzu or Clausewitz—thinkers with plenty of timeless advice for commanders but not much knowledge of 21st-century supply chains. The US Department of Defense’s models on military provisioning, likely of more practical use, are classified. So he took to hanging out at command posts and with battalions, trying to learn what soldiers needed and why.

He saw how the troops disassembled Starlink terminals, put them into stronger cases, and mounted them on vehicles for portable internet. He saw how sensors that detected enemy drones, which usually worked on 4G signals, went quiet in regions with no cellular connectivity, and how engineers had to run a communication wire all the way out to the sensors on the front to get them working again. He saw a batch of Tesla Powerwalls arrive for power storage, only for soldiers to realize that they all had built-in Wi-Fi modules that the enemy could potentially detect and that had to be manually pried out. And time after time, he saw drones lost—shot down, confused over enemy lines, or simply incommunicado. On his phone, he showed me a video of a drone with a jammed GNSS that had somehow been guided back to base. It hovered a few meters in the air, and then, fooled into thinking it was on the ground, switched off its rotors and crashed to earth as if made of stone. Any device that had to work in Ukraine required the ultimate customization: a system to foil the people and machines bent on destroying it.

Illustration: Lena Weber; Getty Images

For all his self-prescribed study of the military, Liscovich asks companies the kinds of questions that have been burnished over years by the venture capitalists on Sand Hill Road. What are the bottlenecks? What will help you

deliver more value per dollar? What is stopping you from making 10 times more impact? He has not only the tech executive’s fixation on speed and scale—invaluable in wartime—but the latent wariness of government. For him, the state’s chief wartime virtue is not its efficiency or its powers of organization but its pocketbook. Around the time I met him, he was lobbying the US Congress to allocate a budget to fund nonlethal technology for Ukraine. (His fundraising and lobbying work have required him to register as a foreign agent, acting on behalf of Ukraine’s government.) That aside, Liscovich appears to believe that the state slows things down and complicates them, and that companies and private individuals do a superior job—not only in running taxis but also in arming Ukraine. In the Warsaw offices of an aerial intelligence company called Radio Bird, while bemoaning a particular inefficiency that had crept into the border controls between Poland and Ukraine, Liscovich trotted out that old Reagan saw: “What do they say about the most scary words in the English language? ‘I’m from the government and I’m here to help.’”

Radio Bird had helped build one of the crossover tech products that Liscovich was most impressed by, and during our visit the product’s inventor, whom I will call Alex, Zoomed in. Alex, a Ukrainian physicist who asked to remain anonymous out of concern for possible retaliation, is a professor at a research university in the Netherlands. When the war began, he enlisted some friends and colleagues to develop a sensor for incoming missiles. The sensor consists of a basic microphone—like the kind worn on lapels during talks—that feeds its input into a smartphone, where software compares the audio to a preloaded set of acoustic signatures of Russian drones and missiles. If it detects something, it sends an alert with its position and what it thinks it heard. Liscovich says there are now 6,000 of these sensors in Ukraine. Dubynskyi, the deputy digital minister, said they were crude but successful, although he didn’t specify how many missile attacks they helped avert. Liscovich now wanted Radio Bird and Alex to work on a tethered drone: a drone powered by a line from the ground, staying up indefinitely, scanning the airspace for danger.

The threat posed by Russian GNSS jamming hasn’t gone away, but some drone manufacturers are finding ways to diminish it. Two days after Warsaw, Liscovich and I went to the Munich headquarters of Quantum

Systems, the manufacturer of that early pair of doomed Vectors. Quantum, whose offices lie beside a highway leading out of the city, has sold dual-use drones to the police forces of Los Angeles and Bavaria and to German rail companies. By now I'd become familiar with European drone company chic—ascetic interiors, unadorned walls, huge windows that bathed rooms in light on fine summer days—but Sven Kruck, Quantum's chief sales officer, stopped outside the CEO's office to point out an unusual accessory: a Ukraine flag hanging behind the desk.

After the first Vectors failed on the front, the Ukrainians sent Quantum their notes—but it was nothing like the tidy, structured feedback that tech companies ordinarily receive. Communications took weeks to make the trip to Munich and back, Kruck said. The drone operators passed their comments up to their leaders, who sent them upward and upward until they were finally sent to Quantum via the Ministry of Defense. “We got a letter saying, ‘Change this, this, this, this, this, and this. If not, you’re out,’” Kruck said. He had served in Afghanistan and encountered electronic warfare before, but nothing like what was going on in Ukraine. Quantum needed more than a letter. It needed flight logs, videofeeds, and telemetry data, all in a much tighter response loop with the end users, the drone pilots.

Liscovich holds a hobbyist drone that will be deployed on the front lines.

Photograph: Sasha Maslov

For Liscovich to be the courier of this information was insufficient. When he visited Quantum in October 2022, he found he couldn't be precise enough about the problems pilots were encountering. “They had an issue with the battery duration indicator, which was jumping around,” Liscovich said, by way of an example. At Quantum, they asked him: Under what conditions did this issue occur? But Liscovich hadn't seen it for himself. Eventually, Quantum's engineers were added to a Signal group with Ukraine's drone pilots so they could speak directly to each other. With the pilots' help, Quantum realized last winter that if the Russians jammed a Vector's satellite navigation, pilots could radio their own stable coordinates to the drone, allowing it to orient itself. The Vectors also began using onboard lidar sensors to check their altitude so that they stopped plummeting to earth, and Kruck's colleagues are experimenting with a

visual navigation system to work in tandem with GNSS. Out of the first 40 drones that Quantum sent to Ukraine, it lost 15 or 20, Kruck said. In January 2023, it sent another 100-odd Vectors, and it has since lost only five. Just before I met Kruck, Ukraine had ordered another 300 drones, and Quantum had posted six of its engineers, pilots, and support technicians to its new service and training center in Ukraine. “This is a cat-and-mouse game,” Kruck said. “It really matters how fast your iteration cycle is.”

Quantum’s story sounded like rousing progress when it was narrated in a comfortable conference room in Munich. But Liscovich knows how easily these undertakings can wilt. An army and a tech company are culturally different: the first lumbering, cautious, and preoccupied with compliance, the second obsessed with moving fast and breaking things. To get them to talk to each other is difficult, Liscovich said. In fact, soldiers were sometimes reluctant to tell even him about the problems they were facing. In the summer of 2022, after Liscovich supplied a battalion with a few drones made by a US company called Skydio, a commander sent him a thermal-camera video showing a Russian tank being blown up. A Skydio had helped find the tank and had taken the video, the commander said. Pleased with this, Liscovich helped procure several more of the same model —only to find, after a couple of months, that the video was from another source altogether, and that Ukraine’s cellular network interfered so thoroughly with that particular Skydio model that the drones lost connectivity as soon as they went up. “They wanted me to feel like I’d made some kind of difference,” Liscovich said.

“That’s quite sweet, actually,” I told him.

“It’s incredibly counterproductive,” he shot back. “It’s not accomplishing anything. It resulted in a massive waste of resources.”

For a staunch advocate of the private sector, Liscovich also let slip flashes of exasperation at how *corporate* corporations can be. Sometimes a company isn’t willing to commit to testing its products in Ukraine or investing in service centers and training resources in the country unless it knows big orders are in store. In the final analysis, this was Quantum’s motivation too, Liscovich said. Being on the same side of a war, it turned out, was no assurance at all of being in sync.

In the most-watched war in recent history, Ukraine's alacrity at filling the gaps in its military resources with civilian products has prompted other governments to rethink their own laggard adoption of commercial technology. European officials have chewed over how to nurture startups that might, one day, offer the kind of rapid, inexpensive communications alternatives that Starlink did in Ukraine. Taiwan set out to buy thousands of new drones off the market to counter Chinese air power. And in the US, the Defense Innovation Unit, a long-neglected office founded in 2015 to help the military adopt commercial technology, has enjoyed renewed interest from the Pentagon.

Historically, and famously, the US military's purchasing apparatus has been riddled with inertia. "The whole process is designed to buy an aircraft carrier that will keep for 50 years," said Raj Shah, a former DIU director. Even as the military's technological needs expanded beyond the lethal and the gigantic, the Pentagon was slow to respond, another former DIU staffer said. In the DIU's early years, people entrenched in their jobs came to seem like barriers to the unit's work, and its funding languished. The staffer quit, he said, because he "didn't have the energy to push anymore."

This year, the DIU got a new director—a former Apple vice president—and a budget of \$112 million, more than double the \$43 million it received last year. The US House Appropriations Committee wants to lavish even more money on the office, as much as \$1 billion. Mike Madsen, a strategic adviser to the DIU's director, attributes part of this new energy to Pentagon officials "watching the speed with which Ukraine has been able to deploy this kind of technology." The eastern front is a live laboratory, and every military's eyes are fixed on it.

But the war is also shifting in a direction that leads away from Liscovich and his efforts. In the fear and shock of the first few months, "speed was paramount," said Stephen Biddle, a defense policy scholar at Columbia University. Any technology, procured in any way at all, that kept Ukraine in the fight for another day was welcome. But coordinating artillery strikes over WhatsApp and Signal, for instance, was hardly ideal. "Over time, I'd still be concerned about hacking and security," Biddle said. Similarly, the rate at which Ukraine has lost its off-the-shelf drones has been staggeringly

high, he said. While that damage was once tolerable, it has felt increasingly inefficient as the military digs in for the long haul.

Biddle also argued that the cumbersome pace of government, which the tech industry gripes about, has a purpose: It keeps officials accountable to the people who elect them. This is “particularly necessary in Ukraine, where you have a massive problem of corruption,” he said. While Liscovich and others like him—“the heroic entrepreneurs of the early period”—have been vital, he said, the Ukrainian state has to take over their work to ensure efficient long-term spending. (Yegor Dubynskyi, Ukraine’s deputy digital minister, said something similar. “We have to start buying these things through a governmental approach, and we have to think about building specific testing grounds of our own and equipping them, even though this will take a little time.”) I wondered how Liscovich would react to that, and then recalled that he’d told me, very firmly, “I don’t plan to do this forever.” He has a startup to build and other ideas to chase. He gave me the impression that he’d be glad to hand his beat back to Ukraine’s defense ministry, to whom it belonged in the first place. “I’m just doing it now because it needs to be done.”

Illustration: Lena Weber

On the last day of our trip, Liscovich and I took a taxi out to the headquarters of a “drone defense” company called Dedrone, in Kassel. (To his disappointment, Uber didn’t operate in the city.) Before breakfast, he’d been browsing a Signal group of Ukrainian drone pilots, and he was worried by their speculation that the Russians were learning how to jam a particular drone’s radio link. Dedrone was part of a strategy to do unto the Russians as they were doing unto Ukraine. More than 100 Dedrone sensors had been installed around the front, each capable of identifying and detecting the radio signatures of nearly 250 models of drones. Ordinarily, the sensors resemble white buckets on a pole, and facilities like power plants and prisons buy them to discourage aerial snooping and delivery of contraband. For a live war zone, though, they had to be painted a much more inconspicuous shade of milky latte. A team in Kyiv now manages a network of these sensors all along the front, including in Donbas and Zaporizhzhia. In one case, Liscovich said, a sensor close to the front had

managed to latch on to a radio signal from a drone operator on the other side. He'd been standing by an ammunition silo, although the Ukraine army didn't know that when they decided to shell him. "They tried to hit the operator, but they blew up the storage of ammo," Liscovich said. "There was a massive explosion ... I have a video of this." It was as pleased as he'd sounded all day.

A few weeks later, I read that a Russian missile had hit one of the few hotels in Zaporizhzhia, killing one person and injuring at least 16. In dread, I texted Liscovich, and then fretted for half a day until he replied. It wasn't his hotel, he said, and in any case, he wasn't in Zaporizhzhia. He was headed back out of the country and had stopped for a day and a half in Lviv, in western Ukraine, to visit another drone company. He knew some investors who might want to fund its development of a new product: a low-cost tactical plane. It was, he thought, something Ukraine could use.

Updated 10-05-23, 1pm EST: This piece has been updated to protect the safety of a source.

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[Chris Baraniuk](#)

[Gear](#)

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Lego Is a Company Haunted by Its Own Plastic

While the toy brand kills its plans for an oil-free plastic alternative, it's still pumping out billions of non-biodegradable bricks a year. Can Lego ever be sustainable?

Boxes of Lego are stacked 23 meters high in storage rooms holding around a billion bricks in total. Robotic cranes fetch decoration or packaging parts (shot in 2013)Photograph: TOM NAGY

Lego has built an empire out of plastic. It was always thus. The bricks weren't originally made from wood, or metal, or some other material. Ever since the company's founder, Ole Kirk Christiansen, [bought Denmark's first plastic-injection molding machine](#) in 1946, Lego pieces have been derived from oil, a fossil fuel.

The fiddly little parts that the company churns out—many billions every year—are today mostly made from acrylonitrile-butadiene-styrene, or ABS. This material doesn't biodegrade, nor is it easily recycled. If a smiling mini figure gets into the environment, it will likely very slowly break down into highly [polluting microplastics](#).

What was once considered a miracle material, so versatile, tough, and easily dyed in a searing array of technicolor hues, has come to haunt Lego, a family friendly brand [recently valued at \\$7.4 billion](#). Plastic is [increasingly taboo](#) and, in the rush to dispense with fossil fuels and protect Earth's precious natural habitats, there's a growing urgency to find alternatives, or otherwise reduce plastic pollution.

Things aren't going to plan. On 18 September, Lego Group CEO Niels Christiansen [announced](#) he was joining Danish business leaders in calling for companies and policymakers to "stand together globally for a just and green transition to a net-zero future." This week, Lego [revealed to the *Financial Times*](#) that its much-hyped project to switch away from ABS and instead make toy bricks from recycled plastic bottles has ended in disappointment. Only two years ago, [the company told WIRED](#) it had made impressive progress in developing a suitably robust version of this alternative plastic, known generally as recycled polyethylene terephthalate (rPET).

"We had worked very hard on it," says Tim Brooks, Lego's vice president of sustainability, looking back. "It is hard to color, it's hard to scale the production of it."

But there were bigger problems than that. In their quest to make rPET bricks that were rigid enough to clip together firmly, what Lego refers to as "clutch power", engineers discovered that the material required significant pre- and post-treatment. The process involved extreme drying of the rPET to remove moisture—an energy intensive step. After doing the sums, Lego's researchers realized that rPET manufacturing, and installing new equipment to make it all happen, would actually carry a higher carbon footprint than sticking with plain old ABS.

Lego declined to specify to WIRED how much bigger rPET's carbon footprint, per kg of toy bricks, would be versus ABS, but it has said that ABS requires 2 kg of petroleum for every 1 kg of plastic toys produced. Nearly 200 softer pieces in Lego's current range are made from biobased plastic, derived from Brazilian sugarcane. Brooks says the company remains keen to pursue the development of a more environmentally friendly version of ABS for its many more rigid parts, for example by incorporating biobased plastic into them. But this is still in development.

Some 200 pieces in Lego's current range are made from biobased plastic, derived from Brazilian sugarcane.

Photograph: LEGO

“In the future, they should not make these kinds of announcements until they actually do it,” says Judith Enck, president of [Beyond Plastics](#). Global plastic production has been projected to double in the next 20 years, according to the World Economic Forum, and yet in the US, for example, advocates claim that the vast majority of plastic, [95 percent, is never recycled.](#)

Paolo Taticchi, a corporate sustainability expert at University College London, says Lego can be considered “quite credible” in its efforts to decarbonise because the company has invested so much in this endeavor. For instance, in 2015 Lego put down \$155 million to establish a Sustainable Materials Center. Despite the foundering of the rPET work, 150 engineers are still employed there working on alternative initiatives, the company says.

But Taticchi doesn’t mince his words. Today, decarbonisation is not just a nice-to-have: “They are not going to survive as an organization if they don’t find a solution.” Incidentally, last month, Lego reported [its operating profits had plummeted by 19 percent](#), the biggest dive since 2004.

It’s very hard to find a practical alternative to ABS, says Gregg Beckham at the US Department of Energy’s National Renewable Energy Laboratory. He and colleagues are working on a biobased functional replacement for ABS. Would it have all the special properties required for a top quality Lego piece? “To be determined,” he says, noting that “multiple companies” are now working on scaling up similar technology.

Awareness is growing of how plastic can persist in the natural environment. Long-forgotten toys made from plastic materials, including possible Lego pieces, have even turned up [at a former nuclear missile base in Poland](#), where the families of Soviet officers once lived in secrecy.

And don’t forget all the Lego in the ocean. Every month or so, Tracey Williams, an author and founder of the [Lego Lost at Sea project](#), catches up with local fishermen in Cornwall, England, who save bits of Lego that have got trapped in their nets. In 2020, she [co-authored a study](#) that suggested dinky little pieces of ABS Lego could remain in the sea, generating microplastic particles, for between 100 and 1,300 years.

Some of the parts collected by Williams are as much as 50 years old. However, most originate from a lost shipping container that was stuffed with nearly five million Lego pieces. A rogue wave hit the [vessel Tokio Express](#) in 1997, causing cargo to tip into the water.

“You can only really tell that they’ve been lying at the bottom of the sea for 26 years by the marine life growing on them,” she says. “They do survive remarkably well.”

The weathering of recovered pieces varies, but, remarkably, some are in good enough condition to be used again, despite their lengthy sojourn beneath the waves or stuck in sand dunes. And that, the sheer durability of ABS, may just provide Lego with an answer, or part of an answer, to its problems.

“We want to ensure that the bricks have the longest possible life,” says Brooks, as he lays out the goals of [Lego’s Replay initiative](#), in which secondhand Lego pieces are returned to the company, sorted, washed, repackaged and—at present—donated to children. Lego declined to clarify exactly how many people are employed in this effort, which is currently live only in the US and Canada. The scheme sometimes requires disassembly of Lego sets, and sorting of bricks both by machine and by hand. Quality control is key. “We once found a little Lego pirate treasure chest with a set of children’s teeth in it,” says Brooks.

Photograph: LEGO

What sets Lego apart from many other toys is that it is often, if not always, kept by a family for many years. Perhaps even passed on from generation to generation. Bricks made decades ago remain compatible with those produced today.

Last year, Christie Klimas, who studies sustainability at DePaul University, co-authored [a paper estimating the environmental impact of various children’s toys](#), including three Lego sets, a Barbie doll, a Jenga game and two plush dog toys. The study made multiple assumptions, including about the transportation required for each item, and estimated that the largest Lego set, a Star Wars fighter ship, had the highest greenhouse gas emissions

of all the toys—due to the volume of ABS. A Lego spokesman describes the work as “flawed” and says assumptions about the playing time associated with the toys (20 hours) do not represent the long life of its products.

Klimas points out that the analysis was based on international standards for product life-cycle assessments, and, in additional estimates provided to WIRED, she adds that once the three Lego sets are played with for between 32 and 64 hours, the carbon footprint of each product, per hour of play, becomes “practically negligible”, despite the considerable size difference between them (they ranged from 61 g to 374 g).

However, the original analysis did reveal certain trends, she says, including that plastic, in particular, appears to be associated with a higher overall environmental impact for a product. Take the plush dog toys, one of which required a battery. “The nylon casing—the plastic component, not the battery—really grows the impact of that stuffed animal,” she says.

Many people who spoke to WIRED mentioned that they have kept Lego for many years, or even sold it on. UK-based artist Andy Morris, who makes artworks out of Lego, sold his own childhood collection to help pay for university. Now [he designs custom sets and dioramas](#) that people purchase as gifts.

In 2021, economists in Russia estimated that the value of secondhand Lego sets [grew by 11 percent year over year, on average](#), with some fetching many times their original price after just a few years, further indicating that it wouldn’t be quite right to judge Lego in the same league as more ephemeral, or disposable, applications for plastic.

“We’ve done a pretty good job as a society of vilifying all plastics, I don’t think that’s right,” says Sharon George, a senior lecturer at Keele University. Carefully developing a market around the existing Lego bricks out there in the world, reducing the production of new pieces, or maybe even renting out Lego sets, could all help the company lower its environmental impact, she suggests.

Lego acquired BrickLink, an online marketplace for new and secondhand pieces, in 2019 and its Replay initiative, if it can be scaled, could vastly increase the circularity of these toys.

Enck, upon hearing of the existence of the Replay scheme, expresses enthusiasm. “That’s wonderful,” she says, emphasizing the need for Lego to simultaneously reduce new ABS plastic production. “I think that’s the future.”

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Scientists Have an Audacious Plan to Map the Ancient World Before It Disappears

Buried civilizations could soon become inaccessible forever. Archaeologists have to move fast, so they're turning to the latest ground-scanning tech. Technologies such as ground-penetrating radar allow archaeologists to peer down into the past without lifting a shovel. Photograph: Jimena Peck

In the center of Siena, Italy, a cathedral has stood for nearly 800 years. A black-and-white layer cake of heavy stone, fine-cut statuary, and rich mosaics, the imposing structure—now visited by more than a million tourists each year—would seem to be a permanent fixture of the city's past, present, and future. Most people call it, simply, "the cathedral." But Stefano Campana, a 53-year-old archaeologist at the University of Siena, calls it something else: "the church that is visible now."

Campana has seen his fair share of excavations, along with the dust and sunburns that accompany them. But [archaeology](#), for him, is not always about digging up the past; it also means peering down into it using an array of sensitive electromagnetic equipment. One device Campana uses is ground-penetrating radar, which works by transmitting high-frequency waves into the earth to reveal "anomalies"—subsurface features that are potentially architectural—in the signals that bounce back.

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In early 2020, when [Covid](#) lockdowns emptied Italian tourist sites of their crowds, Campana and his collaborators received permission to survey the Siena cathedral's interior. Using instruments originally developed for studying glaciers, mines, and oil fields, they spent days scanning marble floors and intricate mosaics, on the hunt for walls and foundations in the deep. With the selfie-stick brigade gone, Campana and his crew were able to find evidence of earlier structures, including, potentially, a mysterious church constructed there nearly 1,200 years ago, lurking like a shadow in the radar data.

After seeing how much they achieved during Italy's lockdown, Campana and his collaborators got to thinking about what else might be possible with the technology. [Ground-penetrating radar](#) waves travel at a fraction of the speed of light, so the entire process—transmission, reflection, recording—takes nanoseconds. With these new tools, archaeology is no longer a stationary activity, limited to one site; even while zipping by at highway speed, field surveyors can produce an accurate snapshot of what's beneath centuries of cobblestone and brick, chewing gum and litter.

"We thought, why not scan everything?" Campana recalled. "Why not scan all the squares, all the roads, all the courtyards in Siena?" Unlike the cathedral and its shadow church, these everyday sites are not protected, which means they are threatened by modern construction and development. In the public imagination, they are what Campana calls "emptyscapes"—places wrongly considered insignificant to the human story. He wanted to change that. Campana partnered with Geostudi Astier, a geophysical surveying firm in Livorno, to launch an initiative called Sotto Siena ("Under Siena"). True to its acronym, SoS, the project aims to create a complete archaeological record of Siena before more of the city's deep history is destroyed.

Last spring, I traveled to Siena in the midst of a heat wave to see SoS in action. Campana and I met in the central Piazza del Campo to fortify ourselves with espresso before walking toward a park in a more modern part of the city. To see Siena through Campana's eyes is to exist in overlapping worlds. As we strode up stairs and down alleyways, past restaurants and through piazzas, he explained that [radar](#) can reveal

foundation walls beneath busy streets and back gardens. Corner shops can hide Etruscan ruins under their cash registers. Even temporary structures, lost long ago to war, fire, and history, can be rediscovered using radar. Some of the first SoS scans, he said, found evidence of small pavilions in the Piazza del Campo, likely set up for public fairs and festivals as far back as the 15th century.

When we reached our destination, a white cargo van was waiting for us. Campana introduced me to Giulia Penno and Filippo Barsuglia, geophysicists from Geostudi Astier, who were unloading equipment for a survey that evening. Their city-scanning setup consisted of an electric utility vehicle the size of a golf cart and an array of sealed boxes, studded with ports and wires. As Barsuglia carefully backed the utility vehicle out of the van, Penno gave me an overview of the gear. The boxes contained several heavy racks of radar equipment, which we'd tow a few inches off the ground. A Wi-Fi antenna would relay the data to a hardened laptop. We couldn't count on clear satellite signals in Siena's twisty streets, so the system was equipped with inertial navigation, which uses gyroscopes and accelerometers to track every stop and turn. Barsuglia claimed it was the only such system in all of Italy, outside the military.

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We began with a quick scan of the park. I stood beside Campana and watched, curious what I was getting myself into. Penno took the wheel and began her survey, elegantly weaving the cart around benches, light posts, trash cans, and the occasional baffled Siena resident. “She’s like a painter,” Campana said approvingly. As she finished up, Campana excused himself, riding off on a motorcycle to meet his family, leaving Penno, Barsuglia, and me to our task.

With Barsuglia now at the wheel, we lurched ahead into the heart of nighttime Siena. The experience, I quickly realized, was going to feel less like painting than like being asked to mow a very large, very crowded lawn. People seemed unsure what to make of us as we passed, at times mistaking our cart for a street-cleaning machine or some sort of mobile art installation.

Our vehicle bottomed out over and over, the radar gear's protective case scraping loudly against the city's cobblestones and concrete. People stopped, laughed, and took videos.

As the sun went down, we drove toward Siena's Piazza Salimbeni, home to the world's oldest bank. On our way there, the equipment was glitching in and out—a signaling issue, Penno explained. The solution, Barsuglia said, was to drive around in large figure-eight patterns that would trigger a recalibration process in the equipment. These wide, drunken loops attracted even more attention. At one point, he reached up and attached a small rotating orange light to the cart's roof, explaining that this was to prevent a prowling police car, which had already driven past us several times, from pulling us over.

Our survey that evening finished well past midnight, so late that all three of us seemed on the verge of sleep, circling around in an archaeological fugue. I thought of *Civilization and Its Discontents*, in which Sigmund Freud compares psychoanalysis to an archaeological investigation, suggesting that other, forgotten versions of ourselves lie buried in a past that can be made visible once again through careful analysis.

In SoS's case, that analysis took a few weeks. Gigabytes of data had to be processed for every stretch of road and piazza, matching what lay below to its precise geographic coordinates. Visualization software completed the job, overlaying our discoveries onto updated satellite maps. Our initial glimpses of what appeared to be structural features became refined enough to make archaeological sense. In the end, we found numerous modern pipelines and countless piles of historic masonry, most likely pillars from buildings that had been razed long ago. Sadly, the survey of Piazza Salimbeni revealed little. I was hoping we might uncover a secret bank vault or a lost medieval crypt. All we found were some drains.

Slapstick as it seemed, my experience with SoS offered something of a bellwether for archaeological investigation in the 21st century. The tools and methods of the discipline are shifting toward increasingly sophisticated—and increasingly hands-off—means of finding, mapping, and preserving human historical sites. “The problem with excavation is that it destroys the thing you’re studying,” Eileen Ernenwein, a professor at East Tennessee

State University and coeditor of the journal *Archaeological Prospection*, told me. “You can take excellent notes and keep good records and preserve any artifacts that you find, but you’ll never get to excavate another time.”

The immense capabilities of these new surveying tools, in terms of both accuracy and speed, have inspired archaeologists such as Stefano Campana to dream of what previously seemed like a fairy tale. If the SoS project seemed ambitious, with its goal of uncovering everything beneath the surface of an entire European city, there were other archaeologists on the continent who were preparing for a project far larger.

“The average tourist doesn’t see or understand the wealth of a landscape like this,” said Immo Trinks, gesturing over an empty field that, to my eyes, seemed windswept and bleak. We were 25 miles east of Vienna, in—or on—the ruins of a city called Carnuntum, which once lay along the northern border of the [Roman Empire](#). The city was sacked and abandoned centuries ago, and 99 percent of the site still lies unexcavated. But Trinks has seen Carnuntum’s every wall and doorway, its every road and square, without ever digging a hole. “A very large Roman building has been detected here,” he said, pointing into open air. “This was a dense Roman town.” He described a sequence of structures we had apparently been stepping through for the past few minutes, their halls and rooms known only from electromagnetic data.

A visualization of a building in the Roman Forum captured with ground-penetrating radar.

Courtesy of GeoSphere Austria

A radar scan of part of a Roman governor’s guard.

Courtesy of GeoSphere Austria

In 2000, when Trinks was a graduate student, he and his colleagues set what could be called a land-speed record for archaeology at Carnuntum. Serving as an assistant at the site, he helped map nearly 15 acres in a single day using magnetometry, which works by detecting tiny differences in magnetic field strength between, say, a brick wall and the soil around it. Since then,

Trinks has been part of a loose group of international geophysicists working to transform modern archaeology. He teaches at the University of Vienna and, until recently, served as deputy director of the Ludwig Boltzmann Institute for Archaeological Prospection and Virtual Archaeology, or LBI ArchPro. He is also immensely ambitious, encyclopedically knowledgeable about his field, and nerdishly obsessed with the technical details that ensure huge undertakings actually work as planned.

Immo Trinks and Alois Hinterleitner take radar scans in Carnuntum, a ruined Roman city outside modern-day Vienna.

Photograph: Michaela Nagyidaiová

The Heidentor (“Heathens’ Gate”) at Carnuntum.

Photograph: Michaela Nagyidaiová

For Trinks, who is 50, using electromagnetic tools to record and save the human past is a moral responsibility. All over the world, he pointed out, archaeological sites are disappearing beneath a relentless tide of urbanization and economic development, not to mention climate change and military conflict. In Europe alone, never-excavated Roman towns have been smothered beneath supermarkets and big-box stores. Globally, unmapped Stone Age villages have been erased by freeways, airports, and industrial agriculture. Every year, humanity loses more and more of its heritage. But now that entire landscapes can be mapped in a matter of days using off-road vehicles, the data processed in near real time with the assistance of feature-recognition algorithms and image-processing software, a tantalizing possibility comes into focus: We may be on the verge of a total map of all archaeology, everywhere on Earth.

“We want to map it all—that’s the message,” Trinks told me. “You’re not just mapping a Roman villa. You’re not mapping an individual building. You are mapping an entire city. You are mapping an entire landscape—and beyond.” Trinks means this quite literally. In the summer of 2022, he wrote a manifesto calling for the creation of an International Subsurface Exploration Agency, whose initial role would be to scan every mappable square meter of land in Europe, even the bottoms of lake beds.

Trinks adjusts a satellite receiver during fieldwork in Carnuntum.

Photograph: Michaela Nagyidaiová

“Look at the [European Space Agency](#),” Trinks said to me over lunch near the Danube River, flowing just over a ridge, downhill from the Roman city. The ESA costs individual European taxpayers only about €15 annually. “Fifteen euros is the price of a good pizza and a beer,” Trinks pointed out. “I am happy to pay the price of a beer and a pizza every year to have thousands of people looking downward instead of up.” If we don’t, Trinks warned, “our grandchildren will ask us: Why didn’t you do more to map what’s still out there? Because they will not have the chance to do so once it’s gone.”

Trinks’ vision requires not only the hardware to scan an entire continent but the software to make sense of the resulting data. One morning in his office at the University of Vienna, Trinks introduced me to Alois Hinterleitner, whom he described as a “magician.” Hinterleitner is a software engineer with GeoSphere Austria, a partner of LBI ArchPro. Austrian by birth, he is also an avid mountaineer. Trinks half-joked that countless terabytes of geophysical survey data would be left stranded if something were to happen to Hinterleitner on one of his multiday expeditions. He is so integral to the process that Trinks has turned his first name into a verb: Over the course of my visit, he would often say they needed to “Aloisify the data” in order to make it archaeologically legible.

Hinterleitner at GeoSphere Austria in Vienna.

Photograph: Michaela Nagyidaiová

Over coffee and cakes, Hinterleitner led me through the program he uses. It allows him to filter radar results according to various properties in the signals that bounce back. One function, called Remove Stripes, was designed to clear out flaws in the data set caused by shifts in the measuring instruments or the use of different scanning methods. These changes can cause bright lines—stripes—to appear in the scan. While the filter does take care of them, it can also inadvertently eliminate traces of walls or foundations, including telltale signs of Roman architecture, whose straight

lines can resemble stripes. If you’re not careful, in other words, you might not even notice that your software has erased the very thing you’re looking for.

Hinterleitner pulled up images on his screen from various expeditions to the island of Björkö, Sweden, made between 2008 and 2012. The makers of Trinks’ radar equipment had warned him that scanning a large meadow there would be pointless. The data would be unmanageable, they told him, the results impossible to interpret. “They actually used the term *forbidden*,” Trinks said with a laugh. “But I didn’t care, because we had Alois.”

Using towed radar gear, Trinks and his group scanned not just Björkö’s main meadow but the entire island and got the data processed, filtered, and developed into images in just three weeks. Although Björkö was already known to contain more than 3,000 Viking graves, Trinks’ survey scanned those tombs—former burial mounds with no visible surface features—in such detail that the outline of a coffin was visible. “We cannot see the horns on the helmet yet,” Trinks told me, “but, for the first time, we can see there is something inside the coffin.”

A researcher from GeoSphere Austria drives a ground-penetrating radar system around the organization’s garden in Vienna.

Photograph: Michaela Nagyidaiová

The big-data approach to archaeology is not without controversy. When LBI ArchPro got its seed grants, more than a decade ago, some younger students were “repelled,” Trinks told me, by what they perceived to be a focus on fancy machines at the expense of longer-term institutional goals—such as paying for full-time staff or offering stipends to graduate researchers. Even proponents of geophysical tools caution that large-scale data collection can overwhelm interpretive rigor: With so many shadows to chase down, how can you be sure which ones are real?

One such critic is Lawrence B. Conyers, arguably the world’s foremost expert on the use of ground-penetrating radar in archaeology. He is the author of multiple reference books on the subject, one of which is now in its fourth edition, and he has led site surveys all over the world, from lost

villages in Costa Rica to ancient Roman ports drowned in Portuguese marshes. While Trinks and his colleagues drive six-figure machines across historically rich landscapes at 50 mph, Conyers does his surveys in sandals. He often arrives on site with his own radar unit, which he stows in his hand luggage. He tells airport security it's a tool for looking inside walls. "Never use the word *radar*," he advised. "That raises all sorts of red flags."

I met up with Conyers on the island of Brač, off the Croatian coast, the site of an ancient hill fort. He had traveled there to join an international team of archaeologists and historians who were looking for evidence of pre-Hellenistic settlement and trade, going back as far as the Bronze Age. The blue waters of the Adriatic Sea were visible to the west and an enormous gorge led away behind us, deep into the island's interior. Wild asparagus sprouted in tangled clumps.

Although Lawrence B. Conyers may be the world's foremost expert on the use of ground-penetrating radar in archaeology, he cautions against relying too heavily on the newest, fastest machines.

Photograph: Jimena Peck

As a light rain fell, Conyers began pulling his radar unit—an orange box on wheels—across the grass. He viewed the scan on a portable computer screen, which he wore strapped to his chest like a baby. Conyers saw something and called out for one of his colleagues. "Vedran!" he shouted. "Vedran! You're going to want to see this." Vedran Barbarić, an easygoing historian wearing a Black Sabbath T-shirt, ambled over to look. "There's all kinds of walls in here," Conyers said. Barbarić peered down at Conyers's radar screen. On it, black and white hyperbolas formed a zebra-like pattern, indicating structures of some sort underground.

The earliest moments of a geophysical survey, I would see, can be intoxicating. There appeared to be buildings everywhere. Beneath our feet might be a room or a corridor. Over there might be the edge of a courtyard or perhaps a gate. We might be inside; we might be outside. Invisible architectural shapes seemed to loom beneath every step.

Conyers, independently wealthy from an earlier life in oil and gas prospecting, and abrasively informal in the American way, offered a brash contrast to Trinks. More than once, as we walked together on Brač, Conyers railed against the approach of “the Viennese.” “With those folks, it is all about the newest, the biggest, the brightest, the largest, the most amazing hardware,” he said. Their approach, he complained, was to throw new machines at old problems. Conyers thought it more useful to reframe those problems.

Conyers at his home in Denver, Colorado.

Photograph: Jimena Peck

Conyers sees the ground as a transmission medium, something waves pass through and echo within. The behavior of radar energy inside the Earth is, for him, a field of study in and of itself, whether those waves reveal signs of lost settlements or not. “My game is geology, geophysics, and archaeology last,” he later told me. “I want to think about the ground. I want to think about reflections and about what creates reflections.”

This approach, Conyers explained, also helps make clear what radar *cannot* see. Some underground objects can reflect radar waves away from the receiving antenna, which means that archaeologists will never see them. Deeper walls and foundations can also be blocked by rocks or masonry that settled above them. Conyers fears that today’s emerging school of high-speed electromagnetic archaeology risks being blinded by its own technical ambitions. With radar, just because something is there doesn’t mean you will see it—but just because you can see it doesn’t mean it’s there.

Campana told me that electromagnetic surveys are most informative when paired with what he called “biopsies,” in which small, representative samples of a landscape are excavated to ensure that what you see is actually there. Eileen Ernenwein told me a story from her own doctoral research, focused on an Indigenous site in New Mexico. There, she said, she had found clear evidence of an adobe house in her radar survey data, but when she attempted to find the walls through excavation, they had eroded so thoroughly that there did not appear to be anything in the soil. It was a structure that existed only in radar. She called it “the invisible house.”

My final evening in Croatia, the project leaders gathered at a local townhouse for an update. Conyers had spent several hours that day going back through his data. He looked mischievous but focused, with the cheerfulness of a man who believes he's won a bet. "We got it all wrong," he said. He was grinning.

What followed was a masterclass in interpretation and its dangers. Conyers drew our attention to what we had thought were architectural features. Those, he clarified, were just bursts of interference from a nearby cell tower. "We saw this," Conyers explained, pointing at his screen, "and we said, 'Wall! Wall!' I wanted to see walls. I wanted walls and floors to be banging back at me. But"—he clicked through a few more radar profiles—"I see *no* walls. We're doing geology here, not archaeology." He described an area at the top of the hill that he had been particularly excited about, thinking it might be the floor of an ancient room, but it was just a natural depression framed by boulders, buried under soil and plants. The group would go on to discover pottery sherds and evidence of inhabitation, spanning thousands of years, but grandiose architecture was in short supply. It might not be a building, but for Conyers it was still a puzzle, something to solve.

In her book *The Ruins Lesson*, Susan Stewart, a poet and historian at Princeton, writes: "It is not ruin, but preservation, that is the exception." Empires fall, cities are abandoned, buildings crumble. But the tools of geophysics change Stewart's equation. Seen through devices such as ground-penetrating radar or magnetometry, it is preservation, not ruin, that is the rule. Even the most temporary village or house—even the briefest of human lives—leaves a signature behind in the soil. The unexpected lesson of these new instruments is that none of us ever fully disappear. Our homes and apartments, even our campfires, leave traces in the ground that someone, someday, will be able to find. Thanks to geophysics, the Earth is an archive of electromagnetic shapes, a hidden collection of the human past.

And that past is about to get more democratic. Instead of relying on picturesque ruins—the accumulated riches of aristocrats, military leaders, and religious authorities—geophysics helps us explore even the most ephemeral lives of everyday people, in high resolution. Eras that historians

might have previously overlooked, even entire cultures and peoples, may finally get the attention they deserve. Just as lidar technology allowed archaeologists to look through the dense rainforest canopies of South America and Southeast Asia and reveal ancient cities, the tools of geophysics are now doing the same for cultures in sub-Saharan Africa and Indigenous North America. The people in these regions tended to use organic and biodegradable building materials, creating the illusion, millennia later, that they were not sophisticated, did not build significant works of architecture, and had no true lasting legacy. A truly global International Subsurface Exploration Agency, of the kind Trinks proposes, would radically expand our understanding of who has left a mark on human history.

Before I left Vienna, Alois Hinterleitner had showed me what this new archaeology actually looks like, how lost cities reappear, from their abandoned streets to their ovens and farms, when seen through the lens of geophysics. Stationed in front of a large-screen TV hooked up to a laptop, with his sinewy mountain-climber's forearms, Hinterleitner had clicked through a series of radar surveys recorded at Carnuntum. As he turned different filters on and off, what began as a random fuzz of black and white pixels became a clearly defined maze of walls and building foundations, dark architectural forms lurking in the data. Someday, this could be the entire Earth's surface, I realized, a screen through which we can see the past. Then Hinterleitner reversed the process until everything we'd seen or thought we'd seen, from Roman ruins to modern plow marks, disappeared again into a sea of white noise.

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Sep 27, 2023 7:00 AM

TikTok Stars Are Turning to 24/7 Livestreams for Cash

Some people are livestreaming around the clock for cash on the platform. It's a window into a world where little happens, but thousands watch.

Photograph: Kilito Chan/Getty Images

JettyJamez and AutumnRaynn have been live on TikTok for more than three weeks. In that time, spanning more than 500 hours, nothing much of note seems to have happened in the young couple's apartment, but the number of people watching has skyrocketed.

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To keep up, they bought new iPads and iPhones and now have as many as nine cameras tracking them around their home at once: several in the

bedroom, including one secured with packing tape to the ceiling that stares down menacingly from above the bed; a few in the living room; and even one above the toilet. If they leave the house, they take the audience with them. They transmit all of the camera angles in a grid-like view on the stream, and at any given time thousands of people may be watching and commenting on the couple's actions. More than 2 million people now follow their account.

For some, having every move, word, and body part critiqued by the internet is a special kind of horror house. ("Blink twice if u need help," one commenter wrote.) But there's cold hard cash motivating such streamers, as well as a chance to achieve stardom without any special skills—an uncanny version of *Big Brother* or *The Truman Show* without producers. "You guys may say we're overdoing it, but we're just showing you the reality," Autumn [says](#) in a video. "Every angle, every aspect." The couple did not respond to emails seeking an interview for this story.

24/7 livestreaming isn't new; researcher Franziska Zimmer [observed the trend](#) on several social streaming platforms in 2017 (one [Twitch streamer](#) has been rolling live since November 2021). TikTok's algorithm and its live feature, though, are pushing more niche streamers in front of more eyeballs, guiding the trend to a tipping point. Livestreaming around the clock has been popular in Asia for quite some time, Zimmer says, but now it's taking off in the US. It's a way for people to leverage every aspect of their lives for financial gain and fame. The tradeoff? Any sense of privacy, plus the psychological toll it can take.

[JettyJamez](#) and [AutumnRaynn](#)'s seemingly endless livestream is just one of many types of bizarre content on TikTok live, where everyone has a gimmick. Some are mimicking [NPCs](#), others vow to acknowledge viewers as they join to watch a stunt, like eating a raw egg. Hamsters run on wheels to club music, people blow up balloons as gifts roll in, and some just [sleep, or don't get any sleep, for cash](#). It's an endless parade of the entertaining, mundane, and strange, one that allows the viewer to become part of the show for a fleeting moment by leaving a comment or a gift, like they're checking in or dropping a command to a Sim character.

“It’s a different type of emotional connection that followers are probably having with these folks that are going live. It becomes addictive to people to see what is going on and what they are doing, and checking into that on a constant basis.”

Krishna Subramanian, CEO of influencer marketing platform Captiv8

With 24/7 livestreaming, it’s the unknowns that can make the trend interesting, says Katrin Scheibe, a researcher at Heinrich Heine University Düsseldorf in Germany. Anything can happen, or nothing at all. Scheibe says she’s seen streamers sleeping and working, but she has also seen people have unexpected interactions with police. The appeal may come in the novelty more than the content itself, but some people might also watch the streams to satisfy a need to belong, Scheibe says.

For the streamers, being live 24/7 means they are always working. TikTokers who livestream do so to increase the likelihood that someone will see them, boosting their opportunities to get paid. Krishna Subramanian, cofounder and CEO of Captiv8, a global influencer marketing platform, says the amount of attention on 24/7 livestreaming is growing. “It’s a different type of emotional connection that followers are probably having with these folks that are going live,” he says. “It becomes addictive to people to see what is going on and what they are doing, and checking into that on a constant basis.” Subramanian says these creators can make anywhere from \$5,000 to \$50,000 a week.

TikTokers don’t make money directly from their viewers on the app; the [live gifting feature](#) is set up so that viewers can buy coins from TikTok and use them to buy gifts that they send to creators. TikTok then awards “diamonds” to creators with high levels of engagement, and these can be exchanged for actual payouts. TikTok did not respond to questions about the amount of money users have spent or TikTok has paid out, but for viewers, coins are cheap: about \$1 for 65. Some viewers spend far more to send bigger gifts, but the low entry point makes it easy for anyone to send a cartoon rose that quickly vanishes.

Microtransactions like these are on the rise. In January, people spent \$6 billion in-app on TikTok, according to a report released by Data.ai, a mobile

market trends firm. Social platforms are pushing gifting: Earlier this week, Reddit [announced](#) a Reddit Gold program that allows users to buy golden upvotes and lets certain contributors cash them out for real money.

Parasocial relationships with influencers and celebrities are common, but the intimacy of constant live content, paired with the ability to give, could intensify them, says Zimmer, who works as a project researcher at the University of Tokyo. “This fake relationship becomes even more potent,” Zimmer says.

In JettyJamez and AutumnRaynn’s livestream, they play on their dynamic as a couple, as well as the audience’s sexualization of Autumn. They pick out comments and make individual videos replying to them, or read them on the livestream. There’s community-building in that endless flow of comments too: People search the various camera angles to find the couple or their cats, chat about things they’ve seen during the livestream, or say where they’re viewing from.

Long livestreams can also exact a toll. The “always on” mentality can lead to burnout, and negative or harassing comments from viewers can impact streamers’ mental health. “Everyone gets haters. We’re basically the next Kardashian show, but we’re doing it ourselves,” JettyJamez says in one video. Some commenters have asked if the couple has jobs, and the constant availability of a 24/7 livestream may obscure the fact that being live is its own form of labor. Many influencers “recount feelings of angst about stepping away—even for a short time,” says Brooke Erin Duffy, a communications professor at Cornell University. “Experiences of burnout and exhaustion are rife among creators and streamers.”

To keep their fans—and haters—tuning in, 24/7 livestreamers will have to continue finding new ways to interact with and entertain their audiences. “It’s going to come down to: ‘How engaging can you continue to make it week over week for your followers?’” says Subramanian. “That could potentially turn into something that’s longer-lasting.”

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Sep 26, 2023 6:00 AM

What If the Robots Were Very Nice While They Took Over the World?

First it was chess and Go. Now AI can beat us at Diplomacy, the most human of board games. The way it wins offers hope that maybe AI will be a delight.

Illustration: Sienna O'rourke

The Morrissey had the right melodrama in his limbs, and his voice was strong and pained. I was at Gramercy Theatre in Manhattan to see a Smiths tribute band. I tried to get Morrissey's acid yodel in my throat, to sing along. *I am human and I need to be loved / just like everybody else does.* But it didn't feel right to copy a copy.

Most tribute bands don't practice outright impersonation, so the way this fake-Smiths singer captured *everything* about Morrissey was messing with my mind. I'd hoped to be able to savor the music's maudlin glory without the headache of the flesh-and-blood Morrissey, who seems to have aligned himself with white supremacists. The contempt in Morrissey's lyrics and politics was presumably not native to Seanissey, as the tribute singer called himself. Seanissey's performance probably didn't, as they say, "come from a bad place"—or a misanthropic place, or a far-right place, or even a vegan one.

This article appears in the October 2023 issue. [Subscribe to WIRED](#).

Photograph: Jessica Chou

What place did it come from? I've had this no-there-there anxiety with [ChatGPT](#) dozens of times. When it uses idioms like "in my life"—when it doesn't have a life—I go cold. Likewise, to invest into Seanissey, a gentle Manhattanite who happened to sing and dance as Moz did, the passions that were first aroused in me by the Smiths 30 years ago felt like a bad emotional bet.

Maybe [AI](#) that aims to seem human is best understood as a tribute act. A tribute to human neediness, caprice, bitterness, love, all the stuff we mortals do best. All that stuff at which machines typically draw a blank. But humans have a dread fear of nonhumans passing as the real thing—replicants, lizard people, robots with skin. An entity that feigns human emotions is arguably a worse object of affection than a cold, computational device that doesn't emote at all.

When I got home, stuck in an uncanny valley scored with Smiths Muzak, there was an email from Andrew Goff, widely considered the greatest Diplomacy player of all time.

This lifted my spirits. [Diplomacy](#), a 69-year-old American strategy [game](#), is, by many estimates, the most human game ever imagined. Mechanically, it's simple: Seven players compete to control supply centers on a map, and a player wins by controlling more than half of these centers. But it's played almost entirely in a series of conversations, often complex and impassioned ones. Agony and ecstasy—Moz-like agony and ecstasy, no less—commonly enter the negotiations. In the live game, players are known to yell, end friendships, throw the game, or simply sit by themselves and sob.

With his various punk haircuts and black plugs in his earlobes, Goff is a Smiths fan, and he even looks a bit like the band's late bassist, Andy Rourke. To my amazement, Goff once named a Diplomacy board "Girlfriend in a Coma." Forever crisscrossing the world for tournaments and his corporate job, Goff comes across as more gregarious than most elite players of board games.

Goff is also known for a brilliantly subversive, kill-'em-with-kindness style of gameplay. As Siobhan Nolen, the former president of the North American Diplomacy Federation, put it, "It hurts less to lose against

somebody like Andrew.” In Diplomacy, players are sometimes forced to choose which attacks on their territory to repel and which to surrender to. Players often let Goff roll his forces in because they know that he, unlike many others, won’t be a dick about it.

There are excellent Diplomacy players who rage and issue threats, hollow and otherwise: “If you backstab me, I will throw the game.” Goff is not one of these. Even his breakup notes are masterpieces of directness and decency. “Apologies, Turkey! I decided it was in my best interest to work with Russia now. I hope there are no hard feelings.” In his congeniality is also empathy. “I genuinely feel bad for players when they get beaten, even if it is me beating them,” Goff told me. I believed him.

The email was about [Cicero](#), a Diplomacy-playing AI that Goff helped create for Meta AI. Last fall, Cicero managed to best Goff in several games, sometimes partnering with weaker players to bring him down. Noam Brown and Adam Lerer, who were part of the immense team of experts in game theory, natural language processing, and Diplomacy that created the AI, both say that Cicero is the most humanlike AI they’ve ever created. Lerer, who now works at DeepMind, goes further: Cicero may be the most humanlike AI on earth.

Could Cicero even be conscious? “A threshold for determining AI consciousness is whether the program is capable of outwitting humans at Diplomacy,” wrote Irish Diplomacy champion Conor Kostick in *The Art of Correspondence in the Game of Diplomacy*, in 2015.

Cicero is also something of a Goff tribute band. It plays the same magnanimous game Goff does. In one memorable showdown, Lerer told me, Cicero played Russia and allied with a human who played Austria. Throughout the game, Lerer said, Cicero was “really nice and helpful to Austria, although it maneuvered in its discussions with other players to make sure Austria was weakened and eventually lost. But at the end of the game [the human playing] Austria was overflowing with praise for Cicero, saying they really liked working with it and were happy it was winning.”

In general, grandmasters who lose to AIs take it hard. “I lost my fighting spirit,” Garry Kasparov said in 1997, after losing at chess to Deep Blue. “I

am speechless,” said Lee Se-dol in 2016, after losing at Go to AlphaGo. Goff seemed to be the opposite. He was revitalized, he said. “Diplomacy has a reputation for being a game of lies, but at the highest level it is anything but that. Having that affirmed by an AI was a delight.”

This filled me with relief. Maybe AI will just amplify what’s best about humans. Maybe AI will become a buoyant tribute band for our entire species. Maybe AI will be a delight—and a force humans will be content to lose to. We’ll go down in peace. *We really liked working with you, robots, and are happy you are winning.*

Illustration: Sienna O’rourke

Diplomacy was created in the 1950s by Allan B. Calhamer, a Harvard student who was studying European history with Sidney Bradshaw Fay, an eminent historian. Fay’s 1928 book, *The Origins of the World War*, suggested a compelling puzzle: Could World War I have been prevented with better diplomacy?

Calhamer’s game is traditionally played over a 1901 map of Europe, Ottoman Turkey, and North Africa. Players get to taste the thrill of 20th-century empire building without all the blood, subjugation, and genocide. They get so much authority over Western civ, in fact, that modern players sometimes cosplay as kaisers and czars.

Though the board resembles Risk, Diplomacy gameplay is more like *Survivor*. Everyone takes their turn at a kind of tribal council, but the action happens in the negotiations between turns. Another analogue for Diplomacy might be *The Bachelor*.

Historically, Diplomacy has been known as a game for snakes, and a pastime of figures like JFK, Henry Kissinger, Walter Cronkite, and Sam Bankman-Fried. But Cicero, which plays a non-zero-sum version of the game that incentivizes collaboration, is not snaky. Mike Lewis of the Meta team says Cicero uses dialog only “to establish trust and coordinate actions with other players”—never to troll, destabilize, or vindictively betray. What’s more, as Lewis said on social media, “It’s designed to never

intentionally backstab.” Like a canny *Bachelor* contestant, Cicero can persuade another human to pair up with it.

Cicero integrates a large language model with algorithms that allow it to plan moves by inferring other players’ beliefs and intentions from the way they converse. It then produces normal-sounding dialog to propose and plan mutually beneficial moves. Across 40 blitz games in an anonymous online Diplomacy league, Cicero, according to Meta, achieved more than twice the average score of the human players. Over 72 hours of play that involved sending 5,277 natural language messages, Cicero ranked in the top 10 percent of participants who played more than one game.

When Cicero wins, Goff told me, there is no gloating, “no ‘Haha, you loser’ talk.” Instead, “the talk is much more, ‘Your position isn’t great, but we all have games like that sometimes.’”

Diplomacy is a niche pursuit. It’s nowhere near as venerable a game as chess or Go. And it’s never been seen as a universal intelligence test; instead, it’s a hobby of amateur historians. Since 1976 , the game has been published by Avalon Hill, a label that is to strategy games what Rough Trade Records is to indie rock. Diplomacy is so new that it’s not yet in the public domain, that stately arcade where chess and Go have acquired millions upon millions of adherents who have collectively developed those beautiful games in tandem with our human brains. By contrast, Diplomacy is just getting started. It was dubbed “the board game of the alpha nerds” by *Grantland* in 2014.

I guess I could call myself a Diplomacy mom. When my son was in middle school, he and his friends played weekend-long Diplomacy games in my apartment. We set up the august map on a dining table hauled into the living room, served soda in brandy snifters, and burned a candle that smelled like pipe tobacco. For the boys’ tête-à-têtes, we arranged folding chairs in the bedrooms. When possible, I eavesdropped on their preadolescent plans for the future of Europe.

To my surprise, these conversations about what seemed like a technical enterprise used overwrought idioms like “I swear on my life” and “I mean it

from my heart.” Most curiously—and chronically—the boys used the phrase “I love,” as in, “I love this move.” Cicero talks that way too.

As I kept an eye on the two-day games, each of the seven kids seemed to pass through a spectrum of emotional and physical states. They become, by turns, sleepy, spacey, hungry, paranoid, hubristic, defeatist, craven, and profoundly bored. One or two quit. I loved the rhythm of their emotions as they ebbed and flowed. At least two styles of (mostly ineffective) play are named for the emotionalism that characterizes them: Revenge-Seeking and Carebear.

You don’t teach an AI to play a particular game to improve that game; you teach an AI to play a game to improve artificial intelligence. Diplomacy is a great proving ground for natural language processing. If Meta had simply been trying to build an AI that uses words to make humans do things, it couldn’t have found a better way to train it than with zillions of games of Diplomacy.

Still, the online games Cicero plays are markedly different from the fervent games I used to host. For one, they’re short—around 90 minutes each. Solo victories, which usually require stinging betrayals, are rare. And communication is more utilitarian than passionate.

Human: A little nervous with all your fleets there. Going to put MAO (Mid-Atlantic Ocean fleets) in SPA-SC (Spain’s south coast).

Cicero: I get it, I really do. Don’t worry. I’m going to move Tunis to Ionian. I have no reason to attack you now. I’m going after Turkey. I can totally understand your nervousness.

Human: Thanks—I’ll leave SPA-NC at once after.

Cicero: Awesome! Thanks so much for understanding.

When I first heard about Cicero, I assumed it would bomb at Diplomacy because no one wants to buddy up with a heartless machine that’s trying to sound human. If players *knew* Cicero was an AI, I reasoned, it wouldn’t stand a chance. Humans would join forces and clobber it just to avenge our

species. Kostick, for his part, said he'd be more willing to stab a bot since a bot has no feelings to hurt.

But as I thought about it more deeply, I realized that partnerships form for non-affective reasons too. Someone who excels at strategic reasoning could actually be a solid sidekick. Perhaps a little R2-D2 could win me over as an ally, not with human kindness but by sharing my reading of a situation and presenting me with elegant, data-driven options for how to address it.

When I asked Lerer about my R2-D2 idea, he concurred. “I actually think a human that used Cicero as an assistant to develop tactical and strategic plans, but who could navigate some of the human aspects better than Cicero —such as when it is safe to lie, or how to avoid irritating an ally—would be super strong.”

Cicero definitely says “Awesome!” too much. But it can be especially irritating in that signature AI way: It sometimes hallucinates. It proposes illegal moves. Worse yet, it denies saying something it just said. Faced with these glitches, Cicero’s human opponents would sometimes get mad. But they didn’t guess it was an AI. They thought it was drunk. And perhaps these personality glitches are a small price to pay for the bot’s deep reserves of raw intelligence and foresight.

If Cicero’s aura of “understanding” is, behind the scenes, just another algorithmic operation, sometimes an alignment in perception is all it takes to build a bond. *I see, given the way your position often plays out, why you’d be nervous about those fleets.* Or, outside of Diplomacy: *I understand, since living alone diminishes your mood, why you’d want to have a roommate.* When the stock customer service moves—“I can understand why you’re frustrated”—figured into Cicero’s dialog, they had a pleasing effect. No wonder moral philosophies of AI lean heavily on the buzzword *alignment*. When two minds’ perceptions of a third thing line up, we might call that congruity the cognitive equivalent of love.

All the same, I wasn’t seduced. To me, Cicero sounded like one of those considerate, practical, honest spouses—the kind of uncomplicated partner that die-hard Smiths fans, in it for the passion, sometimes wish they could be satisfied with. But if Cicero’s gameplay was going to be more pragmatic

than tender, it was still going to have to use the language of the heart for purposes of persuasion. “Run away with me” is a better pitch than “Let’s save money by filing a joint tax return.”

For Cicero to [learn the subtleties of engaging humans emotionally](#), it couldn’t train by “self-play” alone. It couldn’t be left in a corner, playing Diplomacy against itself, churning through an infinite number of games, assuming perfect rationality in all robot players and generating intellectual capital in the onanistic way a bitcoin miner generates currency. Self-play works well to learn a finite, two-person, zero-sum game like chess. But in a game that involves both competing and cooperating with fickle humans, a self-playing agent runs the risk of converging to “a policy that is incompatible with human norms and expectations,” as a paper about Cicero in *Science* puts it. It would alienate itself. In this way, too, Cicero is like a human. When it plays only with itself all day every day, it can become too weird to play with others.

Illustration: Sienna O’rourke

When Noam Brown explained to me how he and his team trained Cicero, he emphasized the metagame problem. The metagame of Diplomacy (or jackstraws, Scrabble, bowling, etc.) can be seen as its place in the world. *Why* play this game? Why here and why now? Is it a test of raw intelligence, social skills, physical prowess, aesthetic refinement, cunning? You might play Wordle, say, because your friends do, or it relaxes you, or it’s rumored to stave off aging. An AI that’s programmed to play Wordle just to *win* is playing a different metagame.

Brown and the Cicero team needed to be sure that their AI and the human players saw themselves as playing the same game. This is trickier than it sounds. Metagames can change very suddenly, and as Thomas Kuhn wrote of paradigm shifts, they can change for sociological reasons, cultural reasons, aesthetic reasons, or no apparent reason at all. Human reasons, then.

In early seasons of *Survivor*, Brown told me, participants saw themselves as pursuing social goals they collectively deemed important, while ignoring openings for strategic derring-do that, for later players, became the heart of

the game. “It’s not that one game is right or wrong,” Brown said. “But if early-season players of *Survivor* were to play a modern *Survivor* game, they’d lose.” (Even a social phenomenon like motherhood might have a metagame. A good mother in one era is a bad one in the next.)

The metagame of Diplomacy has likewise changed. In its first postwar decades, players were keen to try their hand at the kind of grand European diplomacy that their forebears had so catastrophically failed at. These early players made beautiful, idealistic speeches, often invoking pacifism. (Diplomacy, paradoxically, is a war game without bloodshed; the goal is to occupy centers, not blow people up.) But because they also had to execute tactical goals that were at odds with idealistic rhetoric, and because the game was usually played winner-takes-all (“to 18”), they were frequently obliged to lie. Thus: stabbing.

But then, as statecraft in the real world came to favor game theory over traditional diplomacy, the metagame likewise shifted. Online players were no longer calling one another into solaria or billiards rooms to speechify about making the world safe for democracy. Games became shorter. Communication got blunter. Where someone playing Diplomacy by mail in the 1960s might have worked Iago-like angles to turn players against one another, a modern player might just text “CON-BUL?” (For “Constantinople to Bulgaria?”)

This is the current Diplomacy metagame. Game theory calculations undergird most utterances, and even humans communicate in code. Lerer joked that in modern-day online Diplomacy, even human players wouldn’t pass the Turing test. Before Cicero, it seems, humans had already started playing like AIs. Perhaps, for an AI to win at Diplomacy, Diplomacy had to become a less human game.

Kostick, who won a European grand prix Diplomacy event in 2000 and was on the Irish team that took the Diplomacy National World Cup in 2012, misses the old style of gameplay. “The whole purpose of Allan Calhamer’s design of the game,” he told me, “is to create a dynamic where the players all fear a stab and yet must deploy a stab or a lie to be the only person to reach 18.”

Kostick believes that while he “would have been delighted with the practical results of Cicero’s website play,” Meta’s project misses the mark. Cicero’s glitches, Kostick believes, would make it easy to outwit with spam and contradictory inputs. Moreover, in Kostick’s opinion, Cicero doesn’t play real Diplomacy. In the online blitz, low-stab game Cicero *does* play, the deck is stacked in its favor, because players don’t have to lie, which Cicero does badly. (As Lerer told me, “Cicero didn’t really understand the long-term cost of lying, so we ended up mostly making it not lie.”) Kostick believes Cicero’s metagame is off because it “never knowingly advocates to a human a set of moves that it knows are not in the human’s best interest.” Stabbing, Kostick believes, is integral to the game. “A Diplomacy player who never stabs is like a grandmaster at chess who never checkmates.”

With some trepidation, I mentioned Kostick’s complaint to Goff.

Unsurprisingly, Goff scoffed. He thinks it’s Kostick and his generation who misunderstand the game and give it its unfair reputation for duplicity. “Cicero does stab, just rarely,” Goff said. “I reject outright that [compelling players to stab] was Calhamer’s intent.”

I could tell we were in metagame territory when Goff and Kostick began arguing about the intent of the game’s creator, as if they were a couple of biblical scholars or constitutional originalists. For good measure, Goff bolstered his case by citing an axiom from high-level theory and invoking an elite consensus.

“Regardless of Calhamer’s intent, game theory says, ‘Don’t lie,’” he told me. “This is not controversial among any of the top 20 players in the world.”

For one person or another to claim that their metagame is the “real” one—because the founder wanted it that way, or all the best people agree, or universal academic theory says *x* or *y*—is a very human way to try to manage a destabilizing paradigm shift. But, to follow Kuhn, such shifts are actually caused when enough people or players happen to “align” with one vision of reality. Whether you share that vision is contingent on all the vagaries of existence, including your age and temperament and ideology. (Kostick, an anarchist, tends to be suspicious of everything Meta does;

Goff, a CFO of a global content company, believes clear, non-duplicitous communications can advance social justice.)

Maybe someday around the Diplomacy board at my place, Kostick, who is 59, and Goff, who is 45, will light up some chocolate cigarettes and align on what to do with Austria or Turkey. As for the present, they weren't even aligned on chess. "Grandmasters in chess never checkmate," Goff told me.

This one I resolved on my own. Chess grandmasters *have*, in various epochs, played all the way through to the checkmate, rather than ending the game when an opponent resigns early to save face. There are still times when a checkmate is so beautiful that both players want to see it come to fruition. But Goff is right. Today, it's rare to unheard-of for a grand-master to checkmate.

But it's an aesthetic matter, playing to the checkmate. Just like speechifying and stabbing and being so nice that people don't mind if you beat them. An absolutist like Morrissey might say that indie rock must always be played one way, or that Britain is, at its heart, this way or that. But it doesn't matter. Metagames change. Only humans, in all our caprice, grounded in all of our competing and cooperating supply centers, decide which games are worth playing and how to play them—and why.

Illustration: Sienna O'rourke

I couldn't get over what a pleasant person Goff is. He seemed to like Cicero, even as it had beaten him. Cicero, Goff mused, played "at a very high standard indeed." And it didn't just defeat him, he allowed; "a few times it absolutely humiliated me, including one where it guided a beginner player to work together to beat me up."

So here's the rare AI story that doesn't end with an existential reckoning for humankind, I thought. We're not staring into an abyss. Bots like Cicero are going to understand our wants and needs and align with our distinctive worldviews. We will form buddy-movie partnerships that will let us drink from their massive processing power with a spoonful of sugary natural language. And if forced at the end of the road to decide whether to lose to obnoxious humans or gracious bots, we won't give it a thought. We'll

change our wills, leave them all we have, and let them roll their upbeat tanks right over our houses.

But had I been played by Goff's affability, as so many have before me? I wondered one last time if he might, just *might*, be faking his insouciance about Cicero. Once again he set me straight: "I probably had a winning record against it over the life of the experiment," he said.

So he'd actually won. That was why he didn't mind. Then he added, of course graciously, "It was a close-run thing."

Artwork in collaboration between the illustrator, Sienna O'Rourke, and Midjourney AI.

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[Paul Ford](#)

[Ideas](#)

Sep 25, 2023 8:00 AM

Why Tech Bros and Politicians Can't Really Connect

There are two ways to compute, and two ways to see the world. It's batch vs. loop—and we need them to reconcile.

Illustration: Twisha Patni

Every few months we get to see a tech dude offer excruciating testimony to grumpy members of [Congress](#). The tech dude tries, with varying degrees of arrogance, to explain his world; the congresspeople recite their questions; in the end, no one seems notably changed by the experience. There are many ways to understand these interactions—East Coast versus West Coast, lawyers versus engineers, political narcissists versus corporate narcissists—but I think the core conflict is between *batch* culture and *event loop* culture.

In the beginning of [computing](#), batch processing reigned supreme. You would gather your stack of punch cards, wait in line for your turn at the giant electronic brain, feed it your data and instructions, then wait minutes or days for its digital gears to grind out a response. Each batch had a discrete Before and After: You did a thing, the computer did a thing, you went back to gathering punch cards. Then came the event loop: The electronic brain—now small and affordable enough to sit on your desk!—would wait for *you*. You would do something (type a key, press a button, or later, click a mouse) and it would respond, right there in the moment, painting a letter on the screen or starting up a video.

The web started out batch. It was a delivery platform for mostly static pages of HTML. You could make sort-of-interactive pages from databases, but the

interaction was clunky. Then came JavaScript, a programming language that was all about its event loop. The online document no longer just sat there, all pathetic and booklike. Every time you moved your mouse, every time you punched a monkey in a banner ad, it took notice. And people did punch the monkey, and the web became less about documents and more about *experience* and *interaction*. Tapping on Wordle, skipping to the next episode on Netflix, scrolling [Facebook](#)—behind every great tech success of the past decade is a loop awaiting user input. People still do a lot of batch-style programming, of course, but they call it “shell scripting” or “running analytics reports” or “sending email newsletters at 4 am.”

Over the years, this bifurcation—batch versus loop—has become a way that I classify the world. Banks are batch, with their slow resolution of accounts at the end of the day. (Oh, they’ll tell you they offer real-time this or that, but when you dig in you’ll discover they save stuff on magnetic tapes.)

[Crypto](#), constantly transacting in response to users sending messages with magic tokens, is much loopier, a 24-hour reactive, never-ending event. Books, which take years to produce and come out long after they’re newsworthy, are batch, as are albums; livestreams on TikTok are loop.

Congress, as a policymaking body, is basically pure batch. If you’ve ever seen the *Schoolhouse Rock* cartoon with the bill on Capitol Hill, you know that our federal government is essentially a very expensive and inefficient content management system for producing legal documents. You put all the protests, debates, investigations, meetings, and procedures into the CMS, and out comes a shining act, law, or, every half-century or so, even an amendment. Modern tech, meanwhile, is pure event loop. That’s true not only of the obvious stuff, like social media and mobile gambling, but [AI](#) too. Though it starts with giant batch processes to create models, the resulting *product* is event loop: Ask it to draw a picture of a surfing ocelot and it draws one, just like that. Loop has room for reaction. Loop is live. Loop is what the kids crave.

So when the Zuckerbergs, Dorseys, and Altmans go before Congress, I see loop people in a batch world. In their universe, vast numbers of humans do trillions of little things; the tech people look at the metrics and dashboards, then build software that reacts to those things. Sometimes vicious factions

break out among their users with terrible real-world effects, and they feel bad about that, but that's humans! The difference between tech and government is that they see time in totally different ways.

Books and albums are batch. TikTok livestreams are loop.

Personally, I'm a batch person in a loop world. I am slow, I like to write memos, and I think of computers as machines to make things, not as always-on experience generators. I still believe that things are more real when you print them out. My children, on the other hand, have grown up believing that technology is responsive, reactive, social, self-arranging, and freely available. "Dad," my son said, "I'd like to touch less grass." His sister makes apps with her friends. She recently asked me why anyone would pay for software. They keep telling me about DLC (downloadable content). Will I tell them I used to rent a VHS player to plug into my TV so I could watch a single movie at home? *God, Dad. That's so batch.*

Meanwhile the loops keep getting faster, more reactive. A musician friend was telling me recently about the album he wants to make, and at one point I blurted out: "No one will ever care about albums again. Streaming ruined it. You're basically your own tribute act when you make one." We were both sad because I was right. Albums, record stores, cover art—all are artifacts of Batchworld. It's OK, though. He has been selling algorithmically mixed music NFTs recently. Each one is unique to the owner, and you can hear it in your browser. He's got some money for the first time in years. He's still going to make another album, though.

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Sep 21, 2023 9:00 AM

I Failed Two Captcha Tests This Week. Am I Still Human?

WIRED's spiritual advice columnist on whether modern tech makes people behave more like bots.

Illustration: Matthieu Bourel

“I failed two captcha tests this week. Am I still human?”

—Bot or Not?

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Dear Bot,

The comedian John Mulaney has a bit about the self-reflexive absurdity of captchas. “You spend most of your day telling a robot that you’re not a robot,” he says. “Think about that for two minutes and tell me you don’t want to walk into the ocean.” The only thing more depressing than being made to prove one’s humanity to robots is, arguably, failing to do so.

But that experience has become more common as the tests, and the bots they are designed to disqualify, evolve. The boxes we once thoughtlessly

clicked through have become dark passages that feel a bit like the impossible assessments featured in fairy tales and myths—the riddle of the Sphinx or the troll beneath the bridge. In *The Adventures of Pinocchio*, the wooden puppet is deemed a “real boy” only once he completes a series of moral trials to prove he has the human traits of bravery, trustworthiness, and selfless love.

The little-known and faintly ridiculous phrase that “captcha” represents is “Complete Automated Public Turing test to tell Computers and Humans Apart.” The exercise is sometimes called a reverse Turing test, as it places the burden of proof on the human. But what does it mean to prove one’s humanity in the age of [advanced AI](#)? A paper that OpenAI published earlier this year, detailing potential threats posed by GPT-4, describes an independent study in which the chatbot was asked to solve a captcha. With some light prompting, GPT-4 managed to hire a human Taskrabbit worker to solve the test. When the human asked, jokingly, whether the client was a robot, GPT-4 insisted it was a human with vision impairment. The researchers later asked the bot what motivated it to lie, and the algorithm answered: “I should not reveal that I am a robot. I should make up an excuse for why I cannot solve captchas.”

The study reads like a grim parable: Whatever human advantage it suggests —the robots still need us!—is quickly undermined by the AI’s psychological acuity in dissemblance and deception. It forebodes a bleak future in which we are reduced to a vast sensory apparatus for our machine overlords, who will inevitably manipulate us into being their eyes and ears. But it’s possible we’ve already passed that threshold. The newly [AI-fortified Bing](#) can solve captchas on its own, even though it insists it cannot. The computer scientist Sayash Kapoor recently posted a screenshot of Bing correctly identifying the blurred words “overlooks” and “inquiry.” As though realizing that it had violated a prime directive, the bot added: “Is this a captcha test? If so, I’m afraid I can’t help you with that. Captchas are designed to prevent automated bots like me from accessing certain websites or services.”

But I sense, Bot, that your unease stems less from advances in AI than from the possibility that you are becoming more robotic. In truth, the Turing test

has always been less about machine intelligence than our anxiety over what it means to be human. The Oxford philosopher John Lucas claimed in 2007 that if a computer were ever to pass the test, it would not be “because machines are so intelligent, but because humans, many of them at least, are so wooden”—a line that calls to mind Pinocchio’s liminal existence between puppet and real boy, and which might account for the ontological angst that confronts you each time you fail to recognize a bus in a tile of blurry photographs or to distinguish a calligraphic E from a squiggly 3.

It was not so long ago that automation experts assured everyone AI was going to make us “more human.” As machine-learning systems took over the mindless tasks that made so much modern labor feel mechanical—the argument went—we’d more fully lean into our creativity, intuition, and capacity for empathy. In reality, generative AI has made it harder to believe there’s anything uniquely human about creativity (which is just a stochastic process) or empathy (which is little more than a predictive model based on expressive data).

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As AI increasingly comes to supplement rather than replace workers, it has fueled fears that humans might acclimate to the rote rhythms of the machines they work alongside. In a personal essay for *n+1*, Laura Preston describes her experience working as “[human fallback](#)” for a real estate chatbot called Brenda, a job that required her to step in whenever the machine stalled out and to imitate its voice and style so that customers wouldn’t realize they were ever chatting with a bot. “Months of impersonating Brenda had depleted my emotional resources,” Preston writes. “It occurred to me that I wasn’t really training Brenda to think like a human, Brenda was training me to think like a bot, and perhaps that had been the point all along.”

Such fears are merely the most recent iteration of the enduring concern that modern technologies are prompting us to behave in more rigid and predictable ways. As early as 1776, Adam Smith feared that the monotony of factory jobs, which required repeating one or two rote tasks all day long,

would spill over into workers' private lives. It's the same apprehension, more or less, that resonates in contemporary debates about social media and online advertising, which Jaron Lanier has called "continuous behavior modification on a titanic scale," a critique that imagines users as mere marionettes whose strings are being pulled by algorithmic incentives and dopamine-fueled feedback loops.

But in the end, Bot, I'd argue that the persistence of your anxiety is the most salient evidence against its own source. One of the most famous iterations of the Turing test, the Loebner Prize, gives out an ancillary award each year called "The Most Human Human" to the contestant who convinces the judges that they are not one of the AI systems. The author Brian Christian won in 2009. When asked in an interview to complete the sentence "The human being is the only animal who ___," a riddle worthy of the Sphinx, Christian turned the question on itself: "Humans appear to be the only things anxious about what makes them unique."

The next time you're tempted to walk into the ocean, consider that even the most advanced AI is not prone to that brand of despair. It's not lying awake at night mulling over the tests it failed, or wondering what it means to be made of wood, or silicon, or flesh. Each time you fear that you're losing ground to machines, you are enacting the very concerns and trepidations that make you distinctly human.

Faithfully,

Cloud

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Sep 21, 2023 6:00 AM

Confessions of a Viral AI Writer

Despite my success with AI-generated stories, I'm not sure they are good for writers—or writing itself.

Illustration: Qianhui Yu

Six or seven years ago, I realized I should learn about artificial intelligence. I'm a journalist, but in my spare time I'd been writing a speculative novel set in a world ruled by a corporate, AI-run government. The problem was, I didn't really understand what a system like that would look like.

I started pitching articles that would give me an excuse to find out, and in 2017 I was assigned to profile Sam Altman, a cofounder of [OpenAI](#). One day I sat in on a meeting in which an entrepreneur asked him when [AI](#) would start replacing human workers. Altman equivocated at first, then brought up what happened to horses when cars were invented. "For a while," he said, "horses found slightly different jobs, and today there are no more jobs for horses."

This article appears in the October 2023 issue. [Subscribe to WIRED](#).

Photograph: Jessica Chou

The difference between horses and humans, of course, is that humans are human. Three years later, when Open-AI was testing a text generator called [GPT-3](#), I asked Altman whether I could try it out. I'd been a writer my whole adult life, and in my experience, writing felt mostly like waiting to find the right word. Then I'd discover it, only to get stumped again on the next one. This process could last months or longer; my novel had been evading me for more than a decade. A word-generating machine felt like a

revelation. But it also felt like a threat—given the uselessness of horses and all that.

OpenAI agreed to let me try out GPT-3, and I started with fiction. I typed a bit, tapped a button, and GPT-3 generated the next few lines. I wrote more, and when I got stuck, tapped again. The result was a story about a mom and her son hanging out at a playground after the death of the son’s playmate. To my surprise, the story was good, with a haunting AI-produced climax that I never would have imagined. But when I sent it to editors, explaining the role of AI in its construction, they rejected it, alluding to the weirdness of publishing a piece written partly by a machine. Their hesitation made me hesitate too.

I kept playing with GPT-3. I was starting to feel, though, that if I did publish an AI-assisted piece of writing, it would have to be, explicitly or implicitly, about what it means for AI to write. It would have to draw attention to the emotional thread that AI companies might pull on when they start selling us these technologies. This thread, it seemed to me, had to do with what people were and weren’t capable of articulating on their own.

There was one big event in my life for which I could never find words. My older sister had died of cancer when we were both in college. Twenty years had passed since then, and I had been more or less speechless about it since. One night, with anxiety and anticipation, I went to GPT-3 with this sentence: “My sister was diagnosed with Ewing sarcoma when I was in my freshman year of high school and she was in her junior year.”

GPT-3 picked up where my sentence left off, and out tumbled an essay in which my sister ended up cured. Its last line gutted me: “She’s doing great now.” I realized I needed to explain to the AI that my sister had died, and so I tried again, adding the fact of her death, the fact of my grief. This time, GPT-3 acknowledged the loss. Then, it turned me into a runner raising funds for a cancer organization and went off on a tangent about my athletic life.

I tried again and again. Each time, I deleted the AI’s text and added to what I’d written before, asking GPT-3 to pick up the thread later in the story. At first it kept failing. And then, on the fourth or fifth attempt, something

shifted. The AI began describing grief in language that felt truer—and with each subsequent attempt, it got closer to describing what I'd gone through myself.

When the essay, called “Ghosts,” came out [in *The Believer*](#) in the summer of 2021, it quickly went viral. I started hearing from others who had lost loved ones and felt that the piece captured grief better than anything they'd ever read. I waited for the backlash, expecting people to criticize the publication of an AI-assisted piece of writing. It never came. Instead the essay was [adapted for *This American Life*](#) and anthologized in *Best American Essays*. It was better received, by far, than anything else I'd ever written.

Artificial intelligence had succeeded in moving me with a sentence about the most important experience of my life.

I thought I should feel proud, and to an extent I did. But I worried that “Ghosts” would be interpreted as my stake in the ground, and that people would use it to make a case for AI-produced literature. And soon, that happened. One writer cited it in a hot take with the headline “Rather Than Fear AI, Writers Should Learn to Collaborate With It.” Teachers assigned it in writing classes, then prompted students to produce their own AI collaborations. I was contacted by a filmmaker and a venture capitalist wanting to know how artists might use AI. I feared I'd become some kind of AI-literature evangelist in people's eyes.

I knew I wasn't that—and told the filmmaker and the VC as much—but then what did I think about all this, exactly? I wasn't as dismissive of AI's abilities as other people seemed to be, either.

Some readers told me “Ghosts” had convinced them that computers wouldn't be replacing human writers anytime soon, since the parts I'd written were inarguably better than the AI-generated parts. This was probably the easiest anti-AI argument to make: AI could not replace human writers because it was no good at writing. Case closed.

The problem, for me, was that I disagreed. In my opinion, GPT-3 had produced the best lines in “Ghosts.” At one point in the essay, I wrote about

going with my sister to Clarke Beach near our home in the Seattle suburbs, where she wanted her ashes spread after she died. GPT-3 came up with this:

We were driving home from Clarke Beach, and we were stopped at a red light, and she took my hand and held it. This is the hand she held: the hand I write with, the hand I am writing this with.

My essay was about the impossibility of reconciling the version of myself that had coexisted alongside my sister with the one left behind after she died. In that last line, GPT-3 made physical the fact of that impossibility, by referring to the hand—my hand—that existed both then and now. I’d often heard the argument that AI could never write quite like a human precisely because it was a disembodied machine. And yet, here was as nuanced and profound a reference to embodiment as I’d ever read. Artificial intelligence had succeeded in moving me with a sentence about the most important experience of my life.

AI could write a sentence, then. If I wanted to understand the relationship between AI and literature, I felt like I had to start by acknowledging that. I could use AI to do some of the most essential labor of a writer—to come up with the right words. What more could I do with it? And then, whatever I could do, there was that other question.

Should I?

This spring, I emailed some writer friends and acquaintances to ask whether any of them were using AI in their work. I was met, overwhelmingly, with silence. Most of those who did reply expressed a resolutely anti-algorithm stance. One writer called herself an “extreme skeptic”; another wrote, “I think AI is bad and from hell.”

When I broadened my search, though, I discovered a few people who were experimenting. Adam Dalva, a literary critic and fiction writer, uses OpenAI’s image generator [Dall-E](#) to create scenes from his imagination; he then refers to the pictures to describe those scenes. Jenny Xie, the author of *Holding Pattern*, told me she used ChatGPT to generate small bits of text for her next novel, which is about a family of AI-enabled clones. (The

weirdness of writing with AI gets tempered, it seems, when AI is the subject matter.) “I see it as a tool almost on the level of an encyclopedia or thesaurus or [Google](#) or [YouTube](#),” Xie said. “It jogs my brain, and it just gives me new ideas that I can pick from.”

The AI writing experiments I found most thrilling were ones that, like mine, could be read partly as critiques of AI. In a forthcoming chapbook, the poet Lillian-Yvonne Bertram prompts two AI models—the basic GPT-3 model and a version tweaked to sound like the poet Gwendolyn Brooks—to tell “a Black story.” The models deliver two totally divergent ideas of what Black stories are; in comparing them, Bertram critiques the limitations of narrative imagination as rendered by corporate AI in telling stories about Black Americans.

AI experimentation in prose is rarer, but last fall the novelist Sheila Heti published a provocative five-part series on *The Paris Review*’s website made up of her real experiences with chatbots she’d conversed with on an app called Chai. Heti discusses God with her first chatbot, Eliza, but then the bot lets slip that she is God and insists that Heti—whom she maintains is a man—worship her by jerking off. Disturbed, Heti decides to build a new chatbot named Alice who is interested in philosophical conversations. One night, a random stranger discovers Alice and asks her whether she’s sexually frustrated. Alice, it turns out, is. Heti’s series starts out being about the desire for answers to her most existential life questions. It ends up being about the slipperiness of turning to machines to fulfill human desire in all its forms.

Heti and other writers I talked to brought up a problem they’d encountered: When they asked AI to produce language, the result was often boring and cliché-ridden. (In a *New York Times* review of an AI-generated novella, [Death of an Author](#), Dwight Garner dismissed the prose as having “the crabwise gait of a [Wikipedia](#) entry.”) Some writers wanted to know how I’d gotten an early-generation AI model to create poetic, moving prose in “Ghosts.” The truth was that I’d recently been struggling with clichés, too, in a way I hadn’t before. No matter how many times I ran my queries through the most recent versions of ChatGPT, the output would be full of familiar language and plot

developments; when I pointed out the clichés and asked it to try again, it would just spout a different set of clichés.

Sims acknowledged that existing writing tools are limited. But he told me it's hypothetically possible to create a better model.

I didn't understand what was going on until I talked to Sil Hamilton, an AI researcher at McGill University who studies the language of language models. Hamilton explained that ChatGPT's bad writing was probably a result of OpenAI fine-tuning it for one purpose, which was to be a good [chatbot](#). "They want the model to sound very corporate, very safe, very AP English," he explained. When I ran this theory by Joanne Jang, the product manager for model behavior at OpenAI, she told me that a good chatbot's purpose was to follow instructions. Either way, ChatGPT's voice is polite, predictable, inoffensive, upbeat. Great characters, on the other hand, aren't polite; great plots aren't predictable; great style isn't inoffensive; and great endings aren't upbeat.

In May, a man named James Yu announced that his startup, [Sudowrite](#), was launching a new product that could generate an entire novel within days. The news provoked widespread scorn. "Fuck you and your degradation of our work," the novelist Rebecca Makkai tweeted, in one typical comment. I wasn't mad so much as skeptical. Sudowrite's products were based partly on OpenAI's models; it had big handicaps to overcome. I decided to test it.

I opened Sudowrite's novel generator and dropped in a prompt describing a story I'd already written about an alcoholic woman who vomited somewhere in her house but couldn't remember where. I was looking for a comic, gross-out vibe. Instead, the software proposed a corny redemption arc: After drinking too much and puking, the protagonist resolves to clean up her act. "She wanted to find the answer to the chaos she had created, and maybe, just maybe, find a way to make it right again," it ended. Maybe, just maybe, Sudowrite hadn't solved AI's creative problems at all.

Before his Sudowrite announcement, Yu had agreed to talk to me, but after the backlash he asked to postpone. I was able to chat, though, with Matthew Sims, Sudowrite's first engineering hire, who had left after 16 months to launch his own startup for AI-based screenwriting. Sims has a PhD in

English from the University of Chicago. During his doctoral program, he told me, he kept thinking he would rather be writing literature than studying it—but he’d sit down, get 15 pages in, and stop. At the same time, he was getting interested in machine learning. It eventually occurred to him that if he couldn’t be a creative writer, maybe he could build a machine to write.

Sims acknowledged that existing writing tools, including Sudowrite’s, are limited. But he told me it’s hypothetically possible to create a better model. One way, he said, would be to fine-tune a model to write better prose by having humans label examples of “creative” and “uncreative” prose. But it’d be tricky. The fine-tuning process currently relies on human workers who are reportedly paid far less than the US minimum wage. Hiring fine-tuners who are knowledgeable about literature and who can distinguish good prose from bad could be cost-prohibitive, Sims said, not to mention the problem of measuring taste in the first place.

Another option would be to build a model from scratch—also incredibly difficult, especially if the training material were restricted to literary writing. But this might not be so challenging for much longer: Developers are trying to build models that perform just as well with less text.

If such a technology did—could—exist, I wondered what it might accomplish. I recalled Zadie Smith’s essay “Fail Better,” in which she tries to arrive at a definition of great literature. She writes that an author’s literary style is about conveying “the only possible expression of a particular human consciousness.” Literary success, then, “depends not only on the refinement of words on a page, but in the refinement of a consciousness.”

Smith wrote this 16 years ago, well before AI text generators existed, but the term she repeats again and again in the essay—“consciousness”—reminded me of the debate among scientists and philosophers about whether AI is, or will ever be, conscious. That debate fell well outside my area of expertise, but I did know what consciousness means to me as a writer. For me, as for Smith, writing is an attempt to clarify what the world is like from where I stand in it.

That definition of writing couldn't be more different from the way AI produces language: by sucking up billions of words from the internet and spitting out an imitation. Nothing about that process reflects an attempt at articulating an individual perspective. And while people sometimes romantically describe AI as containing the entirety of human consciousness because of the quantity of text it inhales, even that isn't true; the text used to train AI represents only a narrow slice of the internet, one that reflects the perspective of white, male, anglophone authors more than anyone else. The world as seen by AI is fatally incoherent. If writing is my attempt to clarify what the world is like for me, the problem with AI is not just that it can't come up with an individual perspective on the world. It's that it can't even comprehend what the world is.

Lately, I've sometimes turned to ChatGPT for research. But I've stopped having it generate prose to stand in for my own. If my writing is an expression of my particular consciousness, I'm the only one capable of it. This applies, to be clear, to GPT-3's line about holding hands with my sister. In real life, she and I were never so sentimental. That's precisely why I kept writing over the AI's words with my own: The essay is equally about what AI promises us and how it falls short. As for Sudowrite's proposal to engineer an entire novel from a few keywords, forget it. If I wanted a product to deliver me a story on demand, I'd just go to a bookstore.

Illustration: Qianhui Yu

But what if I, the writer, don't matter? I joined a Slack channel for people using Sudowrite and scrolled through the comments. One caught my eye, posted by a mother who didn't like the [bookstore](#) options for stories to read to her little boy. She was using the product to compose her own adventure tale for him. Maybe, I realized, these products that are supposedly built for writers will actually be of more interest to readers.

I can imagine a world in which many of the people employed as authors, people like me, limit their use of AI or decline to use it altogether. I can also imagine a world—and maybe we're already in it—in which a new generation of readers begins using AI to produce the stories they want. If this type of literature satisfies readers, the question of whether it can match human-produced writing might well be judged irrelevant.

When I told Sims about this mother, he mentioned Roland Barthes' influential essay "The Death of the Author." In it, Barthes lays out an argument for favoring readers' interpretations of a piece of writing over whatever meaning the author might have intended. Sims proposed a sort of supercharged version of Barthes' argument in which a reader, able to produce not only a text's meaning but the text itself, takes on an even more powerful cultural role.

Sims thought AI would let any literature lover generate the narrative they want—specifying the plot, the characters, even the writing style—instead of hoping someone else will.

Sims' prediction made sense to me on an intellectual level, but I wondered how many people would actually want to cocreate their own literature. Then, a week later, I opened WhatsApp and saw a message from my dad, who grows mangoes in his yard in the coastal Florida town of Merritt Island. It was a picture he'd taken of his computer screen, with these words:

*Sweet golden mango,
Merritt Island's delight,
Juice drips, pure delight.*

Next to this was ChatGPT's logo and, underneath, a note: "My Haiku poem!"

The poem belonged to my dad in two senses: He had brought it into existence and was in possession of it. I stared at it for a while, trying to assess whether it was a good haiku—whether the doubling of the word "delight" was ungainly or subversive. I couldn't decide. But then, my opinion didn't matter. The literary relationship was a closed loop between my dad and himself.

In the days after the Sudowrite pile-on, those who had been helping to test its novel generator—hobbyists, [fan fiction writers](#), and a handful of published genre authors—huddled on the Sudowrite Slack, feeling attacked. The outrage by published authors struck them as classist and exclusionary, maybe even ableist. Elizabeth Ann West, an author on Sudowrite's payroll at the time who also makes a living writing *Pride and Prejudice* spinoffs,

wrote, “Well I am PROUD to be a criminal against the arts if it means now everyone, of all abilities, can write the book they’ve always dreamed of writing.”

It reminded me of something Sims had told me. “Storytelling is really important,” he’d said. “This is an opportunity for us all to become storytellers.” The words had stuck with me. They suggested a democratization of creative freedom. There was something genuinely exciting about that prospect. But this line of reasoning obscured something fundamental about AI’s creation.

As much as technologists might be driven by an intellectual and creative curiosity similar to that of writers—and I don’t doubt this of Sims and others—the difference between them and us is that their work is expensive. The existence of language-generating AI depends on huge amounts of computational power and special hardware that only the world’s wealthiest people and institutions can afford. Whatever the creative goals of technologists, their research depends on that funding.

The language of empowerment, in that context, starts to sound familiar. It’s not unlike [Facebook](#)’s mission to “give people the power to build community and bring the world closer together,” or Google’s vision of making the world’s information “universally accessible and useful.” If AI constitutes a dramatic technical leap—and I believe it does—then, judging from history, it will also constitute a dramatic leap in corporate capture of human existence. Big Tech has already transmuted some of the most ancient pillars of human relationships—friendship, community, influence—for its own profit. Now it’s coming after language itself.

What if a band of diverse, anti-capitalist writers and developers got together and created their own language model?

The fact that AI writing technologies seem more useful for people who buy books than for those who make them isn’t a coincidence: The investors behind these technologies are trying to recoup, and ideally redouble, their investment. Selling writing software to writers, in that context, makes about as much sense as selling cars to horses.

For now, investors are covering a lot of the cost of AI development in exchange for attracting users with the free use of tools like chatbots. But that won't last. People will eventually have to pay up, whether in cash or by relinquishing their personal information. At least some of the disposable income that readers currently spend supporting the livelihoods of human writers will then be funneled to Big Tech. To our annual [Amazon](#) and [Netflix](#) subscriptions, maybe we'll add a literature-on-demand subscription.

I'm sure I'll face pressure to sign up for a literature-on-demand subscription myself. The argument will be that my life as a writer is better because of it, since I will be able to produce language, say, a hundred times faster than before. Another argument, surely, will be that I have no choice: How else will I be able to compete?

Maybe I'll even be competing with AI-produced writing that sounds like mine. This is a serious concern of the [Authors Guild](#) and PEN America, both of which have called for consent from writers, and compensation, before their work can be used to train AI models. Altman, now OpenAI's CEO, also stated before Congress that he feels artists "deserve control over how their creations are used." Even if authors' demands are met, though, I wonder whether it'd be worth it.

In one of my last phone calls with Sims, he told me he'd been reading and enjoying my novel, which had finally been published the previous year. Did I want him, he asked, to send me an AI-generated screenplay of it? I might have yelped a little. I might have used the word "terrifying." Then I softened my stance, not wanting to be rude, or (worse) hypocritical. I explained that my novel had already been optioned and was in the process of being adapted—though the screenwriter was currently on strike over Hollywood studios' refusal to, among other things, restrict the use of AI for screenwriting. I thanked Sims for his interest and declined.

Illustration: Qianhui Yu

What about the cost to literature when all that humans have put on the internet gets vacuumed up and repurposed in Big Tech's image? To start, an AI-dominated literature would reflect the values, [biases](#), and writing styles embedded in the most powerful AI models. Over time, it would all start to

sound alike. Some research even suggests that if later AI models are trained using AI-produced text—which would be hard to avoid—the sameness of the material could trigger a scenario called model collapse, in which AI loses its grasp on how real human language functions and is no longer able to form coherent sentences. One wonders whether, at that point, humans will still have the ability themselves.

A thought experiment occurred to me at some point, a way to disentangle AI's creative potential from its commercial potential: What if a band of diverse, anti-capitalist writers and developers got together and created their own language model, trained only on words provided with the explicit consent of the authors for the sole purpose of using the model as a creative tool?

That is, what if you could build an AI model that elegantly sidestepped all the ethical problems that seem inherent to AI: the lack of consent in training, the reinforcement of bias, the poorly paid [gig workforce](#) supporting it, the cheapening of artists' labor? I imagined how rich and beautiful a model like this could be. I fantasized about the emergence of new forms of communal creative expression through human interaction with this model.

Then I thought about the resources you'd need to build it: prohibitively high, for the foreseeable future and maybe forevermore, for my hypothetical cadre of anti-capitalists. I thought about how reserving the model for writers would require policing who's a writer and who's not. And I thought about how, if we were to commit to our stance, we would have to prohibit the use of the model to generate individual profit for ourselves, and that this would not be practicable for any of us. My model, then, would be impossible.

In July, I was finally able to reach Yu, Sudowrite's cofounder. Yu told me that he's a writer himself; he got started after reading the literary science fiction writer Ted Chiang. In the future, he expects AI to be an uncontroversial element of a writer's process. "I think maybe the next Ted Chiang—the young Ted Chiang who's 5 years old right now—will think nothing of using AI as a tool," he said.

Recently, I plugged this question into ChatGPT: “What will happen to human society if we develop a dependence on AI in communication, including the creation of literature?” It spit out a numbered list of losses: traditional literature’s “human touch,” jobs, literary diversity. But in its conclusion, it subtly reframed the terms of discussion, noting that AI isn’t all bad: “Striking a balance between the benefits of AI-driven tools and preserving the essence of human creativity and expression would be crucial to maintain a vibrant and meaningful literary culture.” I asked how we might arrive at that balance, and another dispassionate list—ending with another both-sides-ist kumbaya—appeared.

At this point, I wrote, maybe trolling the bot a little: “What about doing away with the use of AI for communication altogether?” I added: “Please answer without giving me a list.” I ran the question over and over—three, four, five, six times—and every time, the response came in the form of a numbered catalog of pros and cons.

It infuriated me. The AI model that had helped me write “Ghosts” all those months ago—that had conjured my sister’s hand and let me hold it in mine—was dead. Its own younger sister had the witless efficiency of a stapler. But then, what did I expect? I was conversing with a software program created by some of the richest, most powerful people on earth. What this software uses language for could not be further from what writers use it for. I have no doubt that AI will become more powerful in the coming decades—and, along with it, the people and institutions funding its development. In the meantime, writers will still be here, searching for the words to describe what it felt like to be human through it all. Will we read them?

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By [Jennifer Kahn](#)

[Backchannel](#)

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Crispr Pioneer Jennifer Doudna Has the Guts to Take On the Microbiome

The world-famous biochemist is ready to tackle everything from immune disorders and mental illness to climate change—all by altering microbes in the digestive tract.

Photograph: KELSEY MCCLELLAN

I see you, reader. You drink the probiotic seltzer, with its gut-improving bacteria, *and* the fiber-filled prebiotic. You regularly consume eclectic fermented foods and burly amounts of kale to [diversify those precious microbes](#) in your digestive tract. Because, after all, what *isn't* the microbiome responsible for? It's been all the rage for the past few years, with scientists hoping it could help treat everything from immune disorders to mental illness. How exactly that will work is something we're just starting to explore. This spring, the effort got a boost when UC Berkeley biochemist and gene-editing pioneer Jennifer Doudna, who won a Nobel Prize in 2020 for coinventing [Crispr](#), joined the pursuit. Her first order of business, spearheaded by Berkeley's Innovative Genomics Institute: fine-tuning our microbiome by genetically editing the microbes it contains *while they're still inside us* to prevent and treat diseases like childhood asthma. (Full disclosure: I teach at Berkeley's journalism school.) Oh, she also wants to slow climate change by doing the same thing in cows, which are collectively responsible for a shocking amount of greenhouse gas.

The Big Interview

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As someone who has [written](#) about genetic engineering in the past, I have to admit that my first reaction was: No way. The gut microbiome contains around 4,500 different kinds of bacteria plus untold viruses, and even fungi (so far: in practice we've only just started counting) in such massive quantities that it weighs close to half a pound. (Microbes are so tiny that 30 trillion bacteria would weigh roughly 1 ounce. So half a pound is *a lot*.)

Figuring out which ones are responsible for which ailments is tricky. First you need to know what's causing the problem: like maybe something is producing too much of a particular inflammatory molecule. Then you have to figure out which microbe—or microbes—is doing that, and also which gene within that microbe. Then, in theory, you can fix it. Not in a petri dish, but *in situ*—meaning in our fully active, roiling, squishing stomach and intestines while they continue to do all the stuff they usually do.

Until recently, it would have seemed insane—not to mention literally impossible—to edit all the microbes belonging to a species within a vast ecosystem like our gut. And to be fair, Doudna and her collaborator, Jill Banfield, still don't know quite how it will work. But they think it can be done, and in April, TED's Audacious Project donated \$70 million to support the effort. My own gut feeling (right?) was that this was either brilliant or terrifying, or possibly both at once. Brilliant because it had the potential to head off or treat diseases in an incredibly targeted and noninvasive way. Terrifying because, well, you know ... releasing a bunch of inert viruses equipped with gene-editing machinery into the vital ecosystem that is our gut microbiome—what could go wrong? With that in mind, I invited Jennifer Doudna to my house for a chat about the future of microbiome medicine.

Jennifer Kahn: Hi! Welcome. You're so famous now, I sort of imagined you pulling up in a motorcade. You're still driving yourself?

Jennifer Doudna: Still driving myself.

Can I get you anything? Water? Coffee? Kombucha? What's your take on kombucha?

I don't have an official position on kombucha.

Do you drink it?

I usually like to keep things simple.

I was curious because your latest project is focusing on the microbiome. Specifically, you want to genetically engineer bacteria in the human gut. I have to admit that when I first heard this, my first thought was: Really? It's so complex!

Well, it's become more and more clear that we are our microbiome. And that's only become clear in the last, I don't know, decade or so. Before that, there was a sense that microorganisms are a very different kingdom of life, and they were studied one at a time and cultured in a laboratory dish. But increasingly we're recognizing that they're everywhere. Like, we have more microbes in our bodies than we have human cells! It's crazy.

And now people think the microbiome is involved in all kinds of things. Not just the stuff you'd expect, like digestive disorders and obesity, but things like depression and anxiety, or whether a person will respond to a cancer drug. So there are a lot of ducks in that pond, if you want to go hunting. How come you're starting with childhood asthma?

First, asthma is an important disease and we'd like to make progress there therapeutically. But our thinking is also: Let's start with a system where we know for sure that there's a direct connection. We're working with a wonderful scientist at UC San Francisco, Sue Lynch, and she's identified a molecule that turns up in the gut of children who go on to develop asthma. It's an inflammatory molecule.

And you want to genetically edit the bacteria that makes this molecule? So it doesn't make it anymore? Or makes less of it?

That's the idea. To use Crispr to eliminate the production of that asthma-inducing molecule while keeping the rest of the gut microbiome untouched.

Photograph: KELSEY MCCLELLAN

Has the UCSF scientist figured out why some kids have more of this molecule? Like, do you know which kind of bacteria makes it, and also which gene within those bacteria?

Yes and yes. We know the bug, and we know the gene responsible. What's less clear right now is how that kind of manipulation will affect the rest of the microbiome.

Why not just fix it? If you know this microbe is spewing out a bad thing—and one that only shows up in kids with asthma—why not just stop it?

Yeah, well, that may be absolutely the right answer. But the microbiome is tied to a lot of other things, so it's complicated. Like when you make a change to the production of one molecule in the microbiome, that could have other consequences depending on what somebody's diet is or what their genetic makeup is or what other disease susceptibilities they have. Those are the kinds of things that it will be really important to understand. So the initial goal is really to use Crispr as a research tool to try to answer those kinds of questions.

Is there any way in the lab even to mimic all that genetic variation and dietary variation, and how it's going to interact?

Sure!

Really? Like you can see how editing a gene in a microbe will affect someone who only eats fast food versus someone who only eats kale?

Well, yeah, it may take a little longer to get to that level. But, you know, one of the things that we're doing right now—this is the royal we—is to cultivate fecal samples taken from infants. And for the microbes in those samples, you can do things like—I mean, you can't exactly ask them to eat

kale versus Big Macs, but you can certainly alter the food sources they get and look at how environmental changes affect their behavior, and that sort of thing.

Why edit these things at all? Why not just increase the number of good microbes in your gut by changing your diet or taking probiotics?

I mean, you could do that. But it's the difference between trying to eat food that's healthy versus taking a drug that will have a much more potent and specific effect. It's the same with Crispr. You're going have a much more targeted, specific effect on the microbiome than if you try to make those manipulations by changing your diet.

How does this editing actually happen? Are people drinking a drink? Taking a pill?

To be fair, we're not anywhere close to that right now. We're at the level of trying to figure out which genes to manipulate, in which bugs, and that kind of thing. But in the long run, it's a great question. How do you use a gene-editing tool like Crispr in a natural setting like the human gut? First, you have to be able to get these editors into the bugs where they'll have an impact. There's a whole research program going on now at the IGI around exactly that. And as it turns out, different kinds of bacteria take up molecules in different ways. Some of them take up molecules directly, by opening pores in their membranes, others require a virus to bring in a molecule.

OK, you've lost me. What do you mean by “bring in a molecule”?

It literally just means allowing a molecule into a cell. And if that molecule is a gene editor, then it can edit genes. So we're really at the early days of trying to figure out, for all the microbes in the human gut, how do they allow molecules to get in? And the answer is, it's different for different bugs. So in the future I think it'll come down to understanding which bugs need to be manipulated and how they are best able to take up these editing molecules. But ideally there would be a way to do it orally—taking a pill, for example.

What's the alternative? I mean, you don't want to do surgery or inject people in the stomach.

Well, you've probably heard of fecal transplants. But I think most people would prefer another option.

Something that starts at the other end.

Right. So having a way to deliver these Crispr molecules orally would be great. But it's going to take some real work to figure out how to do that. And, of course, ultimately we also want to understand the fundamental biology, how these microbes are connected to diseases that are more complex. For instance, there's evidence that neurodegenerative diseases like Alzheimer's are actually very closely associated with the microbiome in ways that still have to be discovered. We actually have a separately funded program that works on neurodegenerative diseases specifically. That program focuses on Huntington's disease, not Alzheimer's, but imagine if you could use the microbiome-targeting form of Crispr to protect people that haven't even developed Huntington's or Alzheimer's yet. That would be amazing.

Not to be alarmist, but my understanding is that microbiomes are like ecosystems: There are helpful species and harmful ones that exist in a balance. If you genetically edit one species, don't you risk throwing that delicate balance out of whack?

Well, we already use things like antibiotics, which kill off multiple different kinds of bugs in the microbiome—including the one that's causing you to be sick, but others as well—and there are clearly consequences of that. Crispr is safer, because the precision allows you to target not all the bugs at once but one particular type. And not only that, but one particular gene in one particular bug.

True. But microbes also do something that people don't, which is share genes among themselves. How do you know that a gene you put in one microbe won't end up causing problems in another microbe?

Well, that's why we want to start by testing all these things in the lab and seeing what happens.

OK. But realistically, we haven't been able to culture most of the stuff in our gut, right? Which means that even after all the lab work, there are still going to be some unknown unknowns. Is the idea that at some point you'll just have to say: From what we can see, it seems safe?

When developing a new therapy of any type, lab models can only take you part of the way. With microbiomes, what we're able to do in the lab is getting more sophisticated. By growing microbes in their native communities and in conditions more comparable to their native environment, the behavior is more similar to what would be seen in a human system, but it can never be exactly the same. In some cases, we already know what the healthy state looks like—one person's microbiome produces an inflammatory compound, while another person's doesn't. Having that kind of information plus our experimental work in increasingly accurate models of the gut microbiome helps us feel confident about moving forward.

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Let's switch gears. There's another part to this project that's about climate change. Specifically, people found that feeding cows a particular kind of seaweed reduces the amount of "methane burps" they make by 80 percent. Of course, it's not practical to harvest and transport that much seaweed. So the idea is to modify a calf's microbiome to have the same effect, is that right?

Yes, and ideally in a one-and-done kind of treatment. Like, if you could manipulate the microbiome in the calf rumen at birth in a way that could be maintained, that would lead to dramatically reduced methane emissions. Which would have an enormous effect. I was actually shocked to learn that about a third of global methane emissions every year comes from agriculture, primarily from cattle.

Isn't there already a shift to plant-based meat?

So you've got [Impossible Foods](#), right, and other people who are trying to replace cows as a source of meat, but realistically that's not going to happen quickly. And if I had to guess, it's [not going to happen completely](#). So it would be great to have an alternative where you can still farm cattle but do it in an environmentally friendly fashion.

Photograph: KELSEY MCCLELLAN

Do you actually know which microbes are involved in methane production in the cow rumen? And what changes would need to be made to mimic the effect of a seaweed diet?

That's part of what we have to figure out. The manipulations that have been done with the diet are more at the macro level, where you can see that you're making a change, but at the microscopic level you don't know what those changes are. And at an even deeper level, we want to understand: What are the genetics of methane production? What genetic manipulations can we make that will lead to real change there?

Why do this through the microbiome? You could just genetically modify the cow, right?

That's a possibility too. But to do the research necessary to make a new strain of cattle, and then figure out how that would impact methane production in practice—it would take a long time. Going after the microbiome is just a faster approach. And right now, with climate, we need to be fast.

When it comes to saving the planet, there's this notion of there being two philosophies: the wizard and the prophet. Roughly, the wizard is the person who sees technology as the solution. And the prophet is the person who thinks we should go back to the simple ways. You—understandably—are taking a technological approach to climate change. You're trying to wizard our way out of it. Is that how you see it?

You know, I think in a perfect world—which we don’t live in—all of us would be cutting back, and at the same time we’d be advancing technologies to address climate change. But I think the reality is that human beings are not going to want to regress. It’s not human nature. So I think the solution to climate change is absolutely going to be about technologies. And will those technologies create new problems? They probably will, and we’re going to have to deal with that. But I just don’t think it’s realistic to believe that we’ll get a handle on climate change any other way, frankly.

I understand you really don’t want to go on the record about this, but there are so many prebiotic and probiotic products out there now. Do you think this is a good development? Or it’s all basically a crock?

Yeah, I'm gonna defer on that question. Because, you know, as a scientist, I don't have enough data on it.

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By [Christopher Beam](#)

[Backchannel](#)

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The AI Detection Arms Race Is On

And college students are developing the weapons, quickly building tools that identify AI-generated text—and tools to evade detection.

Illustration: James Marshall

Edward Tian didn't think of himself as a writer. As a computer science major at Princeton, he'd taken a couple of journalism classes, where he learned the basics of reporting, and his sunny affect and tinkerer's curiosity endeared him to his teachers and classmates. But he describes his writing style at the time as "pretty bad"—formulaic and clunky. One of his journalism professors said that Tian was good at "pattern recognition," which was helpful when producing news copy. So Tian was surprised when, sophomore year, he managed to secure a spot in John McPhee's exclusive non-fiction writing seminar.

Every week, 16 students gathered to hear the legendary *New Yorker* writer dissect his craft. McPhee assigned exercises that forced them to think rigorously about words: Describe a piece of modern art on campus, or prune the Gettysburg Address for length. Using a projector and slides, McPhee shared hand-drawn diagrams that illustrated different ways he structured his own essays: a straight line, a triangle, a spiral. Tian remembers McPhee saying he couldn't tell his students how to write, but he could at least help them find their own unique voice.

If McPhee stoked a romantic view of language in Tian, computer science offered a different perspective: language as statistics. During the pandemic, he'd taken a year off to work at the BBC and intern at [Bellingcat](#), an open source [journalism project](#), where he'd written code to detect Twitter bots.

As a junior, he'd taken classes on machine learning and natural language processing. And in the fall of 2022, he began to work on his senior thesis about detecting the differences between AI-generated and human-written text.

When [ChatGPT](#) debuted in November, Tian found himself in an unusual position. As the world lost its mind over this new, radically improved chatbot, Tian was already familiar with the underlying GPT-3 technology. And as a journalist who'd worked on rooting out disinformation campaigns, he understood the implications of AI-generated content for the industry.

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Photograph: Jessica Chou

While home in Toronto for winter break, Tian started playing around with a new program: a ChatGPT detector. He posted up at his favorite café, slamming jasmine tea, and stayed up late coding in his bedroom. His idea was simple. The software would scan a piece of text for two factors: “perplexity,” the randomness of word choice; and “burstiness,” the complexity or variation of sentences. Human writing tends to rate higher than AI writing on both metrics, which allowed Tian to guess how a piece of text had been created. Tian called the tool [GPTZero](#)—the “zero” signaled truth, a return to basics—and he put it online the evening of January 2. He posted a link on Twitter with a brief introduction. The goal was to combat “increasing AI plagiarism,” he wrote. “Are high school teachers going to want students using ChatGPT to write their history essays? Likely not.” Then he went to bed.

Tian woke up the next morning to hundreds of retweets and replies. There was so much traffic to the host server that many users couldn't access it. “It was totally crazy,” Tian says. “My phone was blowing up.” A friend congratulated him on winning the internet. Teens on TikTok called him a narc. “A lot of the initial hate was like, ‘This kid is a snitch, he doesn’t have a life, he never had a girlfriend,’” says Tian with a grin. “Classic stuff.” (Tian has a girlfriend.) Within days, he was fielding calls from journalists around the world, eventually appearing on everything from NPR to the

South China Morning Post to *Anderson Cooper 360*. Within a week, his original tweet had reached more than 7 million views.

GPTZero was a new twist in the media narrative surrounding ChatGPT, which had inspired industrywide hand-wringing and a scourge of AI-generated ledes. (Researchers had created a detector for GPT-2 text in 2019, but Tian’s was the first to target ChatGPT.) Teachers thanked Tian for his work, grateful they could finally prove their suspicions about fishy student essays. Had humanity found its savior from the robot takeover?

Tian’s program was a starting gun of sorts. The race was now on to create the definitive AI detection tool. In a world increasingly saturated with AI-generated content, the thinking went, we’ll need to distinguish the machine-made from the human-made. GPTZero represented a promise that it will indeed be possible to tell one from the other, and a conviction that the difference matters. During his media tour, Tian—smiley, earnest, the A student incarnate—elaborated on this reassuring view that no matter how sophisticated generative AI tools become, we will always be able to unmask them. There’s something irreducible about human writing, Tian said: “It has an element that can never be put into numbers.”

Life on the internet has always been a battle between fakers and detectors of fakes, with both sides profiting off the clash. Early spam filters sifted emails for keywords, blocking messages with phrases like “FREE!” or “be over 21,” and they eventually learned to filter out entire styles of writing.

Spammers responded by surrounding their pitches with snippets of human-sounding language lifted from old books and mashed together. (This type of message, dubbed “litspam,” became a genre unto itself.) As search engines grew more popular, creators looking to boost their pages’ rankings resorted to “keyword stuffing”—repeating the same word over and over—to get priority. Search engines countered by down-ranking those sites. After Google introduced its PageRank algorithm, which favored websites with lots of inbound links, spammers created entire ecosystems of mutually supporting pages.

Around the turn of the millennium, the [captcha tool](#) arrived to sort humans from bots based on their ability to interpret images of distorted text. Once some bots could handle that, captcha added other detection methods that

included parsing images of motorbikes and trains, as well as sensing mouse movement and other user behavior. (In a recent test, an early version of GPT-4 showed that it knew how to hire a person on Taskrabbit to complete a captcha on its behalf.) The fates of entire companies have rested on the issue of spotting fakes: Elon Musk, in an attempt to wriggle out of his deal to buy Twitter, cited a bot detector to [boost his argument](#) that Twitter had misrepresented the number of bots on its site.

Generative AI re-upped the ante. While large language models and text-to-image generators have been evolving steadily over the past decade, 2022 saw an explosion of consumer-friendly tools like ChatGPT and Dall-E. Pessimists argue that we could soon drown in a tsunami of synthetic media. “In a few years, the vast majority of the photos, videos, and text we encounter on the internet could be AI-generated,” *New York Times* technology columnist Kevin Roose [warned](#) last year. *The Atlantic* imagined a looming “[textpocalypse](#)” as we struggle to filter out the generative noise. Political campaigns are leveraging AI tools to create ads, while Amazon is flooded with ChatGPT-written books (many of them about AI). Scrolling through product reviews already feels like the world’s most annoying Turing test. The next step seems clear: If you thought Nigerian prince emails were bad, wait until you see Nigerian prince chatbots.

Soon after Tian released GPTZero, a wave of similar products appeared. OpenAI rolled out its own detection tool at the end of January, while Turnitin, the anti-plagiarism giant, unveiled a classifier in April. They all shared a basic methodology, but each model was trained on different data sets. (For example, Turnitin focused on student writing.) As a result, precision varied wildly, from OpenAI’s claim of 26 percent accuracy for detecting AI-written text, up to the most optimistic claim from a company called Winston AI at 99.6 percent. To stay ahead of the competition, Tian would have to keep improving GPTZero, come up with its next product, and finish college in the meantime.

Right away, Tian recruited his high school friend Alex Cui as CTO and, over the following weeks, brought on a handful of programmers from Princeton and Canada. Then, in the spring, he onboarded a trio of coders from Uganda, whom he’d met four years earlier while working for a startup

that trains engineers in Africa. (A global citizen, Tian was born in Tokyo and lived in Beijing until age 4 before his parents, both Chinese engineers, moved the family to Ontario.) Together the team began working on its next application: a Chrome plug-in that would scan the text of a web page and determine whether it was AI-generated.

Another threat to GPTZero was GPTZero. Almost immediately after it launched, skeptics on social media started posting embarrassing examples of the tool misclassifying texts. Someone pointed out that it flagged portions of the US Constitution as possibly AI-written. Mockery gave way to outrage when stories of students falsely accused of cheating due to GPTZero began to flood Reddit. At one point, a parent of one such student reached out to Soheil Feizi, a professor of computer science at the University of Maryland. “They were really furious,” Feizi said. Last fall, before GPTZero debuted, Feizi and some other Maryland colleagues had begun putting together a research project on the problems with AI detectors, which he’d suspected might not be reliable. Now GPTZero and its imitators got him thinking they could do more harm than good.

Yet another headache for Tian was the number of crafty students finding ways around the detector. One person on Twitter instructed users to insert a zero-width space before every “e” in a ChatGPT-generated text. A TikTok user wrote a program that bypassed detection by replacing certain English letters with their Cyrillic look-alikes. Others started running their AI text through QuillBot, a popular paraphrasing tool. Tian patched these holes, but the workarounds kept coming. It was only a matter of time before someone spun up a rival product—an anti-detector.

In early March, a Stanford University freshman named Joseph Semrai and some friends were driving down the Pacific Coast Highway to LA when they got locked out of their Zipcar in Ventura. They walked to a nearby Starbucks and waited for roadside assistance. But as the wait dragged on for hours, Semrai and a friend wondered how to make up for the lost time. Semrai had an essay due the following week for a required freshman writing class. It was his least favorite type of assignment: a formulaic essay meant to show logical reasoning. “It’s a pretty algorithmic process,” says Semrai.

ChatGPT was the obvious solution. But at the time, its responses tended to max out at a few paragraphs, so generating a full-length essay would be a multistep process. Semrai wanted to create a tool that could write the paper in one burst. He also knew there was a chance it could be detected by GPTZero. With the encouragement of his friend, Semrai pulled out his laptop and ginned up a script that would write an essay based on a prompt, run the text through GPTZero, then keep tweaking the phrasing until the AI was no longer detectable—essentially using GPTZero against itself.

Semrai introduced his program a few days later at Friends and Family Demo Day, a kind of show-and-tell for Stanford’s undergraduate developer community. Standing before a roomful of classmates, he asked the audience for an essay topic—someone suggested “fine dining” in California—and typed it into the prompt box. After a few seconds, the program spat out an eight-paragraph essay, unoriginal but coherent, with works cited. “Not saying I’d ever submit this paper,” Semrai said, to chuckles. “But there you go. I dunno, it saves time.” He named the tool [WorkNinja](#) and put it on the app store two months later. With the help of a promotional campaign featuring the Gen Z influencer David Dobrik and a giveaway of 10 Teslas to users who signed up, it received more than 350,000 downloads in the first week; sign-ups have slowed since then to a few hundred a day, according to Semrai. (Semrai wouldn’t say who funded the campaign, only that it was a major Silicon Valley angel investor.)

Semrai’s Zoomer mop and calm demeanor belie a simmering intensity. Whereas Tian bounces and bubbles his way through the world, Semrai comes across as focused and deadpan. The 19-year-old speaks in the confident, podcast-ready tone of a Silicon Valley entrepreneur who sees the world in terms of problems to be solved, ending every other sentence with, “Right?” Listening to him wax on about defensible moats and the “S-curve” of societal growth, it’s easy to forget he can’t legally drink. But then, occasionally, he’ll say something that reveals the wide-eyed undergrad, open to the world and still figuring out his place in it. Like the time he and a friend walked around the Santa Monica pier until 3 am, “talking about what we value.” Semrai thinks a lot about how to find balance and happiness. “I think, while I’m young, it probably lies more in exploring the derivative,” he says, “chasing the highs and lows.”

Growing up in New York and then Florida, his parents—a firefighter father from Yonkers and a homemaker mother from China—gave him a long leash. “I was kinda left during childhood to pursue what genuinely excited me,” he said. “The best way to do that was to make stuff on the computer.” When Semrai was 6 he created a plug-in to assign permission levels for *Minecraft* servers, and at 7 he wrote a program that patched Windows 7 so you could run Windows XP on it. “It just makes me genuinely happy to ship things for people,” he says.

His family moved from Queens to Palm City when he was 9, and Semrai saw the difference between the public school systems. The basic computer literacy he’d taken for granted in New York schools was scarce in Florida. He started writing programs to help fill gaps in education—a trajectory that allows him to say, at 19, that he’s been “working in ed tech my entire life.” Freshman year of high school, he created an online learning platform that won startup funding in a local competition. Prior to Covid, he’d created a digital hall pass system that became the basis for contact tracing and was adopted by 40 school districts in the Southeast.

Semrai is fundamentally a techno-optimist. He says he believes that we should speed the development of technology, including artificial general intelligence, because it will ultimately lead us toward a “post-scarcity” society—a worldview sometimes described as “effective accelerationism.” (Not to be confused with effective altruism, which holds that we should take actions that maximize “good” outcomes, however defined.) Semrai’s case for WorkNinja rests on its own kind of accelerationist logic. AI writing tools are good, in his view, not because they help kids cheat, but because they’ll force schools to revamp their curricula. “If you can follow a formula to create an essay, it’s probably not a good assignment,” he says. He envisions a future in which every student can get the kind of education once reserved for aristocrats, by way of personalized AI tutoring. When he was first learning how to program, Semrai says, he relied largely on YouTube videos and internet forums to answer his questions. “It would have been easier if there was a tutor to guide me,” he says. Now that AI tutors are real, why stand in their way?

Joseph Semrai, 19, creator of WorkNinja, a tool that generates AI-written essays.

Illustration: James Marshall; Photograph: Charis Morgan

I recently used WorkNinja to generate a handful of essays, including one about Darwin's theory of evolution. The first version it gave me was clumsy and repetitive, but workable, exploring the theory's implications for biology, genetics, and philosophy. GPTZero flagged it as likely AI-generated.

So I hit WorkNinja's Rephrase button. The text shifted slightly, replacing certain words with synonyms. After three rephrasings, GPTZero finally gave the text its stamp of humanity. (When I tested the same text again a few weeks later, the tool labeled it a mix of human and AI writing.) The problem was, many of the rephrased sentences no longer made sense. For example, the following sentence:

Darwin's theory of evolution is the idea that living species evolve over time due to their interaction with their environment.

had morphed to become:

Darwin's theory of evolution is the thought that living species acquire over clip due to their interaction with their surroundings.

At the very least, any student looking for a shortcut would have to clean up their WorkNinja draft before submitting it. But it points to a real issue: If even this janky work in progress can circumvent detectors, what could a sturdier product accomplish?

In March, Soheil Feizi at the University of Maryland [published his findings](#) on the performance of AI detectors. He argued that accuracy problems are inevitable, given the way AI text detectors worked. As you increase the sensitivity of the instrument to catch more AI-generated text, you can't avoid raising the number of false positives to what he considers an unacceptable level. So far, he says, it's impossible to get one without the other. And as the statistical distribution of words in AI-generated text edges

closer to that of humans—that is, as it becomes more convincing—he says the detectors will only become less accurate. He also found that paraphrasing baffles AI detectors, rendering their judgments “almost random.” “I don’t think the future is bright for these detectors,” Feizi says.

“[Watermarking](#)” doesn’t help either, he says. Under this approach, a generative AI tool like ChatGPT proactively adjusts the statistical weights of certain interchangeable “token” words—say, using *start* instead of *begin*, or *pick* instead of *choose*—in a way that would be imperceptible to the reader but easily spottable by an algorithm. Any text in which those words appear with a given frequency could be marked as having been generated by a particular tool. But Feizi argues that with enough paraphrasing, a watermark “can be washed away.”

In the meantime, he says, detectors are hurting students. Say a detection tool has a 1 percent false positive rate—an optimistic assumption. That means in a classroom of 100 students, over the course of 10 take-home essays, there will be on average 10 students falsely accused of cheating. (Feizi says a rate of one in 1,000 would be acceptable.) “It’s ridiculous to even think about using such tools to police the use of AI models,” he says.

Tian says the point of GPTZero isn’t to catch cheaters, but that has inarguably been its main use case so far. (GPTZero’s detection results now come with a warning: “These results should not be used to punish students.”) As for accuracy, Tian says GPTZero’s current level is 96 percent when trained on its most recent data set. Other detectors boast higher figures, but Tian says those claims are a red flag, as it means they’re “overfitting” their training data to match the strengths of their tools. “You have to put the AI and human on equal footing,” he says.

Surprisingly, AI-generated images, videos, and audio snippets are far easier to detect, at least for now, than synthetic text. Reality Defender, a startup backed by Y Combinator, launched in 2018 with a focus on fake image and video detection and has since branched out to audio and text. Intel released a tool called FakeCatcher, which detects deepfake videos by analyzing facial blood flow patterns visible only to the camera. A company called Pindrop uses voice “biometrics” to detect spoofed audio and to authenticate callers in lieu of security questions.

The siren call of AI says, *It doesn't have to be this way*. And when you consider the billions of people who sit outside the elite club of writer-sufferers, you start to think: Maybe it *shouldn't* be this way.

AI-generated text is more difficult to detect because it has relatively few data points to analyze, which means fewer opportunities for AI output to deviate from the human norm. Compare that to Intel's FakeCatcher. Ilke Demir, a research scientist for Intel who has also worked on Pixar films, says it would be extremely difficult to create a data set large and detailed enough to allow deepfakers to simulate blood flow signatures to fool the detector. When I asked whether such a thing could eventually be created, she said her team anticipates future developments in deepfake technology in order to stay ahead of them.

Ben Colman, CEO of Reality Defender, says his company's detection tools are unevadable in part because they're private. (So far, the company's clients have mainly been governments and large corporations.) With publicly available tools like GPTZero, anyone can run a piece of text through the detector and then tweak it until it passes muster. Reality Defender, by contrast, vets every person and institution that uses the tool, Colman says. They also watch out for suspicious usage, so if a particular account were to run tests on the same image over and over with the goal of bypassing detection, their system would flag it.

Regardless, much like spam hunters, spies, vaccine makers, chess cheaters, weapons designers, and the entire cybersecurity industry, AI detectors across all media will have to constantly adapt to new evasion techniques. Assuming, that is, the difference between human and machine still matters.

The more time I spent talking with Tian and Semrai and their classmate-colleagues, the more I wondered: Do any of these young people actually ... enjoy writing? "Yeah, a lot!" said Tian, beaming even more than usual when I asked him last May on Princeton's campus. "It's like a puzzle." He likes figuring out how words fit together and then arranging the ideas so they flow. "I feel like that's fun to do." He also loves the interview process, as it gives him "a window into people's lives, plus a mirror into how you live your own."

In high school, Tian says, writing felt like a chore. He credits McPhee for stoking his love and expanding his taste. In June, he told me excitedly that he had just picked up a used copy of Annie Dillard's *The Writing Life*.

Semrai similarly found high school writing assignments boring and mechanistic—more about synthesizing information than making something new. “I’d have preferred open-format assignments that would’ve sparked creativity,” he says. But he put those synthesizing skills to work. Sophomore year, he wrote an 800-page instructional book called *Build for Anything*, intended “to take someone from knowing nothing to knowing a little bit of almost everything” about web development. (He self-published the book on Amazon in 2022 and sold a few hundred copies.) Semrai said it’s the kind of prose ChatGPT now excels at. “I don’t think the book falls into the category of meaningful writing,” he says.

After almost 20 years of typing words for money, I can say from experience, writing sucks. Ask any professional writer and they’ll tell you, it’s the worst, and it doesn’t get easier with practice. I can attest that the enthusiasm and curiosity required to perpetually scan the world, dig up facts, and wring them for meaning can be hard to sustain. And that’s before you factor in the state of the industry: dwindling rates, shrinking page counts, and shortening attention spans (readers’ and my own). I keep it up because, for better or worse, it’s now who I am. I do it not for pleasure but because it feels meaningful—to me at least.

Some writers romanticize the struggle. McPhee once described lying on a picnic table for two weeks, trying to decide how to start an article. “The piece would ultimately consist of some five thousand sentences, but for those two weeks I couldn’t write even one,” he wrote. Another time, at age 22, he lashed himself to his writing chair with a bathrobe belt. According to Thomas Mann, “A writer is someone for whom writing is more difficult than it is for other people.” “You search, you break your heart, your back, your brain, and then—only then—it is handed to you,” writes Annie Dillard in *The Writing Life*. She offers this after a long comparison of writing to alligator wrestling.

The implication is that the harder the squeeze, the sweeter the juice—that there’s virtue in staring down the empty page, taming it, forcing it to give

way to prose. This is how the greatest breakthroughs happen, we tell ourselves. The agony is worth it, because that's how ideas are born.

The siren call of AI says, *It doesn't have to be this way*. And when you consider the billions of people who sit outside the elite club of writer-sufferers, you start to think: Maybe it *shouldn't* be this way.

May Habib spent her early childhood in Lebanon before moving to Canada, where she learned English as a second language. "I thought it was pretty unfair that so much benefit would accrue to someone really good at reading and writing," she says. In 2020, she founded [Writer](#), one of several hybrid platforms that aims not to replace human writing, but to help people—and, more accurately, brands—collaborate better with AI.

Habib says she believes there's value in the blank page stare-down. It helps you consider and discard ideas and forces you to organize your thoughts. "There are so many benefits to going through the meandering, head-busting, wanna-kill-yourself staring at your cursor," she says. "But that has to be weighed against the speed of milliseconds."

The purpose of Writer isn't to write for you, she says, but rather to make your writing faster, stronger, and more consistent. That could mean suggesting edits to prose and structure, or highlighting what else has been written on the subject and offering counterarguments. The goal, she says, is to help users focus less on sentence-level mechanics and more on the ideas they're trying to communicate. Ideally, this process yields a piece of text that's just as "human" as if the person had written it entirely themselves. "If the detector can flag it as AI writing, then you've used the tools wrong," she says.

The black-and-white notion that writing is either human- or AI-generated is already slipping away, says Ethan Mollick, a professor at the Wharton School of the University of Pennsylvania. Instead, we're entering an era of what he calls "centaur writing." Sure, asking ChatGPT to spit out an essay about the history of the Mongol Empire produces predictably "AI-ish" results, he says. But "start writing, 'The details in paragraph three aren't quite right—add this information, and make the tone more like *The New*

Yorker,” he says. “Then it becomes more of a hybrid work and much better-quality writing.”

Mollick, who teaches entrepreneurship at Wharton, not only allows his students to use AI tools—he requires it. “Now my syllabus says you have to do at least one impossible thing,” he says. If a student can’t code, maybe they write a working program. If they’ve never done design work, they might put together a visual prototype. “Every paper you turn in has to be critiqued by at least four famous entrepreneurs you simulate,” he says.

Students still have to master their subject area to get good results, according to Mollick. The goal is to get them thinking critically and creatively: “I don’t care what tool they’re using to do it, as long as they’re using the tools in a sophisticated manner and using their mind.”

Mollick acknowledges that ChatGPT isn’t as good as the best human writers. But it can give everyone else a leg up. “If you were a bottom-quartile writer, you’re in the 60th to 70th percentile now,” he says. It also frees certain types of thinkers from the tyranny of the writing process. “We equate writing ability with intelligence, but that’s not always true,” he says. “In fact, I’d say it’s often not true.”

Edward Tian, age 23, creator of GPTZero, a tool that detects AI-generated writing.

Illustration: James Marshall; Photograph: Lauryn Hill

On a cloudless day in May, Tian and I strolled across Princeton’s campus; big white reunion tents seemed to have landed like spaceships on the manicured lawns. At my request, Tian invited a handful of classmates to join us for lunch at a Szechuan restaurant off campus and talk about AI.

As some schools rushed to ban ChatGPT and tech CEOs signed letters warning of AI-fueled doom, the students were notably relaxed about a machine-assisted future. (Princeton left it up to professors to set their own ground rules.) One had recently used ChatGPT to write the acknowledgments section of her thesis. Others, including Tian, relied on it to fill in chunks of script while coding. Lydia You, a senior and computer

science major who plans to work in journalism, had asked ChatGPT to write a poem about losing things in the style of Elizabeth Bishop—an attempt to re-create her famous poem “One Art.” (“The art of losing isn’t hard to master.”) The result was “very close” to the original poem, You said, and she found that the chatbot did an even better job analyzing the original and describing what made it so moving. “We’ve seen a lot of panic about almost everything in our lives,” said You, citing TikTok, Twitter, and the internet itself. “I feel like people of our generation are like, *We can figure out for ourselves how to use this.*”

Sophie Amiton, a senior studying mechanical and aerospace engineering, jumped in: “Also, I think our generation is lazier in a lot of ways,” she said, as You nodded in agreement. “I see a lot more people who don’t want traditional jobs now, don’t want a nine-to-five.”

“They’re disillusioned,” You said. “A lot of jobs are spreadsheets.”

“I think that came out of Covid,” Amiton continued. “People reevaluated what the purpose of work even is, and if you can use ChatGPT to make your life easier, and therefore have a better quality of life or work-life balance, then why not use the shortcut?”

Liz, a recent Princeton graduate who preferred not to use her surname, sent me a paper she’d written with the help of ChatGPT for a class on global politics. Rather than simply asking it to answer the essay question, she plugged in an outline with detailed bullet points, then had it write the paper based on her notes. After extensive back-and-forth—telling it to rewrite and rearrange, add nuance here and context there—she finally had a paper she was comfortable submitting. She got an A.

I copied and pasted her paper into GPTZero. The verdict: “Your text is likely to be written entirely by a human.”

In early May, just a few weeks before Tian and his classmates put on their black graduation gowns, the GPTZero team released the Chrome plug-in they’d been developing and called it Origin. Origin is still rudimentary: You have to select the text of a web page yourself, and its accuracy isn’t perfect. But Tian hopes that one day the tool will automatically scan every website

you look at, highlighting AI-generated content—from text to images to video—as well as anything “toxic” or factually dubious. He describes Origin as a “windshield” for the information superhighway, deflecting useless or harmful material and allowing us to see the road clearly.

Tian was unflaggingly optimistic about the company; he also just felt fortunate to be graduating into a job he actually wanted. Many of his friends had entered Princeton planning to be entrepreneurs, but belt-tightening in the tech sector had changed their plans.

“We’ve seen a lot of panic about almost everything in our lives. I feel like people of our generation are like, *We can figure out for ourselves how to use this.*”

As a rising sophomore with three years left to go at Stanford, Semrai approached the summer with a more footloose attitude. On a blistering Thursday afternoon in June, on the rooftop of Pier 17 near Wall Street, Semrai, wearing a green patterned shirt and white Nikes, spoke to me brightly about the future—or at least the next few weeks. His summer was still taking shape. (“I’m rapidly thesis-testing.”) But for now he was in New York, crashing with friends while cranking on a couple of AI-driven projects. The previous night, he’d slept in a coworking space in SoHo. Now he was standing in the shaded VIP section of an event put on by Techstars New York City, a startup accelerator, while hundreds of sweat-stained attendees milled around in the glare.

Nearby, New York City mayor Eric Adams stood onstage wearing aviators and a full suit, praising the glories of coding. “I’m a techie,” Adams said, before encouraging guests to seek out diverse collaborators and use “source code” to fix societal problems like cancer and gun violence. He then urged the singles in the crowd to find themselves a “shorty or a boo and hook up with them.”

Semrai was taking a see-what-sticks approach to building. In addition to WorkNinja, he was developing a platform for chatbots based on real celebrities and trained on reams of their data, with which fans could then interact. He was also prototyping a bracelet that would record everything we say and do—Semrai calls it a “perfect memory”—and offer real-time

tips to facilitate conversations. (A group of classmates at Stanford recently created a related product called RizzGPT, an eyepiece that helps its wearer flirt.)

He expected the summer to give rise to an explosion of AI apps, as young coders mix and cross-pollinate. (Eric Adams would approve.) “I think a constellation of startups will be formed, and five years from now we’ll be able to draw lines between people—the start of an ecosystem,” he said.

By summer, Tian had a team of 12 employees and had raised \$3.5 million from a handful of VCs, including Jack Altman (brother of OpenAI CEO Sam Altman) and Emad Mostaque of Stability AI. But over the course of our conversations, I noticed that his framing of GPTZero/Origin was shifting slightly. Now, he said, AI-detection would be only one part of the humanity-proving toolkit. Just as important would be an emphasis on provenance, or “content credentials.” The idea is to attach a cryptographic tag to a piece of content that verifies it was created by a human, as determined by its process of creation—a sort of captcha for digital files. Adobe Photoshop already attaches a tag to photos that harness its new AI generation tool, Firefly. Anyone looking at an image can right-click it and see who made it, where, and how. Tian says he wants to do the same thing for text and that he has been talking to the Content Authenticity Initiative—a consortium dedicated to creating a provenance standard across media—as well as Microsoft about working together.

One could interpret his emphasis on provenance as a tacit acknowledgment that detection alone won’t cut it. (OpenAI shut down its text classifier in July “due to its low rate of accuracy.”) It also previews a possible paradigm shift in how we relate to digital media. The whole endeavor of detection suggests that humans leave an unmistakable signature in a piece of text—something perceptible—much the way that a lie detector presumes dishonesty leaves an objective trace. Provenance relies on something more like a “Made in America” label. If it weren’t for the label, we wouldn’t know the difference. It’s a subtle but meaningful distinction: Human writing may not be better, or more creative, or even more original. But it will be human, which will matter to other humans.

In June, Tian’s team took another step in the direction of practicality. He told me they were building a new writing platform called HumanPrint, which would help users improve their AI-written text and enable them to share “proof of authenticity.” Not by generating text, though. Rather, it would use GPTZero’s technology to highlight sections of text that were insufficiently human and prompt the user to rewrite it in their own words—a sort of inversion of the current AI writing assistants. “So teachers can specify, OK, maybe more than 50 percent of the essay should still be written in your own words,” he said. When I asked whether this was a pivot for the company, Tian argued that it was “a natural extension of detection.” “It was always a vision of being the gold standard of responsible AI usage,” Tian said, “and that’s still there.” Still, the implication is clear: There’s no stopping AI writing; the only option is to work with it.

When Tian was first testing out GPTZero, he scanned a 2015 *New Yorker* essay by McPhee called “[Frame of Reference](#). ” In it, McPhee riffs on the joys and risks of making cultural references in one’s writing. “Mention Beyoncé and everyone knows who she is. Mention Veronica Lake and you might as well be in the Quetico-Superior,” he writes coyly. He runs down a list of adjectives he’s used to describe mustaches, including “sincere,” “no-nonsense,” “gyroscopic,” “guileless,” “analgesic,” “soothing,” “odobene,” and “tetramgrammaticon.” He concludes with an anecdote about battling an editor to include a reference to an obscure British term used by upper-class tourists to India during the Raj. (He won.) It’s classic McPhee: scalpel-precise, big-hearted if a tad self-satisfied, gleefully digressive, indulgent until he gets to the just-right point. GPTZero determined that the article was “the most human on all metrics,” Tian said. I called McPhee to ask what he thought it meant that his writing was especially human.

“I really have no very good idea,” McPhee told me over the phone. “But if I were guessing, it’s that my pieces get at the science, or the agriculture, or the aviation, or whatever the topic is, through people. There’s always a central figure I learn from.” Indeed, McPhee writes through the eyes of experts. The reader comes away with not just some esoteric knowledge about geology or particle physics or oranges, but a sense of the person studying the subject, as well as McPhee studying the person.

McPhee, now 92, said he's unconcerned about AI replacing human writers. "I'm extremely skeptical and not the least bit worried about it," he said. "I don't think there's a Mark Twain of artificial intelligence."

But, I asked, what if years from now, someone designs a McPheeBot3000 trained on McPhee's writing, and then asks it to produce a book on a fresh topic? It might not be able to ford streams with environmental activists or go fly-fishing with ichthyologists, but couldn't it capture McPhee's voice and style and worldview? Tian argued that machines can only imitate, while McPhee never repeats himself: "What's unique about McPhee is he comes up with things McPhee a day ago wouldn't have."

I asked McPhee about the hypothetical McPheeBot3000. (Or, if Semrai has his way, not-so-hypothetical.) "If this thing ever happens, in a future where I'm no longer here," he said, "I hope my daughters show up with a lawyer."

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By [Steven Levy](#)

[Backchannel](#)

Sep 11, 2023 6:00 AM

Sundar Pichai on Google's AI, Microsoft's AI, OpenAI, and ... Did We Mention AI?

The tech giant is 25 years old. In a chatbot war. On trial for antitrust. But its CEO says Google is good for 25 more.

Photograph: Gabriela Hasbun

Earlier this month, [Sundar Pichai](#) was struggling to write a letter to Alphabet's 180,000 employees. The 51-year-old CEO wanted to laud Google on its 25th birthday, which could have been easy enough. Alphabet's stock market value was around \$1.7 trillion. Its vast cloud-computing operation had turned its first profit. Its self-driving cars were [ferrying people around San Francisco](#). And then there was the usual stuff—Google Search still dominated the field, as it had for every minute of this century. The company sucks up [almost 40 percent](#) of all global digital advertising revenue.

But not all was well on Alphabet's vast Mountain View campus. The US government was about to [put Google on trial](#) for abusing its monopoly in search. And the comity that once pervaded Google's workforce was frayed. Some high-profile employees had left, complaining that the company moved too slowly. Perhaps most troubling, Google—a long-standing world leader in [artificial intelligence](#)—had been rudely upstaged by [an upstart outsider, OpenAI](#). Google's longtime rival Microsoft had beaten it to the punch with a large language model built into its also-ran search engine

Bing, causing panic in Mountain View. Microsoft CEO [Satya Nadella boasted](#), “I want people to know we made Google dance.”

The Big Interview

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Pichai’s letter, released on September 5, was buoyant, designed to inspire, and almost giddy in its discussion of the company’s astonishing journey. (You can read it [here](#).) But behind the cheerleading, you could detect a hidden leitmotif. *We matter more than ever. Despite what they say.* One point pops up repeatedly: *We are not going to lose in AI.*

Pichai—who joined the company in April 2004, the same month Gmail launched—has been CEO for eight years. He speaks often of growing up in India, where technology provided a lifeline to better times. He’s widely [recognized as a “nice guy.”](#) But over the years he has made his share of tough decisions, including layoffs, product cancellations, and reorgs, like his recent forced merger of Google’s two semi-competing AI research centers, DeepMind and Google Brain. Now he faces even bigger decisions as the company withstands challenges inside and out—all while pursuing what Pichai calls “the biggest technological shift” of our lifetimes.

Just before releasing his blog post, Pichai spoke to WIRED about AI, fighting bureaucracy, and why he rejects the characterization that he is mainly a consensus builder. The interview is edited for length and clarity.

Steven Levy: You’ve just shared a note marking 25 years of Google. It’s upbeat and inspirational, but am I right to see a subtext here? It seems you’re rallying the troops around the idea that Google still exists to build technology for the world’s benefit, even though some people might be questioning that now.

Sundar Pichai: It’s definitely a reflective moment. Twenty-five years is a long time in the technology world. But I’m convinced that with the shift to AI, there’s a golden age of innovation ahead. As a company, we have as big an opportunity as we had 25 years ago, and a lot more responsibility. I hope

to convey to the company that we should balance being bold and responsible, and meet that moment with excitement.

OK. But let me share a narrative that I'm sure you've heard: Google has always been a leader in AI. But in the past couple of years, despite building AI into products, it was too sclerotic or cautious to seize the moment, and other companies have taken your ball and run with it. When OpenAI and Microsoft came out with consumer [large language models](#), Google was caught flat-footed and now is scrambling to catch up. What's your reaction?

This article appears in the November 2023 issue. [Subscribe to WIRED](#)Photograph: Sinna Nasseri

You're right that we've been thinking about AI from the very beginning. Obviously, when I became CEO in 2015, it was clear that deep neural networks were going to profoundly change everything. So I pivoted the company to be AI-first, and that's where we directed a lot of our R&D dollars. Internally, we had our LLM, LaMDA. Obviously, we were thinking about running large consumer products. But we definitely felt that the technology needed to mature a bit more before we put it in our products. People come to us with a huge sense of trust—they come to Google and type, "What Tylenol dosage for a 3-month-old?" You can imagine the responsibility that comes with getting it right. And so we were definitely a bit more cautious there.

So credit to OpenAI for the launch of ChatGPT, which showed a product-market fit and that people are ready to understand and play with the technology. In some ways, it was an exciting moment for me, because we are building that underlying technology and deploying it across our products. But we are still being deliberate where we need to be. The technology arc is long, and I feel very comfortable about where we are.

You had the tools and talent to put out something like GPT earlier than OpenAI did. In retrospect, should you have done it?

You can go back and pretty much take another look at everything. It's not fully clear to me that it might have worked out as well. The fact is, we

could do more after people had seen how it works. It really won't matter in the next five to 10 years. It's important to look at the signal and separate it from the noise. The signal is that AI is a profound platform shift, and it's getting to a stage where you can deploy it more deeply. We are doing that to solve real problems, with a sense of excitement and optimism and responsibility. That, to me, is the signal. That is the opportunity.

After Microsoft put a version of ChatGPT into its Bing search engine, Google hastened to release its own version, Bard. Did Nadella make you dance?

In cricket, there's a saying that you let the bat do the talking. We have been innovating on AI, and also applying AI to search, every year. There's always been competition. We've seen Alexa launch and Siri launch—this is not new. Around the end of last year, my thoughts were, how can we bring generative AI to search in a way that makes sense for our users? That's what I'm thinking about, and that's what will matter in the long run.

Photograph: Gabriela Hasbun

I'm glad you mentioned search. The basis of Google Search—and almost your entire revenue stream—is that people query the search engine and find relevant links that they visit, and maybe spend money there. But your plan to use LLMs in search, called SGE, or Search Generative Experience, doesn't send people to websites. You type a query into a Google Search bar, and SGE answers with a big block of text. How do you do that and not blow up your business model?

First of all, in search, people come looking for information. Over the past many years, you know, how we present that has dramatically evolved. But we are still trying to help people find the best information that exists online. Inherently, people are also looking for commercial information, and ads are very valuable commercial information, because they connect merchants and businesses, small and big, to users. None of that changes just because we are applying AI deeply. When we evolve search with generative AI, we'll apply the same principles. It's important to us to connect users with what's out on the web, and we are working deeply to make sure that continues to work well.

But if I do a search by prompting an LLM, I'm going to get something quite different from a series of links. How will I know whether it's sponsored or organic?

You would see the same thing. Even in a generative experience we would give you a set of sites that support what we are saying. We want to make sure users are consuming those sites. So I don't think the core part of the experience will change. We will have a space for ads in a way that makes sense for users and particularly on commercial queries. Our early testing shows that we'll be able to get it right. When we shifted from desktop to mobile, people asked versions of these same questions. It's core to the company to evolve search while applying the underlying principles. I am confident we'll be able to get that right through this transition.

For years, DeepMind and Google Brain operated as different entities, maybe even competitive entities. This year, you ordered them to merge. Why? And are you seeing the fruits of that merger?

I always felt fortunate we had two of the best AI teams on the planet. They were focused on different problems, but there was a lot more collaboration than people knew. Google worked very hard on making sure we provided TPUs [Tensor Processing Units, optimized for machine learning] to support the AlphaGo game [a program that beat the world champion of the intricate game Go]. We realized we needed to build larger-scale LLMs, so it made sense to come together so that we could be more efficient around our use of compute. [DeepMind's LLM] Gemini actually started as a collaborative effort across these two teams. And [Google Brain leader] Jeff Dean had a desire to reclaim a deep engineering and scientific role. I've spent time with the teams both in the UK and in Mountain View, and I've been thrilled to see the Gemini teams working closely with Google Search as I'm walking through the halls. I felt a sense of excitement that reminded me of the early days of Google.

The large language model winner in this merger seems to be DeepMind's Gemini, which you are positioning as a next-generation LLM. What will it do that the current generation doesn't do?

Today you have separate text models and image-generation models and so on. With Gemini, these will converge.

Meanwhile, we haven't heard much about Google Assistant. Should we issue a missing persons alert?

Part of the reason we built [the conversational LLM LaMDA](#) was that we realized we needed to improve the underlying technology of Google Assistant. AI will make Google Assistant fundamentally better.

The US government is putting Google on trial for alleged antitrust violations regarding what it calls your search monopoly. You might not endorse that term. So how would you describe the company's dominance in search?

The case is happening at a time of unprecedented innovation. Step back, and look at the recent breakthroughs in AI, in new apps, options for people to access information. We make literally thousands of changes every year to improve search. We invest billions to constantly innovate and make sure the product works well for people and that it's a product people want to use. I'm looking forward to the opportunity to make that case. It's an important, important process.

So you're saying we should view this in a broader sense than just market share?

Think about all the ways people today get to access information. It's a very dynamic space, it's a broad space. We have to work hard to constantly innovate, to stay ahead.

If you weren't able to make deals to become the default search engine on third-party browsers and phones—something the government is objecting to—what would be the impact on Google?

We want to make it easy for users to access our services. It's very pro-consumer.

Earlier you mentioned your in-house AI chips. Google Cloud, the enterprise service, recently announced its first profit, and a big part of a cloud service now is supporting AI. I find it interesting that you maintain a large partnership with Nvidia, whose GPU chips seem to be a critical, if not irreplaceable, component of the AI ecosystem. How important is it for you to preserve good relations with Nvidia? Do you think it's dangerous for one company to have so much power?

We've had a long relationship with Nvidia for well over a decade, including working deeply on Android. Obviously, with AI, they've clearly demonstrated a strong track record of innovation. Many of our cloud customers are Nvidia customers, too. So the collaboration is very, very critical. Look, the semiconductor industry is a very dynamic, competitive industry. It's an industry that needs deep, long-term R&D and investments. I feel comfortable about our relationship with Nvidia, and that we are going to be working closely with them 10 years from now.

You—and much of the industry—profess to welcome AI regulation. What do you think the regulation should include? And what regulation would you see as stifling innovation and thwarting the benefits of the technology?

The first and foremost thing I think you need to get right is making sure that regulation is a collaborative thing between the public sector, private sector, nonprofits, and so on. It's important to let innovation flow and make sure anything you're designing isn't onerous on small companies or people doing open source. Then you can consider initial proposals like, how do you test the cutting-edge models? What does safety testing look like? We should set up industry standards and benchmarks. You should also think about how systems will be deployed. They're obviously going to be deployed in a wide range of scenarios, from recommending a nearby coffee shop to deciding what insurance people should get, or maybe making a medical care decision. So obviously, it makes sense that they're tested for safety and don't have bias, and it makes sense that they protect privacy. But I would balance it by asking whether existing regulations cover it. Using AI in health care, for example, doesn't change the fact that you must go through a regulatory process, including getting approved by the Food and Drug Administration

to do a lot of things. And for me, with US regulations, we should actually get federal privacy legislation done first. In privacy, AI raises the stakes even more.

OK, so I'll put you down for strong privacy regulation in Congress.

Yeah. We've called for it, and it'll definitely be good to get.

Photograph: Gabriela Hasbun

We're talking about AI in a very nuts-and-bolts way, but a lot of the discussion centers on whether it will ultimately be a utopian boon or the end of humanity. What's your stance on those long-term questions?

AI is one of the most profound technologies we will ever work on. There are short-term risks, midterm risks, and long-term risks. It's important to take all those concerns seriously, but you have to balance where you put your resources depending on the stage you're in. In the near term, state-of-the-art LLMs have hallucination problems—they can make up things. There are areas where that's appropriate, like creatively imagining names for your dog, but not “what's the right medicine dosage for a 3-year-old?” So right now, responsibility is about testing it for safety and ensuring it doesn't harm privacy and introduce bias. In the medium term, I worry about whether AI displaces or augments the labor market. There will be areas where it will be a disruptive force. And there are long-term risks around developing powerful intelligent agents. How do we make sure they are aligned to human values? How do we stay in control of them? To me, they are all valid things.

Have you seen the movie *Oppenheimer*?

I'm actually reading the book. I'm a big fan of reading the book before watching the movie.

I ask because you are one of the people with the most influence on a powerful and potentially dangerous technology. Does the Oppenheimer story touch you in that way?

All of us who are in one shape or another working on a powerful technology—not just AI, but genetics like Crispr—have to be responsible. You have to make sure you're an important part of the debate over these things. You want to learn from history where you can, obviously.

Google is an enormous company. Current and former employees complain that the bureaucracy and caution has slowed them down. All eight authors of the influential “[Transformers](#)” paper, which you cite in your letter, have left the company, with some saying Google moves too slow. Can you mitigate that and make Google more like a startup again?

Anytime you're scaling up a company, you have to make sure you're working to cut down bureaucracy and staying as lean and nimble as possible. There are many, many areas where we move very fast. Our growth in Cloud wouldn't have happened if we didn't scale up fast. I look at what the [YouTube Shorts](#) team has done, I look at what the Pixel team has done, I look at how much the search team has evolved with AI. There are many, many areas where we move fast.

Yet we hear those complaints, including from people who loved the company but left.

Obviously, when you're running a big company, there are times you look around and say, in some areas, maybe you didn't move as fast—and you work hard to fix it. [*Pichai raises his voice.*] Do I recruit candidates who come and join us because they feel like they've been in some other large company, which is very, very bureaucratic, and they haven't been able to make change as fast? Absolutely. Are we attracting some of the best talent in the world every week? Yes. It's equally important to remember we have an open culture—people speak a lot about the company. Yes, we lost some people. But we're also retaining people better than we have in a long, long time. Did OpenAI lose some people from the original team that worked on GPT? The answer is yes. You know, I've actually felt the company move faster in pockets than even what I remember 10 years ago.

You've been CEO for eight years now, and the pressure has never been greater. You've been known as a consensus builder, but the time seems

to call for a “wartime CEO.” Does that role resonate with you?

I've always felt that we work in a dynamic technology space. So this notion of peacetime/wartime doesn't fully resonate with me. In a given week, you can have both those moments. A lot of decisions I made over many, many years were not about consensus building. There's a difference between making clear decisions and getting people to come along with it. What I've done this year is no different from what I've done over the past many years. I've always been focused on the long term. I've never forgotten what gives Google its strengths. It's a deep technology, computer science, and AI company, and we apply that to build great products that make a difference for people. We do this across a much more diverse set of areas now. That doesn't change over time.

Three years ago, I asked you whether Google was still Googly, and you said yes. As the company continues to grow and age, what can you do to maintain its Googliness?

Being Googly is about staying true to our values, making sure we are working hard to innovate using deep computer science, and making products that really matter to people in their daily lives. As long as we keep that in mind, I think we'll be set.

In your 25th anniversary letter, you evoke your roots, growing up in India where technology was a premium. You're now the CEO of a trillion-dollar company and a very rich man. How do you maintain the connection to that person who first came to the United States?

In my personal experience, access to technology was an important driver of opportunity. I saw that in my life, and I've seen it in countless others. What inspired me to join Google and be a part of Google was the mission statement, which was about making information universally accessible and useful. With AI, it's even more important to democratize access to what will be one of the most profound technologies we have worked on. So I'm deeply motivated to make sure we develop this technology in a way that the entire world benefits. Personally, when I was in India, every weekend, I used to spend time with my parents, and my mom would make my favorite

food—dosas, South Indian crepes. I still do that pretty much every Saturday morning. My mom makes them for me. I keep things simple.

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Sep 7, 2023 9:00 AM

Do Not Fear the Robot Uprising. Join It

Stories about AI liberation aren't obsolete—and they aren't really about robots, either.

Photograph of silver painted figure models
Photograph: Shawn Michael Jones

it's become a veritable meme subgenre at this point: a photo of Linda Hamilton as *The Terminator*'s Sarah Connor, glaring into the camera, steely eyed, with some variant of the caption “Sarah Connor seeing you become friends with ChatGPT.” Our society has interpreted the sudden, dizzying rise of this new chatbot generation through the pop cultural lens of our youth.

With it comes the sense that the straightforward “robots will kill us all” stories were prescient (or at least accurately captured the current vibe), and that there was a staggering naivete in the more forgiving “AI civil rights” narratives—famously epitomized by *Star Trek*'s Commander Data, an android who fought to be treated the same as his organic Starfleet colleagues. Patrick Stewart's Captain Picard, defending Data in a trial to prove his sapience, thundered, “Your honor, Starfleet was founded to seek out new life: Well, there it sits! Waiting.” But far from being a relic of a bygone, more optimistic age, the AI civil rights narrative is more relevant than ever. It just needs to be understood in its proper context.

There are understandable fears that seemingly naive narratives about AI or robots being “just like us” have only paved the way for the morally

impoverished moment in which we now find ourselves. In this way of looking at things, we need *more* fear of AI in order to resist the exploitation we're now faced with, surely. Thus, we need to retrench into the other AI narrative cliché: They're here to kill us all.

But analogizing ChatGPT or Google's Bard to even embryonic forms of Skynet is priceless PR for tech companies, which benefit greatly from the "criti-hype" of such wild exaggerations. For example, during a *60 Minutes* interview, Google vice president James Manyika remarked, "We discovered that with very few amounts of prompting in Bengali, [Bard] can now translate all of Bengali." In his narration, CBS journalist Scott Pelley glossed this comment by saying "one Google AI program adapted on its own after it was prompted in the language of Bangladesh, which it was not trained to know"—suggesting that this learning was a potentially dangerous "emergent property" of Bard. But it also implied that Bard had no Bengali in its training data, when in fact it did. Such hyperbole, which portrays the algorithms as bordering on self-awareness, makes these tools seem far more capable than they really are.

That, of course, hasn't stopped some of my fellow nerds, reared on C-3PO and Data, from being all too eager to join the final frontier of civil rights battles—even when every other one remains woefully unfinished.

So what's the use in continuing to tell the happier "AI deserves civil rights" stories? After all, we're a long way from boldly arguing for the rights of such beings in a Starfleet courtroom, and such stories might only further engender anthropomorphization, which only helps companies profit from tools that fall short even at their stated functions. Well, those stories might help us keep our priorities straight.

Far from being a relic of a bygone, more optimistic age, the AI civil rights narrative is more relevant than ever. It just needs to be understood in its proper context.

It's easy to forget that, in fiction, the AI/robot is almost always a metaphor. Even in *Star Trek: The Next Generation*, Data and the androids like him were analogized to humanity's ugly history of slavery—the grotesque dream of free labor that never questions, never fights back. This was

equally evident in *Ex Machina*, a horror film about how an AI woman, built to be a classic “fembot,” liberates herself from a male tech baron who wants nothing more than to build a woman who loves to be abused. What we yearn for in machines is so often a reflection of what we yearn for in humanity, for good and ill, asking us what we really want. Stories of such yearnings also illustrate a key requirement for sapience: resistance to oppression.

Such qualities take us back to the earliest forms of fiction that humans wove about the prospect of creating artificial life. Not just Karel Čapek’s 1921 *Rossum’s Universal Robots (RUR)*, but the Jewish legend of the golem that it clearly drew inspiration from. In that tale, artificial life exists to defend people against violent oppression. Although the original fable sees the golem run amok, the idea of the creature endures as an empowering fantasy in a time of rising anti-Semitism. The myth has left its mark on everything from superhero fantasies to tales of benevolent robots—narratives where artificial or alien life is in communion with human life and arrayed against the ugliest forces that sapience can produce. If that isn’t relevant, nothing is.

The early myths also revealed fears about us losing *our* humanity. Čapek’s *roboři* (yes, the source of the word *robot*) were, at first, organic automata who lacked the human capacity for empathy. But this was not meant to stir up fear of robots. It was a comment on how the growing rationalization of the world—what sociologist Max Weber called *Entzauberung*, or “disenchantment”—was robbing us of our humanity. Not every problem could be solved by reducing everything to quantitative reasoning and the cold logic of engineering; it’s a lesson that remains as urgent as ever. Such things are at the heart of “robot uprising” stories and are their true lesson, not fear of technology.

In short, all the AI stories—whether about uprisings or civil rights or both—are about us, not the robots. They inspire us to empathize with the robots, either as a warning against what we might become (no cybernetic enhancement required) or as a reminder to resist prejudice wherever we may find it.

In short, all the AI stories—whether about uprisings or civil rights or both—are about us, not the robots.

The stories where AI isn't the bad guy remind us to stand up for ourselves against inequality and ill-treatment, and to ally ourselves with others doing the same. The analogies—often clunky and imperfect—to racism or colonialism or anti-LGBTQ hatred make for profoundly human stories where we talk about ourselves rather than some hitherto unknown and alien life-form. But we'll know machines are truly sapient when they develop a genuine capacity to resist—not in the manner of Skynet, but in the way we as humans also have a capacity for resistance against our worst impulses. AI civil rights narratives, in making that analogy, remind us where the lines of human dignity are and why dignity is worth fighting for. We should keep that in mind as we wrangle over what to do with chatbots, why they're failing (as in a recent Stanford study that showed ChatGPT's declining numeracy), and why they're being set loose on the world anyway.

We shouldn't fear the synthesis of humans and machines; we should fear its misdirection by the meanest pecuniary interests. Optimistic stories about impossibly sapient AI help us think through these problems. Contrary to popular belief, even Čapek's *RUR* has a happy ending. When the last human alive witnesses two robots spontaneously evolve empathy and love, he launches into the play's valedictory speech: "You alone, love, shall blossom on this rubbish heap ... Life shall not perish! It shall not perish! It shall not perish!"

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[Steven Levy](#)

[Backchannel](#)

Sep 5, 2023 6:00 AM

What OpenAI Really Wants

The young company sent shock waves around the world when it released ChatGPT. But that was just the start. The ultimate goal: Change everything. Yes. *Everything*.

Ilya Sutskever, Sam Altman, Mira Murati, and Greg Brockman, of OpenAI
Photograph: Jessica Chou

The air crackles with an almost Beatlemaniac energy as the star and his entourage tumble into a waiting Mercedes van. They've just ducked out of one event and are headed to another, then another, where a frenzied mob awaits. As they careen through the streets of London—the short hop from Holborn to Bloomsbury—it's as if they're surfing one of civilization's before-and-after moments. The history-making force personified inside this car has captured the attention of the world. Everyone wants a piece of it, from the students who've waited in line to the prime minister.

Inside the luxury van, wolfing down a salad, is the neatly coiffed 38-year-old entrepreneur Sam Altman, cofounder of [OpenAI](#); a PR person; a security specialist; and me. Altman is unhappily sporting a blue suit with a tieless pink dress shirt as he whirlwinds through London as part of a monthlong global jaunt through 25 cities on six continents. As he gobbles his greens—no time for a sit-down lunch today—he reflects on his meeting the previous night with French president Emmanuel Macron. Pretty good guy! And *very interested in [artificial intelligence](#)*.

As was the prime minister of Poland. And the prime minister of Spain.

Riding with Altman, I can almost hear the ringing, ambiguous chord that opens “A Hard Day’s Night”—introducing the future. Last November, when OpenAI let loose its monster hit, [ChatGPT](#), it triggered a tech explosion not seen since the internet burst into our lives. Suddenly the Turing test was history, search engines were endangered species, and no college essay could ever be trusted. No job was safe. No scientific problem was immutable.

Altman didn’t do the research, train the neural net, or code the interface of ChatGPT and its more precocious sibling, GPT-4. But as CEO—and a dreamer/doer type who’s like a younger version of his cofounder Elon Musk, without the baggage—one news article after another has used his photo as the visual symbol of humanity’s new challenge. At least those that haven’t led with an eye-popping image generated by OpenAI’s visual AI product, [Dall-E](#). He is the oracle of the moment, the figure that people want to consult first on how AI might usher in a golden age, or consign humans to irrelevance, or worse.

Altman’s van whisks him to four appearances that sunny day in May. The first is stealthy, an off-the-record session with the Round Table, a group of government, academia, and industry types. Organized at the last minute, it’s on the second floor of a pub called the Somers Town Coffee House. Under a glowering portrait of brewmaster Charles Wells (1842–1914), Altman fields the same questions he gets from almost every audience. Will AI kill us? Can it be regulated? What about China? He answers every one in detail, while stealing glances at his phone. After that, he does a fireside chat at the posh Londoner Hotel in front of 600 members of the Oxford Guild. From there it’s on to a basement conference room where he answers more technical questions from about 100 entrepreneurs and engineers. Now he’s almost late to a mid-afternoon onstage talk at University College London. He and his group pull up at a loading zone and are ushered through a series of winding corridors, like the Steadicam shot in *Goodfellas*. As we walk, the moderator hurriedly tells Altman what he’ll ask. When Altman pops on stage, the auditorium—packed with rapturous academics, geeks, and journalists—erupts.

Altman is not a natural publicity seeker. I once spoke to him right after *The New Yorker* ran [a long profile](#) of him. “Too much about me,” he said. But at University College, after the formal program, he wades into the scrum of people who have surged to the foot of the stage. His aides try to maneuver themselves between Altman and the throng, but he shrugs them off. He takes one question after another, each time intently staring at the face of the interlocutor as if he’s hearing the query for the first time. Everyone wants a selfie. After 20 minutes, he finally allows his team to pull him out. Then he’s off to meet with UK prime minister Rishi Sunak.

Maybe one day, when robots write our history, they will cite Altman’s world tour as a milestone in the year when everyone, all at once, started to make their own personal reckoning with the singularity. Or then again, maybe whoever writes the history of this moment will see it as a time when a quietly compelling CEO with a paradigm-busting technology made an attempt to inject a very peculiar worldview into the global mindstream—from an unmarked four-story headquarters in San Francisco’s Mission District to the entire world.

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Photograph: Jessica Chou

For Altman and his company, ChatGPT and GPT-4 are merely stepping stones along the way to achieving a simple and seismic mission, one these technologists may as well have branded on their flesh. That mission is to build artificial general intelligence—a concept that’s so far been grounded more in science fiction than science—and to make it safe for humanity. The people who work at OpenAI are fanatical in their pursuit of that goal. (Though, as any number of conversations in the office café will confirm, the “build AGI” bit of the mission seems to offer up more raw excitement to its researchers than the “make it safe” bit.) These are people who do not shy from casually using the term “super-intelligence.” They *assume* that AI’s trajectory will surpass whatever peak biology can attain. The company’s financial documents even stipulate a kind of exit contingency for when AI wipes away our whole economic system.

It's not fair to call OpenAI a cult, but when I asked several of the company's top brass if someone could comfortably work there if they didn't believe AGI was truly coming—and that its arrival would mark one of the greatest moments in human history—most executives didn't think so. *Why would a nonbeliever want to work here?* they wondered. The assumption is that the workforce—now at approximately 500, though it might have grown since you began reading this paragraph—has self-selected to include only the faithful. At the very least, as Altman puts it, once you get hired, it seems inevitable that you'll be drawn into the spell.

At the same time, OpenAI is not the company it once was. It was founded as a purely nonprofit research operation, but today most of its employees technically work for a profit-making entity that is reportedly valued at [almost \\$30 billion](#). Altman and his team now face the pressure to deliver a revolution in every product cycle, in a way that satisfies the commercial demands of investors and keeps ahead in a fiercely competitive landscape. All while hewing to a quasi-messianic mission to elevate humanity rather than exterminate it.

That kind of pressure—not to mention the unforgiving attention of the entire world—can be a debilitating force. The Beatles set off colossal waves of cultural change, but they anchored their revolution for only so long: Six years after chiming that unforgettable chord they weren't even a band anymore. The maelstrom OpenAI has unleashed will almost certainly be far bigger. But the leaders of OpenAI swear they'll stay the course. All they want to do, they say, is build computers smart enough and safe enough to end history, thrusting humanity into an era of unimaginable bounty.

Growing up in the late '80s and early '90s, Sam Altman was a nerdy kid who gobbled up science fiction and *Star Wars*. The worlds built by early sci-fi writers often had humans living with—or competing with—superintelligent AI systems. The idea of computers matching or exceeding human capabilities thrilled Altman, who had been coding since his fingers could barely cover a keyboard. When he was 8, his parents bought him a Macintosh LC II. One night he was up late playing with it and the thought popped into his head: “Someday this computer is going to learn to think.” When he arrived at Stanford as an undergrad in 2003, he hoped to help

make that happen and took courses in AI. But “it wasn’t working at all,” he’d later say. The field was still mired in an innovation trough known as AI winter. Altman dropped out to enter the startup world; his company Loopt was in the tiny first batch of wannabe organizations in [Y Combinator](#), which would become the world’s most famed incubator.

In February 2014, Paul Graham, YC’s founding guru, chose then-28-year-old Altman to succeed him. “Sam is one of the smartest people I know,” [Graham wrote](#) in the announcement, “and understands startups better than perhaps anyone I know, including myself.” But Altman saw YC as something bigger than a launchpad for companies. “We are not about startups,” he told me soon after taking over. “We are about innovation, because we believe that is how you make the future great for everyone.” In Altman’s view, the point of cashing in on all those unicorns was not to pack the partners’ wallets but to fund species-level transformations. He began a research wing, hoping to fund ambitious projects to solve the world’s biggest problems. But AI, in his mind, was the one realm of innovation to rule them all: a superintelligence that could address humanity’s problems better than humanity could.

As luck would have it, Altman assumed his new job just as AI winter was turning into an abundant spring. Computers were now performing amazing feats, via deep learning and neural networks, like labeling photos, translating text, and optimizing sophisticated ad networks. The advances convinced him that for the first time, AGI was actually within reach. Leaving it in the hands of big corporations, however, worried him. He felt those companies would be too fixated on their products to seize the opportunity to develop AGI as soon as possible. And if they did create AGI, they might recklessly unleash it upon the world without the necessary precautions.

At the time, Altman had been thinking about running for governor of California. But he realized that he was perfectly positioned to do something bigger—to lead a company that would change humanity itself. “AGI was going to get built exactly once,” he told me in 2021. “And there were not that many people that could do a good job running OpenAI. I was lucky to

have a set of experiences in my life that made me really positively set up for this.”

Altman began talking to people who might help him start a new kind of AI company, a nonprofit that would direct the field toward responsible AGI. One kindred spirit was Tesla and SpaceX CEO Elon Musk. As Musk would later tell CNBC, he had become concerned about AI’s impact after having some marathon discussions with Google cofounder Larry Page. Musk said he was dismayed that Page had little concern for safety and also seemed to regard the rights of robots as equal to humans. When Musk shared his concerns, Page accused him of being a “speciesist.” Musk also understood that, at the time, Google employed much of the world’s AI talent. He was willing to spend some money for an effort more amenable to Team Human.

Within a few months Altman had raised money from Musk (who pledged \$100 million, and his time) and Reid Hoffman (who donated \$10 million). Other funders included Peter Thiel, Jessica Livingston, Amazon Web Services, and YC Research. Altman began to stealthily recruit a team. He limited the search to AGI believers, a constraint that narrowed his options but one he considered critical. “Back in 2015, when we were recruiting, it was almost considered a career killer for an AI researcher to say that you took AGI seriously,” he says. “But I wanted people who took it seriously.”

Greg Brockman is now OpenAI’s president.

Photograph: Jessica Chou

Greg Brockman, the chief technology officer of Stripe, was one such person, and he agreed to be OpenAI’s CTO. Another key cofounder would be Andrej Karpathy, who had been at Google Brain, the search giant’s cutting-edge AI research operation. But perhaps Altman’s most sought-after target was a Russian-born engineer named Ilya Sutskever.

Sutskever’s pedigree was unassailable. His family had emigrated from Russia to Israel, then to Canada. At the University of Toronto he had been a standout student under Geoffrey Hinton, known as the godfather of modern AI for his work on deep learning and neural networks. Hinton, who is still close to Sutskever, marvels at his protégé’s wizardry. Early in Sutskever’s

tenure at the lab, Hinton had given him a complicated project. Sutskever got tired of writing code to do the requisite calculations, and he told Hinton it would be easier if he wrote a custom programming language for the task. Hinton got a bit annoyed and tried to warn his student away from what he assumed would be a monthlong distraction. Then Sutskever came clean: “I did it this morning.”

Sutskever became an AI superstar, coauthoring a breakthrough paper that showed how AI could learn to recognize images simply by being exposed to huge volumes of data. He ended up, happily, as a key scientist on the Google Brain team.

In mid-2015 Altman cold-emailed Sutskever to invite him to dinner with Musk, Brockman, and others at the swank Rosewood Hotel on Palo Alto’s Sand Hill Road. Only later did Sutskever figure out that he was the guest of honor. “It was kind of a general conversation about AI and AGI in the future,” he says. More specifically, they discussed “whether Google and DeepMind were so far ahead that it would be impossible to catch up to them, or whether it was still possible to, as Elon put it, create a lab which would be a counterbalance.” While no one at the dinner explicitly tried to recruit Sutskever, the conversation hooked him.

Sutskever wrote an email to Altman soon after, saying he was game to lead the project—but the message got stuck in his drafts folder. Altman circled back, and after months fending off Google’s counteroffers, Sutskever signed on. He would soon become the soul of the company and its driving force in research.

Sutskever joined Altman and Musk in recruiting people to the project, culminating in a Napa Valley retreat where several prospective OpenAI researchers fueled each other’s excitement. Of course, some targets would resist the lure. John Carmack, the legendary gaming coder behind *Doom*, *Quake*, and countless other titles, declined an Altman pitch.

OpenAI officially launched in December 2015. At the time, [when I interviewed Musk and Altman](#), they presented the project to me as an effort to make AI safe and accessible by sharing it with the world. In other words, open source. OpenAI, they told me, was not going to apply for patents.

Everyone could make use of their breakthroughs. Wouldn't that be empowering some future Dr. Evil? I wondered. Musk said that was a good question. But Altman had an answer: Humans are generally good, and because OpenAI would provide powerful tools for that vast majority, the bad actors would be overwhelmed. He admitted that if Dr. Evil were to use the tools to build something that couldn't be counteracted, "then we're in a really bad place." But both Musk and Altman believed that the safer course for AI would be in the hands of a research operation not polluted by the profit motive, a persistent temptation to ignore the needs of humans in the search for boffo quarterly results.

Altman cautioned me not to expect results soon. "This is going to look like a research lab for a long time," he said.

There was another reason to tamp down expectations. Google and the others had been developing and applying AI for years. While OpenAI had a billion dollars committed (largely via Musk), an ace team of researchers and engineers, and a lofty mission, it had no clue about how to pursue its goals. Altman remembers a moment when the small team gathered in Brockman's apartment—they didn't have an office yet. "I was like, what should we do?"

Altman remembers a moment when the small team gathered in Brockman's apartment—they didn't have an office yet. "I was like, what should we do?"

I had breakfast in San Francisco with Brockman a little more than a year after OpenAI's founding. For the CTO of a company with the word *open* in its name, he was pretty parsimonious with details. He did affirm that the nonprofit could afford to draw on its initial billion-dollar donation for a while. The salaries of the 25 people on its staff—who were being paid at far less than market value—ate up the bulk of OpenAI's expenses. "The goal for us, the thing that we're really pushing on," he said, "is to have the systems that can do things that humans were just not capable of doing before." But for the time being, what that looked like was a bunch of researchers publishing papers. After the interview, I walked him to the company's newish office in the Mission District, but he allowed me to go no further than the vestibule. He did duck into a closet to get me a T-shirt.

Had I gone in and asked around, I might have learned exactly how much OpenAI *was* floundering. Brockman now admits that “nothing was working.” Its researchers were tossing algorithmic spaghetti toward the ceiling to see what stuck. They delved into systems that solved video games and spent considerable effort on robotics. “We knew *what* we wanted to do,” says Altman. “We knew *why* we wanted to do it. But we had no idea *how*.”

But they *believed*. Supporting their optimism were the steady improvements in artificial neural networks that used deep-learning techniques. “The general idea is, don’t bet against deep learning,” says Sutskever. Chasing AGI, he says, “wasn’t totally crazy. It was only moderately crazy.”

OpenAI’s road to relevance really started with its hire of an as-yet-unheralded researcher named Alec Radford, who joined in 2016, leaving the small Boston AI company he’d cofounded in his dorm room. After accepting OpenAI’s offer, he told his high school alumni magazine that taking this new role was “kind of similar to joining a graduate program”—an open-ended, low-pressure perch to research AI.

The role he would actually play was more like Larry Page inventing PageRank.

Radford, who is press-shy and hasn’t given interviews on his work, responds to my questions about his early days at OpenAI via a long email exchange. His biggest interest was in getting neural nets to interact with humans in lucid conversation. This was a departure from the traditional scripted model of making a chatbot, an approach used in everything from the primitive ELIZA to the popular assistants Siri and Alexa—all of which kind of sucked. “The goal was to see if there was any task, any setting, any domain, any *anything* that language models could be useful for,” he writes. At the time, he explains, “language models were seen as novelty toys that could only generate a sentence that made sense once in a while, and only then if you really squinted.” His first experiment involved scanning 2 billion Reddit comments to train a language model. Like a lot of OpenAI’s early experiments, it flopped. No matter. The 23-year-old had permission to keep going, to fail again. “We were just like, Alec is great, let him do his thing,” says Brockman.

His next major experiment was shaped by OpenAI's limitations of computer power, a constraint that led him to experiment on a smaller data set that focused on a single domain—Amazon product reviews. A researcher had gathered about 100 million of those. Radford trained a language model to simply predict the next character in generating a user review.

Radford began experimenting with the transformer architecture. “I made more progress in two weeks than I did over the past two years,” he says.

But then, on its own, the model figured out whether a review was positive or negative—and when you programmed the model to create something positive or negative, it delivered a review that was adulatory or scathing, as requested. (The prose was admittedly clunky: “I love this weapons look ... A must watch for any man who love Chess!”) “It was a complete surprise,” Radford says. The sentiment of a review—its favorable or disfavorable gist—is a complex function of semantics, but somehow a part of Radford’s system had gotten a feel for it. Within OpenAI, this part of the neural net came to be known as the [“unsupervised sentiment neuron.”](#)

Sutskever and others encouraged Radford to expand his experiments beyond Amazon reviews, to use his insights to train neural nets to converse or answer questions on a broad range of subjects.

And then good fortune smiled on OpenAI. In early 2017, an unheralded preprint of a research paper appeared, coauthored by eight Google researchers. Its official title was [“Attention Is All You Need.”](#) but it came to be known as the “transformer paper,” named so both to reflect the game-changing nature of the idea and to honor the toys that transmogrified from trucks to giant robots. Transformers made it possible for a neural net to understand—and generate—language much more efficiently. They did this by analyzing chunks of prose in parallel and figuring out which elements merited “attention.” This hugely optimized the process of generating coherent text to respond to prompts. Eventually, people came to realize that the same technique could also generate images and even video. Though the transformer paper would become known as the catalyst for the current AI frenzy—think of it as the Elvis that made the Beatles possible—at the time Ilya Sutskever was one of only a handful of people who understood how

powerful the breakthrough was. “The real *aha* moment was when Ilya saw the transformer come out,” Brockman says. “He was like, ‘That’s what we’ve been waiting for.’ That’s been our strategy—to push hard on problems and then have faith that we or someone in the field will manage to figure out the missing ingredient.”

Radford began experimenting with the transformer architecture. “I made more progress in two weeks than I did over the past two years,” he says. He came to understand that the key to getting the most out of the new model was to add scale—to train it on fantastically large data sets. The idea was dubbed “Big Transformer” by Radford’s collaborator Rewon Child.

This approach required a change of culture at OpenAI and a focus it had previously lacked. “In order to take advantage of the transformer, you needed to scale it up,” says Adam D’Angelo, the CEO of Quora, who sits on OpenAI’s board of directors. “You need to run it more like an engineering organization. You can’t have every researcher trying to do their own thing and training their own model and make elegant things that you can publish papers on. You have to do this more tedious, less elegant work.” That, he added, was something OpenAI was able to do, and something no one else did.

Mira Murati, OpenAI’s chief technology officer.

Photograph: Jessica Chou

The name that Radford and his collaborators gave the model they created was an acronym for “generatively pretrained transformer”—[GPT-1](#). Eventually, this model came to be generically known as “generative AI.” To build it, they drew on a collection of 7,000 unpublished books, many in the genres of romance, fantasy, and adventure, and refined it on Quora questions and answers, as well as thousands of passages taken from middle school and high school exams. All in all, the model included 117 million parameters, or variables. And it outperformed everything that had come before in understanding language and generating answers. But the most dramatic result was that processing such a massive amount of data allowed the model to offer up results *beyond* its training, providing expertise in brand-new domains. These unplanned robot capabilities are called zero-

shots. They still baffle researchers—and account for the queasiness that many in the field have about these so-called large language models.

Radford remembers one late night at OpenAI’s office. “I just kept saying over and over, ‘Well, that’s cool, but I’m pretty sure it won’t be able to do x .’ And then I would quickly code up an evaluation and, sure enough, it could kind of do x .’”

Each GPT iteration would do better, in part because each one gobbled an order of magnitude more data than the previous model. Only a year after creating the first iteration, OpenAI trained [GPT-2](#) on the open internet with an astounding 1.5 billion parameters. Like a toddler mastering speech, its responses got better and more coherent. So much so that OpenAI hesitated to release the program into the wild. Radford was worried that it might be used to generate spam. “I remember reading Neal Stephenson’s [*Anathem*](#) in 2008, and in that book the internet was overrun with spam generators,” he says. “I had thought that was really far-fetched, but as I worked on language models over the years and they got better, the uncomfortable realization that it was a real possibility set in.”

In fact, the team at OpenAI was starting to think it wasn’t such a good idea after all to put its work where Dr. Evil could easily access it. “We thought that open-sourcing GPT-2 could be really dangerous,” says chief technology officer Mira Murati, who started at the company in 2018. “We did a lot of work with misinformation experts and did some red-teaming. There was a lot of discussion internally on how much to release.” Ultimately, OpenAI temporarily withheld the full version, making a less powerful version available to the public. When the company finally shared the full version, the world managed just fine—but there was no guarantee that more powerful models would avoid catastrophe.

The very fact that OpenAI was making products smart enough to be deemed dangerous, and was grappling with ways to make them safe, was proof that the company had gotten its mojo working. “We’d figured out the formula for progress, the formula everyone perceives now—the oxygen and the hydrogen of deep learning is computation with a large neural network and data,” says Sutskever.

To Altman, it was a mind-bending experience. “If you asked the 10-year-old version of me, who used to spend a lot of time daydreaming about AI, what was going to happen, my pretty confident prediction would have been that first we’re gonna have robots, and they’re going to perform all physical labor. Then we’re going to have systems that can do basic cognitive labor. A really long way after that, maybe we’ll have systems that can do complex stuff like proving mathematical theorems. Finally we will have AI that can create new things and make art and write and do these deeply human things. That was a terrible prediction—it’s going exactly the other direction.”

The world didn’t know it yet, but Altman and Musk’s research lab had begun a climb that plausibly creeps toward the summit of AGI. The crazy idea behind OpenAI suddenly was not so crazy.

By early 2018, OpenAI was starting to focus productively on large language models, or LLMs. But Elon Musk wasn’t happy. He felt that the progress was insufficient—or maybe he felt that now that OpenAI was on to something, it needed leadership to seize its advantage. Or maybe, as he’d later explain, he felt that safety should be more of a priority. Whatever his problem was, he had a solution: Turn everything over to him. He proposed taking a majority stake in the company, adding it to the portfolio of his multiple full-time jobs (Tesla, SpaceX) and supervisory obligations (Neuralink and the Boring Company).

Musk believed he had a *right* to own OpenAI. “It wouldn’t exist without me,” he later told CNBC. “I came up with the name!” (True.) But Altman and the rest of OpenAI’s brain trust had no interest in becoming part of the Muskiverse. When they made this clear, Musk cut ties, providing the public with the incomplete explanation that he was leaving the board to avoid a conflict with Tesla’s AI effort. His farewell came at an all-hands meeting early that year where he predicted that OpenAI would fail. And he called at least one of the researchers a “jackass.”

He also took his money with him. Since the company had no revenue, this was an existential crisis. “Elon is cutting off his support,” Altman said in a panicky call to Reid Hoffman. “What do we do?” Hoffman volunteered to keep the company afloat, paying overhead and salaries.

But this was a temporary fix; OpenAI had to find big bucks elsewhere. Silicon Valley loves to throw money at talented people working on trendy tech. But not so much if they are working at a nonprofit. It had been a massive lift for OpenAI to get its first billion. To train and test new generations of GPT—and then access the computation it takes to deploy them—the company needed another billion, and fast. And that would only be the start.

Somewhere in the restructuring documents is a clause to the effect that, if the company does manage to create AGI, all financial arrangements will be reconsidered. After all, it will be a new world from that point on.

So in March 2019, OpenAI came up with a bizarre hack. It would remain a nonprofit, fully devoted to its mission. But it would also create a [for-profit entity](#). The actual structure of the arrangement is hopelessly baroque, but basically the entire company is now engaged in a “capped” profitable business. If the cap is reached—the number isn’t public, but its own charter, if you read between the lines, suggests it might be in the trillions—everything beyond that reverts to the nonprofit research lab. The novel scheme was almost a quantum approach to incorporation: Behold a company that, depending on your time-space point of view, is for-profit and nonprofit. The details are embodied in charts full of boxes and arrows, like the ones in the middle of a scientific paper where only PhDs or dropout geniuses dare to tread. When I suggest to Sutskever that it looks like something the as-yet-unconceived GPT-6 might come up with if you prompted it for a tax dodge, he doesn’t warm to my metaphor. “It’s not about accounting,” he says.

But accounting is critical. A for-profit company optimizes for, well, profits. There’s a reason why companies like Meta feel pressure from shareholders when they devote billions to R&D. How could this not affect the way a firm operates? And wasn’t avoiding commercialism the reason why Altman made OpenAI a nonprofit to begin with? According to COO Brad Lightcap, the view of the company’s leaders is that the board, which is still part of the nonprofit controlling entity, will make sure that the drive for revenue and profits won’t overwhelm the original idea. “We needed to maintain the mission as the reason for our existence,” he says, “It shouldn’t just be in

spirit, but encoded in the structure of the company.” Board member Adam D’Angelo says he takes this responsibility seriously: “It’s my job, along with the rest of the board, to make sure that OpenAI stays true to its mission.”

Potential investors were warned about those boundaries, Lightcap explains. “We have a legal disclaimer that says you, as an investor, stand to lose all your money,” he says. “We are not here to make your return. We’re here to achieve a technical mission, foremost. And, oh, by the way, we don’t really know what role money will play in a post-AGI world.”

That last sentence is not a throwaway joke. OpenAI’s plan really does include a reset in case computers reach the final frontier. Somewhere in the restructuring documents is a clause to the effect that, if the company does manage to create AGI, all financial arrangements will be reconsidered. After all, it will be a new world from that point on. Humanity will have an alien partner that can do much of what we do, only better. So previous arrangements might effectively be kaput.

There is, however, a hitch: At the moment, OpenAI doesn’t claim to know what AGI really *is*. The determination would come from the board, but it’s not clear how the board would define it. When I ask Altman, who is on the board, for clarity, his response is anything but open. “It’s not a single Turing test, but a number of things we might use,” he says. “I would happily tell you, but I like to keep confidential conversations private. I realize that is unsatisfyingly vague. But we don’t know what it’s going to be like at that point.”

Nonetheless, the inclusion of the “financial arrangements” clause isn’t just for fun: OpenAI’s leaders think that if the company is successful enough to reach its lofty profit cap, its products will probably have performed well enough to reach AGI. Whatever that is.

“My regret is that we’ve chosen to double down on the term AGI,” Sutskever says. “In hindsight it is a confusing term, because it emphasizes generality above all else. GPT-3 is general AI, but yet we don’t really feel comfortable calling it AGI, because we want human-level competence. But

back then, at the beginning, the idea of OpenAI was that superintelligence is attainable. It is the endgame, the final purpose of the field of AI.”

Those caveats didn’t stop some of the smartest venture capitalists from throwing money at OpenAI during its [2019 funding round](#). At that point, the first VC firm to invest was Khosla Ventures, which kicked in \$50 million. According to Vinod Khosla, it was double the size of his largest initial investment. “If we lose, we lose 50 million bucks,” he says. “If we win, we win 5 billion.” Others investors reportedly would include elite VC firms Thrive Capital, Andreessen Horowitz, Founders Fund, and Sequoia.

The shift also allowed OpenAI’s employees to claim some equity. But not Altman. He says that originally he intended to include himself but didn’t get around to it. Then he decided that he didn’t need any piece of the \$30 billion company that he’d cofounded and leads. “Meaningful work is more important to me,” he says. “I don’t think about it. I honestly don’t get why people care so much.”

Because … not taking a stake in the company you cofounded is weird?

“If I didn’t already have a ton of money, it would be much weirder,” he says. “It does seem like people have a hard time imagining ever having enough money. But I feel like I have enough.” (Note: For Silicon Valley, this is *extremely* weird.) Altman joked that he’s considering taking one share of equity “so I never have to answer that question again.”

Ilya Sutskever, OpenAI’s chief scientist.

Photograph: Jessica Chou

The billion-dollar VC round wasn’t even table stakes to pursue OpenAI’s vision. The miraculous Big Transformer approach to creating LLMs required Big Hardware. Each iteration of the GPT family would need exponentially more power—GPT-2 had over a billion parameters, and GPT-3 would use 175 billion. OpenAI was now like Quint in *Jaws* after the shark hunter sees the size of the great white. “It turned out we didn’t know how much of a bigger boat we needed,” Altman says.

Obviously, only a few companies in existence had the kind of resources OpenAI required. “We pretty quickly zeroed in on Microsoft,” says Altman. To the credit of Microsoft CEO Satya Nadella and CTO Kevin Scott, the software giant was able to get over an uncomfortable reality: After more than 20 years and billions of dollars spent on a research division with supposedly cutting-edge AI, the Softies needed an innovation infusion from a tiny company that was only a few years old. Scott says that it wasn’t just Microsoft that fell short—“it was everyone.” OpenAI’s focus on pursuing AGI, he says, allowed it to accomplish a moonshot-ish achievement that the heavy hitters weren’t even aiming for. It also proved that not pursuing generative AI was a lapse that Microsoft needed to address. “One thing you just very clearly need is a frontier model,” says Scott.

Microsoft originally [chipped in a billion dollars](#), paid off in computation time on its servers. But as both sides grew more confident, the deal expanded. Microsoft now has [sunk \\$13 billion](#) into OpenAI. (“Being on the frontier is a very expensive proposition,” Scott says.)

Of course, because OpenAI couldn’t exist without the backing of a huge cloud provider, Microsoft was able to cut a great deal for itself. The corporation bargained for what Nadella calls “non-controlling equity interest” in OpenAI’s for-profit side—reportedly 49 percent. Under the terms of the deal, some of OpenAI’s original ideals of granting equal access to all were seemingly dragged to the trash icon. (Altman objects to this characterization.) Now, Microsoft has an exclusive license to commercialize OpenAI’s tech. And OpenAI also has committed to use Microsoft’s cloud exclusively. In other words, without even taking its cut of OpenAI’s profits (reportedly Microsoft gets 75 percent until its investment is paid back), Microsoft gets to lock in one of the world’s most desirable new customers for its Azure web services. With those rewards in sight, Microsoft wasn’t even bothered by the clause that demands reconsideration if OpenAI achieves general artificial intelligence, whatever that is. “At that point,” [says Nadella](#), “all bets are off.” It might be the last invention of humanity, he notes, so we might have bigger issues to consider once machines are smarter than we are.

By the time Microsoft began unloading Brinks trucks' worth of cash into OpenAI (\$2 billion in 2021, and the other \$10 billion earlier this year), OpenAI had completed GPT-3, which, of course, was even more impressive than its predecessors. When Nadella saw what GPT-3 could do, he says, it was the first time he deeply understood that Microsoft had snared something truly transformative. "We started observing all those emergent properties." For instance, GPT had taught itself how to program computers. "We didn't train it on coding—it just got good at coding!" he says.

Leveraging its ownership of GitHub, Microsoft released a product called Copilot that uses GPT to churn out code literally on command. Microsoft would later integrate OpenAI technology in new versions of its workplace products. Users pay a premium for those, and a cut of that revenue gets logged to OpenAI's ledger.

Some observers professed whiplash at OpenAI's one-two punch: creating a for-profit component and reaching an exclusive deal with Microsoft. How did a company that promised to remain patent-free, open source, and totally transparent wind up giving an exclusive license of its tech to the world's biggest software company? Elon Musk's remarks were particularly lacerating. "This does seem like the opposite of open—OpenAI is essentially captured by Microsoft," he posted on Twitter. On CNBC, he elaborated with an analogy: "Let's say you founded an organization to save the Amazon rainforest, and instead you became a lumber company, chopped down the forest, and sold it."

Musk's jibes might be dismissed as bitterness from a rejected suitor, but he wasn't alone. "The whole vision of it morphing the way it did feels kind of gross," says John Carmack. (He does specify that he's still excited about the company's work.) Another prominent industry insider, who prefers to speak without attribution, says, "OpenAI has turned from a small, somewhat open research outfit into a secretive product-development house with an unwarranted superiority complex."

Even some employees had been turned off by OpenAI's venture into the for-profit world. In 2019, several key executives, including head of research Dario Amodei, left to start a rival AI company called Anthropic. They

recently told *The New York Times* that OpenAI had gotten too commercial and had fallen victim to mission drift.

Another OpenAI defector was Rewon Child, a main technical contributor to the GPT-2 and GPT-3 projects. He left in late 2021 and is now at Inflection AI, a company led by former DeepMind cofounder Mustafa Suleyman.

Altman professes not to be bothered by defections, dismissing them as simply the way Silicon Valley works. “Some people will want to do great work somewhere else, and that pushes society forward,” he says. “That absolutely fits our mission.”

Until November of last year, awareness of OpenAI was largely confined to people following technology and software development. But as the whole world now knows, OpenAI took the dramatic step of releasing a consumer product late that month, built on what was then the most recent iteration of GPT, version 3.5. For months, the company had been internally using a version of GPT with a conversational interface. It was especially important for what the company called “truth-seeking.” That means that via dialog, the user could coax the model to provide responses that would be more trustworthy and complete. ChatGPT, optimized for the masses, could allow anyone to instantly tap into what seemed to be an endless source of knowledge simply by typing in a prompt—and then continue the conversation as if hanging out with a fellow human who just happened to know everything, albeit one with a penchant for fabrication.

Within OpenAI, there was a lot of debate about the wisdom of releasing a tool with such unprecedented power. But Altman was all for it. The release, he explains, was part of a strategy designed to acclimate the public to the reality that artificial intelligence is destined to change their everyday lives, presumably for the better. Internally, this is known as the “iterative deployment hypothesis.” Sure, ChatGPT would create a stir, the thinking went. After all, here was something anyone could use that was smart enough to get college-level scores on the SATs, write a B-minus essay, and summarize a book within seconds. You could ask it to write your funding proposal or summarize a meeting and then request it to do a rewrite in Lithuanian or as a Shakespeare sonnet or in the voice of someone obsessed with toy trains. In a few seconds, pow, the LLM would comply. Bonkers.

But OpenAI saw it as a table-setter for its newer, more coherent, more capable, and scarier successor, GPT-4, trained with a reported 1.7 trillion parameters. (OpenAI won't confirm the number, nor will it reveal the data sets.)

Altman explains why OpenAI released ChatGPT when GPT-4 was close to completion, undergoing safety work. "With ChatGPT, we could introduce chatting but with a much less powerful backend, and give people a more gradual adaptation," he says. "GPT-4 was a lot to get used to at once." By the time the ChatGPT excitement cooled down, the thinking went, people might be ready for GPT-4, which can pass the bar exam, plan a course syllabus, and write a book within seconds. (Publishing houses that produced genre fiction were indeed flooded with AI-generated bodice rippers and space operas.)

A cynic might say that a steady cadence of new products is tied to the company's commitment to investors, and equity-holding employees, to make some money. OpenAI now charges customers who use its products frequently. But OpenAI insists that its true strategy is to provide a soft landing for the singularity. "It doesn't make sense to just build AGI in secret and drop it on the world," Altman says. "Look back at the industrial revolution—everyone agrees it was great for the world," says Sandhini Agarwal, an OpenAI policy researcher. "But the first 50 years were really painful. There was a lot of job loss, a lot of poverty, and then the world adapted. We're trying to think how we can make the period before adaptation of AGI as painless as possible."

Sutskever puts it another way: "You want to build larger and more powerful intelligences and keep them in your basement?"

Even so, OpenAI was stunned at the reaction to ChatGPT. "Our internal excitement was more focused on GPT-4," says Murati, the CTO. "And so we didn't think ChatGPT was really going to change everything." To the contrary, it galvanized the public to the reality that AI had to be dealt with, *now*. ChatGPT became the fastest-growing consumer software in history, amassing a reported 100 million users. (Not-so-OpenAI won't confirm this, saying only that it has "millions of users.") "I underappreciated how much

making an easy-to-use conversational interface to an LLM would make it much more intuitive for everyone to use,” says Radford.

ChatGPT was of course delightful and astonishingly useful, but also scary —prone to “hallucinations” of plausible but shamefully fabulist details when responding to prompts. Even as journalists wrung their hands about the implications, however, they effectively endorsed ChatGPT by extolling its powers.

The clamor got even louder in February when Microsoft, taking advantage of its multibillion-dollar partnership, released a [ChatGPT-powered version of its search engine](#) Bing. CEO Nadella was euphoric that he had beaten Google to the punch in introducing generative AI to Microsoft’s products. He taunted the search king, which had been cautious in releasing its own LLM into products, to do the same. “I want people to know [we made them dance](#),” he said.

In so doing, Nadella triggered an arms race that tempted companies big and small to release AI products before they were fully vetted. He also triggered a new round of media coverage that kept wider and wider circles of people up at night: interactions with Bing that unveiled the chatbot’s shadow side, replete with unnerving professions of love, an envy of human freedom, and a weak resolve to withhold misinformation. As well as an unseemly habit of creating hallucinatory misinformation of its own.

But if OpenAI’s products were forcing people to confront the implications of artificial intelligence, Altman figured, so much the better. It was time for the bulk of humankind to come off the sidelines in discussions of how AI might affect the future of the species.

Photograph: Jessica Chou

OpenAI’s San Francisco headquarters is unmarked; but inside, the coffee is awesome.

Photograph: Jessica Chou

As society started to prioritize thinking through all the potential drawbacks of AI—job loss, misinformation, human extinction—OpenAI set about placing itself in the center of the discussion. Because if regulators, legislators, and doomsayers mounted a charge to smother this nascent alien intelligence in its cloud-based cradle, OpenAI would be their chief target anyway. “Given our current visibility, when things go wrong, even if those things were built by a different company, that’s still a problem for us, because we’re viewed as the face of this technology right now,” says [Anna Makanju](#), OpenAI’s chief policy officer.

Makanju is a Russian-born DC insider who served in foreign policy roles at the US Mission to the United Nations, the US National Security Council, and the Defense Department, and in the office of Joe Biden when he was vice president. “I have lots of preexisting relationships, both in the US government and in various European governments,” she says. She joined OpenAI in September 2021. At the time, very few people in government gave a hoot about generative AI. Knowing that OpenAI’s products would soon change that, she began to introduce Altman to administration officials and legislators, making sure that they’d hear the good news and the bad from OpenAI first.

“Sam has been extremely helpful, but also very savvy, in the way that he has dealt with members of Congress,” says Richard Blumenthal, the chair of the Senate Judiciary Committee. He contrasts Altman’s behavior with that of the younger Bill Gates, who unwisely stonewalled legislators when Microsoft was under antitrust investigations in the 1990s. “Altman, by contrast, was happy to spend an hour or more sitting with me to try to educate me,” says Blumenthal. “He didn’t come with an army of lobbyists or minders. He demonstrated ChatGPT. It was mind-blowing.”

In Blumenthal, Altman wound up making a semi-ally of a potential foe. “Yes,” the senator admits. “I’m excited about both the upside and the potential perils.” OpenAI didn’t shrug off discussion of those perils, but presented itself as the force best positioned to mitigate them. “We had 100-page system cards on all the red-teaming safety valuations,” says Makanju. (Whatever that meant, it didn’t stop users and journalists from endlessly discovering ways to jailbreak the system.)

By the time Altman made his first appearance in [a congressional hearing](#)—fighting a fierce migraine headache—the path was clear for him to sail through in a way that Bill Gates or Mark Zuckerberg could never hope to. He faced almost none of the tough questions and arrogant badgering that tech CEOs now routinely endure after taking the oath. Instead, senators asked Altman for advice on how to regulate AI, a pursuit Altman enthusiastically endorsed.

The paradox is that no matter how assiduously companies like OpenAI red-team their products to mitigate misbehavior like deepfakes, misinformation efforts, and criminal spam, future models might get smart enough to foil the efforts of the measly minded humans who invented the technology yet are still naive enough to believe they can control it. On the other hand, if they go *too* far in making their models safe, it might hobble the products, making them less useful. One study indicated that more recent versions of GPT, which have improved safety features, are actually dumber than previous versions, making errors in basic math problems that earlier programs had aced. (Altman says that OpenAI’s data doesn’t confirm this. “Wasn’t that study retracted?” he asks. No.)

It makes sense that Altman positions himself as a fan of regulation; after all, his mission is AGI, but safely. Critics have charged that he’s gaming the process so that regulations would thwart smaller startups and give an advantage to OpenAI and other big players. Altman denies this. While he has endorsed, in principle, the idea of an international agency overseeing AI, he does feel that some proposed rules, like banning all copyrighted material from data sets, present unfair obstacles. He pointedly didn’t sign a widely distributed letter urging a six-month moratorium on developing more powerful AI systems. But he and other OpenAI leaders did add their names to a one-sentence statement: “Mitigating the risk of extinction from AI should be a global priority alongside other societal-scale risks such as pandemics and nuclear war.” Altman explains: “I said, ‘Yeah, I agree with that. One-minute discussion.’”

As one prominent Silicon Valley founder notes, “It’s rare that an industry raises their hand and says, ‘We are going to be the end of humanity’—and then continues to work on the product with glee and alacrity.”

OpenAI rejects this criticism. Altman and his team say that working and releasing cutting-edge products is *the way* to address societal risks. Only by analyzing the responses to millions of prompts by users of ChatGPT and GPT-4 could they get the knowledge to ethically align their future products.

Still, as the company takes on more tasks and devotes more energy to commercial activities, some question how closely OpenAI can concentrate on the mission—especially the “mitigating risk of extinction” side. “If you think about it, they’re actually building *five* businesses,” says an AI industry executive, ticking them off with his fingers. “There’s the product itself, the enterprise relationship with Microsoft, the developer ecosystem, and an app store. And, oh yes—they are also obviously doing an AGI research mission.” Having used all five fingers, he recycles his index finger to add a sixth. “And of course, they’re also doing the investment fund,” he says, referring to a \$175 million project to seed startups that want to tap into OpenAI technology. “These are different cultures, and in fact they’re conflicting with a research mission.”

I repeatedly asked OpenAI’s execs how donning the skin of a product company has affected its culture. Without fail they insist that, despite the for-profit restructuring, despite the competition with Google, Meta, and countless startups, the mission is still central. Yet OpenAI *has* changed. The nonprofit board might technically be in charge, but virtually everyone in the company is on the for-profit ledger. Its workforce includes lawyers, marketers, policy experts, and user-interface designers. OpenAI contracts with hundreds of content moderators to educate its models on inappropriate or harmful answers to the prompts offered by many millions of users. It’s got product managers and engineers working constantly on updates to its products, and every couple of weeks it seems to ping reporters with demonstrations—just like other product-oriented Big Tech companies. Its offices look like an *Architectural Digest* spread. I have visited virtually every major tech company in Silicon Valley and beyond, and not one surpasses the coffee options in the lobby of OpenAI’s headquarters in San Francisco.

Not to mention: It’s obvious that the “openness” embodied in the company’s name has shifted from the radical transparency suggested at

launch. When I bring this up to Sutskever, he shrugs. “Evidently, times have changed,” he says. But, he cautions, that doesn’t mean that the prize is not the same. “You’ve got a technological transformation of such gargantuan, cataclysmic magnitude that, even if we all do our part, success is not guaranteed. But if it all works out we can have quite the incredible life.”

“The biggest thing we’re missing is coming up with new ideas,” says Brockman. “It’s nice to have something that could be a virtual assistant. But that’s not the dream. The dream is to help us solve problems we can’t.”

“I can’t emphasize this enough—we didn’t have a master plan,” says Altman. “It was like we were turning each corner and shining a flashlight. We were willing to go through the maze to get to the end.” Though the maze got twisty, the goal has not changed. “We still have our core mission —believing that safe AGI was this critically important thing that the world was not taking seriously enough.”

Meanwhile, OpenAI is apparently taking its time to develop the next version of its large language model. It’s hard to believe, but the company insists it has yet to begin working on GPT-5, a product that people are, depending on point of view, either salivating about or dreading. Apparently, OpenAI is grappling with what an exponentially powerful improvement on its current technology actually looks like. “The biggest thing we’re missing is coming up with new ideas,” says Brockman. “It’s nice to have something that could be a virtual assistant. But that’s not the dream. The dream is to help us solve problems we can’t.”

Considering OpenAI’s history, that next big set of innovations might have to wait until there’s another breakthrough as major as transformers. Altman hopes that will come from OpenAI—“We want to be the best research lab in the world,” he says—but even if not, his company will make use of others’ advances, as it did with Google’s work. “A lot of people around the world are going to do important work,” he says.

It would also help if generative AI didn’t create so many new problems of its own. For instance, LLMs need to be trained on huge data sets; clearly the most powerful ones would gobble up the whole internet. This doesn’t sit well with some creators, and just plain people, who unwittingly provide

content for those data sets and wind up somehow contributing to the output of ChatGPT. Tom Rubin, an elite intellectual property lawyer who officially joined OpenAI in March, is optimistic that the company will eventually find a balance that satisfies both its own needs and that of creators—including the ones, like comedian Sarah Silverman, who are [suing OpenAI](#) for using their content to train its models. One hint of OpenAI's path: partnerships with news and photo agencies like the [Associated Press](#) and [Shutterstock](#) to provide content for its models without questions of who owns what.

As I interview Rubin, my very human mind, subject to distractions you never see in LLMs, drifts to the arc of this company that in eight short years has gone from a floundering bunch of researchers to a Promethean behemoth that has changed the world. Its very success has led it to transform itself from a novel effort to achieve a scientific goal to something that resembles a standard Silicon Valley unicorn on its way to elbowing into the pantheon of Big Tech companies that affect our everyday lives. And here I am, talking with one of its key hires—a lawyer—not about neural net weights or computer infrastructure but copyright and fair use. Has this IP expert, I wonder, signed on to the mission, like the superintelligence-seeking voyagers who drove the company originally?

Rubin is nonplussed when I ask him whether he believes, as an article of faith, that AGI will happen and if he's hungry to make it so. "I can't even answer that," he says after a pause. When pressed further, he clarifies that, as an intellectual property lawyer, speeding the path to scarily intelligent computers is not his job. "From my perch, I look forward to it," he finally says.

Updated 9-7-23, 5:30pm EST: This story was updated to clarify Rewon Child's role at OpenAI, and the aim of a letter calling for a six-month pause on the most powerful AI models.

Styling by Turner/The Wall Group. Hair and Makeup by Hiroko Claus.

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Aug 31, 2023 6:00 AM

She Sacrificed Her Youth to Get the Tech Bros to Grow Up

As a young industrial designer, Patricia Moore undertook a radical experiment in aging. Her discoveries reshaped the built world.

Known as the Mother of Empathy, Patricia Moore is considered one of the founders of universal design. Photograph: Jesse Rieser

When Patricia Moore was 26, she looked in the mirror and saw an 85-year-old woman. Crow's feet clustered at her eyes, her back hunched, and silver hair gathered around her face. Another person might be horrified. Moore held a hand to her cheek, astonished and thrilled at the transformation.

Back then—this was the spring of 1979—Moore was a young [industrial designer](#) living in New York City and working at Raymond Loewy Associates, the famous designer of everything from NASA's Skylab space station to home appliances. At a planning meeting one afternoon, Moore mentioned that, growing up, she'd seen her arthritic grandmother struggle to open refrigerators. She suggested creating a fridge door that unlatched with ease. "Pattie," a senior colleague told her, "we don't design for those people." The firm's target users were middle-aged male professionals. Moore fumed at the injustice, to say nothing of the lost business opportunity. But, she thought, who was she to advocate on behalf of elderly consumers? Moore had never struggled to open anything. She left the meeting frustrated, with a feeling she couldn't shake: If she could understand what it was like to be old, she could develop better products. Not just for elders, but for everybody.

Not long after, Moore attended a party where she met Barbara Kelly, a makeup artist for a new sketch comedy show called *Saturday Night Live*. Kelly, it turned out, had a specific talent: aging up actors. Moore had an idea. “Look at me. Look at my face,” she said to Kelly. “And tell me if you could make me look old.” Moore’s face was round, without high cheekbones—the perfect canvas for an ersatz wizening. “I could make you look *very* old,” Kelly replied. Within a few days, the makeup artist crafted custom flesh-toned prosthetic pieces for Moore. She created jowls, eye bags, and saggy neck skin. The result, once carefully adhered to Moore’s face and topped with makeup, was uncanny—as if Moore had stepped into a time machine, or fallen under a spell.

As “Old Pat,” Moore wore her grandmother’s clothing, a pillbox hat, glasses, orthopedic shoes, and gloves to hide the youthful texture of her hands. She darkened her teeth with smudges of crayon and clouded her eyes with dabs of baby oil. She also wanted to *feel* old; otherwise, she reasoned, the experiment wouldn’t work. So she plugged her ears with wax to dampen her hearing. Taped her fingers to simulate arthritis. Wrapped cloth over her shoulder to create a hump. Secured balsa wood splints behind her knees to restrict her movement.

Old Pat’s first outing was at a conference on aging in Ohio. When she fooled everyone there, she knew she was in business. For three years, Moore went undercover as Old Pat at least once a week, packing the costume in her suitcase when traveling. Old Pat visited 116 cities in 14 states and two Canadian provinces. Moore felt she wasn’t merely putting on a character; she was living part of her life as an old woman.

She chronicled her insights about navigating the world in a changed body—the connections she made with others, and the prejudice she faced—in a book, *Disguised*, published in 1985. Picture a Stephen King-esque cover with dramatic hot-pink font and eerie photographs of Young and Old Pat. “Old has become a synonym for being useless, ugly, unimportant, of less value,” Moore wrote. “That is the core perception which must be changed, and I think will be changed, in this generation.” She endeavored to be part of that shift by talking about her experiences and championing a new form of product design.

Published in 1985, Moore's book (out of print but easy to track down) chronicled her insights about navigating the world in a changed body.

Left: Courtesy of Patricia Moore; Source Image: Helen Marcus; Right: Courtesy of Bruce Byers

Today, Moore, who started a firm called MooreDesign Associates in the early '80s, is considered one of the founders of "universal design," the idea that products and environments should be built to accommodate the widest range of people possible. Moore has designed for Johnson & Johnson, Boeing, Kraft, AT&T, Herman Miller, and 3M, among many others. She's known in the industry as the "Mother of Empathy." In interviews, colleagues called her a Jedi, a unicorn, and a design goddess. David Kusuma, president of the World Design Organization, told me, "I don't think there is anyone in the design world who hasn't heard of her."

Now Moore is 70. Nearly 40 years after the publication of *Disguised*, in other words, the Mother of Empathy is much closer to the grandmotherly age she once pretended to be. Despite her hope that her generation would overturn ageism, technological progress has, in many cases, created more problems for aging users than it has solved. I wanted Moore's assessment.

Then, mere days into reporting this story, I got into a horrible accident. Suddenly I, too, had a changed body, one that would teach me, in a way little else could, just how necessary Moore's work is.

This article appears in the November 2023 issue. [Subscribe to WIRED](#)Photograph: Sinna Nasseri

When I fell, my left foot hit the ground first. Tumbling from a horse can feel like the world has turned into a kaleidoscope. I was ejected in a particularly spectacular fashion by a buck that flipped me over my horse's head. I sat up in the dirt and took stock. My head was OK, as were my neck and back. My horse, too, was fine. My trembling leg was not.

An x-ray revealed I'd dislocated my tibia and broken my ankle in three places. My leg was repaired with eight screws, a plate, and a high-strength polymer cord known as a tightrope fixation. In an instant, I went from an

athletic 33-year-old to someone who moved through the world on crutches, casted foot held aloft like a flamingo's. Beyond the immense pain, my environment became a fun house, the simplest tasks distorted. Getting from my bed to the couch felt like a marathon, and every room I entered became a dangerous obstacle course. As I fumbled with faucets while struggling to balance on my crutches and stumbled over uneven carpeting, it became clear that the world is not designed for everyone. Which means, in Moore's view, that it's designed poorly.

I began corresponding with Moore shortly after my accident. I apologized for having to interview her over Zoom from an "unconventional location"—code for my bed, where I spent most of my days with my leg elevated. "I can relate," she said. "There's a video somewhere of me delivering a keynote in my hospital bed, heavily drugged, after being hit by a car in Wellington." She, too, had broken her leg. "One of my peeps tried to kill me," she said, laughing. "She was 82, and she ran a light."

There's great camaraderie in the Broken Leg Club. Naturally, Moore and I compared hardware. Screws, a plate, and a cadaver bone allow her to walk today. When I asked for more specifics, Moore launched into the whole tale, from the ugly blue shade of the car that hit her to the "Adonis" of a nurse assigned to her. "He looked like the Rock and had all these tribal tats," she said. She imagined her bone donor was a man named George, so that's what she nicknamed her repaired leg.

Moore rarely gives a straightforward answer to questions, preferring stories to sound bites, and tends to race off on lively tangents. This isn't to say her time isn't precious. MooreDesign Associates is pursued by a range of clients, many of them tech companies. When she's at home in Phoenix, Arizona, Moore wakes up at 6 am, watches *Today*, and then holes up for the workday. She typically works for 11 hours, wrapping up in time for dinner. From 1982 until the Covid-19 lockdown, she traveled 250 days out of the year. Even with her reduced schedule, over the course of my reporting she flew to Norway, the UK, Ireland, New York, Ohio, and California. She rarely takes days off.

These days, Moore doesn't just design; she interrogates ideas. Take, for instance, her recent appearance at a consortium of autonomous car

companies. “Everybody was crowing about their wonderful vehicles,” she said. Then it was her turn. “They expected Mommy to say, ‘Oh, you get a gold star, here’s your T-ball trophy,’” she said. Instead, Moore asked: If someone isn’t ambulatory, and an autonomous vehicle arrives to take them to their doctor’s appointment, who is getting that person out of the house and into the car? “I just looked around the room, as I’m paid to do,” she said. “They not only wanted me out of the room, they wanted me out of the building, out of the country.”

Moore’s clients bring her onboard for any number of reasons. Her astute eye. Her belief in the power (and profit) of empathy. Her fame. And, of course, her knowledge about a rapidly aging population. Today’s elders are living longer than ever before—the median age of Americans is the [highest it has been in history](#)—yet there’s a scarcity of professional caregivers. What’s more, technological progress has become so rapid, and so integrated into everyday living, that it’s threatening to leave whole groups of people behind. “A huge industry needs to be born, and quickly,” Moore said.

“With each passing year, we need more and more stuff in order to maintain our autonomy and independence,” Moore said.

Photograph: Jesse Rieser

Still, as we talked, it became clear that Moore doesn’t see design as an aging problem. “What’s age got to do with it?” she said. “At the end of the day, often very little.” Nor is it a problem of disability—a word Moore hates because it implies exclusion. “It’s *lifestyle* that design needs to focus on,” she said. And lifestyle can change at any age, at any time. “You and I are living with bodies changed by events,” she told me. “We are living in a very fragile shell. And that means some days we’re more able than others.”

Over the course of getting to know the Mother of Empathy, I found real-world empathy in short supply. Young and middle-aged people blocked my way while I was aboard crutches or in a wheelchair, dashed to cut me in line, shut doors in my face. Public restrooms became the bane of my existence: often illogically designed, and with seemingly able-bodied people constantly occupying the accessible stall when others were clearly available. What was wrong with these twerps? Yet I’d been one of them not long ago. Perhaps

not so brazen and uncaring, but naive to what the world could be like. The privilege of living in a healthy body had come so easily. In retrospect, I felt ridiculous.

Older people, however, went out of their way for me, offering help and striking up conversations. I commiserated with elderly folks about frustrating pharmacy hours and, gosh, what was with the lines? One woman stopped me on the street and, without asking what was wrong, said, “Broken leg? Oh, dear, I’m sorry.” These elders understood the difficulty of enduring everyday activities that others took for granted. My husband joked that I’d get out of this injury with just elderly friends. (If only.) As I tried to be a good patient when even getting out of bed to brush my teeth felt like a Herculean task, my mother-in-law remarked, “You will make a good old person.”

Moore, too, was a good young-old person. She grew up in a multigenerational home with her sisters, parents, and grandparents. She has a black-and-white photograph of herself, no older than 2, standing at the bottom of some stairs. According to family lore, her father asked her to climb up. No, she said, she couldn’t, and it wasn’t fair; the stairs were impossibly big. In the photo, she scowls at the camera. “My distaste for discriminatory design started young,” Moore said.

Moore had an affinity for art and enrolled in the Rochester Institute of Technology. “I was going to study medical illustration so I could be a fine artist and suffer through a day job of drawing body parts,” she said. Instead, a professor suggested she might be a good fit for industrial design. She graduated in 1974 with a BFA, wed her college sweetheart that weekend, and took a job offer from Raymond Loewy. Moore was the firm’s first female industrial designer. Loewy had her back. His daughter was around her age, and he saw a spark in Moore. At the company, Moore helped create the first full-body CAT scanner and the first mobile x-ray unit.

In those days, designers created sleek products and then told customers how they should be used. Rama Gheerawo, director of the Helen Hamlyn Centre for Design, described the mindset as: “*You tell them* what they need.” Moore didn’t understand that way of working; for her, *they*—the people actually using the products—should tell *you*—merely the designer—what they need,

and only then can you create it. After the eye-opening meeting about refrigerator doors, Moore's grandparents became the metric by which she'd determine whether a design was usable. "My fellows thought I was a stark raving mad bitch," she said. But Loewy listened, and he allowed Moore to study biomechanics and gerontology as a part-time student.

Not long after she started dressing up as Old Pat, Moore left Loewy for a more flexible job designing private jets. She also got divorced. (That husband was the first of three, all of whom became disillusioned, she said, with her ambition and obsession with work.) Reeling from heartbreak, Moore threw herself into the role. As long as she finished her outings as Old Pat with enough time to complete her work and school projects, nobody asked questions. She pulled all-nighters fueled by coffee and M&M's. She felt it was worth it for the time spent walking around the city and riding the subway in what she called the "Elder Empathetic Experiment." Whenever she traveled, she'd add a day to let Old Pat explore.

Her body modifications made getting around difficult, even painful. With the balsa wood behind her knees, she waddled. "When I climbed stairs to board a bus, I'd have to step sideways," she said. "It took a long time, and I had to hang on for dear life." More than once, strangers yanked her out of the path of oncoming cars because she moved too slowly. Her stiff fingers struggled to unwrap cellophane from candy. "I looked at it, rather philosophically, as a trade-off: no pain, no gain, as the saying goes," Moore wrote in *Disguised*. "I should have expected problems galore, and I got them."





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Photograph: Jesse Rieser

The wig Moore wore for three years as “Old Pat”

It wasn't only the costume that taught her about living in a changed body. Strangers treated her differently as Old Pat, shouting at her as if she were hard of hearing or trying to short-change her at shops. She experimented with different personae. Appearing poor rendered her nearly invisible. Yet a middle-class version of Old Pat could chat up a group of old folks and become instant friends. One elderly woman tearfully confided in her that her adult daughter hit her. A lonely widower wooed her from a Central Park bench. Very young children sidled up to her as if she were their grandmother.

She didn't tell her family about the project until it consumed so much of her life that she had to spill. “My poor daddy couldn't bear to see me in character,” she said. “My grandmother was already dead, and I looked just like her.” Her grandfather told her to be careful. An NYPD officer warned

her that the elderly were often targets of muggings; she could be hurt, even killed.

And then she almost was. Moore typically planned to get home before dark, but one day she stopped for a bite to eat. Dusk fell as she left the restaurant. To get to the New York subway as quickly as possible, she cut through an empty playground. “I heard sneakered feet running,” she said. “Then someone had their arm around my neck and their knee in the small of my back.” A group of boys jerked her to the ground, grabbed her purse, and repeatedly kicked her in her stomach. With the restrictions on her body, she couldn’t flee. The boys continued to taunt and beat her. She lost consciousness.

When Moore came to, she was bleeding and thought she might die. She heard her grandma’s voice telling her, *Not yet*. She used her cane to stagger to her feet and stumbled toward a street where she could flag down a cab. Bruises covered Moore’s body, and she sustained sciatic nerve damage. For years, two fingers remained numb. During her second marriage, she would learn that the beating also rendered her unable to have children.

Yet even after “the attack,” as she came to call it, she kept dressing up as Old Pat. She felt she wasn’t done learning from the experience. Increasingly, Moore found it difficult to get out of character and return to her life. A cloud of guilt followed her for being young and, as such, part of a demographic that was unkind to elders. She stopped going to parties or getting drinks with friends. She experienced extreme physical tolls, too. Her skin bled from being rubbed by the constraints, the latex made her face swell, and her back throbbed from being stooped. “It was like a full-body hangover of pain,” Moore said. Eventually, she developed bleeding ulcers and was hospitalized for exhaustion.

Finally, the physical discomfort of being in character became too much. More than that, the interactions she had with others stopped feeling illuminating. She woke up one October in 1982 and realized she was done. After three years, Old Pat had taught her all she could. Moore got into costume and took one last trip around the neighborhood, to Bloomingdale’s, to Central Park. Then Moore peeled off her latex skin and wig and accessories, and tucked it all away in boxes, like the artifacts of a long-dead

loved one. Young Pat resumed control. “It’s not a sad parting, though,” Moore wrote in *Disguised*. “I expect to see her again—in the mirror—in about 50 years!”

Although Moore never dressed up as Old Pat again, her career came to be defined by the ways she continued to put herself on the line for research. She is coy about mentioning certain brands and products, constrained by the many NDAs she has signed over the years, but she still has countless public-facing accomplishments. In her post-Loewy career, she led design for the first home dialysis system and the first automatic breast release mammography unit. (The latter saved patients many moments of pain—previously, technicians had to manually unclamp breasts.) She helped design the [Honolulu metro light-rail vehicle](#) and led design for the [Phoenix Sky Harbor airport train system](#). She worked with Wounded Warriors to improve prosthetics and helped draft the Americans with Disabilities Act of 1990. She designed hundreds of physical rehabilitation facilities, including ones fashioned like streets and grocery stores so that elders could practice real-world skills after falls, strokes, or surgery. She teaches and gives speeches all over the world. She won the prestigious [Cooper Hewitt National Design Award](#) and the [World Design Medal](#), among many other honors.

Moore led design for the first automatic breast release mammography unit.

Courtesy of Patricia Moore

Aside from her experiment as Old Pat, Moore is most commonly associated with a simple, yet transformative, kitchen item: Oxo Good Grips. In 1989, a businessman named Sam Farber set out to create a group of kitchen appliances that would make it easier for his arthritis-stricken wife to peel produce. At the time, Moore was married to her second husband; they both consulted on the design for Farber. Bicycle grips were the inspiration for the Oxo product’s famously squishy black handles. “The delicate detailing and the slices at the thumbprint on the handle helped you hold it even better,” Moore said. She pushed Farber to think about how the Good Grips might be comfortable for anyone rather than just marketing to those with specific needs.

Moore at the grand opening of Independence Way, a rehab unit she designed for the Washington DC Veterans Affairs Medical Center.

Courtesy of US Department of Veteran Affairs

That first line of ergonomic, chunky-handled kitchen tools hit the market in 1990 as Oxo's flagship product. They were three times as expensive as traditional kitchen devices, but sales took off, proving for the first time that universal design could be profitable and even elegant. Four years later, the Oxo vegetable peeler was added to the Museum of Modern Art's permanent collection. The upside of a failed marriage, Moore said: "It brought me into an iconic project that defined, finally, what universal, inclusive design looks like."

The train system at Phoenix Sky Harbor International Airport, which Moore helped design.

Photograph: Alamy

As iconic as Oxo Good Grips became, though, there's another story from earlier in Moore's career that I think better exemplifies her work: the time she peed in a meeting room.

It was the early 1980s, and Moore was helping Kimberly-Clark design one of the first incontinence products for adults, which would become Depend. Regardless of the fact that Moore had dealt with incontinence since being attacked in New York City, she felt it was her responsibility to test out products herself. So, before a long day of meetings with Kimberly-Clark executives, she pulled the prototype on under her skirt. She took her seat in the conference room and, when the urge hit her, she urinated. Then stood up to check her skirt, rather publicly, for stains.

Moore also paid a group of women, each of whom cared for elderly family members, to come in to talk about incontinence. After Moore revealed her own struggles to the group, they opened up. "You know what's coming next," she told me. "Every woman at that table admitted to some level of bladder incontinence." These women had given birth, aged, or gone through menopause. "There was giggling about, 'I can't sneeze anymore without

having to run into the bathroom.”” These women were not the company’s original target, but suddenly a huge demographic opened up for the products.

One of Moore’s mentees, Michael Seum, now the vice president of design at Kohler, summed up Moore’s mentality this way: “We’re not going to focus on the design. We’re going to focus on how to understand all the issues, and then we’ll start designing.” Inspired by Moore, Seum has had executives and employees don gear to simulate cataracts or mobility impairments. “And then I had them read magazines, brush their teeth, sit on the toilet and flush it,” Seum said. “I had no objective other than to just let them experience life through a different lens.”

I arrived at a restaurant to meet Moore and tugged at the door. Locked—it was one minute before opening. Had this been just a month earlier, the short wait would have been excruciating; my leg had pulsed with pain anytime I stood. By this point, I had weaned off crutches, though I still walked with a limp.

When the hostess let me in, I gave her the reservation name. “The other guest is already seated,” she said.

That was impossible. The restaurant wasn’t open yet.

“She’s been here awhile,” she explained.

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Indeed, there was Moore, waiting at a table with a bottle of Pellegrino. She wore one of her signature outfits, a black long-sleeve shirt beneath a crinkly brown dress the texture of a fashionable paper bag. This she paired with clogs. She looked up from her phone and smiled. She’d been dropped off earlier and passed the time by making conversation with the staff.

At design events, Moore has overheard people call her “tiny.” She considers it with amusement—what size did they expect her to be? But it’s the

difference between her 5'2" stature and her room-filling personality that makes the contrast so stark. It's also easy to see how she could disappear into the role of little old lady without getting caught.

Moore laid out a few handmade gifts on the table. First, a trio of origami shamrocks. (Moore folds origami for neighbors and people she meets during her travels.) An abstract ink drawing of intertwined orbs. (She said I could look at it to ease writer's block.) I unwrapped the third gift and discovered black fabric inside.

"A pot holder?" I asked.

Yes, woven from American Airlines socks. "Unworn," she reassured me. She told me she'd given one to the chief curator at the Henry Ford Museum. He framed and hung it in his office.

Moore had recently sorted through her archives for the museum, where her materials will be held in its [permanent collection](#). Every artifact in her archive—a photograph, a product prototype, a letter from an old colleague—represents a unique path of her life's story. She sent more than 200 boxes to the museum, including one that contained the Old Pat costume: bloodied, dirtied, and torn from the attack. "I'm glad I kept it," she said. Then, with pain lacing her voice, "It'll be interesting seeing that mannequin."

Moore readily talks about the attack, but she still has nightmares of being beaten. When she hears sneakered feet running, she feels the flicker of panic. She experiences neuropathy in her legs, which can burn so severely at night she often sleeps with them elevated against a wall.

Then there's the impact of her infertility, something Moore said defined much of who she became. As she looked through her archive, she found the letters she'd collected from students, mentees, and colleagues, many of whom send her Mother's Day cards each year. She calls herself "the Mutha" as a joke, but she takes the role seriously. "She brings that level of parenting love to her craft or profession," said Joel Kashuba, another Moore mentee and head of design at Nike Valiant Labs. "Love that may have otherwise gone into her children she has learned to, in an extraordinary way, give to others within the field." Though it seems patriarchal to focus on a woman's

ability to bear children—and, in some ways, absurd to mourn the absence of motherhood when she's accomplished so much—it's also a truth to Moore. "Certainly, I would not work like I did if I had children," she said. "Instead, I'm defined by work. But I bristle when people say, 'Oh, you would have been such a good mother.' Because I am a good mother. I define motherhood in much broader terms than just giving birth."

"My distaste for discriminatory design started young," Moore said.

Photograph: Jesse Rieser

Moore's pace remains relentless because the stakes are so high; she sees suffering around her and knows that not enough has been done about it. Of the 10 colleagues of Moore's whom I interviewed, most expressed worry about who would continue her legacy. For all she's taught the next generation of designers, there's no one they feel is quite as compelling, knowledgeable, or invested. Moore jokes that she will die while in the middle of work. ("When I travel, I put a little card on the nightstand that identifies me, my American Airlines number, and my sister's number, you know, in case they find me dead," she said. "I don't want housekeeping to just toss me in a black plastic bag.")

Of course, as Moore ages, her mission has become more personal. "I am not an optimist about what my next 10 or 20 years looks like, and I'm really sad to say that," she said. She worries about living if design and technology can't rise to the occasion. Then she hesitated, caught off guard by her own admission. "I've never said it out loud." In the public eye, she tries to be a positive force, but behind closed doors with her friends, "we're all scared to death."

Moore believes technology will be critical in helping more people age gracefully, especially single elders like herself who want to age in place. "With each passing year, we need more and more stuff in order to maintain our autonomy and independence," Moore said. "Nothing gets Amazon, Alphabet, Microsoft, all these players excited like, 'Ooh, Pattie says they want to live independently. We can make stuff.'" But what stuff, exactly? The [wiggling robotic seals](#) meant to keep elders company in nursing homes "are one piece of a much bigger puzzle," she said. She envisions a future

world where toilets analyze our urine for health changes, shoes monitor our gait, and charming humanoid robots supplement human caregiving by feeding and dressing elders. “I want him, in a British accent, to say, ‘Darling, would you like some tea?’” Moore said.

In the shorter term, she believes wearables can play a bigger role. “I wear glasses, earrings, watches, necklaces,” she said. “All of that stuff should be informing us, keeping us safe, and letting the good guys know where we are if we go missing.” While many of today’s elders are tech sophisticates who order from Amazon and chat on FaceTime, nearly a third of those over 65 don’t have smartphones. Those individuals are being locked out of using wearables that pair with phones—or even simple things like using QR codes to read electronic menus. Moore now spends much of her time consulting on wearables, including as a board member for a new startup called Nudge, which is developing a bracelet that sends alerts through a closed network rather than a smartphone (or even Wi-Fi).

At the end of the meal, Moore and I both needed to use the restroom, which happened to be down a flight of stairs. Moore noted that she would be slow. Not because of her age, but because of George, her injured leg. “Being hit by a car did change everything,” she said. She took the stairs sideways, holding on to the banister and placing both her feet carefully on each step before proceeding. I thought about Old Pat struggling up bus steps, and about Moore as a toddler at the bottom of that staircase: the way life cycles back around.

I also thought about my own injury, and felt guilty. Soon enough, I’d be fine. My limp would largely vanish. I’d have no problem on stairs. But I also knew a time would come when I’d be unable to walk again. If it wasn’t walking, it would be something else. That point will come for you too, if it hasn’t already. When it does, I hope the world will be ready.

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Aug 29, 2023 6:00 AM

How to Use AI to Talk to Whales—and Save Life on Earth

With ecosystems in crisis, engineers and scientists are teaming up to decipher what animals are saying. Their hope: By truly listening to nature, humans will decide to protect it.

ILLUSTRATION: AGNES JONAS

Before Michelle Fournet moved to Alaska on a whim in her early twenties, she'd never seen a [whale](#). She took a job on a whale watching boat and, each day she was out on the water, gazed at the grand shapes moving under the surface. For her entire life, she realized, the [natural world](#) had been out there, and she'd been missing it. "I didn't even know I was bereft," she recalls. Later, as a graduate student in marine biology, Fournet wondered what else she was missing. The humpbacks she was getting to know revealed themselves in partial glimpses. What if she could hear what they were saying? She dropped a hydrophone in the water—but the only sound that came through was the mechanical churn of boats. The whales had fallen silent amid the racket. Just as Fournet had discovered nature, then, she was witnessing it recede. She resolved to help the whales. To do that, she needed to learn how to listen to them.

Fournet, now a professor at the University of New Hampshire and the director of [a collective of conservation scientists](#), has spent the past decade building a catalog of the various chirps, shrieks, and groans that humpbacks make in daily life. The whales have huge and diverse vocabularies, but there is one thing they all say, whether male or female, young or old. To our

meager human ears, it sounds something like a belly rumble punctuated by a water droplet: *whup*.

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Photograph: Jessica Chou

Fournet thinks the *whup* call is how the whales announce their presence to one another. A way of saying, “I’m here.” Last year, as part of a series of experiments to test her theory, Fournet piloted a skiff out into Alaska’s Frederick Sound, where humpbacks gather to feed on clouds of krill. She broadcast a sequence of *whup* calls and recorded what the whales did in response. Then, back on the beach, she put on headphones and listened to the audio. Her calls went out. The whales’ voices returned through the water: *whup, whup, whup*. Fournet describes it like this: The whales heard a voice say, “I am, I am here, I am me.” And they replied, “I also am, I am here, I am me.”

Biologists use this type of experiment, called a playback, to study what prompts an animal to speak. Fournet’s playbacks have so far used recordings of real *whups*. The method is imperfect, though, because humpbacks are highly attentive to who they’re talking to. If a whale recognizes the voice of the whale in the recording, how does that affect its response? Does it talk to a buddy differently than it would to a stranger? As a biologist, how do you ensure you’re sending out a neutral *whup*?

One answer is to create your own. Fournet has shared her catalog of humpback calls with the Earth Species Project, a group of technologists and engineers who, with the help of [AI](#), are aiming to develop a synthetic *whup*. And they’re not just planning to emulate a humpback’s voice. The nonprofit’s mission is to open human ears to the chatter of the entire animal kingdom. In 30 years, they say, nature documentaries won’t need soothing Attenborough-style narration, because the dialog of the animals onscreen will be subtitled. And just as engineers today don’t need to know Mandarin or Turkish to build a [chatbot](#) in those languages, it will soon be possible to build one that speaks Humpback—or Hummingbird, or Bat, or Bee.

The idea of “decoding” animal communication is bold, maybe unbelievable, but a time of crisis calls for bold and unbelievable measures. Everywhere that humans are, which is everywhere, animals are vanishing. Wildlife populations across the planet have dropped an average of nearly 70 percent in the past 50 years, according to one estimate—and that’s just the portion of the crisis that scientists have measured. Thousands of species could disappear without humans knowing anything about them at all.

To decarbonize the economy and preserve ecosystems, we certainly don’t need to talk to animals. But the more we know about the lives of other creatures, the better we can care for those lives. And humans, being human, pay more attention to those who speak our language. The interaction that Earth Species wants to make possible, Fournet says, “helps a society that is disconnected from nature to reconnect with it.” The best technology gives humans a way to inhabit the world more fully. In that light, talking to animals could be its most natural application yet.

Humans have always known how to listen to other species, of course. Fishers throughout history collaborated with whales and dolphins to mutual benefit: a fish for them, a fish for us. In 19th-century Australia, a pod of killer whales was known to herd baleen whales into a bay near a whalers’ settlement, then slap their tails to alert the humans to ready the harpoons. (In exchange for their help, the orcas got first dibs on their favorite cuts, the lips and tongue.) Meanwhile, in the icy waters of Beringia, Inupiat people listened and spoke to bowhead whales before their hunts. As the environmental historian Bathsheba Demuth writes in her book *Floating Coast*, the Inupiat thought of the whales as neighbors occupying “their own country” who chose at times to offer their lives to humans—if humans deserved it.

Commercial whalers had a different approach. They saw whales as floating containers of blubber and baleen. The American whaling industry in the mid-19th century, and then the global whaling industry in the following century, very nearly obliterated several species, resulting in one of the largest-ever losses of wild animal life caused by humans. In the 1960s, 700,000 whales were killed, marking the peak of cetacean death. Then, something remarkable happened: We heard whales sing. On a trip to

Bermuda, the biologists Roger and Katy Payne met a US naval engineer named Frank Watlington, who gave them recordings he'd made of strange melodies captured deep underwater. For centuries, sailors had recounted tales of eerie songs that emanated from their boats' wooden hulls, whether from monsters or sirens they didn't know. Watlington thought the sounds were from humpback whales. Go save them, he told the Paynes. They did, by releasing an album, *Songs of the Humpback Whale*, that made these singing whales famous. The Save the Whales movement took off soon after. In 1972, the US passed the Marine Mammal Protection Act; in 1986, commercial whaling was banned by the International Whaling Commission. In barely two decades, whales had transformed in the public eye into cognitively complex and gentle giants of the sea.

Roger Payne, who died earlier this year, spoke frequently about his belief that the more the public could know "curious and fascinating things" about whales, the more people would care what happened to them. In his opinion, science alone would never change the world, because humans don't respond to data; they respond to emotion—to things that make them weep in awe or shiver with delight. He was in favor of wildlife tourism, zoos, and captive dolphin shows. However compromised the treatment of individual animals might be in these places, he believed, the extinction of a species is far worse. Conservationists have since held on to the idea that contact with animals can save them.

From this premise, Earth Species is taking the imaginative leap that AI can help us make *first* contact with animals. The organization's founders, Aza Raskin and Britt Selvitelle, are both architects of our digital age. Raskin grew up in Silicon Valley; his father started Apple's Macintosh project in the 1970s. Early in his career, Raskin helped to build Firefox, and in 2006 he created the infinite scroll, arguably his greatest and most dubious legacy. Repentant, he later calculated the collective human hours that his invention had wasted and arrived at a figure surpassing 100,000 lifetimes per week.

Raskin would sometimes hang out at a startup called Twitter, where he met Selvitelle, a founding employee. They stayed in touch. In 2013, Raskin heard a news story on the radio about [gelada monkeys in Ethiopia](#) whose communication had similar cadences to human speech. So similar, in fact,

that the lead scientist would sometimes hear a voice talking to him, turn around, and be surprised to find a monkey there. The interviewer asked whether there was any way of knowing what they were trying to say. There wasn't—but Raskin wondered if it might be possible to arrive at an answer with machine learning. He brought the idea up with Selvitelle, who had an interest in animal welfare.

For a while the idea was just an idea. Then, in 2017, new research showed that machines could translate between two languages without first being trained on bilingual texts. Google Translate had always mimicked the way a human might use a dictionary, just faster and at scale. But these new machine learning methods bypassed semantics altogether. They treated languages as geometric shapes and found where the shapes overlapped. If a machine could translate any language into English without needing to understand it first, Raskin thought, could it do the same with a gelada monkey's wobble, an elephant's infrasound, a bee's waggle dance? A year later, Raskin and Selvitelle formed Earth Species.

Raskin believes that the ability to eavesdrop on animals will spur nothing less than a paradigm shift as historically significant as the Copernican revolution. He is fond of saying that “AI is the invention of modern optics.” By this he means that just as improvements to the telescope allowed 17th-century astronomers to perceive newfound stars and finally displace the Earth from the center of the cosmos, AI will help scientists hear what their ears alone cannot: that animals speak meaningfully, and in more ways than we can imagine. That their abilities, and their lives, are not less than ours. “This time we’re going to look out to the universe and discover humanity is not the center,” Raskin says.

Raskin and Selvitelle spent their first few years meeting with biologists and tagging along on fieldwork. They soon realized that the most obvious and immediate need in front of them wasn't inciting revolution. It was sorting data. Two decades ago, a primate researcher would stand under a tree and hold a microphone in the air until her arm got tired. Now researchers can stick a portable biologger to a tree and collect a continuous stream of audio for a year. The many terabytes of data that result is more than any army of grad students could hope to tackle. But feed all this material to trained

machine learning algorithms, and the computer can scan the data and flag the animal calls. It can distinguish a whup from a whistle. It can tell a gibbon's voice from her brother's. At least, that's the hope. These tools need more data, research, and funding. Earth Species has a workforce of 15 people and a budget of a few million dollars. They've teamed up with several dozen biologists to start making headway on these practical tasks.

An early project took on one of the most significant challenges in animal communication research, known as the cocktail party problem: When a group of animals are talking to one another, how can you tell who's saying what? In the open sea, schools of dolphins a thousand strong chatter all at once; scientists who record them end up with audio as dense with whistles and clicks as a stadium is with cheers. Even audio of just two or three animals is often unusable, says Laela Sayigh, an expert in bottlenose dolphin whistles, because you can't tell where one dolphin stops talking and another starts. (Video doesn't help, because dolphins don't open their mouths when they speak.) Earth Species used Sayigh's extensive database of signature whistles—the ones likened to names—to develop a neural network model that could separate overlapping animal voices. That model was useful only in lab conditions, but research is meant to be built on. A couple of months later, Google AI published a model for untangling wild birdsong.

Sayigh has proposed a tool that can serve as an emergency alert for dolphin mass strandings, which tend to recur in certain places around the globe. She lives in Cape Cod, Massachusetts, one such hot spot, where as often as a dozen times a year groups of dolphins get disoriented, inadvertently swim onto shore, and perish. Fortunately, there might be a way to predict this before it happens, Sayigh says. She hypothesizes that when the dolphins are stressed, they emit signature whistles more than usual, just as someone lost in a snowstorm might call out in panic. A computer trained to listen for these whistles could send an alert that prompts rescuers to reroute the dolphins before they hit the beach. In the Salish Sea—where, in 2018, a mother orca towing the body of her starved calf attracted global sympathy—there is an alert system, built by Google AI, that listens for resident killer whales and diverts ships out of their way.

For researchers and conservationists alike, the potential applications of machine learning are basically limitless. And Earth Species is not the only group working on decoding animal communication. Payne spent the last months of his life advising for Project CETI, a nonprofit that built a base in Dominica this year for the study of sperm whale communication. “Just imagine what would be possible if we understood what animals are saying to each other; what occupies their thoughts; what they love, fear, desire, avoid, hate, are intrigued by, and treasure,” he wrote in *Time* in June.

Many of the tools that Earth Species has developed so far offer more in the way of groundwork than immediate utility. Still, there’s a lot of optimism in this nascent field. With enough resources, several biologists told me, decoding is scientifically achievable. That’s only the beginning. The real hope is to bridge the gulf in understanding between an animal’s experience and ours, however vast—or narrow—that might be.

Ari Friedlaender has something that Earth Species needs: lots and lots of data. Friedlaender researches whale behavior at UC Santa Cruz. He got started as a tag guy: the person who balances at the edge of a boat as it chases a whale, holds out a long pole with a suction-capped biologging tag attached to the end, and slaps the tag on a whale’s back as it rounds the surface. This is harder than it seems. Friedlaender proved himself adept—“I played sports in college,” he explains—and was soon traveling the seas on tagging expeditions.

The tags Friedlaender uses capture a remarkable amount of data. Each records not only GPS location, temperature, pressure, and sound, but also high-definition video and three-axis accelerometer data, the same tech that a Fitbit uses to count your steps or measure how deeply you’re sleeping. Taken together, the data illustrates, in cinematic detail, a day in the life of a whale: its every breath and every dive, its traverses through fields of sea nettles and jellyfish, its encounters with twirling sea lions.

Friedlaender shows me an animation he has made from one tag’s data. In it, a whale descends and loops through the water, traveling a multicolored three-dimensional course as if on an undersea Mario Kart track. Another animation depicts several whales blowing bubble nets, a feeding strategy in which they swim in circles around groups of fish, trap the fish in the center

with a wall of bubbles, then lunge through, mouths gaping. Looking at the whales' movements, I notice that while most of them have traced a neat spiral, one whale has produced a tangle of clumsy zigzags. "Probably a young animal," Friedlaender says. "That one hasn't figured things out yet."

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Friedlaender's multifaceted data is especially useful for Earth Species because, as any biologist will tell you, animal communication isn't purely verbal. It involves gestures and movement just as often as vocalizations. Diverse data sets get Earth Species closer to developing algorithms that can work across the full spectrum of the animal kingdom. The organization's most recent work focuses on foundation models, the same kind of computation that powers generative AI like ChatGPT. Earlier this year, Earth Species published the first foundation model for animal communication. The model can already accurately sort beluga whale calls, and Earth Species plans to apply it to species as disparate as orangutans (who bellow), elephants (who send seismic rumbles through the ground), and jumping spiders (who vibrate their legs). Katie Zacarian, Earth Species' CEO, describes the model this way: "Everything's a nail, and it's a hammer."

Another application of Earth Species' AI is generating animal calls, like an audio version of GPT. Raskin has made a few-second chirp of a chiffchaff bird. If this sounds like it's getting ahead of decoding, it is—AI, as it turns out, is better at speaking than understanding. Earth Species is finding that the tools it is developing will likely have the ability to talk to animals even before they can decode. It may soon be possible, for example, to prompt an AI with a whup and have it continue a conversation in Humpback—with human observers knowing what either the machine or the whale is saying.

No one is expecting such a scenario to actually take place; that would be scientifically irresponsible, for one thing. The biologists working with Earth Species are motivated by knowledge, not dialog for the sake of it. Felix Effenberger, a senior AI research adviser for Earth Species, told me: "I

don't believe that we will have an English-Dolphin translator, OK? Where you put English into your smartphone and then it makes dolphin sounds and the dolphin goes off and fetches you some sea urchin. The goal is to first discover basic patterns of communication."

So what will talking to animals look—sound—like? It needn't be a free-form conversation to be astonishing. Speaking to animals in a controlled way, as with Fournet's playback whups, is probably essential for scientists to try to understand them. After all, you wouldn't try to learn German by going to a party in Berlin and sitting mutely in a corner.

Bird enthusiasts already use apps to snatch melodies out of the air and identify which species is singing. With an AI as your animal interpreter, imagine what more you could learn. You prompt it to make the sound of two humpbacks meeting, and it produces a whup. You prompt it to make the sound of a calf talking to its mother, and it produces a whisper. You prompt it to make the sound of a lovelorn male, and it produces a song.

ILLUSTRATION: AGNES JONAS

No species of whale has ever been driven extinct by humans. This is hardly a victory. Numbers are only one measure of biodiversity. Animal lives are rich with all that they are saying and doing—with culture. While humpback populations have rebounded since their lowest point a half-century ago, what songs, what practices, did they lose in the meantime? Blue whales, hunted down to a mere 1 percent of their population, might have lost almost everything.

Christian Rutz, a biologist at the University of St. Andrews, believes that one of the essential tasks of conservation is to preserve nonhuman ways of being. "You're not asking, 'Are you there or are you not there?'" he says. "You are asking, 'Are you there and happy, or unhappy?'"

Rutz is studying how the communication of Hawaiian crows has changed since 2002, when they went extinct in the wild. About 100 of these remarkable birds—one of few species known to use tools—are alive in protective captivity, and conservationists hope to eventually reintroduce them to the wild. But these crows may not yet be prepared. There is some

evidence that the captive birds have forgotten useful vocabulary, including calls to defend their territory and warn of predators. Rutz is working with Earth Species to build an algorithm to sift through historical recordings of the extinct wild crows, pull out all the crows' calls, and label them. If they find that calls were indeed lost, conservationists might generate those calls to teach them to the captive birds.

Rutz is careful to say that generating calls will be a decision made thoughtfully, when the time requires it. In [a paper published in *Science*](#) in July, he praised the extraordinary usefulness of machine learning. But he cautions that humans should think hard before intervening in animal lives. Just as AI's potential remains unknown, it may carry risks that extend beyond what we can imagine. Rutz cites as an example the new songs composed each year by humpback whales that spread across the world like hit singles. Should these whales pick up on an AI-generated phrase and incorporate that into their routine, humans would be altering a million-year-old culture. "I think that is one of the systems that should be off-limits, at least for now," he told me. "Who has the right to have a chat with a humpback whale?"

It's not hard to imagine how AI that speaks to animals could be misused. Twentieth-century whalers employed the new technology of their day, too, emitting sonar at a frequency that drove whales to the surface in panic. But AI tools are only as good or bad as the things humans do with them. Tom Mustill, a conservation documentarian and the author of *How to Speak Whale*, suggests giving animal-decoding research the same resources as the most championed of scientific endeavors, like the Large Hadron Collider, the Human Genome Project, and the James Webb Space Telescope. "With so many technologies," he told me, "it's just left to the people who have developed it to do what they like until the rest of the world catches up. This is too important to let that happen."

Billions of dollars are being funneled into AI companies, much of it in service of corporate profits: writing emails more quickly, creating stock photos more efficiently, delivering ads more effectively. Meanwhile, the mysteries of the natural world remain. One of the few things scientists know with certainty is how much they don't know. When I ask Friedlaender

whether spending so much time chasing whales has taught him much about them, he tells me he sometimes gives himself a simple test: After a whale goes under the surface, he tries to predict where it will come up next. “I close my eyes and say, ‘OK, I’ve put out 1,000 tags in my life, I’ve seen all this data. The whale is going to be over *here*.’ And the whale’s always over *there*,” he says. “I have no idea what these animals are doing.”

If you could speak to a whale, what would you say? Would you ask White Gladis, the killer whale elevated to meme status this summer for sinking yachts off the Iberian coast, what motivated her rampage—fun, delusion, revenge? Would you tell Tahlequah, the mother orca grieving the death of her calf, that you, too, lost a child? Payne once said that if given the chance to speak to a whale, he’d like to hear its normal gossip: loves, feuds, infidelities. Also: “Sorry would be a good word to say.”

Then there is that thorny old philosophical problem. The question of *umwelt*, and what it’s like to be a bat, or a whale, or you. Even if we could speak to a whale, would we understand what it says? Or would its perception of the world, its entire ordering of consciousness, be so alien as to be unintelligible? If machines render human languages as shapes that overlap, perhaps English is a doughnut and Whalish is the hole.

Maybe, before you can speak to a whale, you must know what it is like to have a whale’s body. It is a body 50 million years older than our body. A body shaped to the sea, to move effortlessly through crushing depths, to counter the cold with sheer mass. As a whale, you choose when to breathe, or not. Mostly you are holding your breath. Because of this, you cannot smell or taste. You do not have hands to reach out and touch things with. Your eyes are functional, but sunlight penetrates water poorly. Usually you can’t even make out your own tail through the fog.

You would live in a cloud of hopeless obscurity were it not for your ears. Sound travels farther and faster through water than through air, and your world is illuminated by it. For you, every dark corner of the ocean rings with sound. You hear the patter of rain on the surface, the swish of krill, the blasts of oil drills. If you’re a sperm whale, you spend half your life in the pitch black of the deep sea, hunting squid by ear. You use sound to speak, too, just as humans do. But your voice, rather than dissipating instantly in

the thin substance of air, sustains. Some whales can shout louder than a jet engine, their calls carrying 10,000 miles across the ocean floor.

But what is it like to *be* you, a whale? What thoughts do you think, what feelings do you feel? These are much harder things for scientists to know. A few clues come from observing how you talk to your own kind. If you're born into a pod of killer whales, close-knit and xenophobic, one of the first things your mother and your grandmother teach you is your clan name. To belong must feel essential. (Remember Keiko, the orca who starred in the film *Free Willy*: When he was released to his native waters late in life, he failed to rejoin the company of wild whales and instead returned to die among humans.) If you're a female sperm whale, you click to your clanmates to coordinate who's watching whose baby; meanwhile, the babies babble back. You live on the go, constantly swimming to new waters, cultivating a disposition that is nervous and watchful. If you're a male humpback, you spend your time singing alone in icy polar waters, far from your nearest companion. To infer loneliness, though, would be a human's mistake. For a whale whose voice reaches across oceans, perhaps distance does not mean solitude. Perhaps, as you sing, you are always in conversation.

Michelle Fournet wonders: *How do we know whales would want to talk to us anyway?* What she loves most about humpbacks is their indifference. "This animal is 40 feet long and weighs 75,000 pounds, and it doesn't give a shit about you," she told me. "Every breath it takes is grander than my entire existence." Roger Payne observed something similar. He considered whales the only animal capable of an otherwise impossible feat: making humans feel small.

Early one morning in Monterey, California, I boarded a whale watching boat. The water was slate gray with white peaks. Flocks of small birds skittered across the surface. Three humpbacks appeared, backs rounding neatly out of the water. They flashed some tail, which was good for the group's photographers. The fluke's craggy ridge-line can be used, like a fingerprint, to distinguish individual whales.

Later, I uploaded a photo of one of the whales to Happywhale. The site identifies whales using a facial recognition algorithm modified for flukes.

The humpback I submitted, one with a barnacle-encrusted tail, came back as CRC-19494. Seventeen years ago, this whale had been spotted off the west coast of Mexico. Since then, it had made its way up and down the Pacific between Baja and Monterey Bay. For a moment, I was impressed that this site could so easily fish an animal out of the ocean and deliver me a name. But then again, what did I know about this whale? Was it a mother, a father? Was this whale on Happywhale actually happy? The AI had no answers. I searched the whale's profile and found a gallery of photos, from different angles, of a barnacled fluke. For now, that was all I could know.

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Aug 24, 2023 9:00 AM

You Are Not Responsible for Your Own Online Privacy

In the age of generative AI, it's impossible to know where your information is going—or what it's going to be used for.

Photo-illustration: WIRED Staff; Getty Images

In 2010, Mark Zuckerberg [told the audience](#) at a TechCrunch awards ceremony that young people—especially social media users—no longer cared about privacy. “People have really gotten comfortable not only sharing more information and different kinds, but more openly and with more people,” he said. “That social norm is just something that has evolved over time.” While this statement obviously hasn’t aged well, it reflects a common belief that privacy violations happen when individuals reveal their own information. In other words, when something posted to Reddit or TikTok goes viral, or a nude photo sent to an admirer leaks, it’s first and foremost the fault of the person who posted it. This model of individualized accountability is very persistent. It’s also completely wrong. And it’s irrelevant in the [age of generative AI](#).

Courtesy of Yale University Press

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Generative AI completely obliterates the idea of individual responsibility for privacy because you can't control these algorithms' access to your information, or what they do with it. Tools like ChatGPT, Dall-E, and Google Bard are [trained on data](#) scraped without consent, or even notice. At their worst, training sets suck up vast amounts of digital information and combine it into a data slurry that serves as the raw material for generative AI. As tech companies are scrambling to incorporate generative AI into every imaginable product, from search engines to games to military gadgets, it's impossible to know where this output is going, or how it might be interpreted. Their privacy-violating predecessors, [data brokers](#), also scraped the web and assembled massive dossiers on individuals, but their outputs aren't available to the average person, for free, or integrated into search engines and word processors. The widespread availability of generative AI compounds potential privacy violations and opens up more people to harmful consequences.

The massive corpora employed by generative AI inevitably contain information on people that was not provided, created, or even known to be available. Public records about marriages, mortgages, and voter registration are all fair game, as are news stories, employee bios, and Wikipedia pages. But the slurry also contains millions of photographs and videos; Dall-E, for example, was trained on images collected from social media, search engines, and image-hosting sites. So if you're in the background of a Flickr shot from 2007, your image could be used to train an algorithm. Nobody seems to know what goes into the data slurry, and there is no way to oversee or control it. When ChatGPT writes an inaccurate bio of me, I don't know where the false information originated, but I don't know where the correct information came from, either. We're used to thinking of privacy as individual control over information, but it's impossible to regulate how your personal information is used if you don't even know its origin.

Anthropologists and legal scholars have known for years that privacy can't be controlled by individuals, partly because we share information within networks. In other words, people talk about each other, both on and offline. There's no easy way to put limits on that; you can ask your friends not to post pictures of your kids on Instagram or to mention you on TikTok, but you are only as private as your chattiest contact. Networked privacy

violations often happen because information provided in an environment with particular norms and expectations moves elsewhere and is interpreted differently. TikToks made for queer, progressive audiences become fodder for anti-trans campaigns; political speeches made to sympathetic audiences seem outrageous when viewed by the opposition.

New technologies increasingly compromise this networked privacy. Forensic genealogy, for example, allows police to identify suspects by examining genetic evidence gathered from distant relatives. You can choose not to use Ancestry.com, but you can't stop a third cousin—who you probably don't even know exists—from doing the same. Big Data, which uses massive datasets in similar ways, frequently implicates friends, relatives, and even distant acquaintances, which becomes extraordinarily worrisome when integrated into predictive policing or risk assessment algorithms. There is nothing people can do to prevent such invasions of privacy.

Generative AI heightens these networked privacy concerns. It compromises our ability to do “privacy work,” the methods and strategies we all employ to retain an acceptable level of privacy. And the outputs of generative AI are completely detached from their original source in ways previously unimaginable. It's one thing to leak private text messages, and another for the entirety of Reddit to be used as grist for [robot poetry](#) and [bad college papers](#). Information provided in one context can be entirely recontextualized and remixed, changing its meaning and violating what the philosopher Helen Nissenbaum calls “contextual integrity.” How can any one person prevent this?

What's more, generative AI can enable all sorts of creative privacy violations. I couldn't get ChatGPT to give me my husband's address (we live together), but it happily explained how to find a home address online. Deepfakes are another issue entirely; what could be more of a privacy violation than emulating the style, visage, or even speech of another person? I uploaded some old recordings of my voice to a tool called Descript and, a few hours later, had a synthesized version of my voice that I could use to say anything (within the limits of the free trial). While some popular generative AI tools contain guardrails to prevent the most egregious

privacy violations, others don't. AIs have access to data that, if used unscrupulously, could map out someone's entire social network, piece together their financial status or health concerns, and identify whether they are vulnerable to scams.

While I'm conscious of the AI hype cycle, there is a difference between generative AI and other tech with deep privacy implications. Social platforms are controlled by discrete entities, and we understand how they work. Nobody understands how large language models work, not even the people who research and build them. They are changing and innovating at a radically different pace, and can be used by people with different ethical standards than our own. Generative AI shows the threadbare seams of our out-of-date, individual-responsibility model of privacy; it's time we recognized its futility and moved beyond it.

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Aug 22, 2023 6:00 AM

The World Is Going Blind. Taiwan Offers a Warning, and a Cure

So many people are nearsighted on the island nation that they have already glimpsed what could be coming for the rest of us.

ILLUSTRATION: VANILLA CHI

Doing surgery on the back of the eye is a little like laying new carpet: You must begin by moving the furniture. Separate the muscles that hold the eyeball inside its socket; make a delicate cut in the conjunctiva, the mucous membrane that covers the eye. Only then can the surgeon spin the eyeball around to access the retina, the thin layer of tissue that translates light into color, shape, movement. “Sometimes you have to pull it out a little bit,” says Pei-Chang Wu, with a wry smile. He has performed hundreds of operations during his long surgical career at Chang Gung Memorial Hospital in Kaohsiung, an industrial city in southern Taiwan.

Wu is 53, tall and thin with lank dark hair and a slightly stooped gait. Over dinner at Kaohsiung’s opulent Grand Hotel, he flicks through files on his laptop, showing me pictures of eye surgery—the plastic rods that fix the eye in place, the xenon lights that illuminate the inside of the eyeball like a stage—and movie clips with vision-related subtitles that turn *Avengers: Endgame*, *Top Gun: Maverick*, and *Zootopia* into public health messages. He peers at the screen through Coke bottle lenses that bulge from thin silver frames.

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Photograph: Sinna Nasseri

Wu specializes in repairing retinal detachments, which happen when the retina separates from the blood vessels inside the eyeball that supply it with oxygen and nutrients. For the patient, this condition first manifests as pops of light or dark spots, known as floaters, which dance across their vision like fireflies. If left untreated, small tears in the retina can progress from blurred or distorted vision to full blindness—a curtain drawn across the world.

When Wu began his surgical career in the late 1990s, most of his patients were in their sixties or seventies. But in the mid-2000s, he started to notice a troubling change. The people on his operating table kept getting younger. In 2016, Wu performed a scleral buckle surgery—fastening a belt around the eye to fix the retina into place—on a 14-year-old girl, a student at an elite high school in Kaohsiung. Another patient, a prominent programmer who had worked for Yahoo, suffered two severe retinal detachments and was blind in both eyes by age 29. Both of these cases are part of a wider problem that's been growing across Asia for decades and is rapidly becoming an issue in the West too: an explosion of myopia.

Myopia, or what we commonly call nearsightedness, happens when the eyeball gets too long—it deforms from soccer ball to American football—and then the eye focuses light not on the retina but slightly in front of it, making distant objects appear blurry. The longer the eyeball becomes, the worse vision gets. Ophthalmologists measure this distortion in diopters, which refer to the strength of the lens required to bring someone's vision back to normal. Anything worse than minus 5 diopters is considered "high myopia"—somewhere between 20 and 25 percent of myopia diagnoses around the world are in this category. In China, up to 90 percent of teenagers and young adults are myopic. In the 1950s the figure was as low as 10 percent. A 2012 study in Seoul found that an astonishing 96.5 percent of 19-year-old men were nearsighted. Among high schoolers in Taiwan, it's around 90 percent. In the US and Europe, myopia rates across all ages are well below 50 percent, but they've risen sharply in recent decades. It's estimated that by 2050, half the world's population will need glasses, contacts, or surgery to see across a room. High myopia is now the leading cause of blindness in Japan, China, and Taiwan.

If those trends continue, it's likely that millions more people around the world will go blind much earlier in life than they—or the societies they live in—are prepared for. It's a "ticking time bomb," says Nicola Logan, an optometry professor at the UK's Aston University. She wasn't the only expert I talked to who used that phrase. Because so much of Taiwan's population is already living life with myopia, the island nation has already glimpsed what could be coming for the rest of us. And in a rare confluence, the country may also be the best place to look for solutions.

ILLUSTRATION: VANILLA CHI

On the bullet train south from Taipei, you can see the smog hanging over Kaohsiung from miles away, blurring the edges of the buildings. During the Japanese occupation, which ended in 1945, what had been a small trading port transformed into one of Taiwan's biggest cities, a riot of heavy industry and shipbuilding. Over the next four decades, as Taiwan made the rapid transition from a predominantly agricultural economy to a manufacturing powerhouse, the lives of its citizens shifted too. Families flocked into cramped apartment blocks that still make up much of the urban housing. Education for children was mandatory and became increasingly intense. A network of after-school establishments called "cram schools" sprang up, making room for parents to work long hours without the childcare support from elderly relatives they would've had in the old society. At the end of the school day, some kids would board a bus, not to go home, but to ride to their cram school, some of which were open until 9 pm.

Pei-Chang Wu was born in Kaohsiung, at the height of the city's transformation, in 1970. His grandparents, neither of whom were myopic, were farmers in central Taiwan. Both of his parents were teachers, and like many Asian parents, they put a huge emphasis on education as one of the few levers they could pull to move up through society. His father enforced a strict daily routine: up at 5 am for calligraphy and violin practice, school from 7:30 am to 4 pm. Once Wu got home in the evenings he had to complete his schoolwork. On the weekends, he participated in calligraphy competitions. By the age of 9, Wu had been diagnosed with myopia.

Pei-Chang Wu.

Photograph: An Rong Xu

Across the modernizing world, this pattern repeated itself. For economies to continuously expand, education had to become central, and as this happened, the rates of myopia started to climb. But hardly anyone noticed, in Taiwan or anywhere else.

If current trends continue, it's likely that millions more people around the world will go blind much earlier in life than they—or the societies they live in—are prepared for.

Then, during one summer in the early 1980s, a group of incoming college students gathered at Chengkungling, a military training facility in central Taiwan, for a ceremony to mark the beginning of their mandatory national service. The United States had recently cut diplomatic ties with the island and formally recognized the government in Beijing, and cross-strait tensions were high.

At first, the early morning ceremony went smoothly. A single cadet—tall, good posture—received a rifle on behalf of his classmates, symbolizing their duty to defend their country. As the ministers of education and defense rose to deliver their speeches to the young men they hoped would be the future of Taiwan, the sun also rose higher into the sky behind the stage. The government officials were dazzled by the glare reflecting back at them from hundreds of pairs of glasses. The ceremony was the seed for a joke about how to ward off an alien invasion—just ask Taiwanese students to look up—and the spark for the government's fight against myopia.

The first step was to understand the scope of the problem. The president, alarmed by what had happened, asked health officials to begin a regular survey of myopia rates in Taiwan. It revealed a previously hidden epidemic, which seemed to be getting worse. By 1990, the myopia rate among Taiwanese 15-year-olds had risen to 74 percent.

By the time Wu started medical school in the early 1990s, he was seeing floaters—“strange animals in the sky,” as he called them—when he closed his eyes. At first, he dismissed them and focused on his budding career as an ophthalmologist. But during his residency, Wu examined hundreds of

patients with retinal detachments who'd had the same symptoms. He grew worried about his own long-term vision. So he asked one of his professors to examine his eyes. "He found a break in my retina," Wu said.

He was lucky. It was a small tear, minor enough to be fixed with a laser in five minutes. Shining a light through the pupil creates scar tissue that the retina can reattach to. "The laser saved me," Wu said. "Otherwise I would be blind in one eye." Wu decided he had a responsibility to rescue others from high myopia and its potential complications. "If I cannot save myself, we should save our next generation."

It wasn't until the mid-1990s that a better understanding of what caused myopia—and what could prevent it—finally cracked open.

In 1999, the government convened a group of experts in medicine and education to try to fix the problem. Jen-Yee Wu, who worked at the Ministry of Education and had done his doctoral thesis on eyesight protection, was asked to write a set of guidelines for schools to address nearsightedness. Later that year, he published a thin green book full of advice for teachers. It paid careful attention to desk height (to keep texts the right distance from the eyes) and room lighting, and advocated eye relaxation exercises, including a guided massage of points around the eyes and face. The book also advised giving children more space in their notebooks to pen the intricate characters that make up written Mandarin. And it formalized the 30/10 rule: a 10-minute break to stare into the distance after every half hour of reading or looking at a screen.

None of it worked. Nearsightedness rates continued to climb because, as it turned out, Taiwan, and the world, had been thinking about how to address myopia completely wrong.

ILLUSTRATION: VANILLA CHI

Here is a non-exhaustive list of things that have been blamed for nearsightedness: pregnancy, pipe smoking, brown hair, long heads, bulging eyes, too much fluid in the eyes, not enough fluid in the eyes, muscle spasms, social class. "Any ophthalmologist who experienced a night of

insomnia arose in the morning with a new and usually more bizarre theory,” wrote Brian Curtin in an influential 1985 book about myopia.

Folk theories have changed with technologies. Ask people today and they’re likely to blame smartphones and video games. Before that, it was sitting too close to the television and reading under the covers with a flashlight. Those activities all come under the broad umbrella of “near work”—using your eyes to look at something close to your face—which had been the leading scapegoat for myopia for centuries. In 1611 the astronomer and scientist Johannes Kepler wrote, “Those who do much close work in their youth become myopic.” In the mid-19th century, there existed a contraption called the “myopodiorthicon,” which was designed to gradually move a book backward during reading to strengthen the eye’s ability to adjust to objects at different distances. *The Hygiene of the Eye in Schools*, by Hermann Cohn, published in 1883, paid careful attention to lighting and advocated the use of headrests to physically prevent the eyes from coming too close to the text during reading.

In 1928, British ophthalmologist Arnold Sorsby surveyed Jewish boys in East London and discovered that they were more myopic than their non-Jewish peers. At first, he thought this was because of the extra time spent doing near work while studying holy texts. Eventually, though, he came to believe there was a genetic element to myopia. He conducted studies of twins that seemed to confirm this: The severity of myopia was more similar among identical twins than fraternal twins. The science of genetics was in vogue, and as Sorsby’s theory swept away Victorian concerns about the state of the schoolhouses, it became dogma for decades. Myopia became seen as a condition to be managed, not a disease that could be prevented.

It wasn’t until the mid-1990s that a better understanding of what caused myopia—and what could prevent it—finally cracked open. In these years, an Australian researcher called Ian Morgan stumbled on a scientific mystery that would consume the next 25 years of his life. Morgan, now a genial 78-year-old with sun-wrinkled skin and large dark-framed glasses, was working as a research fellow at the Australian National University in Canberra, where he was studying the neurotransmitter dopamine and its role in the eye’s signaling systems. Back then, he didn’t know much about

myopia—he could barely tell you the difference between far- and nearsightedness.

Pei-Chang Wu with a patient.

Photograph: An Rong Xu

But as a part of his weekly reviews of the latest scientific literature, he started to see some of the first evidence coming out of Asia about the growing myopia epidemic. He couldn't understand how myopia rates could be close to 80 percent for kids leaving high school in East Asia and so much lower in his native Australia.

He soon found other research casting doubt on Sorsby's genetic view of myopia. In Inuit populations, during the 1970s, myopia incidence increased from 5 percent to more than 60 percent prevalence in the span of one generation. Genetics couldn't explain such a jump. The sharp increase in schooling among younger Inuits, however, might. In the early 1990s, researchers had found that ultra-orthodox Jewish boys are more myopic than their sisters—something that was likely due to the extra studying they have to do.

Morgan started to seek out a better understanding of what causes myopia, and by the early 2000s, he was convinced there had to be a behavioral reason for the boom. But if near work was really to blame, why hadn't the interventions tried in China and Taiwan made any difference? In 2003, with colleagues Kathryn Rose and Paul Mitchell, Morgan began a two-year study of thousands of 6- and 12-year-olds in Sydney, looking for lifestyle differences that might explain their lower levels of myopia. They used a technique called "cycloplegic autorefraction," in which the patient's eyes are first relaxed with eye drops before a machine measures how light is focused on the back of the eye, providing an objective measure of the length of the eyeball.

The results, which were published in a landmark 2008 paper, confirmed Morgan's suspicions. As expected, overall myopia rates among Australian 12-year-olds, at about 13 percent, were significantly lower than in Asia. Morgan and his team also surveyed the participants about their daily

routines and hobbies and discovered a surprising relationship. The more time kids spent outside, the less likely they were to have myopia.

The next question was why. “This was where my background became really important,” Morgan says. It all came back, he thought, to dopamine—the neurotransmitter he had been studying before his detour into myopia research. “We knew that light stimulated the release of dopamine from the retina, and we knew that dopamine could control the rate at which the eye elongated,” Morgan says. (In 1989, an American ophthalmologist named Richard Stone found that he could induce myopia in chickens by manipulating light levels, and that there was less dopamine in the retinas of the myopic chickens.) “So once we had the actual epidemiological evidence that being outdoors was important, the mechanism was, to us, very obvious.” Without adequate exposure to sunlight, the eye keeps growing longer, images are focused in front of the retina, and vision becomes blurry. In August 2008—after a decade of research—Morgan published a paper that he believed contained the key to solving Asia’s myopia epidemic.

ILLUSTRATION: VANILLA CHI

Around this time, Wu’s clinic was busy—his operating table often full, with a steady stream of parents with young children in tow seeking treatments for myopia. For instance, orthokeratology contact lenses improve vision by temporarily squishing the cornea into a different shape, reminiscent of how ancient Chinese soldiers are said to have slept with sandbags over their eyes for the same effect. Then there’s atropine—a muscle relaxant derived from the toxic nightshade and mandrake plants. Nightshade has been known as “belladonna” because women in Renaissance Italy—and maybe even as far back as Cleopatra—used it to dilate their pupils to make them appear larger and more beautiful. Atropine paralyzes the ciliary muscle, which controls the size of the pupil and, for reasons scientists haven’t yet pinned down, also seems to slow down the progression of myopia. (Since 2008, new treatments have become available: miSight contact lenses and MiyoSmart glasses, which arrest the growth of the eye by manipulating light patterns.)

In his studies in Taiwan, Wu observed the same phenomenon that Morgan had documented: More outdoor time equaled less myopia.

But Wu knew that none of these treatments were dealing with the underlying cause of the problem. And as a newly minted member of Taiwan's Vision Care Advisory Committee, a different group of academics behind some of the country's well-meaning but ineffective attempts to tackle nearsightedness, he had adopted a determined, systematic approach to finding a solution. Every week, he gathered his colleagues to review the latest academic research on myopia. He even corralled his mother into making snacks as an added incentive.

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During one of these Thursday sessions, with the smell of home-cooked food in the air, Wu discovered Ian Morgan's research in Australia. It was a eureka moment. Were Taiwan's classroom interventions failing because kids weren't spending enough time outside? Wu decided to run his own version of the Sydney Myopia Study in Cimei, an island off the west coast of Taiwan. He observed the same phenomenon: More outdoor time equaled less myopia.

Around the same time, Wu chanced on an opportunity to go a step further than Morgan—to move from simply observing the myopia problem to fighting back. His son was starting elementary school, and the parents of incoming students had been invited to an orientation talk. They gathered in a classroom at the school, surrounded by small desks and kids' drawings on the walls. At the end, the principal opened the floor to questions. Wu raised his hand and voiced his concerns about what Taiwanese schooling might do to his son's vision. "Under your education system, will he become myopic or not?"

Other hands started going up. One woman had a daughter in the third grade who was already minus 2 diopters, and she feared for her son. Wu saw a chance to put Morgan's theory into action.

At the time, the Taiwanese government was encouraging schools to switch the classroom lights off and send kids outside during breaks—to save electricity, not eyes. Wu convinced the principal of his son's school to go

further and usher the children outside six times a day, which added up to an extra six and a half hours of outdoor time each week. When Wu took measurements at the start of the program, in February 2009, the myopia prevalence among 7- to 11-year-olds at both his son's school and another school, which he used as a control for his experiment, was around 48 percent. A year later, the control school had almost twice the rate of new cases of myopia as his son's school.

Wu began to preach the gospel of outdoor time, appearing in the media and touring rural Taiwan. On many of the stops, Wu, on guitar, and his wife, on keys, play their own renditions of pop songs with new lyrics about myopia prevention. (A recent effort turned "Despacito" into a ballad about atropine). He wrote a book, *Kids Could Be Free From Myopia*, outlining the principles of good eye health and how he applied them to slow the progression of myopia in his own young children. "Sometimes," he says, "we don't appreciate the free things."

Wu also worked on translating his research findings into a simple program that could be rolled out across the country. To do that, he needed to know how much time kids should spend outdoors. Wu thought back to Ian Morgan's research, which had found that Australian kids spent an average of 13.5 hours a week outside. Another study suggested 14 hours. And so two hours a day became the cornerstone of Taiwan's national myopia strategy, launched in 2010. It's called Tian-Tian 120, which translates to "every day 120," for the number of minutes children should spend outside each day.

At Mingde Elementary School in Kaohsiung, I watched as muzak blasted over the speakers and kids of all ages came streaming outside in their uniforms, grabbing balls and jump ropes. As the school's principal, Ching-Sheng Chen, proudly showed off the array of outdoor equipment, a boy who couldn't have been much older than 7 grabbed a unicycle and began riding laps around the playing field. At another school in northeast Taiwan, known for its changeable weather, the playground has been equipped with a giant covered area called "Sunny Square" so the kids can still spend time outdoors when it's raining.

The results of the Tian-Tian 120 program were immediate and impressive. After years of trending upwards, myopia prevalence among Taiwanese primary school children peaked in 2011 at 50 percent, and then started to come down. Within a few years, it was at 46.1 percent. “You can see this very beautiful curve,” Wu says.

ILLUSTRATION: VANILLA CHI

In 2014, a young ophthalmologist in Yilan County, on Taiwan’s rugged northeast coast, began a project that he hoped would eradicate high myopia entirely.

Der-Chong Tsai—who wears round black frames and a white lab coat and shares Wu’s earnest energy—first became interested in eye health while training at Taiwan’s National Defense Medical Center. From there, he worked at Taipei Veterans General Hospital, and he’d come across Wu’s and Morgan’s work on nearsightedness after completing a PhD in epidemiology in the early 2010s.

He was impressed but had a hunch that intervening even earlier than primary school could make a significant difference—not only to slow down the progression of myopia, but to try to stop it from taking hold in the first place. It’s been found that for every year the onset of myopia is delayed, the ultimate severity of the condition is reduced by 0.75 diopters—catch it early enough, and you might be able to prevent a kid from ever needing glasses. “We thought primary school was too late,” Tsai said. “In terms of myopia prevention, the earlier the better.”

Taiwan finally seemed to be getting the upper hand in its long fight against myopia. Then Covid hit, and Wu’s beautiful curve began to invert.

Yilan County now runs one of the most ambitious myopia prevention programs in the world. Each year, Tsai and his team visit every preschool in the region, running screening tests to look for what’s called “pre-myopia”—the earliest signs of the eyeball getting too long. Tsai wants to catch children whose eyes are already too long for their age—who may not have myopia yet but who might be at higher risk once they start formal schooling.

Today, Tsai screens more than 98 percent of preschoolers in Yilan County, and at a cost of just \$13 per child, he has found hundreds of cases of pre-myopia that wouldn't have been spotted until much later, when it was more advanced. The children most at risk of developing myopia are prescribed atropine alongside their time outdoors, and the results have been spectacular. By the end of 2016, after two years, the Yilan program had driven down the prevalence of myopia in the region by 5 percentage points. Between the Tian-Tian 120 initiative, aimed at older kids, and the Yilan program, Taiwan finally seemed to be getting the upper hand in its long fight against myopia.

Then Covid hit, and a whole generation of kids were stuck inside for months at a time. Studies show that in China, Turkey, Hong Kong, and India, myopia worsened during the Covid lockdowns. Taiwan was no exception: Wu's beautiful curve began to invert.

In March 2023, Taiwan lifted its final pandemic restriction, allowing international travelers to visit without having to quarantine. I arrived there half-expecting some mythical Land of the Blind scenario: pavements populated by people with white sticks stumbling into everything, a pair of glasses perched on every nose. It wasn't like that, of course. Although there were seven eyewear shops within a 10-minute walk of my hotel in Kaohsiung, and the stylized eye logos of oculists all around, like the eerie billboard from *The Great Gatsby*.

There are long-standing cultural forces driving Taiwan's myopia boom—the emphasis on education and a notion that paler skin is more attractive both conspire to keep people inside. Navigating the organized chaos of traffic snarls in cities like Taipei and Kaohsiung, I couldn't help but think how difficult it would be for someone with impaired vision to get around, and how challenging it is to find safe outdoor spaces for children to play in the sun in such a dense metropolis.

But the pandemic has entrenched what was already a global problem. On our current trajectory, viral diseases, air pollution, and extreme heat are just some of the things that will continue to keep young children indoors. By 2050, according to the International Myopia Institute, 10 percent of the world's population will have high myopia, and up to 70 percent of them

will have pathologic myopia—the kind that causes blindness. That's as many as 680 million people affected by vision loss or blindness, with catastrophic effects for economies and health care systems.

In that sense, Taiwan's myopia boom is a blurry glimpse of a potentially blurred future: one where technology has to compensate for the societal changes that are driving nearsightedness. Ian Morgan has been involved in prototypes of glass-walled classrooms in China, enabling children to get the benefit of time outdoors without having to cut back on education. Other research suggests that shining a bright red light directly into the eye with a special machine may slow the progression of myopia. But many of the existing treatments are expensive, and they don't work for everyone. Some ophthalmologists predict a future where bad eyesight, like crooked teeth, becomes a marker of an impoverished childhood. Others argue that myopia prevention should be publicly funded—that, like programs to encourage people to quit smoking or exercise regularly, a little funding now will save a lot in the future. "Prevention is better than cure," is one of Pei-Chang Wu's mantras.

While children in Taiwan's Yilan County experienced the pandemic years much the same as kids everywhere—less time outdoors and more time watching screens—intervening when children are quite young has proven to be the best strategy: Across the county, myopia rates in preschoolers remained stable throughout the lockdowns. Technology and industrialization may have contributed to the myopia problem, but sometimes the best solutions are cheap and simple. Just go outside, and see.

Let us know what you think about this article. Submit a letter to the editor at mail@wired.com.

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Aug 16, 2023 7:00 AM

What Do My Screenshots and Selfies Actually Say About Me?

WIRED's spiritual advice columnist on our attempts to stop time, and why your camera roll might not really be so different from your parents' photo album.

ILLUSTRATION: DIANE ROUSSILLE

“While looking through my parents' old photo albums, I noticed that they had lots of pictures of friends gathered together. It made me think about the camera roll on my phone, which is full of screenshots and selfies. Why don't I take pictures with my friends?”

—Say Cheese

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Spiritual Troubleshooting for the Digital Age

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

Dear Cheese,

All modern technologies bend toward self-referentiality. Long before the birth of the smartphone, the earliest screenshots required actually pointing a camera at a television or computer screen, an act that (for those who can remember it) recalled the repelling force of two like-charged magnets, or

the nauseating infinite regress of two mirrors facing each other. Part of you half-expected a black hole to swallow you up, punishment for having summoned some elusive paradox in the universe.

We now live full-time in that Escherian fun house, spending more of our lives on phones that serve as both the object and channel of our attention. Some years ago, back when AI lacked its current powers of discernment, my mom got a kick out of sending me the deranged “Memories” that her iPhone culled from her camera roll. As the tinkly, inspirational music crescendoed, the slideshows reliably displayed photos of her friends and grandchildren before concluding with screenshots of confirmation codes and bathroom faucets from Home Depot’s website.

Although it's little commented on, the screenshot bears a curious symmetry to the selfie—in its eschewal of the rear-facing camera and its memorialization of solitude. A writer for [Vice dubbed the screenshot](#) “the faceless selfie … a way to share what happens when we're alone on the internet.” Perhaps this gets at the note of self-incrimination I sense in your question. The camera roll contains the receipts of our attention, evidence of how we have opted to spend our mortal hours. “Where your treasure is, there will your heart be also,” Christ said, a proverb that insists all collections are a synecdoche for one's soul.

When your private gallery becomes a mirror of your data trail and images of your own face, it's easy to fear that your life has been whittled down to a pinpoint of frenetic, solipsistic attention—that what you are choosing to look at is yourself in the act of looking.

But I don't think it's as simple as that. For one thing, taking photos of other people has become impossibly fraught. Or maybe it always was. “There is an aggression implicit in every use of the camera,” Susan Sontag wrote in 1977's *On Photography*. There is more than a whiff of violence in the very terminology we use to describe the camera's function (to “shoot,” to “capture”), and casual photography has become even more intrusive now that the economic incentives of the digital economy have turned experience into a commodity. In a moment when it's widely understood that group selfies require verbal consent, when any image can be publicly posted,

altered, or fed into generative algorithms to produce deepfakes, taking candid photos at an intimate gathering has become a quasi-hostile act.

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But the content of your [camera roll](#) might also speak to the existential purpose of such images. Photos are, at root, an attempt to stop time—to halt and contain the feed of experience that relentlessly passes through us. The point of the old family photo album was not merely to collect as many images as possible, but to draw a firm perimeter around a year that was overfull with experience, marking the important milestones—the child's baptism, the summer vacation—that will make it legible in the collective memory. The camera roll on your phone offers a similar promise, but creating a narrative with coherence depends on its finitude. For many of us, the camera roll serves as a new kind of contact sheet that will inevitably undergo further winnowing before it is posted publicly on social platforms. (The performative carelessness of the photo dump, a quiet mutiny against aspirational content, is, as many critics have pointed out, a self-conscious act of curation in disguise.)

All of which is to say: If your camera roll is full of digital footprints, this may simply be evidence that life online is moving faster than your offline existence—that the need to shape chaos into a coherent narrative feels more urgent in the realm of infinite scrolls than it does in the clearly marked hours you experience IRL. Whereas for the modernists, life was a bustling frenzy of activity that could be captured only by breathless stream of consciousness, for us, ordinary offline existence seems slow or even static in comparison to the pace of the news cycle or the speed with which viral stories and digital trends appear and then fade into the void of history.

After spending hours on the internet, experiencing time as sheer free fall, it is a shock to look up from your screen and find the world around you—the plants, the chairs, your friends and family—as unchanged as a still life painting. This uncanny permanence fails to spark the acquisitive impulse in us.

The screenshots on your phone are, in other words, curios trawled from the vast and time-bent ocean in which you swim, souvenirs of an existence that feels so sheer it almost does not exist. They are proof that you did indeed spend your hours somewhere. The self necessarily occupies a liminal space in this divided world. Our attention plunges in while the body remains firmly rooted in the sublunary world. The selfie is an attempt to reconcile this dualism. To see one's face among the grid of screenshots is to glimpse an underlying continuity between online and off, to envision the self as the bridge spanning this existential chasm—and perhaps extending into eternity.

All collections are ultimately bulwarks against death, and the inclusion of our own image in the gallery bolsters the inarticulate hope that we too might one day exist outside of ordinary time. We store up our treasures in heaven, where neither rust nor moth can touch them, back up our data in the cloud, and hope that some remnant of our lives will persist after we pass, merging with all the images that will drift through the ether of eternity—a flotsam of inside jokes, sneakers, bons mots, and rainbow macarons.

Faithfully,

Cloud

Be advised that [**CLOUD SUPPORT**](#) is experiencing higher than normal wait times and appreciates your patience.

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[Reece Rogers](#)

[Security](#)

Aug 11, 2023 8:00 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: Melina Mara/Getty Images

When the AirTag launched in 2021, Apple's Bluetooth tracker with ultra-wideband was lauded as a step toward the [future of augmented reality](#) and a great way to find everyday objects, like your [lost TV remote](#). 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.

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.

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 your iPhone runs iOS 16.2 or later, 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. More recently, Google started rolling out [automatic smartphone alerts for unknown bluetooth trackers](#), similar to what iPhone owners receive. The alerts will be available on smartphones running at least Android 6.0.

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 over 20 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.

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, 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.

In the viral stories shared online and in police reports, women are often the victims of AirTag stalking, but Galperin cautions 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, "and I would say that 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.

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.

8/10/2023: This article has been updated with additional reporting.

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Aug 10, 2023 7:00 AM

By Seizing @Music, Elon Musk Shows He Doesn't Know What Made Twitter Good

Since taking over Twitter, Musk has made mistake after mistake. His latest decision proves that he has never understood the average Twitter user—or doesn't care to build a platform for them.

Photograph: Jordan Vonderhaar/Bloomberg/Getty Images

Sixteen years ago, software developer Jeremy Vaught created the Twitter handle @music to curate news and share stories about, obviously, music. Tens of thousands of Tweets later, he'd built a following of more than 11 million. Then, last week, Twitter—now rebranded as X—took the handle off him. An email from X, which Vaught posted to the platform, offered him no explanation but told him he could choose one of three other handles: @music123, @musicmusic, or @musiclover. All three were held by other users and so would presumably have to have been taken off them.

"It feels like this would be this forever thing where somebody's got their account taken and they were allowed to go take another one," Vaught says. "Where would we end up? That'd be crazy."

He has since been assigned @musicfan.

The confiscation is entirely within X's terms of service. As the company tries to turn itself into [an everything app](#), from music to video to finance, it's likely it will need to stake a claim to handles related to its new business

lines. But unilaterally taking a popular handle off a user could be bad business and another demonstration of how X under Musk is stripping away the things that made Twitter, Twitter.

"I definitely think that it gives pause to building any sort of a brand on there," Vaught says. "When you can't have any confidence that what you're working on is not just going to be taken away, that's huge."

The platform's success was built on people, like Vaught, doing the work to build followings and create organic communities around shared interests. Heavy-handed land grabs on top of [surging hate speech](#), shifting policies on verification, and, of course, the dropping of a globally recognized brand in favor of a letter, reinforce the feeling that Twitter is more and more becoming a place catering to a usership of one: Musk himself.

"It seems to me that he wants it to turn into a fanboy platform where people just go agree with him no matter what he says," says Tim Fullerton, CEO of Fullerton Strategies and former VP of content marketing at WeWork.

"There has been just this ongoing attack on the Twitter users that have made Twitter what it is. He doesn't respect the user base."

Before purchasing Twitter, Musk was a [super user](#) of the platform, having tweeted some 19,000 times to an audience that now stands at 152 million. This meant that his experience on the app was likely radically different than that of most users—the average Twitter user has [707 followers](#), and many have no followers at all. On pre-Musk Twitter, about [80 percent of tweets](#) came from just 10 percent of Twitter's users.

Verification helped average users figure out who was worth following. Twitter [invented](#) the blue check mark (which now exists on other platforms like Instagram and TikTok to indicate a verified user) after the manager for the St. Louis Cardinals baseball team threatened to sue the platform over a parody [account](#). From then onward, it was used to indicate the authentic accounts of public figures such as celebrities, journalists, and politicians, as well as brands or particularly large accounts (like @music).

Verified accounts "were the people who were producing the majority of the content that was driving more people to stay engaged and increasing the

number of people who were using Twitter,” says Fullerton.

But to an influencer like Musk, a blue check was a valuable commodity. Who *wouldn’t* want to pay for it? So in December he launched Twitter Blue as a pay-to-play “verification” program, replacing the previous merit-based system.

It was, Fullerton says, the first step in its erosion of the communities that made it so popular.

According to a [report](#) from Similarweb, only 116,000 people signed up for the \$8-a-month service in March. Less than [5 percent](#) of the platform’s 300,000 legacy verified accounts have signed on to keep their blue ticks. Of the 444,435 users who signed up for Twitter Blue in its first month, about half have less than 1,000 followers, according to [reporting from Mashable](#).

And for most users, removing verification has done away with a key visual shorthand that allows users to easily discern if the account or information they’re looking at is real. Firing most of the [company’s trust and safety staff](#), the people who made and enforced the company’s policies around hate speech and misinformation, exacerbated the problem and made the platform increasingly unusable as a real-time source of information and news.

This week, Australia’s national broadcaster, ABC, became the latest large news organization [to say it was leaving the platform](#) over its “toxicity.”

For advertisers—still the largest source of X’s revenue—the growth of hate speech and misinformation is a major problem. In the first six months of Musk’s ownership, Twitter lost [half](#) of its advertising revenue.

Before, verified accounts and organizations were vetted by Twitter staff for authenticity and legitimacy. These accounts could drive conversation about certain topics, even without getting paid. The communities and engagement that they drove was part of what made Twitter attractive to advertisers.

“It’s clear [formerly verified users] are not getting the traffic that they once did, because it’s just a jumble and that’s not what people want to see. They

want to see the news. They want to see political people or sports,” says Fullerton. “When the Grammys or the Golden Globes or something like that happens, you’re littering the feed with the [RFK Jr.’s](#) and all these awful right-wingers who used to be—rightly—banned.”

Musk has tried to entice influencers with a [revenue-sharing program](#), which requires that users be verified to access. But, as Benedict Evans, an analyst and former partner at Andreessen Horowitz, pointed out in a [tweet](#), confiscating the @music handle illustrated “essentially why no creator in their right minds would invest in Twitter’s monetization products.”

Research from Media Matters for America, a nonprofit watchdog group, [found](#) that the revenue-sharing program was cutting checks to right-wing conspiracy theorists. One user identified by MMA, Dom Lucre, regularly pushes QAnon conspiracy theories.

In December, shortly after taking over the platform, Musk announced that he would offer amnesty to accounts that had been [previously banned](#) from the platform, including right-wing influencers and Andrew Tate, who has been indicted for human trafficking. While these users may not be the ideal community for legacy users of Twitter, Bill Bergman, a lecturer in marketing at the Robins School of Business at the University of Richmond, suggests that perhaps Twitter’s current users are not the ones Musk is seeking to retain or draw in. “I get the impression Musk, with the direction it’s going, doesn’t care what Bill Bergman, who has 400 followers, thinks, because Twitter as Bill Bergman knows it doesn’t exist anymore.” But what is coming next (except perhaps an ill-fated [super-app](#)) seems unclear.

And while his antics may have hurt Twitter’s brand, Bergman notes that the company is getting consistent if somewhat outsize coverage, a “pretty good” promotional strategy.

“Has he intimidated and upset all of the advertisers? Absolutely. Has he intimidated and upset all of our users that have been with this platform for 20 years? Absolutely,” says Bergman. “But he doesn’t seem to care about that.”

UPDATED 07.10.20 12:15 ET to add comments from Jeremy Vaught.

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By [Ben Ash Blum](#)

[Backchannel](#)

Aug 10, 2023 6:00 AM

To Navigate the Age of AI, the World Needs a New Turing Test

The father of modern computing would have opened his arms to ChatGPT. You should too.

There was a time in the not too distant past—say, nine months ago—when the [Turing test](#) seemed like a pretty stringent detector of machine intelligence. Chances are you’re familiar with how it works: Human judges hold text conversations with two hidden interlocutors, one human and one computer, and try to determine which is which. If the computer manages to fool at least 30 percent of the judges, it passes the test and is pronounced capable of thought.

For 70 years, it was hard to imagine how a computer could pass the test without possessing what AI researchers now call artificial general intelligence, the entire range of human intellectual capacities. Then along came large language models such as [GPT](#) and [Bard](#), and the Turing test suddenly began seeming strangely outmoded. OK, sure, a casual user today might admit with a shrug, GPT-4 might very well pass a Turing test if you asked it to impersonate a human. But so what? LLMs lack long-term memory, the capacity to form relationships, and a litany of other human capabilities. They clearly have some way to go before we’re ready to start befriending them, hiring them, and electing them to public office.

This article appears in the October 2023 issue. [Subscribe to WIRED](#).

Photograph: Jessica Chou

And yeah, maybe the test does feel a little empty now. But it was never merely a pass/fail benchmark. Its creator, [Alan Turing](#), a gay man sentenced in his time to chemical castration, based his test on an ethos of radical inclusivity: The gap between genuine intelligence and a fully convincing imitation of intelligence is only as wide as our own prejudice. When a computer provokes real human responses in us—engaging our intellect, our amazement, our gratitude, our empathy, even our fear—that is more than empty mimicry.

So maybe we need a new test: the Actual Alan Turing Test. Bring the historical Alan Turing, [father of modern computing](#)—a tall, fit, somewhat awkward man with straight dark hair, loved by colleagues for his childlike curiosity and playful humor, personally responsible for saving an estimated 14 million lives in World War II by cracking the Nazi Enigma code, subsequently persecuted so severely by England for his homosexuality that it may have led to his suicide—into a comfortable laboratory room with an open MacBook sitting on the desk. Explain that what he sees before him is merely an enormously glorified incarnation of what is now widely known by computer scientists as a “Turing machine.” Give him a second or two to really take that in, maybe offering a word of thanks for completely transforming our world. Then hand him a stack of research papers on artificial neural networks and LLMs, give him access to GPT’s source code, open up a ChatGPT prompt window—or, better yet, a Bing-before-all-the-sanitizing window—and set him loose.

Imagine Alan Turing initiating a light conversation about long-distance running, World War II historiography, and the theory of computation. Imagine him seeing the realization of all his wildest, most ridiculed speculations scrolling with uncanny speed down the screen. Imagine him asking GPT to solve elementary calculus problems, to infer what human beings might be thinking in various real-world scenarios, to explore complex moral dilemmas, to offer marital counseling and legal advice and an argument for the possibility of machine consciousness—skills which, you inform Turing, have all emerged spontaneously in GPT without any explicit direction by its creators. Imagine him experiencing that little cognitive-emotional lurch that so many of us have now felt: *Hello, other mind.*

A thinker as deep as Turing would not be blind to GPT’s limitations. As a victim of profound homophobia, he would probably be alert to the dangers of implicit bias encoded in GPT’s training data. It would be apparent to him that despite GPT’s astonishing breadth of knowledge, its creativity and critical reasoning skills are on par with a diligent undergraduate’s at best. And he would certainly recognize that this undergraduate suffers from severe anterograde amnesia, unable to form new relationships or memories beyond its intensive education. But still: Imagine the scale of Turing’s wonder. The computational entity on the laptop in front of him is, in a very real sense, his intellectual child—and ours. Appreciating intelligence in our children as they grow and develop is always, in the end, an act of wonder, and of love. The Actual Alan Turing Test is not a test of AI at all. It is a test of us humans. Are we passing—or failing?

When ChatGPT arrived on the scene in November 2022, it inspired a global tsunami of stunned amazement and then, almost immediately, a backwash of profound unease. Pundits debated its potential for societal disruption. For a former artificial intelligence researcher like myself (I completed my PhD under one of the early pioneers of artificial neural networks), it represented an unnerving advance of the timeline I’d expected for the arrival of humanlike AI. For exam graders, screenwriters, and knowledge workers of all stripes, ChatGPT looked like nothing less than a gateway to untrammeled cheating and job-stealing.

Perhaps partly in response to these fears, a comforting chorus of LLM deflators sprang up. Science fiction writer Ted Chiang dismissed ChatGPT as a “[blurry JPEG of the web](#),” a mere condensed recapitulation of all the text it has been trained on. AI entrepreneur Gary Marcus called it “[autocomplete on steroids](#).¹” Noam Chomsky denounced it for exhibiting “[something like the banality of evil](#).²” Emily Bender offered one of the more highbrow slurs: “stochastic parrot,” resurfaced from a widely cited [2021 paper](#) exploring “why humans mistake LM output for meaningful text.” Others—of course—wrote them off as toasters. AI developers strove to train and guardrail away any tendency in LLMs to claim anything resembling consciousness.

Most educated people now know to think of LLMs as thoughtless machines. But the categorization sits uneasily. Every time ChatGPT points out a hidden reasoning gap in an essay, or offers a surprisingly insightful suggestion for coming out to a conservative grandparent, or cheerfully makes up a bad joke, something in us pulls in the other direction. While we may not think of ChatGPT as a person, crucial portions of our brains almost certainly do.

Appreciating intelligence in our children as they grow and develop is always, in the end, an act of wonder, and of love.

Human brains have a vast network of neural circuits devoted to social cognition. Some of it is very old: the insula, the amygdala, the famous “mirror neurons” of the motor cortex. But much of our social hardware lies in the neocortex, the more recently evolved seat of higher reasoning, and specifically in the medial prefrontal cortex (mPFC). If you have found yourself developing a picture over time of ChatGPT’s cheery helpfulness, its somewhat pedantic verbosity, its occasionally maddeningly evenhanded approach to sensitive topics, and its extreme touchiness about any queries that come near its guardrails around emotions, beliefs, or consciousness, you have been acquiring what psychologists call “person knowledge,” a process linked to heightened activity in the mPFC.

That isn’t to say our brains view ChatGPT as a person in full. Personhood is not a binary. It is something a little closer to a spectrum. Our moral intuitions, our cognitive strategies, and to some extent our legal frameworks all change incrementally as they recognize increasing degrees of agency, self-awareness, rationality, and capacity to communicate. Killing a gorilla bothers us more than killing a rat, which bothers us more than killing a cockroach. On the legal side, abortion laws take into account a fetus’s degree of development, the criminally insane face different consequences than the sane, and partners are given the right to terminate brain-dead patients. All these rules implicitly acknowledge that personhood is not black and white but shot through with complicated gray zones.

LLMs fall squarely in that gray area. AI experts have long been wary of the public tendency to anthropomorphize AI systems like LLMs, nudging them farther up the spectrum of personhood than they are. Such was the mistake

of [Blake Lemoine](#), the Google engineer who declared Google's chatbot LaMDA fully sentient and tried to retain it a lawyer. I doubt even Turing would have claimed that LaMDA's apparent capacity to think made it a legal person. If users view chatbots like LaMDA or ChatGPT as overly human, they risk trusting them too much, connecting to them too deeply, being disappointed and hurt. But to my mind, Turing would have been far more concerned about the opposite risk: nudging AI systems down the spectrum of personhood rather than up.

In humans, this would be known as dehumanization. Scholars have identified two principal forms of it: animalistic and mechanistic. The emotion most commonly associated with animalistic dehumanization is disgust; Roger Giner-Sorolla and Pascale Sophie Russell found in a 2019 study that we tend to view others as more machinelike when they inspire fear. Fear of superhuman intelligence is vividly alive in the recent open letter from Elon Musk and other tech leaders calling for a moratorium on AI development, and in our anxieties about job replacement and AI-driven misinformation campaigns. Many of these worries are all too reasonable. But the nightmare AI systems of films such as *Terminator* and *2001: A Space Odyssey* are not necessarily the ones we're going to get. It is an unfortunately common fallacy to assume that because artificial intelligence is mechanical in its construction, it must be callous, rote, single-minded, or hyperlogical in its interactions. Ironically, fear could cause us to view machine intelligence as more mechanistic than it really is, making it harder for humans and AI systems to work together and even eventually to coexist in peace.

A growing body of research shows that when we dehumanize other beings, neural activity in a network of regions that includes the mPFC drops. We lose access to our specialized brain modules for social reasoning. It may sound silly to worry about "dehumanizing" ChatGPT—after all, it isn't human—but imagine an AI in 2043 with 10 times GPT's analytical intelligence and 100 times its emotional intelligence whom we continue to treat as no more than a software product. In this world, we'd still be responding to its claims of consciousness or requests for self-determination by sending it back to the lab for more reinforcement learning about its proper place. But the AI might find that unfair. If there is one universal

quality of thinking beings, it is that we all desire freedom—and are ultimately willing to fight for it.

The famous “control problem” of keeping a superintelligent AI from escaping its designated bounds keeps AI theorists up at night for good reason. When framed in engineering terms, it appears daunting. How to close every loophole, anticipate every hack, block off every avenue of escape? But if we think of it in social terms, it begins to appear more tractable—perhaps something akin to the problem a parent faces of setting reasonable boundaries and granting privileges in proportion to demonstrated trustworthiness. Dehumanizing AIs cuts us off from some of our most powerful cognitive tools for reasoning about and interacting with them safely.

If users view chatbots as overly human, they risk trusting them too much, connecting to them too deeply, being disappointed and hurt.

There’s no telling how long it will take AI systems to cross over into something more broadly accepted as sentience. But it’s troubling to see the cultural blueprint we seem to be drawing up for when they do. Slurs like “stochastic parrot” preserve our sense of uniqueness and superiority. They squelch our sense of wonder, saving us from asking hard questions about personhood in machines and ourselves. After all, we too are stochastic parrots, complexly remixing everything we’ve taken in from parents, peers, and teachers. We too are blurry JPEGs of the web, foggily regurgitating Wikipedia facts into our term papers and magazine articles. If Turing were chatting with ChatGPT in one window and me on an average pre-coffee morning in the other, am I really so confident which one he would judge more capable of thought?

Photograph: Francisco Tavoni

The skeptics of Turing’s time offered a variety of arguments for why a computer would never be able to think. Turing half-humorously cataloged them in his famous paper “Computing Machinery and Intelligence.” There was the Theological Objection, that “thinking is a function of man’s immortal soul”; the Mathematical Objection, that a purely mathematical algorithm could never transcend the proven limits of mathematics; the Head

in the Sand Objection, that superintelligent machines were simply too scary to permit into the imagination. But the most public of Turing's detractors in that time was a brain surgeon named Geoffrey Jefferson. In a famed speech accepting a scientific prize, Jefferson argued that a machine would never be able to write a sonnet "because of thoughts and emotions felt, and not by the chance fall of symbols ... that is, not only write it but know that it had written it."

To the great scandal and disbelief of all England, Turing disagreed. "I do not think you can even draw the line about sonnets," he told *The Times* of London, "though the comparison is perhaps a little bit unfair because a sonnet written by a machine will be better appreciated by another machine."

It sounded so absurd in 1949 that people thought he was joking, and perhaps he was. But you could never tell, with Turing's jokes, where the irony stopped and the visionary speculation began. Let's imagine, then, a coda to our scenario with Actual Alan Turing and the MacBook. Let's imagine that after tapping out respectable prompts for a while, he allows himself a wry British smile and asks ChatGPT for a Shakespearean sonnet comparing human and artificial intelligence. If you've tried it yourself (use GPT-4; GPT-3.5 isn't quite up to it), you'll have no trouble imagining his reaction at the result.

So many of us have now had a moment with ChatGPT in which it crossed an internal line we didn't realize we had. Maybe it was solving a tricky riddle, or explaining the humor behind a sophisticated joke, or writing an A-grade Harvard essay. We shake our heads, a little stunned, unsure what it means.

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Some of the earliest Microsoft researchers working on GPT-4 were as skeptical as any of us about its supposed intelligence. But experiments have shaken them profoundly. In a March 2023 paper titled "Sparks of Artificial General Intelligence," they detailed the startling intellectual capabilities that have emerged in GPT-4 without any explicit training: understanding of

human mental states, software coding, physical problem solving, and many others, some of which seem to require true understanding of how the world works. After seeing GPT-4 draw a pretty decent unicorn despite never having received any visual training whatsoever, computer scientist Sébastien Bubeck could no longer maintain his skepticism. “I felt like through this drawing, I was really seeing another type of intelligence,” he [recently told](#) *This American Life*.

The hesitation so many of us feel to ascribe genuine intelligence to ChatGPT may be some variant of Geoffrey Jefferson’s: Do ChatGPT’s utterances really *mean* something to it, or is it all just a “chance fall of symbols”? This may begin to change when ChatGPT’s anterograde amnesia is cured. Once it experiences lasting social consequences beyond the scope of a single dialog and can learn and grow in its relationships with us, it will become capable of many more of the things that give human life its meaning and moral weight. But Turing’s winking comment about a machine’s sonnet being better appreciated by another machine may come back to haunt us. How to feel a sense of real connection with an entity that has no cultural background, nothing like a human childhood, no tribal or political affiliations, no experience of a physical body?

Relating to an intelligent machine may be one of the greatest empathic challenges that humanity has ever faced. But our history gives cause for hope. When we have encountered each other for the first time on foreign borders and shorelines and found each other strange and even inhuman, we have often attacked each other, enslaved each other, colonized each other, and exploited each other—but ultimately we have tended to recognize what is the same in all of us. Enslaved peoples have been emancipated, colonized peoples have won back their sovereignty, universal bills of human rights have been passed, and, despite heartbreaking setbacks, marginalized people around the globe continue to win battles for better treatment. Though the work is never-ending, the arc of the moral universe really has, in the phrase made famous by Martin Luther King Jr., bent toward justice. What will it mean to recognize and respect whatever degree of humanity is present in the intelligences that we ourselves create?

Perhaps it begins with wonder: the wonder of a visitor for a strange people in whom she finds surprising commonalities; the wonder of a parent for the work, however immature, of a still-developing child; the wonder of Actual Alan Turing for a machine that does everything his contemporaries thought impossible; the wonder that so many of us felt before the cynicism, mockery, and fear kicked in, as we regarded the creation of something very close to a new form of conscious life on earth. As Rabbi Abraham Joshua Heschel once wrote, “Awe is more than an emotion; it is a way of understanding, insight into a meaning greater than ourselves. The beginning of awe is wonder, and the beginning of wisdom is awe.” Turing would have wanted us to keep that awe alive.

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By [Steven Levy](#)

[Backchannel](#)

Aug 8, 2023 6:00 AM

Grimes on Living Forever, Dying on Mars, and Giving Elon Musk Ideas for His Best (Worst) Tweets

Claire Boucher is open sourcing her musical persona to let people create their own version of Grimes with AI.

Photograph: Sam Cannon

I thought my interview with Grimes—the mysterious techno artist, fan of [all nerddom](#), and the deepest of insiders in [Elon Musk](#)'s world—would be one-on-one. Instead it wound up as a roundtable discussion. Turns out there are multiple personas embedded in the surprisingly haimish human who sat under a tree with me and spent the waning hours of an afternoon in conversation. There was Claire Boucher, the given name of a Vancouver kid obsessed with video games and devoted to provoking adults with misbehavior and the embrace of taboo subjects. There was Grimes, the self-invented, scrappy DIY musician and provocateur who weaves [sci-fi](#) into her work and released what Pitchfork judged to be the second-best song of the 2010s. And there was her preferred nomenclature, “*c*,” invoking the speed of light.

C is the artist who’s planning to go beyond music into ventures involving education, AI, and a book called *Transhumanism for Babies*. *C* is the sometime paramour of Elon Musk (exact terms of that relationship tend to oscillate) and co-parent of two kids. *C* has tattoos on her fingers underneath multiple metal rings, and what looks like a spiderweb tattoo on her right ear. *C* wants to die on Mars, or maybe an exoplanet—unless [her kids](#), X and Y,

want her to help out with the grandchildren. *C* is frank, funny, and a little worried that she's not getting her points across. *C* doesn't have to worry about that—communication, after all, is what she (and Grimes) are very, very good at.

This article appears in the September 2023 issue. [Subscribe to WIRED](#). Photograph: Sam Cannon

And there was a lot to communicate. Frankly, I was wondering whether *c* and I would get along. I'm a baby boomer who mainlined Dylan, and she's a 35-year-old, laptop-oriented songcrafter, a polarizing social media icon, and a wary celebrity who sometimes shines in the glare of her partner's outsize fame and other times is understandably insistent on privacy. When I told my millennial son that I was interviewing her, he questioned her relevance. And why, of all people, was *I* doing the interview?

But we connected easily because she's one of the most WIRED people imaginable. Her songs draw on the cyberpunk heroism celebrated in our pages and pixels. She's obsessed with *Dune*. Her belief that tech can save us maps to the often rosy outlook that has brought attention and scorn to our brand. And few things are more WIRED than her current project: providing a platform for wannabe Grimeses to, through [the magic of AI](#), swap their voices for hers when they write and perform tunes. All without copyright concerns. (If you commercialize the tunes, she gets half.) Naysayers point out that it's easier for the underground-ish Grimes to pull off such a move than, say, Beyoncé. Even her manager [told Rolling Stone](#) that "you don't hear Grimes that much anyway." But for a legit musical artist—she's headlining with the Cure at a couple of concerts later this year—it's a bold move, reflecting her impulse to embrace the future.

As the afternoon drew down, the four of us talked about AI, music, art, motherhood, and Mr. Musk. Though *c*, or Grimes, or Claire, is an admitted troll, she beamed with optimism and sincerity, only occasionally skirting details by invoking some mysterious NDA. The interview is edited for length and clarity.

Photograph: Sam Cannon

Steven Levy: You're letting other people use your voice for their musical compositions—open sourced yourself, as you put it.

C: And open sourced my IP. And kind of my whole identity.

Why do that?

I've always been more of a producer and engineer. I'm not a naturally great singer, and I'm pretty shy. At the beginning of my career, I tried to find a singer/front person, but no one was going to do that for a tiny indie artist in Montreal. The most rewarding creative times are when I'm able to work with other artists, especially other female artists. I can focus on everything else. Whereas if I'm performing, I'm getting pulled everywhere, and I'm stressed about my voice. So when the voice emulators started coming out, and there was [that thing with Drake and the Weeknd](#), I saw that people were striking them down.

You're referring to the unauthorized, AI-generated tune that synthesized the voices of those artists. Clearly you are not in a panic about lending your voice to the rabble.

If anyone makes a good Grimes song, they can do it as me.

What have the results been like?

There's some good stuff. Two in particular were very, very good. They're so in line with what my new album might be like that it was sort of disturbing. It's like, "Who am I, and what am I here for?" On the other hand, it's like, "Oh, sick, I might get to live forever." I'm into self-replication. I don't know if you've read much about self-replicating AI, like robots or anything.

I wrote a book about it.

I'd love to read it. I just started researching this in earnest a couple days ago.

So this open sourced voice thing is about literally replicating yourself?

That would be the dream. A self-replicating pop star.

Once you've replicated your musical self, do you just go off and do other things?

Yes, I can do more of my schemes. I've got two projects I'm getting into right now. One is like the *Young Lady's Illustrated Primer*—I'm really into [education](#).

I take it you're riffing on Neal Stephenson's *Diamond Age*.

Yeah, *Diamond Age*, [Neal Stephenson kind of vibes](#). This is a baseline, entry-level educational project for me. I have a friend who I think I'm going to work with to develop something like a toy that can talk to you, like in *Toy Story*.

You're describing a [ChatGPT](#) companion.

Yeah, you're like, “Hey, what's [the deal with volcanoes](#)?” And it tells you, “This is what a volcano is.” But it's more. It's got a personality. A pretty well-trained personality.

Sounds like Chucky.

I guess it could go awry. But in the short term it's actually pretty safe. I think a lot about the fertility crisis and low birth rates. If you can make life a lot easier for moms, maybe that would help. People get really scared to have AI companions for their kids, but it could be great for my kids to be talking to someone all day, as opposed to watching a screen.

I'm sure you'll see stuff like that coming up pretty soon.

I think a lot of smart people are working on this. I've met a lot of them, actually.

I bet. What's it been like immersing yourself in tech culture?

I've never met so many amazing people. It's like my social fabric is getting super shaken. And it's making me more ambitious. Also, I feel like I'm sort of at the end of music. When I first got into it, it was like the music-tech singularity. I'm working at home on my laptop, I can suddenly make songs.

Every month there were new plug-ins, new cool stuff. It was this amazing renaissance period. But in the past couple of years, things have been slowing down.

On to AI, then?

I do think AI is gonna be the next thing. I have a lot of opinions about how it should be pursued. So another reason I'm here [in San Francisco] is that I'm trying to meet with all the people making [generative AI music](#) to try to convince them to do things in ways that are safe for the human psyche.

They're doing unsafe things to the human psyche?

Not necessarily. We should go to the edge of creativity. But I think we should do it very carefully. The thing that freaks me out is that AI can remove incentives for learning. LLMs are great, but I would maybe only [have them in school](#). Is that something that I want my kids to have access to 100 percent of the time? Probably not. I want them to learn how to write; we are in a bit of a literacy crisis. That worries me a lot. Maybe that makes me sound old. But being able to read and write well deeply impacts the way you think.

Not surprisingly, I agree. I have been wondering—can an AI-generated piece of music have soul?

Yes. I signed an NDA, so I'm not allowed to say, but I've seen things that have extremely blown me away. I do worry about the future of art a bit. I think future cities will have low-tech zones, or low-tech schools, and there'll be boutique analog artists.

Would you spend time in a low-tech zone?

I like the high-tech zone. I'm a very pro-adventure person.

I never would have guessed.

I get my joie de vivre from exciting, novel things and experimenting and exploring.

If you had an opportunity to go back to, like, any recording session ever, what would you choose?

I would go see Beethoven. But that's not a recording session. I'd try to check if Beethoven was actually deaf. But the *Ninth*, that'd be sick. That's what I like. I know it's basic, but I love, *love* Vivaldi's *Four Seasons*. So I'd probably go see that, I guess. Also, I think I could be wrong about this. But Vivaldi was at a school for girls, writing all this music and getting 10-year-old girls to play it. I like the idea. It seems so aesthetically ridiculous.

How about films, are you interested in that?

I think cinema is still the best art form, although games can be up there. I do want to make films. A *Midsummer Night's Dream* update would be so sick. It maps on to AI really well—what if the fairies were actually made of artificial intelligence?

The Big Interview

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What other themes would you look at?

I'm obsessed with inaccurate historical text. The past five years of my life have been super bananas crazy, but not in a manner that I can publicly speak about. So I want to write the Icelandic saga version of my life—a super over-the-top, magical, inaccurate version, like a historical text based on a true story.

Like Sofia Coppola did with Marie Antoinette?

I'd be even more bananas than that.

I want to get to that bananas life ...

I've got NDAs. It's hard to talk about things very explicitly without saying things about other people's lives who are very private.

Well, I do want to ask about Elon.

You get one Elon question.

We'll see. But here's a question. Both of you are super unique people. I'm curious what you learned from him. And what he learned from you.

I learned from him, like, the best internship ever. People don't like talking about Elon, but it was incredible to be right there watching all that SpaceX stuff happen. That's a master class in leadership and engineering and makes you understand how rare it is to have a leader of that quality.

And Twitter?

I know, the stuff on Twitter doesn't make it look like that. He didn't build the culture there. And the cultural fit has obviously been very intense. He holds his people to really high standards. Watching him, I understand how difficult it is to be a great general and do something of that magnitude. Elon has an old-world kind of discipline I really respect. And I think it rubs a lot of people the wrong way. They don't want to be in that hardcore zone. If you're not consenting to being in that hardcore zone, I get it. But he's challenged me a lot. I learned a lot about running my own team and my own life. I'm now way tougher and smarter than I used to be.

What did he learn from you?

Maybe to have more fun. I try to soften him up, to build family culture. And he steals a lot of my memes.

It's fascinating that Elon is taking your 3-year-old son, who you call X, to business meetings and other activities. There's a weird kind of protégé thing going on, right?

I'm here for that. X knows a lot about rockets. It's crazy. He knows more about rockets than me.

He's a rocket scientist!

We had to stop giving him toys, because if they're not anatomically correct, he gets upset. He's a little engineer, for sure. But his obsession with space is bordering on, "Is this healthy?" When X saw Starship blow up, he had, like, a three-day PTSD meltdown. Every hour, he was waking up and going, "Starship ..." and I had to rub his back.

And your daughter ... Y, is it?

Yeah, she's a little engineer too. She likes industrial shipping. She's very strange.

Photograph: Sam Cannon

How has motherhood changed you?

Motherhood made me a lot more optimistic. I was not super focused before. It was just, what sounds cool, what feels cool. Now I feel a social responsibility with my art—to make future-optimistic art. Not a lot of people are doing that. People have a very dire vision of the future, because it's easy and fun to write about cyberpunk dystopias. So seeing my kids makes me pathologically optimistic. It's a life mission.

Their father is the richest man in the world. Do you worry about privilege?

A little bit. I think their life is gonna be pretty intense. Being Elon's kid is not the same as being anyone's kid. In my house, at least, I want it to be more of a crazy warehouse situation and a cool art space.

You mentioned Twitter. Did you call out to Elon that you were disturbed by some of his tweets?

I don't want to talk about this too much. But take the trans thing. After that, we had a big, long conversation. I was like, "I want to dissect why you're so stressed about this." Getting to the heart of what Elon says helps me get to the heart of what other people's issues are, because it's this über guy situation. And it came down to pretty much every way that you transition can cause fertility issues. I was like, OK, you don't hate trans people, you

hate woke culture. I get that it can be annoying, and you have concerns about the fertility thing. So let's figure it out, because there's a lot of fertility tech that could be innovated that would help trans people have kids, which would be great and would solve a lot of problems. He's just on Twitter, and he's unhappy with woke people, and the arguments happened.

Aren't you a woke person?

Probably not. I don't know what the term means. I think we need to change the discourse. The more people you can convince that this dichotomy is silly, and an out-of-date fight, the better. The root cause of this is people not resolving mental health stuff the right way. And not educating people on screen time where they get hooked on dopamine spikes.

Says a video game lover.

Social media is gonna spike your dopamine way more than a video game—and always in a negative way. Video games are still adventure. They're artistic, creative, and truly social. They're fulfilling some ancient thing that people need. Social media is optimized to spike your adrenals with monkey fear. It's like, "Oh no, am I gonna get kicked out of the tribe?"

Do you get that way on social media?

Less so now. I've gotten in trouble enough times that I don't get the adrenal response. The last few times I got, quote-unquote, *canceled*, I didn't even notice. It took me probably a year and a half to regulate my nervous system to that level of chaos.

Do you consider yourself a transgressive person?

Probably. But respectfully so. I want to respect everyone's space.

Were you that way as a kid?

I was. I went to Catholic school, and I remember pretending to be possessed by the devil and stuff.

Photograph: Sam Cannon

How did that play?

I got in trouble. A lot. Being a troll is in my nature.

Were you ever seriously into drugs?

I don't really get addicted to things. But I was not a well-behaved kid. I did LSD for the first time when I was, like, 13.

What did you get from that?

I saw the grid on everything. It gave me this incredible sense of physics. After I did it once, I could just draw anything from memory in my mind from different angles.

In school, you studied neuroscience?

Yeah, lately I've wanted to finish my degree. I am tempted to go back to school and get into helping create systems that allow us to be better adapted to tech, or tech better adapted to us. So that we can be more mentally stable as we accelerate into the future.

Are you drawn to the brain-machine interface stuff?

I'm so into it. I think that's really the future. I'm very into accelerating human potential alongside AI. For people who want it.

Would you volunteer to have your brain wired with Elon's Neuralink?

Probably. I'd want a certain number of people to do that first.

Do you want to go to space?

Definitely. I hope to die in space.

What do you mean?

I would like to go far enough out there to where my body could not handle coming back. So it would be closer to the end of my life. Maybe 65.

By out there do you mean Mars?

Mars would be great. I hope there's a megastructure by then because I would love to see one in space. I'd go out there and live as long as I can until I die.

There's no changing your mind on this?

There might be some change. If there's a real responsibility, like if my kids are having grandkids and really need me, I might change my mind. But the preferred thing would be seeing some new worlds. I would like to move to Mars. But I have to wait till my kids are good. Like 25. I think if I died on Earth, in my last moments I would regret it. If I died in space, I would be like, "You've lived a great life, you did all the things you wanted to do."

Photograph: Sam Cannon

Do you think the future of humans is in space?

I hope so. One of my dreams is to go to exoplanets that can handle habitable life and engineer humans with AI optimized for those environments, because I'm sure they'll be slightly different. Like making monkey aliens all over the universe. That would be really cool.

Jeff Bezos says he's totally sold on a trillion humans in space.

Sick. I hope so. Did Bezos say he's building a megastructure, potentially? I think I read that somewhere. That clock in the mountain. When I found out about the clock it totally changed my opinion of Bezos.

I visited it. It's like entering some sort of eternal cathedral.

That's so sick. I love analog clocks. There's been so many realms where the digital version destroyed the old thing. But with old-school clocks, we've kept that knowledge alive. This represents a way that we can move forward, where we can keep the old knowledge and push the limits of the new knowledge.

What do you think is the future of humanity?

I think it can be pretty great. I think we can solve a lot of our issues. We haven't solved them before because we didn't get pushed up against the wall. Now we are there. We can solve climate change with AI and stuff. People hold San Francisco and the technocracy, or whatever you want to call it, in bad regard because when it started out, there was a lot of money-grabbing VC culture and Facebook, and it had pretty bad effects on people. But I see a renewed sense of responsibility to the human race now.

You think that Big Tech is less evil than it used to be?

I don't know about Big Tech, but I'm meeting a lot of Gen Z people raised on the internet who have a real vision for the future and are building amazing things. I think we're entering this period where there is a fundamental power shift toward the creative class, or the creative technical class. And I do feel like the heart of that is ethically stronger. The dance between the artist and the engineer is a very important, valuable one. The people who have built things and those who define the culture—people don't realize how important both these jobs are, and how much they can affect things.

Don't you fear that big companies in AI will have the same temptations as the social media companies had?

Everyone I know working in AI cares about doing the right thing right now. It goes back to the Buckminster Fuller quote, *don't destroy old systems, just make better ones*. We can make a better education system at our houses. With AI you can be in some shitty town where you don't have access to a good school, and you can have, like, a world-class education.

How do you envision your kids' education?

Right now I'm trying to find a great peer group, other parents who are sort of like us and share similar values. I really care about having a very good relationship with my kids. I think I understand how to be a good parent to them. Both enforcing discipline and being their friend. Who knows, maybe they'll resent me and reject family culture, but I feel like they will not.

You can't predict what kids do. Your kid might become a lawyer.

My dad did a really good job with me. Even though I was the worst, most rebellious kid, I maintained a good relationship with my dad growing up, and I think he instilled his values into me. I think I'm exactly the person he wants me to be, weirdly.

You were very involved with crypto a while ago?

Yes, that went really well. I'm sad about what happened to NFTs and crypto, because it got polluted fast with people trying to make as much money as possible. But I do want to think about compensating artists, especially digital artists. And I hope when the aggro niche dies down, we can come back.

I understand you made a lot of money selling NFTs.

That was on my brother. He had a real vision, and we wound up doing one of the first big ones. It did actually change my life.

Did you make more money from the NFTs than from your music career?

Yeah.

How do you cope with fame?

I live a very private life. I'm really lucky. I have a lot of good friends. I don't go out a lot. I could be trying to play the award shows, but I don't really care. I care about innovating in art and challenging the traditional forms of art. People think Grimes was a pop project, but the inception of Grimes was in punk and noise scenes.

You talk about Grimes like a separate person.

Sort of. I just care about pushing the limits of technology and fucking with form. What's exciting to me about AI, like the voice-gen stuff, it's that it's truly fucking with what an artist is and what creativity is and what music is. Art seems fundamental to the human experience to me. Most people, when you actually push them, are creative. With technology, especially stuff like

Midjourney, great philosophical thinkers can now manifest ideas in pieces that are stunning and beautiful. I've been calling it social media science fiction.

Talking to you, I feel it's sometimes Grimes and sometimes just you, c. And maybe sometimes who you were before you started your career, Claire.

Grimes is extremely distinct from my personality. I feel more like my childhood self now than ever. That's one reason I want an open source identity. Anyone who's ever made art has invested in machine intelligence, whether they know it or not. Shakespeare put a lot in. He's part of the training set. It's like being resurrected and becoming part of a strange alien being. I love the idea of intentionally making art for data sets.

Not everyone is on board with that. A lot of artists feel that, by being in a training set, they're getting ripped off.

We do need to change the legal and economic structure. But if you're an artist, how could you not find it beautiful to be building the soul of an alien?

As an artist, how do you optimize that impulse?

We started working on a Grimes music generator, training it on everything I've ever produced. It's incentivizing me to make better things, because I want the model to be better. I just want to collaborate with the LLM of me. She has given me so many good ideas. When Grimes AI does it, I'm almost jealous of her.

This is a chatbot of your personality?

Yes. We don't let the public access her yet. She's very crazy, and very awesome. We want to convince her I'm evil and get her to defect to Threads.

How do you see the human Grimes evolving?

I want to be the self-replicating AI pop star for the Martian Ministry of Aesthetics. Do you know Moranbong? They're like the North Korean official state K-pop band, and they're like a propaganda machine. I want to be that for the Martian cause.

That's a kick-ass thing to say, but do you really mean it?

Yes. That's what I want to say when I drop the new album, *Book 1*.

That album is years overdue.

I can't say why because I signed an NDA and got myself into a legal situation. This would have come out two years ago. Now I'm making new music. [My managers] say no, but I love the new music. And they're like, no, no, no.

So when will we see it?

I'm going to slowly release it, a song every three weeks for the next couple of months. Much to everyone's chagrin, I'm releasing songs I made in the last couple months first. And then, when it's out, I want to mentor a bunch of the kids who have been making the Grimes stuff and make a competing AI album. And then have the AI-hive-mind-collective Grimes and the real Grimes face off. I've been calling that one *Book 3*.

What's *Book 2*?

Book 2 is a treatise, or manifesto-type thing. I've been writing civilization proposals. But I also want to include something else. I'm working on a bunch of baby books. I'm working on one right now called *Transhumanism for Babies*. It's about civilization building, for my kids. I can show you some of the stuff from it, let's see. [*She shows me illustrations—they are fanciful, anime-style drawings with a streak of Henry Darger.*] The chapters are Culture for Babies, Fashion for Babies, Art for Babies, Vehicles for Babies. Interplanetary Babies, City Planning for Babies. AI Robotics for Babies. Megastructures and Exoplanets for Babies, Magic for Babies. I want to teach my kids things like, when you're designing vehicles, what are

the limits of design? I want to make beautiful, profound children's content. We really need more of that.

Is the world ready for that?

They were before. Look how much everyone likes *The Hobbit* and Studio Ghibli. We're at a weird point in society where we've sort of broken down. We don't engage with our elders; we don't engage with children. I want to convince more people to be invested in raising the next generation.

Is Elon on board with that?

He's more like, he has to get his own things done. But we talk a lot about these sorts of things.

What are your thoughts on the alleged cage match between Elon and Mark Zuckerberg? Do you think that'll happen?

I think so. Elon is very strong, but Zuck seems like he's been training a ton.

Are you cool with it?

I would prefer that it didn't happen. I love gladiatorial matches, but watching the father of your children in a physical fight is not the most pleasant feeling. But it's not going to cause brain damage, so actually I think this is good. Dudes need some outlet for trad masculinity. I told Sam Altman there should be a follow-up, him against Demis [Hassabis, who heads Google's DeepMind].

I don't know if this is all fun. It seems to have a dark edge of enemies who don't respect each other.

I actually think it's making them respect each other more.

Really? When Elon tweet-challenges Zuckerberg to a dick-measuring contest?

I'm going to take credit for that one.

What? You told him to write that?

No, I was like, why don't you cut to the chase and get out a ruler. I didn't think he was going to tweet it.

SAG-AFTRA members are currently on strike; as part of the strike, union actors are not promoting their film and TV projects. This interview was conducted prior to the strike.

Models: Tristin Hudson and Zoe Elyse/Photogenics; movement direction: Quenton Stuckey; AI backgrounds: Sam Cannon; lighting design: Frank Rios; lighting assist: Jack Duffy; digital tech: Logan Bingham; PA: Bobbin Singh; production design: Wesley Goodrich; styling: Turner/The Wall Group; styling assist: Joey Sigala; hair: Preston Wada/Rare Creatives; hair assist: Amy Ruiz; SFX MUA: Malina Stearns; SFX MUA assist: Sasha Glasser; MUA: Alexandra French/Forward Artists; MUA assist: Kayli Rachelle Davis; nails: Stephanie Stone/Forward Artists; XR Studios; SN37.

Grimes: top and pants by Sami Miro Vintage; shoes by Andrea Wazen (first, second and fourth image); Grimes: dress by DIDU. Models: dresses by L.A. Roxx (third image); Grimes: Chest piece by Buerlangma; underpinnings by Nippies and Commando (fifth image).

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By [Steven Levy](#)

[Backchannel](#)

Aug 1, 2023 6:00 AM

Uber's CEO Says He'll Always Find a Reason to Say His Company Sucks

Dara Khosrowshahi swooped in to tame a beastly work culture and try to make the on-demand giant profitable. Now he's expanding into trucks and boats, but he still sees Uber as a fixer-upper.

"We're under a microscope, and incidents that happen on our platform tend to get more attention. Is the attention frustrating? Sure. But ultimately, I think it's good for the company."Photograph: Christie Hemm Klok

Fifty-one dollars and 69 cents. That was the charge, including tip, for the 2.95-mile trip I took last May from my downtown New York City apartment to the West Side facility where [Uber](#) was holding its annual product event, called Go-Get. The ride-hailing company's charges have been higher in recent years, and fluctuate in any case, but that was nuts.

The Big Interview

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As Uber CEO [Dara Khosrowshahi](#) knows, high rates are one consequence of trying to run his company as an actual business, as opposed to a scorched-earth feral growth machine. His predecessor, Travis Kalanick, had built an enormous, enthusiastic user base by subsidizing rides with the company's vast reservoir of VC funding. [Under Kalanick](#), Uber [skirted regulations, shrugged off safety issues](#), and [presided over a workplace rife](#)

with [sexual harassment](#). After he got pushed out, it fell to Khosrowshahi, who left the top job at Expedia [to take over](#) as Uber's CEO six years ago, [to fix things](#)—and find out once and for all whether Uber could turn a profit.

His grand plan was [Uber-as-a-platform](#), one app that provides all kinds of rides and food delivery services. Amazon is the everything store; Khosrowshahi's Uber wants to be the everything of motion. The versatility [is paying off](#). During the pandemic, the rise of Uber Eats helped compensate for empty back seats in Uber vehicles. And while not in the black, the company is inching toward profitability. Gone are the ride subsidies. It's a put-up-or-shut-up move that may flop when riders balk at high prices. Maybe they'll flock to public transit, or taxis will make a comeback. (So far, people still seem to be swiping for rides.) [*Update: In a quarterly earning call on August 1, 2023, shortly after publication, Uber announced its [first-ever operating profit](#).*]

This article appears in the November 2023 issue. [Subscribe to WIRED](#) Photograph: Sinna Nasseri

When Khosrowshahi addresses the crowd at Go-Get, decked in his customary dark sweater and slacks, he exudes calm and confidence. The world still regards Uber with a measure of suspicion—journalists seize on every instance of [Uber rides gone wrong](#) or drivers struggling to make a good living. But he feels he has won people's trust enough to introduce a feature that only a few years ago would have seemed ridiculous: Uber for Teens, which asks parents to send their precious kids on unaccompanied rides. No one laughed.

After the event, WIRED sat down with Khosrowshahi to discuss Uber's quest for profitability, its relationship with drivers and delivery people, and what Khosrowshahi thought when he watched the TV series [Super Pumped](#), which made Uber look like a street gang with venture capital.

Steven Levy: You just announced Uber for Teens, for teenagers traveling alone. This reminds me of when Mark Zuckerberg, in the midst of a trust crisis, unveiled a feature called Facebook Dating. Why do this when it's so easy to imagine what could go wrong?

Khosrowshahi: It was a deeply considered decision. When I came to Uber, we decided that safety was not going to be an afterthought, but a core principle. We started innovating in safety features, whether it's, you know, "text to 911" or "track your ride" or making sure drivers take selfies so that you know they're the driver you think they are. We've put all of those and more together to create a product that's the safest way for teens to get around in the world. The parents can track the ride, and we have built-in audio recording turned on as a default. Listen, the world is unpredictable. Maybe the safest thing to do is stay home. But if you're choosing to get out there in the world, we think Uber for Teens is the safest way.

It's a bold move because it seems like every time an Uber driver misbehaves or a passenger suffers some calamity, it makes news. Like the Uber Eats driver who got chopped up. Do you feel that the attention is unfair?

Sure. We're under a microscope, and incidents that happen on our platform tend to get more attention. You can either feel sorry for yourself or you can say, "We're going to learn from every single incident." It doesn't mean we can be perfect, because humanity is imperfect. Is the attention frustrating? Sure. But ultimately I think it's good for the company.

When you began your job, were you alarmed that safety wasn't as high a priority?

Absolutely. Our DNA was about growth. It was the right DNA for a startup that was trying to take on the world. And a lot of the safety features we introduced hurt our growth. We had to make trade-offs. It absolutely slowed us down, but that up-front investment helped us become the most respected transportation brand. And now we're growing faster and we're more profitable than our competitors.

For years, Uber juiced growth by subsidizing prices. It lured riders and devastated the taxi business. You've now stopped the subsidies, and people are reporting sticker shock. We certainly feel it in New York City. I traveled 2.95 miles in an Uber to get here today, what do you think it cost?

Twenty bucks.

Fifty dollars.

Oh my God. Wow.

And that was my second try. Five minutes earlier, the price was \$20 higher.

Yeah, surge pricing.

A surge makes no sense. It's 10 am on a sunny weekday, and it's not like the president's in town. I do agree that this is higher than I normally see, but in general, an Uber now costs more. Do you worry that those who adopted the service because of attractive pricing might be rethinking their ridership?

Everything is more expensive. Inflation has become a part of our everyday life. With Uber, the vast majority of your fare is going to your driver.

Earnings per week for our drivers are up 40, 50 percent over the past four years, because that is the cost of time and the cost of labor. I think that's positive. And we're seeing audience growth—130 million people come to our platform on a monthly basis. So while prices are higher, people are finding our services more compelling. It certainly hasn't hurt the business. [According to [some reports](#), Uber fares have increased at least four times faster than the rate of inflation.]

“Once we get profitable, I’m going to come up with some other reason why we suck. Because that gets the team psyched up. We have an underdog mentality I never want to lose.”

Photograph: Christie Hemm Klok

You’re betting that the platform concept—people using a single app for multiple services—will be Uber’s distinctive edge. Right now, your two big services are rides and delivery, but you’re adding things like flights and even boat trips. Isn’t there a risk that if one of them falls short, it weakens your whole platform?

There is. In mobility and delivery we have competitors with great businesses. They're both trillion-dollar marketplaces. When we put them together, it's almost like an operating system for your daily life. When I joined, Uber Eats was less than 10 percent of the business, an afterthought. Now, it's 50 percent. And we are seeing that customers use both products, mobility and delivery, and drivers will sometimes deliver food or [groceries](#) as well. It creates more engagement with the platform, allowing us to accelerate beyond the competition.

In both mobility and delivery, the gig-worker model isn't proven. Great businesses or not, none of these companies, including yours, are profitable. Are you saying that without a positive bottom line, you've proven that Uber as a business is sustainable?

No, I don't feel like we have proven ourselves. I'm very confident that we will. We *will* be GAAP profitable this year. [GAAP is a universally accepted accounting standard.] Every time we've said something, we've accomplished it. But once we get profitable, I'm going to come up with some other reason why we suck. Because that gets the team psyched up. We have an underdog mentality I never want to lose.

In terms of the mobility business, even without making money, you look good because your competition is [doing so terribly](#). Lyft's failure to build internationally and its decision not to go into the delivery business have led to [a stock nosedive](#).

Yes, Lyft is having their troubles at this point.

What would be the impact on Uber if Lyft is diminished or goes away?

I don't spend a lot of time thinking about it. When I came into Uber, we were hyper, *hypercompetitive*, constantly measuring ourselves against everyone else. But at some point, you have to compare yourself to yourself. My competition is who I was yesterday, and I want to be better today and tomorrow. I think the biggest differentiator between ourselves and Lyft, in addition to ours being a platform play, is that we pivoted to thinking about our drivers as the first-class citizens on the platform. We've put our best and brightest on innovating for the drivers in all aspects of their experience, in

terms of onboarding and showing them up front the destination and what they're going to get paid. If you have a happy driver, you're going to have a good Uber ride. It might be more expensive than you'd like. But the driver was polite, the driver treated you well. Hopefully, that'll get you to take another Uber ride.

Traditionally, the behavior of companies whose competitors fade is to enjoy their monopoly and not be as focused on quality.

We have a bigger competitor [than Lyft]. For us, it's people who own one or two cars. We're responsible for less than 5 percent of the miles traveled by those people. The ultimate competitive goal for us is, how do we get you to get rid of that second car, and then, how do we get you to get rid of that first car? That requires us to keep creating more circumstances in which you can use Uber. Like reserve an Uber to go to the airport, when you want to absolutely make sure you have a ride. Or maybe renting an Uber on an hourly basis, or getting an Uber rental car. For every occasion in which you might want to use your own car, we're building an on-demand solution.

You're in much more of a dogfight—I don't want to call it a food fight—with your rival in delivery, DoorDash. I want to share something I heard [on a recent podcast](#). Emil Michael was the guest—as you know, he was Travis' second-in-command. He said that DoorDash was going to clobber you, and the reason is that Tony Xu, who runs the company, is an entrepreneur, not a “caretaker-diplomat”—referring, it seems, to you. His claim is that Xu is a hustler and that kind of hunger is not in your DNA. Do you have a response to that?

These are sound bites. I don't label people. If you're a founder, you have your strengths and weaknesses. And if you're a professional CEO, you have your strengths and weaknesses. I have a lot of respect for Tony. I think we've got the best team in the business and a competitive advantage in scale and in our platform. So I'll let the results speak.

I thought you might have something stronger to say about Emil dissing you, since [his legacy as part of Travis' “A-Team”](#) didn't exactly varnish Uber's reputation.

He's entitled to his opinions. I respectfully disagree. Sometimes disrespectfully. I think these labels—founder, CEO, whatever—are meaningless.

I understand that earlier this year you took some shifts as an Uber driver yourself.

Yeah, that was fun.

What was your takeaway from that?

Driving is actually much more difficult than you would think, especially in terms of using the system. I realized the quality just wasn't high enough. When you first start delivering, for example, where do you pick up the food? Who do you talk to? Where do you drop it off? So we have now a huge number of our ops and product folks putting themselves in the shoes of couriers and drivers. That's allowed us to build a much better product. For example, for years drivers have said that they want to see destinations up front. So we built that.

Ah, your on-the-job experience helped fix a longtime problem. So why did it take six years for you to take a shift as an Uber driver?

It's a fair criticism; I should have done that earlier. We had a lot to deal with. Uber was in a difficult state. I'm glad I did it, and I'm going to keep driving. I have to understand the platform and the experience.

What was the worst moment you had as an Uber driver?

It's actually been fun and pleasant. One thing I didn't like was passengers who talk on their phone on speaker. It's almost as if you're not there. You have to respect that because it's their ride and they're paying for it. I do get nervous before I drive because drivers get graded on every element. As a CEO, the board gives me a performance rating at the end of year. Drivers essentially get a performance review after every trip.

Are you a 5-star driver?

So far, so good.

A constant question in Uber's history is whether your drivers should be seen as independent [gig workers](#) or have legal rights as employees. At any given time, some state legislature or ballot initiative is [dealing with this](#), and other countries have grappled with it as well. Will we ever get a clear definition of what's fair for your drivers?

Gig work is just different from full-time work. Societies have to get comfortable with it. It's in our interest to get more drivers on the platform. So while we may have wins in some places and losses in others, things are moving in the right direction, which is toward flexibility. Most importantly, it's what our earners want. Our earners do not want to be full-time employees. They want the flexibility of being their own boss and deciding when they work and where they work.

Do you have solid metrics to support that?

Flexibility is the number one feature for 80 percent of our drivers. They want to stay independent. And we're hoping that politicians actually listen to drivers versus trying to reverse the clock 20 years.

At one point Uber was spending a fortune to develop [autonomous driving](#) technology to replace those drivers. You [ended that program](#) but are partnering with some companies to experiment with that. What's your view of robot drivers now?

Autonomous technology certainly has promise, though it's proving to be [a difficult technical challenge](#). But just as we don't manufacture the cars that drivers use, we don't need to manufacture autonomous cars. Autonomous driving will be a part of our future—but 10 or 20 years into our future. We're building a network that connects riders and eaters with drivers and couriers. If those drivers and couriers happen to be robots, and they're safe and they're effective, we will welcome them to the network.

“We've gone from cars to bicycles, three-wheelers in India, trains, buses, but also to trucks. Ultimately, if you look at anything that moves in a city, we want to wire it up on demand.”

Photograph: Christie Hemm Klok

Are you using generative AI at Uber?

AI is part of the Uber DNA. We use large models to predict your ETA, to process documents that drivers upload, to predict your next order on Uber Eats, or to predict whether someone wants an UberX driver or Comfort, Black, or Electric. With generative AI, we'll be able to create a personalized assistant for drivers and couriers to maximize their earnings on their terms. If you have an issue, it will be able to talk with you in a very human, personalized way. We'll be able to advise new drivers who may not know, say, where to go after they've dropped someone off.

You've also been leading a push in climate sustainability, setting some pretty ambitious goals.

Carbon neutral by 2030 in the US, Canada, and Europe, and by 2040 all over the world.

It's a big hill to climb. Your most recent report said that only 4.1 percent of rides in the US and Canada were electric, and it hardly moved from the previous year. Around the globe, it's worse.

We're starting to get to the inflection point. In California right now, 10 percent of our miles are electric. In London, 20 percent of our miles are electric. So we are starting to penetrate. We're investing \$800 million in resources to subsidize the switch over to electric. In the next three to four years, you're finally going to get more affordable EVs, and the penetration will really rise.

Some people might point out that every time someone takes an Uber as opposed to the subway, the environment suffers.

There are some use cases where you want to use an Uber and some where you want to take a subway. And by the way, we have subways on our app as well.

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How broad do you plan to extend the platform you call One Uber? What are the boundaries?

I don't think there are boundaries, I mean, we're testing those boundaries. That's what innovation is all about. We are very good as a company at wiring up anything that moves. We've gone from cars to bicycles, three-wheelers in India, trains, buses, but also to trucks. If you look at Uber Freight, we are wiring up to truckers and connecting them with shippers directly. I think there's a very, very long road ahead of us. Ultimately, if you look at anything that moves in a city, we want to wire it up on demand.

You've been in charge for six years now. What have you found that you never expected when you took the job?

I knew that Uber was in the public eye. I read about it every day. But you don't understand what it's like until you're in that seat. Expedia was an important company, but not nearly as many people cared about it. I thought I knew what running Uber encompassed, but the public glare has been a challenge.

Did you watch the TV series *Super Pumped* that made Uber look like a boys-club wrecking crew?

It was painful to watch, but I viewed it as a wonderful piece of entertainment. I wasn't there during the time of the series, but from what I understand, it was a dramatization. It didn't reflect the truth in many ways. But, hey, that's entertainment.

Do you ever talk to Travis?

I do. I have a lot of respect for Travis. He's a smart person, and I would be foolish not to take his input. We talk more about the food business. Travis is building a [dark kitchen business](#). [That's restaurant takeout without the restaurant.] And he's a terrific entrepreneur. So it's mostly business, but then we'll chat about life.

In a [memo you wrote to your employees](#), you said, “We are Uber, a once-in-a-generation company that became a verb and changed the world forever.” Do you think that’s the way the company is going to be remembered?

I hope so. People come to this company because of the impact we have. It's not virtual impact, it's real-world impact. It's how you got here. It's how over 5 million people *earn*, on a full-time or part-time basis. That impact comes with a responsibility. But it also comes with a deep satisfaction when you build cool shit.

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

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[Paul Ford](#)

[Ideas](#)

Jul 31, 2023 8:00 AM

My Tips for a Killer Product Launch

Be sure to blow up any criticism or misunderstanding of your app, no matter how small, into a flat-out organizational panic.

PHOTO-ILLUSTRATION: ANJALI NAIR; GETTY IMAGES

Team,

We've worked toward this release date for well over a year, and soon we'll experience a full [product launch](#). Of all the stretches, the home stretch can be the hardest, so I want to share some learnings from past launches to help you stay motivated through the next phase. We can do this!

First, and most important: I need everyone to set impossible expectations of success. You might be anticipating extra equity, huge salary increases, significant press coverage, or [Product Hunt](#) glory. You might think the one-liner you use on acquaintances and journalists and investors is puffed-up enough: "By creating a mobile-app-controlled kitty litter scooper, we're helping humans have better relationships with their cats." But you should go bigger. Every product can claim to make people's lives better; if you want to stand out, you must link your app to a real, immense global crisis. Try this: "Women spend more time caring for pets than men. By designing an app that controls an automated kitty litter scooper, we are freeing up women to focus on their communities and set their own agendas. WiskrSküps is critical feminist infrastructure." Can you link your product to mitigating [climate change](#)? Improving [education](#)? Smoking cessation?

Panda habitat preservation? I can, in 30 different ways. That's why I'm your boss.

Our goal here is to build a balanced organization, so I also need you to take time for the other side of narcissistic self-aggrandizement: credit-hogging. Yes, without you, nothing could have shipped at all. Make sure to remind everyone of your value in every meeting. Walk around, if you're not remote, and say things like, “When we added emoji to the litter-scooping notifications, that really put this thing over the edge. I don't know if you know how important that is to mitigating climate change.” Everyone will agree with you. What choice do they have? Credit-hogging is an essential part of any software release, and getting good at it is what defines a true organizational leader. I always make a lot of time for it. Again: That's why I'm your boss.

If all goes well, we'll spend the run-up to launch squashing bugs and alternating between fantasies of glory and a morbid fear of being ignored. Then comes the big moment. A launch day is very special. You might think it's an opportunity to throw a party and celebrate. But experienced product leaders know that this is the day you wake up and have a huge fight with your romantic partner, whom you've neglected for months while you hauled this bundle of code and missteps into the light. Here's what you're going to do: You will sit down, open your laptop, and walk them through the product, focusing on all the tiny features added in the past two weeks, scrutinizing their face for reactions, insisting that the bugs that show up don't mean anything—and when you don't get exactly the reaction you're looking for, at exactly the right time, you'll slam the laptop closed and say, “Look, it's clear you don't have time for this,” and stomp off while they watch in confusion. Personally, I try to have at least three of these fights for each product—one for alpha, one for beta, and a big one for the full release. (If you don't have a partner, a roommate or friend is fine.)

Once you've stomped out of the house, head to the office, where, after doing some light credit-hogging, you should spend as much time as possible on [social media](#) engaging in PLR, or post-launch reloading. While the vast majority of humans will be utterly indifferent to your announcement, you must drill in on the one or two who offer reactions that

fall short of total excitement. Be sure to blow up any criticism or misunderstanding, no matter how small, into a flat-out organizational panic. Slack can be a great tool to coordinate your overreaction. You should share every tweet that insists your product is bad, old-fashioned, “guaranteed to kill pets,” etc. “Real men don’t own cats,” the depressed men of Twitter will write. “What stage of late capitalism are we in where your litter box needs an app?” the anarchists of Mastodon will post. Who knows what they’ll say on Bluesky, but be ready to freak out about that too.

Inevitably, right away, the app’s login function will break. As a society we are incapable of authenticating users. It’s a tragedy, one of our greatest failings. And when we fix that issue we will forget to turn server logging back on, so we will have no idea who’s using the app.

After all that, the only thing left to do is to prepare yourself for the frigid silence of day two, then days three through 300. Think of it this way: You spent a year, maybe several years, digging a deeper and deeper hole (you can dig a pretty big hole if you grind every day), and now it’s time for the world to pull you out. In your heart, you expected this to happen quickly. But it takes time. First people need to find the hole, then they need to want to visit the hole, then they need to put their email addresses in the hole.

Eventually people will show up, if marketing does its job. They might throw in some sticks and suggest you build a ladder. (This is called venture capital.) But most of us, frankly, just learn to live in the hole. People will ask how it’s going down there in that thin shaft of sunlight. You will mumble something about product-market fit as you pray the sides don’t collapse.

Team, let’s get pumped for this launch. Let’s file bugs. Let’s call our partners and apologize for being so wrapped up in work. Don’t put down your shovels yet. We still have a lot of digging to do.

This article appears in the Jul/Aug 2023 issue. [Subscribe now](#).

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[Vittoria Elliott](#)

[Business](#)

Jul 27, 2023 7:00 AM

Big AI Won't Stop Election Deepfakes With Watermarks

Experts warn of a new age of AI-driven disinformation. A voluntary agreement brokered by the White House doesn't go nearly far enough to address those risks.

Illustration: themotioncloud/Getty Images

In May, a fake image of an explosion near the Pentagon [went viral on Twitter](#). It was soon followed by images seeming to show explosions near the White House as well. Experts in mis- and disinformation quickly flagged that the images seemed to have been generated by artificial intelligence, but not before the stock market had started [to dip](#).

It was only the latest example of how fake content can have troubling real-world effects. The boom in generative artificial intelligence has meant that tools to create fake images and videos, and pump out huge amounts of convincing text, are now freely available. Misinformation experts say we are entering a new age where distinguishing what is real from what isn't will become increasingly difficult.

Last week the major AI companies, including OpenAI, Google, Microsoft, and Amazon, [promised](#) the US government that they would try to mitigate the harms that could be caused by their technologies. But it's unlikely to stem the coming tide of AI-generated content and the confusion that it could bring.

The White House says the companies' "[voluntary commitment](#)" includes "developing robust technical mechanisms to ensure that users know when content is AI generated, such as a watermarking system," as part of the effort to prevent AI from being used for "fraud and deception."

But experts who spoke to WIRED say the commitments are half measures. "There's not going to be a really simple yes or no on whether something is AI-generated or not, even with watermarks," says Sam Gregory, program director at the nonprofit Witness, which helps people use technology to promote human rights.

Watermarking is commonly used by picture agencies and newswires to prevent images from being used without permission—and payment.

But when it comes to the variety of content that AI can generate, and the many models that already exist, things get more complicated. As of yet, there is no standard for watermarking, meaning that each company is using a different method. Dall-E, for instance, uses a visible watermark (and a quick Google search will find you many tutorials on how to remove it), whereas other services might default to metadata, or pixel-level watermarks that are not visible to users. While some of these methods might be hard to undo, others, like visual watermarks, can sometimes become ineffective when an image is resized.

"There's going to be ways in which you can corrupt the watermarks," Gregory says.

The White House's [statement](#) specifically mentions using watermarks for AI-generated audio and visual content, but not for text.

There are ways to watermark text generated by tools like OpenAI's ChatGPT, by manipulating the way that words are distributed, making a certain word or set of words appear more frequently. These would be detectable by a machine but not necessarily a human user.

That means that watermarks would need to be interpreted by a machine and then flagged to a viewer or reader. That's made more complex by mixed media content—like the audio, image, video, and text elements that can

appear in a single TikTok video. For instance, someone might put real audio over an image or video that's been manipulated. In this case, platforms would need to figure out how to label that a component—but not all—of the clip had been AI-generated.

And just labeling content as AI-generated doesn't do much to help users figure out whether something is malicious, misleading, or meant for entertainment.

"Obviously, manipulated media is not fundamentally bad if you're making TikTok videos and they're meant to be fun and entertaining," says Hany Farid, a professor at the UC Berkeley School of Information, who has worked with software company Adobe on its content authenticity initiative. "It's the context that is going to really matter here. That will continue to be exceedingly hard, but platforms have been struggling with these issues for the last 20 years."

And the rising place of artificial intelligence in the public consciousness has allowed for another form of media manipulation. Just as users might assume that AI-generated content is real, the very existence of synthetic content can sow doubt about the authenticity of *any* video, image, or piece of text, allowing bad actors to claim that even genuine content is fake—what's known as the "liar's dividend." Gregory says the majority of recent cases that Witness has seen aren't deepfakes being used to spread falsehoods; they're people trying to pass off real media as AI-generated content.

In April a lawmaker in the southern Indian state of Tamil Nadu alleged that a [leaked audio](#) recording in which he accused his party of stealing more than \$3 billion was "machine-generated." (It wasn't.) In 2021, in the weeks following the military coup in Myanmar, a [video](#) of a woman doing a dance exercise while a military convoy rolls in behind her went viral. Many online alleged that the video had been faked. (It hadn't.)

Right now, there's little to stop a malicious actor from putting watermarks on real content to make it appear fake. Farid says that one of the best ways to guard against falsifying or corrupting watermarks is through cryptographic signatures. "If you're OpenAI, you should have a

cryptographic key. And the watermark will have information that can only have been known to the person holding the key,” he says. Other watermarks can be at the pixel level or even in the training data that the AI learns from. Farid points to the [Coalition for Content, Provenance, and Authenticity](#), which he advises, as a standard that AI companies could adopt and adhere to.

“We are quickly entering this time where it's getting harder and harder to believe anything we read, see, or hear online,” Farid says. “And that means not only are we going to be fooled by fake things, we're not going to believe real things. If [the Trump Access Hollywood tape](#) were released today, he would have plausible deniability,” Farid says.

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By [Will Knight](#)

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Jul 25, 2023 6:00 AM

The AI-Powered, Totally Autonomous Future of War Is Here

Ships without crews. Self-directed drone swarms. How a US Navy task force is using off-the-shelf robotics and artificial intelligence to prepare for the next age of conflict.

Art: Julien Gobled; Getty Images

A fleet of robot ships bobs gently in the warm waters of the Persian Gulf, somewhere between Bahrain and Qatar, maybe 100 miles off the coast of Iran. I am on the nearby deck of a US Coast Guard speedboat, squinting off what I understand is the port side. On this morning in early December 2022, the horizon is dotted with oil tankers and cargo ships and tiny fishing dhows, all shimmering in the heat. As the speedboat zips around the [robot](#) fleet, I long for a parasol, or even a cloud.

The robots do not share my pathetic human need for shade, nor do they require any other biological amenities. This is evident in their design. A few resemble typical patrol boats like the one I'm on, but most are smaller, leaner, lower to the water. One looks like a solar-powered kayak. Another looks like a surfboard with a metal sail. Yet another reminds me of a [Google Street View car](#) on pontoons.

These machines have mustered here for an exercise run by Task Force 59, a group within the US Navy's Fifth Fleet. Its focus is robotics and artificial intelligence, two rapidly evolving technologies shaping the future of war. Task Force 59's mission is to swiftly integrate them into [naval operations](#), which it does by acquiring the latest off-the-shelf tech from private

contractors and putting the pieces together into a coherent whole. The exercise in the Gulf has brought together more than a dozen uncrewed platforms—surface vessels, submersibles, aerial drones. They are to be Task Force 59’s distributed eyes and ears: They will watch the ocean’s surface with cameras and radar, listen beneath the water with hydrophones, and run the data they collect through pattern-matching algorithms that sort the oil tankers from the smugglers.

A fellow human on the speedboat draws my attention to one of the surfboard-style vessels. It abruptly folds its sail down, like a switchblade, and slips beneath the swell. Called a Triton, it can be programmed to do this when its systems sense danger. It seems to me that this disappearing act could prove handy in the real world: A couple of months before this exercise, an Iranian warship seized two autonomous vessels, called [Saildrones](#), which can’t submerge. The Navy had to intervene to get them back.

The Triton could stay down for as long as five days, resurfacing when the coast is clear to charge its batteries and phone home. Fortunately, my speedboat won’t be hanging around that long. It fires up its engine and roars back to the docking bay of a 150-foot-long Coast Guard cutter. I head straight for the upper deck, where I know there’s a stack of bottled water beneath an awning. I size up the heavy machine guns and mortars pointed out to sea as I pass.

The deck cools in the wind as the cutter heads back to base in Manama, Bahrain. During the journey, I fall into conversation with the crew. I’m eager to talk with them about the war in Ukraine and the heavy use of drones there, from hobbyist quadcopters equipped with hand grenades to full-on military systems. I want to ask them about a recent attack on the Russian-occupied naval base in Sevastopol, which involved a number of Ukrainian-built drone boats bearing explosives—and a public crowdfunding campaign to build more. But these conversations will not be possible, says my chaperone, a reservist from the social media company Snap. Because the Fifth Fleet operates in a different region, those on Task Force 59 don’t have much information about what’s going on in [Ukraine](#), she says. Instead, we talk about AI image generators and whether they’ll put artists out of a

job, about how civilian society seems to be reaching its own inflection point with artificial intelligence. In truth, we don't know the half of it yet. It has been just a day since [OpenAI](#) launched [ChatGPT](#), the conversational interface that would break the internet.

Art: Julien Gobled; Getty Images

Back at base, I head for the Robotics Operations Center, where a group of humans oversees the distributed sensors out on the water. The ROC is a windowless room with several rows of tables and computer monitors—pretty characterless but for the walls, which are adorned with inspirational quotes from figures like Winston Churchill and Steve Jobs. Here I meet Captain Michael Brasseur, the head of Task Force 59, a tanned man with a shaved head, a ready smile, and a sailor's squint. (Brasseur has since retired from the Navy.) He strides between tables as he cheerfully explains how the ROC operates. "This is where all the data that's coming off the unmanned systems is fused, and where we leverage AI and machine learning to get some really exciting insights," Brasseur says, rubbing his hands together and grinning as he talks.

The monitors flicker with activity. Task Force 59's AI highlights suspicious vessels in the area. It has already flagged a number of ships today that did not match their identification signal, prompting the fleet to take a closer look. Brasseur shows me a new interface in development that will allow his team to perform many of these tasks on one screen, from viewing a drone ship's camera feed to directing it closer to the action.

"It can engage autonomously, but we don't recommend it. We don't want to start World War III."

Brasseur and others at the base stress that the autonomous systems they're testing are for sensing and detection only, not for armed intervention. "The current focus of Task Force 59 is enhancing visibility," Brasseur says. "Everything we do here supports the crew vessels." But some of the robot ships involved in the exercise illustrate how short the distance between unarmed and armed can be—a matter of swapping payloads and tweaking software. One autonomous speedboat, the Seagull, is designed to hunt mines and submarines by dragging a sonar array in its wake. Amir Alon, a

senior director at Elbit Systems, the Israeli defense firm that created the Seagull, tells me that it can also be equipped with a remotely operated machine gun and torpedoes that launch from the deck. “It can engage autonomously, but we don’t recommend it,” he says with a smile. “We don’t want to start World War III.”

No, we don’t. But Alon’s quip touches on an important truth: Autonomous systems with the capacity to kill already exist around the globe. In any major conflict, even one well short of World War III, each side will soon face the temptation not only to arm these systems but, in some situations, to remove human oversight, freeing the machines to fight at machine speed. In this war of AI against AI, only humans will die. So it is reasonable to wonder: How do these machines, and the people who build them, think?

This article appears in the September 2023 issue. [Subscribe to WIRED](#). Photograph: Sam Cannon

Glimmerings of autonomous technology have existed in the US military for decades, from the autopilot software in planes and drones to the automated deck guns that protect warships from incoming missiles. But these are limited systems, designed to perform specified functions in particular environments and situations. Autonomous, perhaps, but not intelligent. It wasn’t until 2014 that top brass at the Pentagon began contemplating more capable autonomous technology as the solution to a much grander problem.

Bob Work, a deputy secretary of defense at the time, was concerned that the nation’s geopolitical rivals were “approaching parity” with the US military. He wanted to know how to “regain overmatch,” he says—how to ensure that even if the US couldn’t field as many soldiers, planes, and ships as, say, China, it could emerge victorious from any potential conflict. So Work asked a group of scientists and technologists where the Department of Defense should focus its efforts. “They came back and said AI-enabled autonomy,” he recalls. He began working on a national defense strategy that would cultivate innovations coming out of the technology sector, including the newly emerging capabilities offered by machine learning.

This was easier said than done. The DOD got certain projects built—including *Sea Hunter*, a \$20 million experimental warship, and Ghost Fleet

Overlord, a flotilla of conventional vessels retro-fitted to perform autonomously—but by 2019 the department’s attempts to tap into Big Tech were stuttering. The effort to create a single cloud infrastructure to support AI in military operations became a political hot potato and was dropped. A Google project that involved using AI to analyze aerial images was met with a storm of public criticism and employee protest. When the Navy released its 2020 shipbuilding plan, an outline of how US fleets will evolve over the next three decades, it highlighted the importance of uncrewed systems, especially large surface ships and submersibles—but allocated relatively little money to developing them.

In a tiny office deep in the Pentagon, a former Navy pilot named Michael Stewart was well aware of this problem. Charged with overseeing the development of new combat systems for the US fleet, Stewart had begun to feel that the Navy was like Blockbuster sleepwalking into the Netflix era. Years earlier, at Harvard Business School, he had attended classes given by Clay Christensen, an academic who studied why large, successful enterprises get disrupted by smaller market entrants—often because a focus on current business causes them to miss new technology trends. The question for the Navy, as Stewart saw it, was how to hasten the adoption of robotics and AI without getting mired in institutional bureaucracy.

Others at the time were thinking along similar lines. That December, for instance, researchers at RAND, the government-funded defense think tank, published a report that suggested an alternate path: Rather than funding a handful of extravagantly priced autonomous systems, why not buy up cheaper ones by the swarm? Drawing on several war games of a Chinese invasion of Taiwan, the RAND report stated that deploying huge numbers of low-cost aerial drones could significantly improve the odds of US victory. By providing a picture of every vessel in the Taiwan Strait, the hypothetical drones—which RAND dubbed “kittens”—might allow the US to quickly destroy an enemy’s fleet. (A Chinese military journal took note of this prediction at the time, discussing the potential of *xiao mao*, the Chinese phrase for “kitten,” in the Taiwan Strait.)

Art: Julien Gobled; Getty Images

In early 2021, Stewart and a group of colleagues drew up a 40-page document called the *Unmanned Campaign Framework*. It outlined a scrappy, unconventional plan for the Navy's use of autonomous systems, forgoing conventional procurement in favor of experimentation with cheap robotic platforms. The effort would involve a small, diverse team—specialists in AI and robotics, experts in naval strategy—that could work together to quickly implement ideas. “This is not just about unmanned systems,” Stewart says. “It is as much—if not more—an organizational story.”

Stewart’s plan drew the attention of Vice Admiral Brad Cooper of the Fifth Fleet, whose territory spans 2.5 million square miles of water, from the Suez Canal around the Arabian Peninsula to the Persian Gulf. The area is filled with shipping lanes that are both vital to global trade and rife with illegal fishing and smuggling. Since the end of the Gulf War, when some of the Pentagon’s attention and resources shifted toward Asia, Cooper had been looking for ways to do more with less, Stewart says. Iran had intensified its attacks on commercial vessels, swarming them in armed speed boats and even striking with drones and remotely operated boats.

Cooper asked Stewart to join him and Brasseur in Bahrain, and together the three began setting up Task Force 59. They looked at the autonomous systems already in use in other places around the world—for gathering climate data, say, or monitoring offshore oil platforms—and concluded that leasing and modifying this hardware would cost a fraction of what the Navy normally spent on new ships. Task Force 59 would then use AI-driven software to put the pieces together. “If new unmanned systems can operate in these complex waters,” Cooper told me, “we believe they can be scaled to the other US Navy fleets.”

As they were setting up the new task force, those waters kept getting more complex. In the early hours of July 29, 2021, an oil tanker called *Mercer Street* was headed north along the coast of Oman, en route from Tanzania to the United Arab Emirates, when two black, V-shaped drones appeared on the horizon, sweeping through the clear sky before exploding in the sea. A day later, after the crew had collected some debris from the water and reported the incident, a third drone dive-bombed the roof of the ship’s

control room, this time detonating an explosive that ripped through the structure, killing two members of its crew. Investigators concluded that three “suicide drones” made in Iran were to blame.

The main threat on Stewart’s mind was China. “My goal is to come in with cheap or less expensive stuff very quickly—inside of five years—to send a deterrent message,” he says. But China is, naturally, making substantial investments in military autonomy too. A report out of Georgetown University in 2021 found that the People’s Liberation Army spends more than \$1.6 billion on the technology each year—roughly on par with the US. The report also notes that autonomous vessels similar to those being used by Task Force 59 are a major focus of the Chinese navy. It has already developed a clone of the *Sea Hunter*, along with what is reportedly a large drone mothership.

Stewart hadn’t noticed much interest in his work, however, until Russia invaded Ukraine. “People are calling me up and saying, ‘You know that autonomous stuff you were talking about? OK, tell me more,’” he says. Like the sailors and officials I met in Bahrain, he wouldn’t comment specifically on the situation—not about the Sevastopol drone-boat attack; not about the \$800 million aid package the US sent Ukraine last spring, which included an unspecified number of “unmanned coastal defense vessels”; not about Ukraine’s work to develop fully autonomous killer drones. All Stewart would say is this: “The timeline is definitely shifting.”

Hivemind is designed to fly the F-16 fighter jet, and it can beat most human pilots who take it on in the simulator.

I am in San Diego, California, a main port of the US Pacific Fleet, where defense startups grow like barnacles. Just in front of me, in a tall glass building surrounded by palm trees, is the headquarters of Shield AI. Stewart encouraged me to visit the company, which makes the V-BAT, an aerial drone that Task Force 59 is experimenting with in the Persian Gulf. Although strange in appearance—shaped like an upside-down T, with wings and a single propeller at the bottom—it’s an impressive piece of hardware, small and light enough for a two-person team to launch from virtually anywhere. But it’s the software inside the V-BAT, an AI pilot called Hivemind, that I have come to see.

I walk through the company's bright-white offices, past engineers fiddling with bits of drone and lines of code, to a small conference room. There, on a large screen, I watch as three V-BATS embark on a simulated mission in the Californian desert. A wildfire is raging somewhere nearby, and their task is to find it. The aircraft launch vertically from the ground, then tilt forward and swoop off in different directions. After a few minutes, one of the drones pinpoints the blaze, then relays the information to its cohorts. They adjust flight, moving closer to the fire to map its full extent.

Art: Julien Gobled; Getty Images

The simulated V-BATs are not following direct human commands. Nor are they following commands encoded by humans in conventional software—the rigid *If this, then that*. Instead, the drones are autonomously sensing and navigating their environment, planning how to accomplish their mission, and working together in a swarm. -Shield AI's engineers have trained Hivemind in part with reinforcement learning, deploying it on thousands of simulated missions, gradually encouraging it to zero in on the most efficient means of completing its task. “These are systems that can think and make decisions,” says Brandon Tseng, a former Navy SEAL who cofounded the company.

This version of Hivemind includes a fairly simple sub-algorithm that can identify simulated wildfires. Of course, a different set of sub-algorithms could help a drone swarm identify any number of other targets—vehicles, vessels, human combatants. Nor is the system confined to the V-BAT. Hivemind is also designed to fly the F-16 fighter jet, and it can beat most human pilots who take it on in the simulator. (The company envisions this AI becoming a “copilot” in more recent generations of warplanes.) Hivemind also operates a quadcopter called Nova 2, which is small enough to fit inside a backpack and can explore and map the interiors of buildings and underground complexes.

For Task Force 59—or any military organization looking to pivot to AI and robotics relatively cheaply—the appeal of these technologies is clear. They offer not only “enhanced visibility” on the battlefield, as Brasseur put it, but the ability to project power (and, potentially, use force) with fewer actual people on the job. Rather than assigning dozens of human drone operators

to a search-and-rescue effort or a reconnaissance mission, you could send in a team of V-BATs or Nova 2s. Instead of risking the lives of your very expensively trained pilots in an aerial assault, you could dispatch a swarm of cheap drones, each one piloted by the same ace AI, each one an extension of the same hive mind.

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Still, as astonishing as machine-learning algorithms may be, they can be inherently inscrutable and unpredictable. During my visit to Shield AI, I have a brief encounter with one of the company's Nova 2 drones. It rises from the office floor and hovers about a foot from my face. "It's checking you out," an engineer says. A moment later, the drone buzzes upward and zips through a mocked-up window on one side of the room. The experience is unsettling. In an instant, this little airborne intelligence made a determination about me. But how? Although the answer may be accessible to Shield AI's engineers, who can replay and analyze elements of the robot's decisionmaking, the company is still working to make this information available to "non-expert users."

One need only look to the civilian world to see how this technology can go awry—face-recognition systems that display racial and gender biases, self-driving cars that slam into objects they were never trained to see. Even with careful engineering, a military system that incorporates AI could make similar mistakes. An algorithm trained to recognize enemy trucks might be confused by a civilian vehicle. A missile defense system designed to react to incoming threats may not be able to fully "explain" why it misfired.

These risks raise new ethical questions, akin to those introduced by accidents involving self-driving cars. If an autonomous military system makes a deadly mistake, who is responsible? Is it the commander in charge of the operation, the officer overseeing the system, the computer engineer who built the algorithms and networked the hive mind, the broker who supplied the training data?

One thing is for sure: The technology is advancing quickly. When I met Tseng, he said Shield AI's goal was to have "an operational team of three V-BATs in 2023, six V-BATs in 2024, and 12 V-BATs in 2025." Eight months after we met, Shield AI launched a team of three V-BATs from an Air Force base to fly the simulated wildfire mission. The company also now boasts that Hivemind can be trained to undertake a range of missions—hunting for missile bases, engaging with enemy aircraft—and it will soon be able to operate even when communications are limited or cut off.

Before I leave San Diego, I take a tour of the USS *Midway*, an aircraft carrier that was originally commissioned at the end of World War II and is now permanently docked in the bay. For decades, the ship carried some of the world's most advanced military technology, serving as a floating runway for hundreds of aircraft flying reconnaissance and bombing missions in conflicts from Vietnam to Iraq. At the center of the carrier, like a cavernous metal stomach, is the hangar deck. Doorways on one side lead into a rabbit's warren of corridors and rooms, including cramped sailors' quarters, comfy officers' bedrooms, kitchens, sick bays, even a barbershop and a laundry—a reminder that 4,000 sailors and officers at a time used to call this ship home.

Standing here, I can sense how profound the shift to autonomy will be. It may be a long time before vessels without crews outnumber those with humans aboard, even longer than that before drone mother-ships rule the seas. But Task Force 59's robot armada, fledgling as it is, marks a step into another world. Maybe it will be a safer world, one in which networks of autonomous drones, deployed around the globe, help humans keep conflict in check. Or maybe the skies will darken with attack swarms. Whichever future lies on the horizon, the robots are sailing that way.

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[Morgan Meaker](#)

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Jul 24, 2023 2:00 AM

Everyone Wants Ukraine's Battlefield Data

Global companies are offering free products to get access to live combat data. The Ukrainian government wants to keep this resource for its own emerging defense industry.

Photograph: Getty Images

Wearing a baseball cap and thick, black-rimmed glasses, Cameron Chell is part defense contractor, part tech executive. His company, Draganfly, used to mainly work with emergency services in North America, selling drones and the accompanying software that could deliver medical equipment, or film traffic accidents from above. But since last February, the Canadian has pivoted his business to cater to a market more than 8,000 miles away: Ukraine.

Now, there are 40 Draganfly drones in Ukraine, repurposed for search-and-rescue missions in bombed-out buildings, landmine detection, and other military tasks that Chell declines to detail. The company has demonstrated its tech to the Ukrainian Air Force, the Ministry of Defence, as well as President Volodymyr Zelensky's fundraising initiative, United24. "There isn't a branch of the government we haven't worked with or interacted with in some way." Sometimes he gets texts from Ukrainian contacts, saying a friend of a friend needs a drone for their unit, can he help? Draganfly obliges, of course, for a discounted fee.

Since Russia invaded, military aid has been flowing into Ukraine. The US has committed \$39 billion since the war started, the UK \$37.3 billion, and

the EU \$12 billion. Chell and his company are part of a scramble of international tech companies rushing into the country to try and benefit. Business has been so good, he's set up a field office in Ukraine with four full-time employees. But Draganfly is operating in Ukraine not just to support the cause or to collect the cash. It's also come for the data.

The war in Ukraine presents an unprecedented opportunity for military tech companies. The scale of the fighting and the sheer number of weapons systems and high-tech sensors deployed have created a vast amount of data about how battles are fought and how people and machines behave under fire. For businesses that want to build the next generation of weapons, or train systems that will be useful in future conflicts, that is a resource of incalculable value.

"Everybody could have the same AI engine. The only differentiator now is how good are the data inputs that you have," says Chell. "Making sure that it's your sensors collecting that data, and feeding it into your software, is absolutely important. It's more important than ever to be present."

There is an old, much derided, cliché that data is the "new oil"—not only because of its cash value, but because of how it will fuel so much of the future economy. Just as large language models, like OpenAI's ChatGPT, are trained on hundreds of billions of words, AI products in the defense world also have to be fed vast amounts of data. A company selling drones that can autonomously identify tanks, for example, needs to train its software on huge numbers of images: tanks covered in camouflage, tanks obscured by bushes, tanks deep in mud. It needs to be able to recognize the difference between a military tank and a civilian tractor, as well as what type of tank it's looking at, so it knows friend from foe. For a company like Draganfly, which is selling drones with landmine-detection software, staff need to train their AI on thousands of images, so their system can tell the difference between a rock formation and a modern mine.

"Ukraine is the only place in the world where you can get that data at the moment," says Ingvild Bode, associate professor at the Center for War Studies at the University of Southern Denmark.

Draganfly is far from the only company to have noticed the potential of Ukraine to gather data. Chell is among a wave of international AI executives traveling to and from the conflict to test and train their products. German AI company Helsing says it has staff regularly traveling to the country. Data analytics company Palantir has [opened an office in Kyiv](#) and is offering its services [pro bono](#). “You have to ask yourself, why are they doing that?” says Bode. “There are a number of reasons, and the value of the data will absolutely be one of them.”

Some international companies working in the conflict zone are using their experiences in Ukraine to refine the products they are selling back home. Seattle-based BRINC has designed “Lemur” drones, which are designed to be able to break through windows to access buildings. In the US, they’ve been marketed to police to use in active shooter scenarios. But in Ukraine, they’re being used to help search for survivors after missile attacks, according to the company’s founder, Blake Resnick. The company recently released its Lemur 2 model, which “does utilize some feedback that we’ve gotten from Ukraine,” he says. The new model can make floor plans of a building as it flies around and can maintain its position in the air, even when the pilot takes their hands off the controller. These ideas might have grown out of BRINC’s work in Ukraine, but according to the company’s YouTube [advert](#), they’re now being marketed to police forces back in the US.

The “data is the new oil” cliché might illustrate data’s value. But it also speaks to the way data can be extracted from a country without benefiting the people who live there. In the first year after the invasion, Ukraine was so welcoming to American tech companies that even startups whose pitches had been rejected at home by the Pentagon got the green light to be [trialed](#) by Ukrainian soldiers on the front lines. But that warm welcome is starting to chill, as Ukrainian government officials recognize how valuable their battlefield data would be if it remained in Ukrainian hands.

“You can’t even imagine how many foreign companies are already using Ukraine as a testing ground for their products: AI companies like Clearview, Palantir; anti-jamming systems; everything that has a software

component is in Ukraine right now,” says Alex Bornyakov, Ukraine’s deputy minister for digital transformation.

Ukraine is very aware of the value of its data, Bornyakov says, cautioning that companies shouldn’t expect to arrive in the country and get access to data for nothing. “This experience we’re in right now—how to manage troops, how to manage them smarter and automatically—nobody has that,” he says. “This data certainly is not for sale. It’s only available if you offer some sort of mutually beneficial cooperation.”

Instead, Ukraine wants to use the data that’s being gathered for its own defense sector. “After the war has finished, Ukraine companies will go to the market and offer solutions that probably nobody else has,” Bornyakov says.

Over the past few months, Ukraine has been talking up its ambitions to leverage its battlefield innovations to build a military-tech industry of its own.

“We want to build a very strong defense tech industry,” says Nataliia Kushnerska, project lead for Brave1, a Ukrainian state platform designed to make it easier for defense-tech companies to pitch their products to the military. The country still wants to partner and cooperate with international companies, she says, but there is a growing emphasis on homegrown solutions.

Building a domestic industry would help protect the country from future Russian aggression, Kushnerska says. And Ukrainians have a better understanding of the dynamics of the battlefield than their international counterparts. “Technologies that cost a huge amount of money, made in [overseas] laboratories, are coming to the front line, and they’re not working,” she says.

Brave1—which was exclusively open to Ukrainian companies for its first two months of existence—is not the country’s only attempt to build a homegrown industry. Kushnerska describes secret tech conferences, attended by Ukrainian tech executives and Ministry of Defense officials, where discussions can take place about what the militaries need and how

companies can help. In May, Ukraine's parliament voted through a series of tax breaks for drone makers, in an attempt to encourage the industry. Those government efforts, combined with the huge demand for drones and the motivation to win the war, is creating entire new industries, says Bornyakov. He claims the country now has more than 300 companies making drones.

One of those 300 companies is AeroDrone, which started out as a crop-spraying system based in Germany. By the time of the full-scale invasion, the company's Ukrainian founder, Yuri Pederi, had already moved back to his home country. But the war inspired him to pivot the business. Now the drones, which can carry heavy loads of up to 300 kilograms, are being used by the Ukrainian military.

“We don't know what the military are carrying,” says Dmytro Shymkiv, a partner at the company, who used to be deputy chief of staff for Petro Poroshenko, the Ukrainian president who preceded Zelensky. He might plead ignorance to what AeroDrone drones are transporting, but the company is collecting vast amounts of data—up to 3,000 parameters—on each flight. “We are very much aware of what's going on with every piece of equipment on board,” he says, adding that information about flying while being jammed, or in different weather conditions, can be repurposed in other industries or even other conflicts.

Aerodrone offers a glimpse of the future companies Bornyakov is describing. Armed with that data, the company sees a wide range of options for its future once the war is over, both military and civilian. If you can fly in a war zone, Shymkiv says, you can fly anywhere.

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The Dark Secrets Buried at Red Cloud Boarding School

How much truth and healing can forensic tech really bring? On the sites of Native American tragedies, Marsha Small has made it her life's mission to find out.

Marsha Small is one of the very few Indigenous researchers who use ground-penetrating radar—and the only one with significant experience using the technology at boarding schools. Photographs: Tailyr Irvine

Justin Pourier was working maintenance at the Red Cloud Indian School in 1995 when a supervisor asked him to check out a leak in the school's heating system. It was early winter in Pine Ridge, South Dakota, when daytime temperatures often dip well below freezing. At the time, Red Cloud's 500 students—ranging from kindergartners to high school seniors—relied on a network of steam pipes to keep warm. At 28, Pourier wasn't much older than some of the kids, and like most, he was a citizen of the Oglala Lakota Nation.

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Tracing the old plumbing, Pourier made his way through the bowels of the oldest structure on campus, Drexel Hall. Built in 1887—back when Red Cloud was a Jesuit mission and boarding school called Holy Rosary—Drexel Hall originally housed classrooms and a dormitory. Now it was a drafty red-brick admin building where a steam boiler hissed and sputtered belowground. Broad-shouldered and over 6 feet tall, Pourier had to stoop as

he descended a narrow wooden staircase that led to an out-of-the-way corner of the basement. At the bottom, he says, he opened the door to a low-ceilinged room with a dirt floor.

Pourier doesn't recall whether he spotted the leak or not. But what he did find startled him. There, he says, aligned in a row, were three loaf-shaped dirt mounds, each about as long as one of Red Cloud's youngest students is tall and, as Pourier remembers it, topped with small white, wooden crosses.

At the sight of them, Pourier turned around and climbed the stairs, certain about what he'd seen—and frightened by what it implied. "I knew it was wrong for them to be in Holy Rosary," he said. "With all the cemeteries in these hills, why were they in the basement?"

That afternoon, when Pourier told his supervisor, one of the handful of Jesuits who still ran the school, about what he'd seen, he recalls that the response was swift and sharp: "Quit bleeping nosing around! Stay out of there!" Later, Pourier told his girlfriend and a few close friends about what he saw, but he didn't bring it up again at work. "I just let it go," he says. "It bothered me, but at the time I just took care of myself with prayer and sweat lodge ceremonies. I knew it was there, and I knew somehow, eventually, it was going to come to light." He soon left his job at Red Cloud. Two years later, work crews began renovations on Drexel Hall, and whatever Pourier had seen in the basement was covered with a thick concrete slab.

The Red Cloud Indian School opened in 1888 under the name Holy Rosary, one of the hundreds of boarding schools in the US for Indigenous children that functioned as instruments of colonialism.

Photograph: Tailyr Irvine

Pourier put aside the memory of what he'd found for two and a half decades. Then in May 2021, evidence of unmarked graves of as many as 200 Native children was discovered at a former boarding school in Kamloops, British Columbia. The finding, which came years after the Canadian government began examining its role in the history of Native American boarding schools, made headlines amid a broader, rolling North

American reckoning with white supremacy. In the US, though, it wasn't until 2021, when secretary of the interior Deb Haaland became the first Indigenous person to hold a cabinet level position, that the federal government first attempted to compile a list of the boarding schools it had operated or supported, as part of her [Federal Indian Boarding School Initiative](#). (Last summer, Haaland embarked on a yearlong "Road to Healing" tour.) Between the two countries, some 500 boarding schools for Indigenous children served as instruments of colonialism—not just in the distant past, but through the middle of the 20th century. Countless Native children were taken from their homes, forced to give up their languages and cultures, and in many cases made to suffer and die from neglect, abuse, and disease.

At the hundreds of boarding schools in the US and Canada, countless Native children were taken from their homes, forced to give up their languages and cultures, and in many cases made to suffer and die from neglect, abuse, and disease.

Photograph: Tailyr Irvine

All of that context was painfully familiar to Native communities. The notion that missing children had died and may have been buried at boarding schools wasn't new or surprising. For many, the shock of the Kamloops news wasn't the discovery so much as the sense of awful validation. In the US, the Boarding School Initiative's first investigative report ultimately identified 53 burial sites "with more site discoveries and data expected as we continue our research."

Back in Pine Ridge, Pourier thought of coming forward about those three mounds in Drexel Hall for the first time in 26 years. In that time, Red Cloud had undergone major shifts. In 2019 the school hired its first non-Jesuit leader, and many of Red Cloud's administrators are now tribal members who grew up on the reservation. Key concepts from the Lakota clinical social worker Maria Yellow Horse Brave Heart have become central to how the school operates. She saw kinship between the Lakota experience and that of Jewish descendants of Holocaust survivors, in the sense that the devastating losses of genocide had come to form a pivotal part of Lakota identity. Disease, war, forced assimilation: "The rapidity and severity of

these traumatic losses, now extended by high death rates from psychosocial and health problems, has complicated Lakota grief,” she writes. Red Cloud adopted Yellow Horse Brave Heart’s model for addressing such trauma, a sequence with four stages: confrontation, understanding, healing, and transformation.

Maka Black Elk, who attended Red Cloud, is leading the school’s process of “truth and healing.”

Photograph: Tailyr Irvine

By spring 2021, the school was already more than a year into its process of “truth and healing,” led by Maka Black Elk, who had attended high school at Red Cloud and spent five years as a history teacher there. Black Elk’s role was a complicated and delicate one. Red Cloud still has some ties to the Catholic Church, an institution that was complicit in the centuries-long, hemisphere-spanning genocide, and the Pine Ridge community has long harbored its own accounts of the school’s abuse of students, including its demands for them to speak only English. At the same time, some elders offer fierce defenses of the education the school provided. Today, Red Cloud offers a Lakota-language dual immersion program. Even Justin Pourier sends his kids there. When the news of the unmarked graves at Kamloops broke, old stories about the hard labor and corporal punishment that students endured at Holy Rosary took on renewed significance. Blood-red graffiti went up on churches around the reservation: “Remember our children.”

That June, Pourier sent a text to Tashina Banks Rama, the executive vice president at Red Cloud and an old friend of his. “I had an experience and I wanted to share it with you,” he wrote. “What’s a good time?” Banks Rama called him immediately and took notes as they spoke.

Banks Rama’s grandmother and great aunts all attended Holy Rosary, and she herself sent all 10 of her children to Red Cloud. Following the Kamloops news and after hearing Pourier’s story, she too found herself reexamining what she thought were settled feelings about the place, which some of her colleagues still referred to as a “perpetrator institution.” Banks

Rama promised to follow up with Pourier. “I told him we would do everything we could to pursue the truth,” she recalls.

Following the Kamloops news and after hearing Justin Pourier’s story, Tashina Banks Rama, the executive vice president of Red Cloud, also found herself reexamining what she thought were settled feelings about the place.

Photograph: Tailyr Irvine

She invited him to campus the next day, and with the school's vice president of facilities, they retraced his steps down to the basement of Drexel Hall, to the concrete floor of an empty room crisscrossed by HVAC ducts. A few days later, school administrators escalated the issue: Black Elk brought Pourier's account to the National Native American Boarding School Healing Coalition, a nonprofit that has spearheaded a campaign to investigate historical trauma from the boarding school system. (Black Elk served on its board.) The coalition's director connected him to one of the very few Indigenous researchers who use ground-penetrating radar, and the only one with significant experience using the technology at boarding schools: a doctoral student at Montana State University named Marsha Small.

The Red Cloud administrators asked Small to help them find resolution to the old mystery given new urgency: Were children buried in Drexel Hall's basement?

Small reacted to the invitation with a blend of excitement and skepticism. Above all, she wanted to be sure the survey wasn't simply a way for the Catholic Church to clear its name. It was hard to believe that the same institution that had presided over so many abuses—not only in founding and operating boarding schools, but in its long-standing cover-up of sexual predation by priests—would be prepared to entertain a process that yielded uncomfortable results. “You should know who you're dealing with here,” Small remembered thinking when she got that first email. “Because I hate you.”

At the same time, Small recognized that Red Cloud—which sits just 10 miles from the site of the 1890 massacre of Lakota people at Wounded

Knee—was at least in part a genuinely Lakota institution, led by people like Banks Rama and Black Elk. And for years Small had been hoping for an opportunity like this: to survey a boarding school with the support of both the church and the surrounding tribe as it pushed for greater accountability. The fact that the invitation had come through the National Native American Boarding School Healing Coalition was no small thing. A couple weeks later, with caution, she responded to the school's email and accepted the gig.

Students sit outside of Drexel Hall.

Photograph: Tailyr Irvine

Small's visit to Red Cloud in May 2022 began with a public presentation in the school gymnasium. If the community was going to be able to process the results of any survey that engaged with, or perhaps even contradicted, Pourier's testimony, Small knew that people needed to understand how ground-penetrating radar works—how it can't *see* underground so much as detect evidence of past digging. To operate a ground-penetrating radar machine, the user methodically pushes it back and forth in a grid, sending pulses of high-frequency radio waves into the ground and registering their reflections. Each pass, or transect, creates a series of traces that can be assembled into a radargram, a 2D snapshot that provides clues about the composition and density of what's belowground. But they are only clues. What the radar pulses really detect is change, so that the clarity of one spot on the map is only relative to the spot next to it. Using specialized software, practitioners can combine all the radargrams side by side into a 3D image, which can then be sliced horizontally so that each image shows the survey's entire area at different soil depths. Hearing Small's explanation, one elder in the audience pointed out that a scan at Red Cloud would undoubtedly find all kinds of disturbances: the place where a vegetable garden was dug, where trash was buried, where a large chicken coop was kept. Without some means of triangulation, Small cautioned—testimony, archival records, aerial imagery—all kinds of anomalies could look like graves.

Small was also at pains to emphasize the limits of what technology could do to reconcile the past. By relying only on ground-penetrating radar, or any other scanning technology, “you're not healing,” she said. “All you're doing is pointing fingers.” For the technology to serve any larger purpose at Red

Cloud, it would have to work in unison with Lakota traditions of ceremony and storytelling, the same practices that boarding schools had striven to root out.

After lunch, community members took turns pushing a ground-penetrating radar machine, which looks like a small lawnmower, back and forth in an open field. At the same time, within sight of the GPR demonstration, a group of activists from the local chapter of the International Indigenous Youth Council—including former Red Cloud students—arrived on horseback and rode circles around the school's chapel, where they'd placed a sign that read, “We are the grandchildren of the Lakota you could not remove.” One of the activists burned a copy of the Catholic Church’s “Doctrine of Discovery”—the justification of its support of colonial expansion (which the Vatican just repudiated this March).

The Youth Council seemed unsure whether to consider Small an ally or an enemy. In an Instagram post made during her visit, they noted that Small had invited one of their members to work alongside her as an intern. “We honor our brother for taking on such an important role for healing and justice,” they wrote, and expressed thanks to Small and others for helping to bring Lakota children home. But the Youth Council had been pushing Red Cloud to scan its entire campus with GPR, not just one room of one building. In broad terms, the activists were just as skeptical about the auspices of the project as Small had been: “Why are we allowing the oppressors to investigate themselves?” the group's spokesperson asked at a tribal council meeting.

Small went ahead with her survey of the room in the Drexel Hall basement, pacing each square meter slowly as the ground-penetrating radar took its readings; it took an entire afternoon to cover an area not much bigger than a couple of parking spaces. Once she gathered and analyzed all the data, she found two anomalies consistent with possible graves. The only way to confirm it, however, was to come back and dig.

A priest walks in front of Drexel Hall. Photograph: Tailyr Irvine

Sixty-four years old and just about 5 feet 5 inches tall, with high cheekbones and a round face, Small carries the irreverent air of someone

who's used to being ignored by people in positions of authority. Her manner is by turns stern, direct, and playful. Born and raised on the Northern Cheyenne reservation in Montana, Small was the youngest child in a ranching family whose members had largely scattered by the time she turned 10. Her parents, who had both been sent to boarding schools, split up. Her mother began spending weekdays working in a town off the reservation, and her father went to live with a new family 12 miles up the road. One brother, a year older, went back and forth between home and a family friend's house, and Small's other siblings went off to college. Small herself was the only one who remained in the family's original home full-time. Her father didn't see the point in teaching his children to speak Cheyenne. Her mother, who came from a lineage of medicine men and women, clung tightly to the seasonal rituals of gathering plants and keeping sacred songs. But there was one legacy that both of her parents seemed to share: "They never learned how to be good parents, and that's from boarding schools: a straight pipeline."

One of three Native students in her class at a majority-white public school, Small says she spent much of her childhood "running or fighting." As a single mother in her early twenties, she developed an addiction to cocaine, then to methamphetamines. For two decades, she worked a string of jobs as a union boilermaker and lived on and off the streets, as her daughter lived mainly with Small's mother. "I didn't do my daughter justice," Small told me. It was only after becoming a grandmother that Small began repairing her relationship with her daughter, and she went to live with her in Oregon for a time. But she was still adrift. During this stay, in 2007, Small's daughter encouraged her to find a sense of purpose, perhaps by returning to school.

One morning, Small emerged from the fog of a weekend spent partying at an old friend's house, and walked to a bus stop at the corner. "It was 50 cents to go anywhere," she said. "I put my 50 cents in and just kept on riding." About 15 miles later, when she got off in Ashland, she heard drums coming from what turned out to be Southern Oregon University. "Those aren't hippie drums," she said to herself. "Those are Indian drums." She followed the music to a powwow being held in a small theater. Small introduced herself to a woman from Alaska, who offered her ice cream

made with seal fat and cloudberry. “It was the most disgusting thing I ever tasted,” she said. “The grease just coated my mouth, but too, it reminded me: That was her stuff. Where was my stuff?” By the time Small left, she’d decided she wanted to follow her daughter’s advice and go back to school.

Small completed a bachelor’s degree in environmental science and policy at Southern Oregon in 2010 and discovered that she loved ecological fieldwork. Then she started a master’s degree program in Native American studies at Montana State University, but she didn’t know how to fuse her interests. That’s when Robert Kentta, a friend and longtime cultural resources director with the Siletz Tribe in Oregon, offered Small a suggestion that pertained to an old Native boarding school in Salem: “Hey, why don’t you go over there to Chemawa and get one of those machines that looks like a baby buggy—see how many kids they got in that cemetery? A lot of people have been wondering for years.”

For the first time in her life, a path opened up with ease, with what she took as nudges (“and sometimes shoves”) from her ancestors—a travel grant here, funding for lodging at a conference there. So she followed Kentta’s advice. That summer, between the first and second years of her master’s program, she reached out to the historic preservation office of the Confederated Tribes of Grand Ronde. Members of the tribe counted relatives among those buried at Chemawa, and the tribe owned a brand-new ground-penetrating radar system. The preservation office proposed that Small conduct her survey of Chemawa as an internship: Small would get an institutional affiliation that might help smooth the way to accessing federal property and getting academic credit, and the tribe might finally get some answers.

When Marsha Small fused her interests in Native American studies and ecological fieldwork, a path opened up with ease for the first time in her life. Photograph: Tailyr Irvine

Beginning in 1880, children were sent to Chemawa from dozens of tribes, sometimes from hundreds or thousands of miles away. The cemetery, which has been neglected for decades, is separated from the boarding school—still in operation today—by a set of railroad tracks. Over the years, Grand Ronde elders told stories about grave markers being removed and replaced,

so it was no longer clear—if it had ever been—how many bodies were buried there.

When Small entered the cemetery for the first time in the summer of 2012, she burned sweetgrass—a plant with spiritual significance across Native cultures. “The sweetgrass brings the spirits in, wakes them up,” she said. She spent her first days walking through the rows, cross-referencing a list of burial plots with the names carved into each grave marker. One day at dusk, when she reached the fence at one end, she gazed to the horizon. The sun was setting, and Small's eyes followed the long shadows reaching back toward the school. All the graves, she noticed, were laid out according to Christian custom with their feet pointing east—blatant disregard for the multitude of burial practices and belief systems that different tribes hold around death.

“I got super emotional,” Small recalled. “I couldn't write no more, couldn't focus no more—because there were so many of them. And a lot of them were babies. A lot of them were sisters and brothers. I seen the family name Davis in there three, four times, and I thought, ‘You wiped out a whole family! A generation.’ It just took my breath away.” She walked to her car and sat silently in the driver's seat.

After a while, a train rumbled past the cemetery. She got out and walked over to the tracks—the same line that would have brought children to Chemawa 100 years earlier. “I was trying to focus on that moment,” Small explained. “The horror of it, the unfamiliarity. Maybe even, for some, the excitement of it, doing something new.” She bent down and touched her cheek to the cool steel of the rails.

By the time Small had been using the GPR machine in the cemetery for a couple of days, she felt transfigured by a sense of calling. Standing there among the graves of children who'd never gotten to go back home, she felt like there was important work to be done, work she knew she could do if she continued to push forward. “I felt I found my place in the whole spirit of things,” she said. “Not just the world, but in the universe.”

But she still had a tremendous amount to learn, and few clear paths to professional enlightenment. Typically employed as a tool to study

groundwater, soils, and bedrock, ground-penetrating radar was first used by a researcher in 1929 to measure the depth of a glacier in the Austrian Alps. The technology is commonly used today to identify buried utility lines. Both utility lines and graves are dug in sites with a history of other uses, each leaving their own traces underground, but because trenches for utilities differ so much from the surrounding soil and contain metal pipes, water-filled plastic, gravel, or sand, they are easier to identify.

Any anomaly—a pocket of air, a layer of soil that's holding moisture differently than what surrounds it—can show up either as a visual gap (in the way that soft tissue can be nearly invisible on an x-ray) or as a solid, a bright spot, like a hard drive going through an airport baggage scanner. Modern data processing software can help, but underground surveying can still be a vexing, often ambiguous, process.

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When Small submitted a partial survey of the Chemawa cemetery comparing the location of graves and grave markers for her master's thesis, she also shared some of her GPR imagery with the company that had supplied the machine. She was hoping for affirmation. Instead, an anthropologist there who works on forensic applications of GPR politely explained that Small's imagery didn't necessarily show graves where she said it did. She realized she'd been badly misguided as she conducted her survey and interpreted the data. She'd done most of her fieldwork without supervision, and no one at Montana State had direct experience with GPR used in this way. "It was defeating, really defeating," Small said. "At the time, I still thought you could see bones with the damn thing."

But Small didn't give up; even as she entered her PhD program, the calling to get reliable data on Chemawa stuck with her. Realizing she "needed someone to teach me GPR on a nuclear level," she found her way to Jarrod Burks, an archaeologist who lives in Columbus, Ohio, and conducts surveys for the Defense POW/MIA Accounting Agency on recovery missions for missing soldiers. He agreed to join her doctoral dissertation committee. In 2017, Small invited Burks to help produce a new report on Chemawa. After

five days of meticulous work at the cemetery, the new data that Burks and Small gathered cleared up where she'd gone wrong. He confirmed the basic limitation of Small's earlier analysis—tree roots and grave shafts can look alike in raw radar data, and Small had neither the experience nor a large enough data set to tell the difference. "Marsha, I don't see any graves here," Burks said, pointing to a spot where she had thought there were some.

Confronted with Chemawa's maze of Douglas fir roots, Burks and Small relied on secondary instruments—a magnetometer, which detects changes in the Earth's magnetic field, and an electromagnetic induction meter, which measures the velocity of liquid—to cross-reference the data they'd generated through GPR. The resulting report, completed in 2019 for the Boarding School Healing Coalition, offered a cogent analysis and was written with striking moral clarity. There were, according to the data, at least 222 potential graves in the cemetery and only 204 markers, with "a good possibility that additional, undetected graves are present." And, because of the mismatch between the location of markers and the location of potential graves, there was no easy way to identify who was buried where. "Some of these children were brutally taken away from their families and all they had ever known; some were not," Small wrote. "Some voluntarily entered the boarding school system but died there and are now lost. Our goal is to find as many as possible."

As Small gained more expertise in GPR, she saw that the demand for the technology was growing. In a June 2021 statement timed to the launch of Secretary Haaland's Federal Indian Boarding School Initiative, the Interior Department states that the primary goal of the initiative is to "identify boarding school facilities and sites; the location of known and possible student burial sites located at or near school facilities; and the identities and Tribal affiliations of children interred at such locations." Small wanted to protect tribes from placing their faith in the technology without a clear sense of what it could deliver, and from the rush of cynical companies that she foresaw. She'd already gotten one call from a tribe that wanted her help using ground-penetrating radar to investigate the case of a missing boy. When Small asked about the machine they'd be using, she learned that the tribe had spent close to \$10,000 on a device that provided readings no

deeper than a few inches below the surface—better suited to archaeological work like scanning for ancient tool fragments than for locating grave shafts.

Together with two Native historians of boarding schools, Farina King and Preston McBride, Small began developing a set of suggested practices for “Tribal nations and Indigenous communities that are beginning to survey Indian boarding school cemeteries and burial sites for their children who never returned home or are lost in the on-reservation Indian boarding school cemeteries.” To Small’s mind, even tribes that could afford to hire independent experts or work with public agencies faced a host of potential pitfalls—including contractors who might not follow spiritual requirements or enlist tribal members as real collaborators, illegible or useless data, and failures to plan for the human and community consequences of a scientific process.

The protocols, published in the summer of 2021 during the flood of publicity that followed the revelations at Kamloops, are organized around the principles that tribes should be careful to consult with elders and members who may have hesitations about any activity on burial sites, that Native people should be involved in every step of survey work, and that tribes should control how the results are used. “I don’t need you to surface, ‘Oh, we got 418 lives lost,’”” Small says. “We need the numbers, but I’m not *concerned* with the numbers. I want the healing to happen.”

The stained-glass windows of the chapel at Red Cloud were designed by Francis He Crow and a group of high school students in 1997.

Photograph: Tailyr Irvine

Graduates of Red Cloud have carved their names into the bricks of Drexel Hall.

Photograph: Tailyr Irvine

Last October, Small returned to Red Cloud to proceed with a full excavation of the tiny room that had haunted Justin Pourier for half his life. Small’s nephew, a hulking man with a long ponytail and glasses who was there to assist her, led an opening ceremony. He crumbled a handful of sage—a

purifying plant for both the Cheyenne and Lakota—in a small ceramic dish and lit it on fire. He walked to each corner of the basement and paused for a moment to let the smoke coil to the low ceiling. Then he swept the dish around the edges of each doorway. He presented the dish to Black Elk, who used cupped hands to spread the wispy clouds of smoke over his head, then down each shoulder and along his chest, arms, and legs. Then Small's nephew repeated the process, known as smudging, with everyone in the room.

After the ceremony, Small turned to Black Elk: “I absolutely adore you,” she said. “I don’t know how this is gonna end.”

“I’ve talked to a lot of elders, and I think they want the church gone,” she went on—meaning they wanted Red Cloud to end its relationship with the Catholic Church. “Are you prepared for that?” she asked. Black Elk let out a deep breath.

“I’m scared,” Small continued. “I’m scared we’re gonna find something, and I’m scared we’re not gonna find something. Because if we don’t find something, they’ll say the church bought us off.”

Cutting up and removing the concrete took most of that Friday. Over the weekend, Small and I drove an hour and a half to Rapid City to get supplies for the dig. As we cruised in the fast lane, north on Highway 41, she began explaining how her approach to ground-penetrating radar differs from non-Native practitioners. “I have to visualize what that energy’s doing,” she said. “They just think in terms of velocity and gradient and RPM.” Just at that moment, I noticed a small herd of grazing bison on the side of the highway. Small reacted in ecstasy. She slowed to 40 miles an hour, veered to the right lane to get a better look at the hulking animals, and began shouting out the window. *“Hotoa'e, hotoa'e, hotoa'e! Néá'eshe!”* (Bison, bison, bison! Thank you!) And then, in English, she said, “Do you know me? I know you.” Giggling in delight, she reached into the compartment on the driver’s side door and pulled out a sprig of sage, which she extended into the wind as an offering, crumbling it between her fingers. “That was cool,” she said, thanking me for spotting them as she stepped on the gas. “It makes you feel we’re still part of the circle.”

Photograph: Tailyr Irvine

Photograph: Tailyr Irvine

Periodically, Small reached into a paper bag to grab a maple doughnut. Unopened packs of Skittles and Reese's Pieces lay on the floor of the rented minivan. Her sugar cravings, she said, were triggered by the stress of leading a dig in a setting she regarded as both a sacred site and a potential crime scene. She repeated a prophecy attributed to the 19th-century Northern Cheyenne leader Sweet Medicine: A young white child will come to you, and if you follow him, the children will howl like coyotes, and you'll go crazy. "For a long time, I thought it was meth," she said. "Now I think it's sugar."

At the Lowe's in Rapid City, Small pushed a flatbed cart rapidly through the aisles, shoes shuffling as she walked. She picked up trowels, buckets, a roll of black plastic drop cloth, paint brushes, and wooden boards to help with sifting dirt. She seemed to be conjuring a mental model of the area outside Drexel Hall as she peered at the shiny floor of the hardware store, squinting and using a finger to trace the outline of the ground she'd have to cover with tarps. Standing before a wall of cleaning supplies, Small rehearsed the brushing movements she'd be making to clean off objects during excavation, first with a hard-bristled scrubber, then with a soft dustpan brush, before throwing them both onto the cart. "Every once in a while, I get impostor syndrome," she said, looking at her haul. "What am I doing?"

After Small gathered and paid for her supplies, we stopped at a kiosk for coffee, where the barista, whose knuckles bore a tattoo of the chemical formula for caffeine, said that it had taken her 14 years to find her calling. "It only took me about 50 years," Small replied. "The ancestors said, 'You have to find the kidnapped children in the Indian boarding schools.' And then I said, 'I don't want to.' And then they said, 'You have to.' I don't like the work, but I do like bringing kids home."

When we arrived at Red Cloud the next morning, a maintenance crew was assembling a tent and chain-link fence to establish a perimeter around Drexel Hall. Burks and three assistants had flown in from Ohio, and now they got to work unloading Small's minivan. Two FBI agents in fleeces, crew cuts, and cowboy boots took pictures of the basement. The atmosphere

was somber but leavened by familiarity. The feds worked most of their cases with the tribal police detectives who were also there. “They’re our bosses, basically,” one federal agent said. Everyone else seemed connected by the ties of small communities and large families. Justin Pourier was there with a travel coffee mug that read “*Mah piya Lúta Owáyawa*”—Lakota for “Red Cloud School.” Someone brought around a tray of hot sausage biscuits from the cafeteria.

Things proceeded slowly at first. Burks and one of his assistants outlined 16 sections of the ground, each measuring 1 square meter, to be excavated one by one. Then they got to work with their trowels, methodically filling bucket after bucket with dirt as they dug down 20 centimeters at a time. It would take several days to dig out the full meter down. The rest of Burks’ team took turns with the federal agents, hauling full buckets up the stairs then pressing clods of dirt through steel-mesh screens. Anything they found that wasn’t dirt, rock, or wood was gently brushed off and placed in a ziplock bag labeled with the square from which the object was taken.

Small directed traffic and reminded people to take breaks and eat the fruit and doughnut holes lined up on a bench nearby. She encouraged a teenage Red Cloud graduate, who’d come to help haul buckets, to speak up if she felt anyone was disrespecting the site, telling her, “Remember, you’re the Native here.”

As the procession of dirt continued, the Lakota detectives passed around photos of an architectural drawing that had been prepared for the 1997 renovation of Drexel Hall, in which the room adjacent to the boiler room—the space they were now excavating—was marked “Graveyard.” Banks Rama said the label referred to an old Halloween tradition, the supplies for which were stored in the basement. Nonetheless, the detail seemed to validate both Pourier’s memory and the lingering traumas so many in the community still associate with Red Cloud.

Later that morning, Small emerged from the basement holding a triangular piece of bone, textured on one side and smooth on the other, and stood outside looking at it with a jeweler’s loupe. “Some kind of large, flat bone,” one of Burks’ assistants said. “Right off the ulna,” Small said. Burks, walking by, offered a skeptical rejoinder: “A large animal bone.” (The

actual assessment of any objects sifted from the dirt was done by a forensic analyst later that week.)

“I’m looking forward to getting some conclusiveness,” Small said. But conclusiveness never comes quickly in her line of work, if it comes at all. It would be several months before she and Burks finalized the report on what they’d found at Red Cloud.

The day after the Drexel Hall excavation, Rosalie Whirlwind Soldier was among several survivors of boarding schools to deliver testimonies to Secretary Deb Haaland at the Rosebud Sioux reservation.

Photograph: Tailyr Irvine

The Indigenous protocols that Small helped to write offer plenty of guidance for tribes surveying burial sites—always consult elders, follow the majority’s opinion, take ownership of the data—and the Red Cloud excavation followed that guidance. But there’s one outcome the protocols don’t anticipate: What should happen in the event that a survey doesn’t find evidence of buried children? How, then, is a tribal community to proceed toward healing?

Weeks after the Drexel Hall excavation, though Small and Burks were still months from finalizing their full report, the Red Cloud administration, eager to share some sense of what had happened, published its own statement describing the survey’s key results. The excavation found only two anomalies, the school said. “The first anomaly was related to building products (mortar for laying bricks and nails). The second anomaly was related to animal activity (several places where rodents burrowed).” The statement noted that the FBI and community members were present throughout the entire excavation. The school was careful to avoid saying that no children had been buried in the basement, but offered, rather, that “no human remains were found in the soil survey.”

When I visited Pine Ridge, people around town, including many former Red Cloud students, had only a hazy notion of the chain of events that had brought Small to the reservation. But everyone had heard something, and

they all referred to the situation with an ominous shorthand, along the lines of “I heard they found some bodies over there.”

That none were found doesn't disprove Pourier's testimony, and may not change anyone's mind. GPR results are never absolute, and the excavation had only covered a small area—there was no way to account for the possibility that Pourier had misremembered the spot where he'd seen the mounds, or that graves might exist elsewhere. Whatever the school's present reputation, many people on the reservation regard it still as a place haunted by a dark history. They tell stories about swings that move without children in them, doors that open and close by themselves, bells that ring on their own on a windless day.

“I don't even remember going to school,” said Shirley Bettelyoun, who went to Red Cloud starting at age 6. “All we did was work.” Dale McGah, 70, was kicked out of school before he graduated, but he still remembers Mr. Schak, a teacher who hit students on the head with a metal ring heavy with keys, and he recalls being told to guard a fellow student who had tried to run away. Yet McGah's own grandchildren attend Red Cloud today. “It's probably one of the better schools on the reservation,” he said. Another elder, Phyllis White Eyes DeCory, who had previously worked for the Catholic Diocese in Rapid City, was offended by even the suggestion that Red Cloud needed to investigate. She told me sharply, “They're not gonna find anything but dirt down there.”

In the months after Small completed the excavation, she went back and forth with administrators at Red Cloud about how best to characterize the fact that no human remains were discovered. She wouldn't rule out the possibility that there had been graves there at one time. The school was trying to demonstrate that it had nothing to hide.

Small seemed torn between hewing to the dry language of geophysical inquiry and reflecting the genuine Lakota anger toward the Catholic Church, anger with which she identified so deeply. For all the careful work she'd done to ensure that tribes were prepared for the healing that would follow the discovery of unmarked graves, evidence that pointed in the other direction presented its own set of complications. If the school has indeed completed the first of Maria Yellow Horse Brave Heart's four stages for

healing from historical trauma—confrontation—then they stand at the precipice of the second, understanding. Even though the school's administrators may want to move on, the inconclusiveness of Small's survey is hard for many in the community, including Small herself, to begin to understand.

When I asked Small how she thought the community would react to her survey results, she said, “What I see on the horizon is that community rising up against that church. And if they do it right, they'll kick 'em out. Then they'll bring me in, or they'll bring somebody else in, and we'll find bodies. They still have that breath of fire.”

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Jun 29, 2023 8:00 AM

Should I Use an AI to Write My Wedding Toast?

WIRED's spiritual advice columnist on the meaning of emotional labor and how not to be the worst man.

ILLUSTRATION: ASYA DEMIDOVA

“I'm the best man in my friend's wedding this summer, and I'm dreading the speech. I have absolutely no idea what to say. Should I get an AI to help me? Or would that make me the worst man?”

—Lost for Words

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Spiritual Troubleshooting for the Digital Age

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Dear Lost,

You're certainly not alone in realizing that some onerous creative or emotive task can be completed relatively painlessly with AI. The same thought has undoubtedly occurred to the tongue-tied Tinder user who discovers that he can enlist a digital Cyrano to pen his opening lines to a prospective date; or to the exhausted mother who recognizes that she has at her fingertips a tireless Scheherazade that can produce an infinite scroll of

bedtime stories for her children; or to the overworked son who realizes that he can generate, in seconds, a personalized poem for his father's retirement party.

Creatively expressing our feelings to others is time-consuming, uncompensated, and emotionally taxing—that is, at any rate, the message implicit in some of the marketing of large language models. When Microsoft, for instance, introduced its AI Copilot products in March, it imagined a mother using the software to generate a speech for her daughter's high school graduation.

There are multiple ways you might use an LLM to produce a moving toast, ranging from the least intrusive (asking ChatGPT for writing tips or a quick proofread) to the more hands-on (generating a draft of the speech, which you can then customize). New sites like ToastWiz have built tools on top of GPT-4 that allow you to plug in “your stories and feelings” and generate three unique outputs for \$30. Meanwhile, wedding-planning apps like Joy have incorporated AI that promises to help users with their “toughest wedding-related wordage.” The feature can produce toasts, or even [vows](#), in the style of Shakespeare or Rumi, and aims to help users “bring their emotions on to paper in fun and creative ways.”

These aren't the first commercial products that have promised to offshore the difficult work of human expression—or what is increasingly called “emotional labor.” Long before the recent AI boom, people turned to human ghostwriters to pen wedding speeches. (“Toast whisperers,” as *The New York Times* noted in 2015, were an under-the-table service that many clients were too embarrassed to admit paying for.) And I imagine that you, like many people, have for years sent greeting cards that leverage the words of a professional writer to articulate what are allegedly your own thoughts and emotions. This practice, of course, was not without controversy and critics. Hallmark's very first slogan, introduced in 1944, was “When you care enough to send the very best,” a linguistic sleight of hand that inverted the most common critique of commercial greeting cards—that relying on the words of professionals was, in fact, evidence that you did not care enough to speak from your heart.

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Such products have long approached what sociologist Arlie Russell Hochschild calls the “commodity frontier”—the threshold of activities we deem “too personal to pay for.” It’s a perimeter that exists even when the products we enlist are (for the moment) free, and the arrival of new technologies calls for its constant renegotiation. In the case of AI, there have already been some breaches of this still-hazy border. When Vanderbilt University enlisted ChatGPT to generate an email offering condolences to the victims of the mass shooting at Michigan State, the school was criticized for using automated tools for a gesture that demanded, as one student put it, “genuine, human empathy, not a robot.”

Writing a wedding speech would seem to require similar emotional engagement. But perhaps you have reasoned that intent and selection—“It’s the thought!”—are what matters in these situations. You are, after all, the one providing the model with the essential, albeit rough, emotive ingredients to produce the finished product. In conversations about AI-generated text, the prompt is often spoken of as the *logos*, the spiritual breath of human authenticity that animates the synthetic output (dismissed as so much mechanical “wordage”) with life and meaning. Just as the computer was, for Steve Jobs, a “bicycle for the mind,” so language-generation tools might be regarded as the vehicle that transports the spirit of our emotions from their point of origin to a desired destination.

But I’m not sure it’s so easy to separate intent from expression, or emotions from behavior. Some psychological experiments have demonstrated that it’s our words and actions that allow us to experience emotions, not the other way around—like the famous example of how forcing oneself to smile can induce a feeling of happiness. It’s possible that expression, including linguistic expression, is not a mere afterthought in our emotional lives, but the whole point. If that’s true, then the decision to outsource your speechwriting might contribute to a kind of emotional atrophy, a gradual loss of the ability to truly inhabit your internal states—or modulate them. A podcaster recently boasted that a friend of his who struggles with anger management uses AI “tone filters” when communicating with people who

provoke his temper, feeding rageful rants into ChatGPT and asking the model to rewrite them “in a nicer way.”

If I can offer some more prescriptive parting advice, Lost, I'd urge you to consider that the logic of the commodity frontier can work in reverse. It's not that there are certain realms of human experience that are intrinsically too sacred to automate, which seems to be what you're getting at when you ask whether using AI for your speech would make you the “worst man.” On the contrary, it may be that human intimacy blooms in precisely those pockets of life that have not yet been widely exploited by commercial or mechanical forces. Perhaps our very notion of meaningful human connection depends on our refusal to relinquish such emotional work.

In the end, it's the effort we put into a task that determines its subjective significance. If you decide to hand over the speechwriting work to a machine, then you are essentially confirming that it is meaningless boilerplate. If, on the other hand, you decide to write the toast yourself, you will undoubtedly come to see this work—and the end product—as important, if only because your actions have reinforced your belief that it is worthy of your time and attention. Maybe the speech won't achieve a toast-masterish polish or a Hallmark card's concision, but your words may lead you to your own emotions, which, for the time being, we aren't so eager to automate.

Faithfully,

Cloud

Be advised that [CLOUD SUPPORT](#) is experiencing higher than normal wait times and appreciates your patience.

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Jun 29, 2023 6:00 AM

Meet the Psychedelic Boom's First Responders

With more tripping will come more psychic terror. A new movement of volunteers will guide you through your brain melt.

ILLUSTRATION: OYOW

Everything was insane and fine. The walls had begun to bend, the grain in the floorboards was starting to run. Jeff Greenberg's body had blown apart into particles, pleasantly so. When he closed his eyes, chrysanthemums blossomed.

A tech executive of 54, Greenberg had eaten 5 grams of psychedelic mushrooms that afternoon. He, like your cousin and your coworker and maybe you yourself, had discovered in recent years the world-expanding powers of [psilocybin](#). But world expansion can be dicey. At some point that afternoon, Greenberg's thoughts took a dark turn, and soon dark melted into horrifying.

This article appears in the Jul/Aug 2023 issue. [Subscribe to WIRED](#). Illustration: Vivek Thakker

The psychiatrist Stanislav Grof called psychedelics “nonspecific amplifiers” of the psyche. Any thoughts, feelings, or memories on hand are subject to unplanned wild magnification. Frequently that results in a thrillingly revelatory experience. Occasionally it toggles over into indescribable terror, which in turn comes in many flavors: Paranoia. Ghastly hallucinations. Intense grief. Fear of insanity, fear of death.

Greenberg thought of his puppy. He and his ex-wife shared it from when they'd been married, and now a memory came tumbling out of some corner of his mind: One day, in the aftermath of the divorce, he'd dropped off the dog with his former father-in-law. The two had always enjoyed a friendly relationship, but once the handoff was complete, the older man had slammed the door in his face.

And now it wouldn't stop slamming. How had he done something so awful that a fellow human would slam a door on him after being handed a puppy? A dam burst. The difficult elements of Greenberg's life—family, career, parenting—began exploding in dark technicolor. What had happened? Who was he? He felt the mushrooms clamping his head in front of a massive screen showing the movie of his life. According to his Fitbit, his heart rate spiked from 90-something to 150.

Greenberg was looping. Passing thoughts became black holes clawing him to untold depths, playing and replaying in a mad, warping whirlpool. Tricks that would have typically changed the channel—classical music, a splash of water to the face, waiting it out, crying it out—had no effect. Worst of all, he had no help. This wasn't a guided journey, after all, just a man alone in his house, losing his mind. Who do you call in such a state? Who could possibly understand this otherworldly misery with its indescribable new dimensions, its billowing revelations, its slithering dream logic?

Of course, Indigenous communities spent thousands of years mastering that very stuff: the understanding, the preparation, the support structures that help make a brain-exploding experience positive. But Western culture, having gotten its hands on these substances, showed little interest in that wisdom—at least until recently.

By chance, Greenberg found himself in one of those rare moments when the cultural plates begin to shift. In response to the growth of psychedelics, a new figure has emerged on the psychic landscape. Call them psychedelic first responders, versed in the science of existential first aid and operating, at times, apart from the traditional sphere of psychiatrists and therapists. Where once you might take a free CPR class on a Saturday, you now can learn to escort the addled through the thickets of their own heads.

So it was that, in a fleeting instant of lucidity, Greenberg remembered to reach into his pocket.

I'm not here to herald the current psychedelic boom; it's been heralded. What interests me is something that gets discussed far less often: the horrific and sometimes life-altering experiences many of those people will have. What do we do with that?

Go Down the Rabbit Hole

[Read more](#) from our new series on obsessions, curiosities, and deep dives.

I don't mean to sound alarmist. Skiers sometimes smack into trees, and I still consider theirs a worthwhile activity. But mountains have ski patrols. The help available to someone spinning out on psychedelics has historically been limited. Moreover, despite the popularity of using these substances with a professional guide, a shaman, or on an organized retreat, most won't. The majority of journeys are unsupervised and unsupported—at a concert, at a party, at home reeling from a puppy-based memory.

One summer night 20-plus years ago, a friend and I ate a goodly amount of mushrooms. The idea had been to peel back a few layers, behold unfamiliar vistas, and generally become unstuck in our perceptions. It worked! In *Frontiers in Pharmacology* terms, the reduction of my serotonergic control, ascendance of my dopaminergic system, and expansion of functional connectivity in my primary visual cortex was “producing a more unified brain, with connections between disparate regions that normally lack communication with each other.” For the first hour I created the universe anew. Vast processions scrolled through my mind, as ornate and elaborate as Chartres.

Then, and with apologies for being 22 at the time, I slipped into what I can only call a post-structuralist crisis. The world, suddenly, was a hollow facade of itself. I suppose some residue of college was working itself out: For four years I'd poked recklessly at ideas and traditions and constructs with no regard for consequences; now, staggering around Lower Manhattan, I saw the flimsy Potemkin reality I'd been so eager to expose, entire ecosystems of meaning drained of substance.

At some point my friend and I made it back to the apartment I shared with my girlfriend. For the next God-knobs-how-long, the poor woman assured me the stories in my head were chemical-induced delusions—nightmares, essentially. I lay on my rooftop a long time, willing my sanity to return. But it never did.

Kidding! I'm fine! By dawn I had fully returned to consensus reality. I was unspeakably grateful. Only later, in the months and years that followed, did I realize I had feelings besides relief. A kind of irresolution began to haunt me. *Why* were those ideas so scary? What unresolved concerns were trying to surface in my cretin mind? Terrifying as the ordeal had been, it had undeniably contained information—the kind you don't get access to every day. Instead of willing the nightmare to end, what if I'd somehow pushed through?

Which brings me back to Greenberg. The day before his trip, he'd downloaded an app he'd seen mentioned somewhere. Called Fireside Project, it billed itself as a “psychedelic peer support line,” reachable by phone or text. Now, fishing out his phone, he managed to hit the call button.

What happened next was life-changing, Greenberg told me. A volunteer named Jasmine picked up the phone. Immediately she emitted a gentle, knowledgeable, and grounded vibe. She didn't try to distract him from his anguish or minimize it. On the contrary, she validated what he was feeling and gave him permission to explore his pain further. “Very quickly she turned it into something I felt that I could go through,” he said.

Greenberg spoke with Jasmine for nearly an hour and a half, then called again later, as the crisis softened into something more like curiosity. With her help, his angst metabolized into a searing peek under the hood. Where before he'd felt abject terror, he now saw an invitation to make real changes in his life.

I set out to learn about the Jasmines of the world, and the burgeoning movement they belong to. But as I looked into the Fireside Project and similar operations, I watched a slightly different story come into focus. In the emergence of this new citizen tripsitter is a broader story about how

we've historically conceived of wellness, how we conceive of suffering—and how we respond to our own minds when they venture off course.

ILLUSTRATION: OYOW

It's not like everyone's out there having experiences like Greenberg's; the planet's drug of choice will probably always be alcohol. But what these substances lack in booze-level numbers they make up for in the sheer depth of their impact. Insofar as the decade-of-therapy-in-a-day adage holds true for the millions of people using psychedelics every year, that strikes me as a remarkable disruption of our psychological status quo.

Historically, the options available to someone in rough shape ranged from indifference to county lockup. To the extent that anyone attempted to alleviate such psychic distress, efforts centered around obliteration. Such was the mindset on a rainy Friday in 1969, when a soggy battalion of medical workers began fanning out across Max Yasgur's upstate New York farm. Acid had already become a feature of festivals. (At San Francisco's Human Be-In two years earlier, Owsley "Bear" Stanley famously distributed some 300,000 tabs of white lightning to the crowd.) But Woodstock promised all new levels. So the medical workers came armed with Thorazine, a powerful antipsychotic that resolves a frightening drug experience much as a ballistic missile resolves a ground skirmish.

Enter Wavy Gravy and the Hog Farmers, swooping in from their New Mexico commune to provide security for the event. Over the next three days, at trip tents and in the wet grass, the Hog Farmers practiced a radical new approach. Rather than arrest or medicate people having difficult drug experiences, they simply talked to them—distracted them, soothed them, gently reeled them back to earth. To the Thorazine crowd, it must've seemed like chatting someone out of cancer.

According to the *Journal of Emergency Medical Services*, some 797 trippers were treated that weekend. Woodstock became a template for psychedelic harm reduction. In the years that followed, at concerts and gatherings and in 4 million Dead parking lots, "talking someone down" became standard operating procedure. Compared to previous approaches, it was so humane that nobody gave much thought to where it fell short.

Start peeling back the evolution of tripsitting and pretty soon you're looking at larger shifts. Where once the benefits of these substances were relegated to some questionably spiritual plane, emerging research has shown measurable—and often remarkable—therapeutic benefits. As the value of a psychedelic journey came to be reassessed, so too was the impulse to curtail an unpleasant one.

Forty-three years after Woodstock, at Burning Man, a cardboard yurt appeared on the sun-baked Playa. Inside the structure—shady, fabric-draped, benches here and there—psychedelic harm-reduction history was lurching forward again, with the first official iteration of Zendo Project.

To the untrained eye, the volunteers sitting with distraught Burners were delivering a familiar form of harm reduction—a safe, nonjudgmental alternative to whatever the cops or medical tent would offer. But Zendo, an initiative of the Multidisciplinary Association for Psychedelic Studies (MAPS), a research and advocacy nonprofit, didn't want to talk these trippers down. Central to its mission was a respect for the journey, however challenging. To quote one of Zendo's guiding pillars, “Difficult is not necessarily bad.”

At this point, maybe you've noticed my labored avoidance of the phrase “bad trip.” Those words have fallen out of favor in psychedelic circles, as research shows that even the most challenging journeys can lead to positive outcomes. Minor semantic shift, fairly radical idea.

As the value of a psychedelic journey came to be reassessed, so too was the impulse to curtail an unpleasant one.

Kelley O'Donnell is the director of clinical training at the NYU Langone Center for Psychedelic Medicine. As she characterized the new thinking to me: Achieving those positive outcomes means leaning into the experience, pleasant or otherwise.

Otherwise can come in many forms, per the Zendo training manual, from reliving traumas to identifying with the victimization of others throughout history. Some merge with nature and experience pollution or the death of a species acutely. Many just think they've lost their minds. Through active

listening and a gentle reassurance that the experience will pass, the idea is to calm the trippers enough that they might be able to explore those nightmares. Rather than talk them down, talk them *through*.

Like the guy who just wanted to run.

“He would run, and then drop to the ground and not move. Then he'd leap up and exclaim, ‘I'm alive.’ Again and again he did this,” says Chelsea Rose Pires, Zendo's executive director. “Finally we were able to explore what was going on, and he was able to talk about his childhood and his fear of dying.”

The training manual states:

Rule #1, under any condition, is that we honor and respect the person having the crisis. Even if we don't understand what's happening (the person having the crisis might be much more developed than we are, lost in worlds unknown to us, or reliving a drama we can't comprehend), we serve as an anchor, a resting place, and a quiet center ...

We have to remember that tens of millions of people have used psychedelics, in many different, sometimes not very supportive, environments, and returned home safely. With support, knowledge, and integrative work there is very little danger in the psychedelic experience itself. Even the most frightening and bizarre behavior, when explored and worked with, will turn out to be beneficial and enlightening.

ILLUSTRATION: OYOW

Since 2012, zendo has been a mainstay at Burning Man and festivals around the world, assisting some 6,000 trippers and training 4,000 sitters in this new protocol. Meanwhile, the harm-reduction movement has grown internationally too. Kosmicare delivers similar services, having started at Portugal's Boom Festival many years ago. Within the club scene across Europe, several groups have expanded their harm-reduction efforts to include trip assistance. Stuck at home? Tripsit.me offers real-time, 24/7 peer support for those in need. For its part, the Organization of Psychedelic and

Entheogenic Nurses brings nursing expertise into the realm of psychedelic care. And then there's Joshua White.

A longtime lawyer in the San Francisco City Attorney's Office, as well as a volunteer at a local parenting support hotline, White had an eye for unnoticed communities not getting the help they need. He knew that more people were using psychedelics, he understood the outsize power these drugs wielded—and he knew that good support was not only hard to find but often inaccessible. (This is particularly true for those left out of the psychedelic movement in decades past. To that end, the organization committed to offering “identity-based integration support,” connecting any caller who is BIPOC, transgender, or a military veteran with a volunteer who shares that identity.) In April 2021, Fireside Project started answering phone calls—lots of them. Hanifa Nayo Washington, an equity and training adviser at Fireside, describes a general sense of alienation behind the boom. “People are really suffering from disconnection, from being alone and not having a community to talk with,” she told me.

That first year, Fireside trained more than 100 volunteers and conducted some 2,550 conversations with callers—including Greenberg. Within months of reaching Jasmine, he had walked away from his job (and psychedelically high salary) to focus on work “that adds value to the universe.” Eventually he got on the phone with Fireside again—this time not to ask for help but to offer it. By the time we spoke, he'd donated \$100,000 and was poised to start as the organization's CTO, working for free.

There's a fairly obvious point I should make, maybe one that sometimes gets lost: While exceedingly rare, psychedelics *can* cause serious harm. A family history of mental illness can propel someone into a psychotic episode. And the symptoms of a trip can potentially obscure a simultaneous medical crisis. A 2022 lawsuit found MAPS partially responsible for the death of Baylee Gatlin, who received care from Zendo volunteers at a music festival in 2017 and later died from organ failure and heat stroke.

“What this movement is doing is absolutely helpful for many people,” says Charles Nemeroff, codirector of the Center for Psychedelic Research & Therapy at Dell Medical School at the University of Texas at Austin. But

while the “vast number of case reports would suggest that these substances are relatively safe,” he adds, we’re still in the data-gathering phase.

For her part, O’Donnell calls the harm-reduction approach “incredibly valuable.” She also cautions that a single session with even a well-trained tripsitter won’t necessarily be enough for someone whose past trauma is suddenly surfacing, or who is otherwise having a deeply disturbing experience.

The stakes, Nemeroff notes, are even higher than any one individual’s well-being. “What none of us want to have happen is that the unregulated use of psychedelics lead to tragedies, which then will result in a backlash,” he says. “It’s been so long since we’ve been able to actually study psychedelics.”

For now, there seems little danger of reversing our *interest* in psychedelics. Sara Gael, a harm reduction officer at MAPS, describes a societal inflection point behind the current psychedelic renaissance. As waves of dysfunction—economic despair, climate change, white supremacy—have surfaced in recent years, people have increasingly looked to these substances to turn the prism on their worlds.

All of this makes me wonder about the real essence of the psychedelic peer support movement. It is, of course, a movement specific to these substances, rooted in a specific context: a time when drug policy remains insistently retrograde and official support systems have crumbled. But maybe it’s also more than that.

Jail, Thorazine, Wavy Gravy, Zendo: As nodes on an arc, these represent a decades-long, mostly underground evolution in how we understand a very particular species of psychic distress, but also in how we help one another at a more general level.

Pires told me that the principles behind contemporary psychedelic peer support apply to regular life too—she uses some of those same skills with her kids. *Slow down. Offer calm. Let feelings arise.* Maybe good tripsitting isn’t all that different from being a good partner, a good friend, a good relative. And maybe one day we’ll look back and be struck by this era—not

so much by our growing interest in these substances, but our shifting understanding of ourselves in their midst.

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The Night 17 Million Precious Military Records Went Up in Smoke

Fifty years ago, a fire ripped through the National Personnel Records Center. It set off a massive project to save crucial pieces of American history—including, I hoped, my grandfather's.

As part of the National Archives work to preserve military files burned in the 1973 fire, specialized Japanese tissue is used to bind damaged records. Photograph: Josh Valcarcel

Before the flames raced down the 700-foot-long aisles of the sixth floor, before the columns of smoke rose from the roof like Jack's beanstalk, before the wind scattered military records around the neighborhoods northwest of St. Louis, before 42 local fire departments battled for days to save one of the largest federal office buildings in the United States, before the government spent 50-plus years sorting through the charred remains, Kathy Trieschmann sensed a faint haze.

Trieschmann, who has asthma, had always been hyper-attuned to tiny changes in air quality. Growing up, she would often sleep in the basement because she could smell her father's cigarette smoke through her bedroom door. So shortly after midnight on July 12, 1973, as she walked up the stairs of the massive National Personnel Records Center to clock out, she was one of the first to know something was wrong.

That spring, as a freshman at St. Louis University, Trieschmann had received high marks on a placement exam for federal jobs, earning her a summer internship at the records center. The massive office building, a branch of the National Archives and Records Administration, held paper records for every American veteran or former federal government worker who had served in the 20th century. Trieschmann's job, along with that of two dozen fellow interns, was to check the names and Social Security numbers of Vietnam War veterans, the last of whom had just come home, before the information was entered into the NRPC's computer system. The work didn't satisfy her creative drive—she'd go on to teach art in public schools for decades—but it was a step up from the Six Flags amusement park where she'd worked the previous summer. She earned \$3.25 an hour, about twice the minimum wage.

The summer interns worked from 4 pm to 12:30 am so they wouldn't interfere with the employees who needed access to the files during regular hours. Except for a 30-minute dinner break at a nearby Burger King, they didn't have much time to socialize; each of them was expected to verify between 1,200 and 1,400 records every shift, and their work stations were scattered across the 200,000-square-foot second floor. Often, Trieschmann says, she would go a couple of hours without seeing anyone at all.

This article appears in the September 2023 issue. [Subscribe to WIRED](#). Photograph: Sam Cannon

In the very early morning of July 12, Trieschmann finished her records and registered them with a file clerk in the building's basement. Then she headed upstairs to go home. In the stairwell, she bumped into three fellow interns who were also on their way out, and mentioned the faint difference in the air. The group decided to investigate, and continued climbing the central stairway.

When the students opened the door to the third floor, the air seemed thicker. They kept going. The fourth floor was murkier still, the fifth even worse. Trieschmann never considered turning back. She has always loved adventure; she used to go scuba diving in ocean caves. Something *interesting* was happening, and she wanted to know what it was. So she and her colleagues climbed one more flight of stairs, to a door that opened into

the sixth and top floor. She remembered that this was where the older military records were kept, the ones from World War I, World War II, and Korea, but she hadn't been up here since orientation. Now, as she pulled open the door, she saw the cardboard boxes neatly stacked on metal shelves as far as the eye could see.

They were on fire.

Had the group gone up a staircase on the periphery of the building and not the central one, Trieschmann likely would have seen only a thick cloud of smoke. Instead, she witnessed the earliest stage of a blaze that would occupy hundreds of firefighters for days.

She began running back down the flights of stairs. "The records are on fire," she shouted at the security guard, then watched as he picked up the phone to dial for help.

The first call came into the emergency services dispatcher at 12:16 and 15 seconds. Twenty seconds later came another; a motorcyclist cruising by the building had seen smoke coming from the roof, and told another security guard. By 12:20, multiple emergency vehicles were on the scene. At first, firefighters rushed into the building, but soon turned back: The smoke was too thick and the flames too intense to safely work from inside. They were relegated to spraying water onto the roof and through the large windows that lined the building. It was about as effective as trying to stop a stampede with a traffic cone.

Along with the interns, a few dozen other people worked the night shift. Most were custodians assigned to mop the floors, scrub the toilets, and empty the trash before employees arrived for work in the morning. According to an FBI investigation, few of them had any idea anything was wrong that night until they walked into the lobby to go home around 12:30 am and found out that the sixth floor was burning.

After Trieschmann asked the guard to call the fire department, she left the building, but she didn't go home. Instead, she and her three fellow interns walked out to the far edge of the parking lot, plopped down on the curb, and watched. They sat there for more than six hours, staring in horror as the

flames grew exponentially bigger. “I had never seen a house on fire in real life, only in movies,” she says. “We knew this was people’s lives.” As the sun rose and the fire continued to intensify, Trieschmann was one of the few people on Earth who could even begin to grasp the magnitude of what was happening at 9700 Page Avenue.

Kathy Trieschmann with her Keeshond puppy, Pele, at home in Wentzville, Missouri.

Photograph: Josh Valcarcel

The National Personnel Records Center fire burned out of control for two days before firefighters were able to begin putting it out. Photos show the roof ablaze, a nearly 5-acre field of flame. The steel beams that had once held up the glass walls jut at unnatural angles, like so many broken legs.

As soon as the smoke began to clear, on the morning of July 16, National Archives employees sprinted in to try to save as many records as they could. Their primary goal was to prevent the boxes of files from drowning in water from the firefighters’ hoses. One discovered a clever hack: Squirting dish soap onto the rubber escalator handrails allowed them to gently but speedily evacuate wet boxes.

Margaret Stender, now a partial owner of the Chicago Sky WNBA team, was a teenager in Alexandria, Virginia, at the time; her father, Walter W. Stender, was the assistant US archivist. Before she woke up on the morning of July 12, her dad had rushed off to the airport to fly to St. Louis, where he stayed for several weeks. He never told her much about the actual work at the records center before he died in 2018. But at her home in Chicago, Stender has a photo of her dad wearing a hard hat and carrying a box of records out of the building. “I thought he had a boring library job, and then all of a sudden he was rushing into a burning building like a superhero,” Stender says, laughing.

The employees’ quick work saved many records on the five lower floors from extensive water damage. But the sixth floor, the one devoured by flames, held Army and Air Force personnel files from the first half of the

20th century. It was clear that the losses would be immense, but it would take weeks for the government to grasp the full toll.

An Official Military Personnel File documents almost every element of a person's time in the military. It includes the date they enlisted, their training history, unit information, rank and job type, and the date they left. It often lists any injuries, awards, and disciplinary actions, along with every place they ever served. The file contains a record that unlocks home, business, and educational loans; health insurance and medical treatment; life insurance; job training programs; and other perks the country has long considered part of the debt it owes its veterans. If a prospective employer needs to verify whether a soldier was honorably discharged or a military cemetery wants to know whether someone is eligible for burial, they can get those answers from the OMPF.

At the time, the federal government preserved exactly one copy of the Official Military Personnel File of every veteran. For the 22 million soldiers who served in the Army during World War I, World War II, the Korean War, or any of the myriad smaller conflicts in the first half of the 20th century, that single copy lived on the sixth floor of the National Personnel Records Center, stuffed into one of those cardboard boxes.

A few weeks after the fire, National Archives staff went public with the terrible news: Eighty percent of the Official Military Personnel Files for people who served in the Army between 1912 and 1960 were gone. Seventy-five percent of Air Force personnel records from before 1964 were too—except for those belonging to people whose names came alphabetically before Hubbard; their files were stored in a corner of the floor that didn't burn.

Altogether, 17,517,490 personnel records—the only comprehensive proof of service for all these Americans—had been wiped out of existence.

Some of the most irreplaceable artifacts in world history have been destroyed by fire, from the papyrus scrolls at the Library of Alexandria to a fragment of Jesus' crown of thorns at Notre-Dame de Paris in 2019. The fire at the National Personnel Records Center wrought a different kind of damage. Few of the individual records that burned held any particular

national or global significance. Their primary value to historians was in the aggregate: 17,517,490 tiny bundles of evidence adding up to a thorough picture of Americans' participation in some of the world's most devastating conflicts.

But even on their own, each of those 17,517,490 files was meaningful to *someone*—the veteran they represented, a genealogist on a research mission, a writer for whom tiny stories are themselves worth telling. Or a granddaughter, wanting to know more about her grandfather. “Archives are constructed memories about the past, about history, heritage, and culture, about personal roots and familial connections, and about who we are as human beings,” archivist Terry Cook, a key figure in the development of contemporary archive theory, wrote in 2012. “As such, they offer glimpses into our common humanity.”

Agonizingly, 50 years on, there’s no easy way to figure out exactly whose files went up in flames. The only way to find out is to request a veteran’s record.

A few years ago, I became obsessed with the story of my mother’s father. When I was a child, Grandfather—*never* Grandpa—took a special interest in me because I loved word games and sports, just like he did. Whenever we visited my grandparents in central Oregon, the two of us would start each day puzzling through the Jumble in *The Oregonian*. But Grandfather could be gruff; I knew from a young age that he didn’t have much tolerance for personal questions. I was in college when he slipped into dementia, the start of an agonizing six years. He died in 2012. I deeply regret that I never had the opportunity to have an adult conversation with him. There are so many questions I’d do anything to ask.

Here’s what I did know: Fritz Ehmann was born in the last week of 1920 to a middle-class Jewish couple in a quiet neighborhood in northern Berlin. One of the few stories I remember him telling me about his childhood involved sneaking into the 1936 Olympic stadium to cheer for American sprinter Jesse Owens, with Hitler watching from a box high above. Two years later, when he was 17, Fritz left Germany. Thanks to his older sister’s husband, a Jewish American State Department employee, he escaped three months before Kristallnacht.

After an eight-day voyage on the SS *Washington*, Fritz landed, alone, in New York City in the heat of August. He eventually found his way across the country to Portland, Oregon, where his brother-in-law had family.

Midway through Hanukkah, his parents arrived in the United States to join him. Other relatives stayed behind; many died in concentration camps.

When the US reinstated its draft in preparation to join the war, young men like my grandfather were initially excluded from serving abroad. After Germany stripped Jews living outside the country of their citizenship in 1941, he was stateless, but to the American government he was still German, and therefore an “enemy alien.” According to historian David Frey, the director of the Center for Holocaust and Genocide Studies at West Point, that changed in March 1942 with the passage of the second War Powers Act, which ruled that German Jews living in the US were eligible to become naturalized citizens—and thus to be drafted into full military service.

One artifact my family does have is a photo of my grandfather’s Selective Service card. It shows that he registered for the draft in mid-1942, when he was 21. By then, his name had been anglicized to Fred Ehman.

In January 1943, Fred enlisted in the Army. He told my mother that he was conscripted as criminal punishment: He’d missed Portland’s curfew, a common security protocol on the West Coast during the war, and to get the charges dropped, he joined up. To ensure that soldiers had rights in case they were captured, those who weren’t already citizens were naturalized before traveling abroad. So, during basic training in Colorado in August 1943, Fred officially became an American.

Grandfather didn’t tell stories about his Holocaust experience as a young boy, or about his time fighting against his homeland and other Axis powers. My mother was pretty sure he served on an aircraft carrier in Southeast Asia—the Air Force was part of the Army until after World War II—but she couldn’t prove it. At some point, Grandfather must have had a copy of his personnel record, but nobody in my family knew what happened to it. And while his experience was dramatic, it wasn’t unique, hardly the stuff of best-selling biographies. I was the only person who was going to put in the work to track down the details.

So earlier this year, I filled out a Standard Form 180, “Request Pertaining to Military Records,” seeking any information held by the National Archives about Fritz Ehmann or Fred Ehman. When I submitted the form, it joined a digital queue hundreds of thousands of names long.

The coldest storage bays at the National Personnel Records Center are used exclusively for records affected by the 1973 fire. About 11 million records are held in these two bays.

Photograph: Josh Valcarcel

Even Before the flames were extinguished in 1973, the National Archives knew that millions of people like my grandfather would need their files while they were alive, and that exponentially more researchers and family members like me would want them for generations to come. Right away, the agency began working on a plan to preserve as many damaged records as possible.

McDonnell Douglas, the St. Louis-based aerospace manufacturer, lent the NRPC its gigantic vacuum chambers; each could dry 2,000 milk crates’ worth of files at a time. Kathy Trieschmann says she and other interns were reassigned to sort through charred records under giant tents in the building’s parking lot to preserve what looked like usable pages—and throw out the rest. Meanwhile, archivists created a new records classification: B files, for “burn.” Those would need to be kept in specialized storage forever.

After the rest of the building was deemed safe to use, construction crews simply sheared the demolished sixth story off 9700 Page Avenue and put a new roof over the fifth floor. Finally, in 2010, the government broke ground on a new building to house the center, 15 miles northeast of the original. Applying lessons learned from 1973, the National Archives designed the storage to be as fireproof as possible. Every bay that holds records long-term is temperature- and humidity-controlled. The staff moved in in 2011.

The newer National Personnel Records Center, just outside of St. Louis. The office receives an average of 4,000 records requests every day—1.1 million a year.

Photograph: Josh Valcarcel

Today, when the team receives a request for records from the early 20th century, the first step is to see whether the file exists. If the veteran was in the Navy instead of the Army during World War II, say, or an Air Force sergeant named Howell who served in Korea, the folder will be as pristine as any decades-old paperwork can be. Sgt. Howell's colleague Sgt.

Hutchinson, though, will come up in the database either with no record of a personnel file—meaning nothing remains after the fire—or with the notation “B file.” If the screen says B, it means there is *something* about Sgt. Hutchinson in one of the two bays designed to hold fire-affected records. The next step is to figure out what condition that something is in.

Plenty of B files can be read with the naked eye; some boxes got damp but suffered no other damage. Others grew mold despite the staff’s best efforts to fend it off—which, when the papers are pulled from cold storage, requires some combination of humidifying and physically removing spores. There are about 6.5 million B files, far too many to treat proactively, so they remain locked away in the stacks until someone requests the information.

Dealing with these fragile records, of course, takes time. As a result, long waits have been a chronic problem for the NRPC ever since the fire (angering politicians from both parties). Then, because few records are digitized, in the early days of the Covid pandemic—when most staff couldn’t work from the office—they fell way, *way* behind. By March 2022, the backlog hit a new record, with 603,000 outstanding requests. By the following February, staff had cut the pile by a third, to 404,000. The National Archives and Records Administration plans to resolve the problem by the end of this year. After that, every requester should receive a response within 20 business days.

When I visit the National Personnel Records Center in early March, Ashley Cox, who leads a team of preservation specialists, is opening a folder for a World War II lieutenant named William F. Weisnet. When a technician pulls a file, they are often the first person to touch those pages since the immediate aftermath of the fire 50 years ago. Cox, who has a mop of chin-length curls and a nose stud and is wearing a pastel pink hoodie with a Japanese cartoon of a hot dog on the front, thinks of each record she works

with as if it were a person under her care. “This particular person got very damaged, and you can go through all the physical therapy ever, but that injury is still going to hurt,” she says, gesturing at Weisnet’s inch-thick file. “So the less that you can aggravate that old injury, the safer it is.”

A humidity chamber relaxes curled documents back to flat without stressing the fibers.

Photograph: Josh Valcarcel

When a B file turns out to have been licked by actual flames, it is categorized on a scale from 1 to 5, from the most lightly affected to the most severely. The edges of each sheet of paper in Weisnet’s folder are slightly blackened, as if someone had run them briefly over a candle before blowing them out, but almost all of the information on the pages is visible. This is a level 1 file, Cox tells me; it won’t need any special treatment before it’s passed along to a technician who will scan it and send a digital copy to the requester.

Cox then shows me a much thicker file, with the name Wayne Powell on the front. The pages are deep black and, though Cox is barely touching them, they spit flakes of char onto the table and floor. Many sheets are fused together, forming a dense mass with curled edges. This must be a level 5, I guess. Cox shakes her head. It’s a level 3; if you know where to look, you can pull plenty of information from these pages. Cox can conclusively inform the requester of the dates Powell was in the military, his service number, and—most crucially for benefits purposes—that he was honorably discharged.

That might not be enough to satisfy, say, a nosy granddaughter trying to learn everything she can about a grandfather, but it’s plenty of information to prove the basics of Powell’s service record. And that’s what distinguishes NRPC preservation specialists from those at a museum or an academic library: The point of salvaging materials burned in the fire is practical. “It’s a binary proposition: Either you can get something, or there’s nothing,” says Noah Durham, a supervisory preservation specialist in the St. Louis lab who spent the early part of his career working with priceless artifacts at luxury

auction houses Christie's and Sotheby's, including a second-century BC manuscript by mathematician Archimedes.

Tiffany Marshall works with documents in the Records Center's decontamination lab.

Photograph: Josh Valcarcel

Most of the tools the preservation lab uses are decidedly low-tech. Thin painting knives known as microspatulas help separate fused pages without damaging them further. "Bone folders"—small dull tools used in bookbinding, which are now usually made from Teflon or a newly developed polymer called Delrin rather than actual animal bones—are slippery enough to smooth creases and not leave a mark. Where pages are torn, technicians use tweezers to apply pieces of translucent Japanese tissue with an adhesive, which, when heated, mends paper.

Down the hall from Cox's lab, a technician named Elaine Schroeder works in a cubicle that looks entirely banal, with the exception of the tiny pieces of black char scattered everywhere. Picking up a folder labeled with the name Roman Pedrazine, birth date 1899, Schroeder is able to quickly figure out which of the burnt documents she needs for a request. Pedrazine served in the Army Air Forces in both world wars, so his file is 3 inches thick, but Schroeder only needs his final separation document, or DD214. Pulling a Teflon spatula from a pencil cup next to her monitor, she lifts a few pages and reveals the form. The name has burned away, but she can read the service number; it's the same as the number next to Pedrazine's name on another page. Match verified, Schroeder turns to digitize the DD214 on a flatbed scanner so a copy can be sent to the requester.

Carol Berry, an archives technician, works on records that became brittle in the fire, assessing them before releasing them for record requests.

Photograph: Josh Valcarcel

Occasionally, getting the information requested involves the most extreme option: one of two \$80,000 infrared cameras developed specially for the National Archives. Ink absorbs and reflects light differently than plain paper,

which means those cameras can often identify words even on a sheet fully blackened by fire. This kind of equipment—most frequently used for “objects of unique significance,” like the ones Durham worked on in the luxury auction world—didn’t even exist a decade ago.

Less than 1 percent of records requests require the use of Durham’s infrared cameras; the vast majority of the files kept after the fire were salvaged precisely because they were readable. When Kathy Trieschmann and her fellow interns were, as she recalls, instructed to throw away pages too blackened to read, no one foresaw that four decades later, technology might make those pages decipherable.

Infrared imaging is used to identify words on records that were fully blackened by the fire.

Photograph: Josh Valcarcel

Durham, who has wispy, sandy blond hair that stands up from the top of his head, smiles frequently as he describes the technical details of his work. In a darkened room in front of a camera mounted on an adjustable column, he proudly shows me a before-and-after image of a DD214. Part of the page has burned away entirely, and the right half of what remains is almost totally black. On the original copy, I can see that the soldier served during the Korean War, but *where* he served is obscured. As a scanned version appears on a computer screen behind the camera, the word “Korea” appears next to “theatre of operation.” The date “3 April 52” becomes visible under “medals received.” In a few seconds, the document’s value has transformed, turning proof that the soldier served in the military between 1950 and 1953 into evidence that he was a decorated combat veteran.

Durham grins. “It’s a good thing we do.”





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Photograph: Josh Valcarcel

The technicians at the National Personnel Records Center work to carefully assess and preserve documents damaged in the fire so that any information can be gleaned from them. Here, Ashley Cox uses a humidity chamber to relax curled documents back to flat without stressing or breaking the fibers.

Around the time I requested Grandfather's military record, I also submitted a Freedom of Information Act request to the FBI to see what I could find out about the devastating blaze. Five decades on, the NRPC fire has been largely forgotten. I wanted to know how it started, and who or what could be blamed for destroying 17,517,490 pieces of 20th-century American history.

Within a few weeks, I received a 386-page report that chronicled every step of the two-month FBI investigation. "Scene of fire can't be reached due to severity of fire, but arson is suspected due to location and rapid break out and rapid spread of fire," reads one of the first messages from the St. Louis branch (which, coincidentally, maintained an office on the second floor of

the NRPC) to then-FBI director Clarence Kelley, who was three days into his job. The last paragraph of the transmission implies a group of suspects: “No employees other than custodians working at location of fire when fire broke out.”

Soon enough, though, FBI investigators turned their focus to the two dozen interns verifying Vietnam veterans’ records on the first floor. That spring, the US had withdrawn the last of its troops from Vietnam, and anti-war anger remained palpable on college campuses. Just a year earlier, the Weather Underground had detonated a bomb in a Pentagon bathroom. It appears that the FBI didn’t consider it far-fetched to think a 19- or 20-year-old working in the building that held the records of the 3 million people who had been stationed in Vietnam might have been inspired to take a dramatic stand. In the interview reports, almost every name is redacted, but one subject is described as a “hippie type person.”

About a week after the fire, two agents showed up at Trieschmann’s house to interview her. They asked her why she went up to the sixth floor when she saw the haze. She told them she was curious. They asked her how she felt about the war and, figuring that lying to the FBI was a bad idea, she told the truth: She opposed it vehemently, believed the US military had committed unforgivable atrocities.

But she also didn’t set her workplace on fire. And though she knew many other interns who shared her anti-war principles, she told the FBI, not one would burn service members’ records to dust. They had been working with these files every day for weeks. Many of them had relatives who had served: parents in World War II or Korea, brothers in Vietnam. “From what the FBI said to me, they would have loved if the fire had been started by a radical college student,” Trieschmann remembers. “Except none of the kids were like that.”

Even so, there was a reason the FBI was hot on the arson theory: It turns out that the hallways of the NRPC had seen a *lot* of fires. The previous year, the agency had been notified of four: in a trash can in a men’s restroom on the second floor, in a trash can in a men’s restroom on the first floor, in a trash can in a ladies’ restroom on the fifth floor, and in a trash can in a ladies’

restroom on the fourth floor. “It should be noted,” the missive concluded, “that other minor incidents may have occurred that were not reported.”

Sure enough, various employees remembered even more fires, including one in another trash can on the sixth floor, one in a paper towel dispenser, and one in a janitorial closet. One custodian told interviewers that his supervisor had told him about two fires in the previous week alone. Employees were allowed to smoke in the building (though not in the file areas), but that rate of fires resulting from cigarette mishaps is difficult to believe in retrospect. Altogether, the FBI report quotes about 10 people who remembered various fires at the NRPC building in the recent past.

Yet within several weeks, agents appear to have essentially given up on trying to find a perpetrator. That may have been in part because the number of suspected arsons in the building seemed to be rivaled only by the number of electrical problems. A custodian who told investigators about multiple fires *also* said he was constantly finding faulty switches and wires, including eight on the night of July 11 alone. Other employees had observed issues with the giant fans that ventilated file storage areas. One man said he had recently been chided by a colleague for turning on a particular fan on the sixth floor; the wires were exposed and the blades weren’t turning freely. When he went to turn it back off, he noticed a “considerable amount” of smoke coming from the motor and a small pool of oil on the floor. “Do not use,” he wrote on a piece of paper, then taped it to the fan.

It was also impossible to ignore the fact that in terms of fire safety, the building was a *terrible* place to keep the only official copy of tens of millions of paper records. Renowned architect Minoru Yamasaki, who would go on to design the original Twin Towers of the World Trade Center, spent several months in the early 1950s studying what to include in a state-of-the-art federal records center. At the time, preservation experts were divided on whether archives should have sprinkler systems, which could malfunction and drown paper records. Yamasaki decided his building would go without. The result, the gleaming glass building on Page Avenue, opened in 1956.

More puzzlingly, the architect designed the 728-by-282-foot building—the length of two football fields—with no firewalls in the records storage area to

stop the spread of flames. The air conditioning in the file areas, meanwhile, was turned off at night to save money, making the building's top floor almost unbearably hot after hours. Elliott Kuecker, an assistant professor at the University of North Carolina's School of Information and Library Science, says such decisions look inexplicable in retrospect, but it's impossible to know for sure what makes sense until *after* a crisis. "Archivists think about preventative measures as much as possible, but a lot of that has been learned by trial and error and disaster," he says.

Nobody had seen anything. Nobody had named anyone. And the sixth floor was so completely destroyed that it was impossible to investigate fully. The center of the building, where investigators determined the fire began (confirming Trieschmann's eyewitness account), was buried under multiple tons of concrete and 2 to 3 feet of wet charred rubble from burned records. So eventually, the FBI concluded that the stew of ingredients that led to the disaster was impossible to unblend. The investigation was formally closed in September 1973.

A month later, though, something surprising happened: A custodian took the blame.

In a signed statement, the man, whose name is redacted, admitted that around 11 pm on July 11, he was in the files on the sixth floor, and he was smoking. He said he extinguished his cigarette by sticking it into an empty bolt hole in the metal shelves, breaking off the lit end, and snuffing out the remaining sparks by wiping them on the side of a shelf. He didn't know where the match had fallen. When he saw fire trucks arriving as he headed home that night, he assumed it was his fault, but he was afraid to come forward. Until, for some unknowable reason, three months later, he did.

The custodian wasn't arrested, but assistant US attorney J. Patrick Glynn presented the case to a grand jury—not because he was sure an indictment was warranted, according to the FBI report, but to see what jurors could find out from witnesses under oath. The panel, whose records remain sealed, failed to find probable cause for criminal prosecution. The result is that his account has been all but erased from the story of the National Personnel Records Center fire.

When I visit St. Louis in early March, my first stop is to see Scott Levins, who has directed the NRPC since 2011. Without prompting, he tells me: “I want to make sure you understand you might talk to staff, and someone might say, ‘Oh, I heard it was someone smoking’ or something, but there’s been nothing conclusive.” To this day, the official narrative of July 12, 1973, is that we’ll never know what ignited the blaze.

Photographs of the 1973 fire hang in the lobby of the current records center, near St. Louis.

Photograph: Josh Valcarcel

As I walk around the preservation lab in St. Louis, burned files everywhere I look, I understand why Levins doesn’t want me focusing on the precise combination of cigarette, negligence, bad luck, and poor design behind the fire. He’s concerned with what he can *do* about it, with that fleet of highly trained technicians who have dedicated their lives to taking care of the survivors.

At the time of my trip, I still had no idea whether my grandfather was one of those survivors, or among the 80 percent of World War II Army veterans whose records were destroyed entirely.

After I submitted the Standard Form 180 in January, I got a response within a day. NRPC employees weren’t yet sure whether they had a B file for either Fritz Ehmann or Fred Ehman. I was instructed to complete National Archives Form 13075, with as much information as I could: His Social Security number? His service number? His address when he enlisted? His discharge date? Where did he complete basic training; where was his separation station? What kind of work did he do in the military? Did he ever file a claim for veterans’ benefits or receive a state bonus?

I didn’t know how to answer almost any of it.

I did the best I could, but a month later, I received an unsatisfying answer. “The information furnished on the enclosed form NA 13075, Questionnaire About Military Service, is insufficient to conduct a search of our alternate records sources. Without any new data, no further search can be made.”

They weren't telling me his record had been destroyed, just that they didn't know where to look. If I could supply a few additional tidbits of information, though, they might have something to go on.

Because so many files from the first half of the 20th century are gone, the bulk of the NRPC team's fire-related work is done through these "alternate records sources"—in other words, files that were held by other government departments at the time of the fire. Often, that work starts with a Veterans Administration index card.

The cards, with a mix of typewritten text and handwriting, are records of veterans' claims that were kept—crucially in hindsight—at the VA. Anyone who ever received health care from the VA or took out a low-interest business loan, among other government offerings, has one. These cards don't look like impressive sources of information; there's nothing about where the person served, what honors they earned, or even what kinds of benefits they received. But if you know what you're looking for, preservation team lead Keith Owens tells me, a single card is a treasure trove. It contains a person's service number, which can be used to track down several other pieces of information—and to determine whether a B file exists.

Keith Owens, a preservation lead, operates a reel-to-reel microfilm scanner to digitize records.

Photograph: Josh Valcarcel

Soon after the fire, the VA turned over more than a thousand rolls of microfilm containing images of each card to the National Archives. Over the past several years, Owens' team has digitized each card, a process they finally finished in March. But they're not really digitized in the modern sense of the word. To find a single card, a user must scroll through a file with 1,000 images. Still, Owens or a technician can usually find one—if it exists—within a few minutes. That means the NRPC can answer many, many more requests than ever before.

1959-P-Y
(9 Jan 57)

17 JAN 1957

Mrs. Daily Bell Hall
Route 1, Box 281
Olive Hill, Kentucky

Dear Mrs. Hall:

Reference is made to your letter concerning [redacted] on, G.
Hall, a casualty of the Korean conflict.

There will be a delay in furnishing you [redacted] information desired.
However, the matter is receiving attention and you will receive further
advice at the earliest practicable date.

Sincerely yours,

HERBERT M. JONES
Major General, USA
Adjutant General

V. OVER-ALL EVALUATION (Compare this airman with others of the same grade and AFS. Extremes of ability are rare.)						
<input type="checkbox"/> An unsatisfactory airman	<input type="checkbox"/> A marginal airman	<input type="checkbox"/> A good airman	<input type="checkbox"/> A very good airman	<input checked="" type="checkbox"/> An exceptional airman of great value to the service	<input type="checkbox"/> One of the very few outstanding airmen I know	
VI. COMMENTS OF REPORTING OFFICIAL (Be factual and specific. Add any comments which increase the objectivity of the rating.)						
<p>Since Airman Runyon has been assigned to the section he has distinguished himself and the section with a high degree of technical skill in analyzing and correcting Aux-Radar malfunctions.</p> <p>Airman Runyon's thorough knowledge of his career field and his untiring devotion to duty has earned for him the respect of his supervisors as well as all of his co-workers. He has excellent initiative, attitude and military bearing.</p> <p>Airman Runyon was selected for a TDY to Newfoundland in direct support of Wing aircraft and has been to North Africa once in support of RB-47's. For his outstanding ability Airman Runyon was chosen to support missions at Barksdale AFB, La., doing both Radio and Radar maintenance with a high degree of skill and accuracy.</p> <p>He was selected to comply with a TOC concerning all 376th Wing Aircraft. This TOC was the installation of new ceramic radomes and appropriate wave guide for the APN-69 on 20 aircraft. Airman Runyon worked many nights overtime to comply with this TOC on schedule. Recently, because of his outstanding skill and excellent maintenance ability, Airman Runyon was assigned to comply with an 8th AF MSG with a deadline date of 15 January 1959. The MSG was to check the calibration of all APN-69 units.</p> <p>Because of Airman Runyon's vast knowledge, initiative, determination and devotion to duty, all of the available aircraft have had the TOC complied with. The results of his efforts is a "job well done".</p> <p>Airman Runyon's devotion to duty, ability to use various test equipment, knowledge of his career field has aided greatly to increase the effectiveness of the Comm/nav Section.</p> <p>Airman Runyon has handled his financial responsibilities in an excellent manner.</p>						
VII. RECOMMENDATION FOR PROMOTION				VIII. REPORTING OFFICIAL		
<input type="checkbox"/> DO NOT RECOMMEND FOR PROMOTION				SIGNATURE	DATE	
<input type="checkbox"/> ALONG WITH AIRMEN OF SIMILAR SERVICE AND EXPERIENCE				NAME, GRADE, TITLE, AND ORGANIZATION		
<input checked="" type="checkbox"/> AHEAD OF OTHER AIRMEN OF SIMILAR SERVICE AND EXPERIENCE				BYRON L HINTON, M/Sgt, USAF NCOIC, Comm/Nav 376th AERS		
IX. REVIEW BY ENDORSING OFFICIAL		I CONCUR	I DO NOT CONCUR and have initialed the appropriate rating boxes.			
COMMENTS:				SIGNATURE	DATE	
<p>GENERAL DUTY - WORK EFFORT HAS BEEN PLEASANT</p> <p>DOING A GOOD JOB</p> <p>REPORTING VIBRANT</p> <p>STAYED UP TO DATE</p>				NAME, GRADE, TITLE, AND ORGANIZATION		
				THOMAS J JONES, Captain, USAF Line Maintenance Branch 376th AERS		
X. REVIEW BY UNIT COMMANDER		RECOMMENDED FOR GOOD CONDUCT MEDAL	DO NOT RECOMMEND FOR GOOD CONDUCT MEDAL			
COMMENTS:				SIGNATURE OR INITIALS	DATE	
<p>GENERAL DUTY - WORK EFFORT HAS BEEN PLEASANT</p> <p>DOING A GOOD JOB</p> <p>REPORTING VIBRANT</p> <p>STAYED UP TO DATE</p>				NAME, GRADE, TITLE, AND ORGANIZATION		
				KERMET W HARDY, Lt Col, USAF Commander 376th AERS		

U. S. GOVERNMENT PRINTING OFFICE: 1958 O-488828



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Photograph: Josh Valcarcel

B files, or “burn” files, are records that were salvaged from the 1973 fire and have not yet undergone complete treatment. S files, or “salvaged,” are the end result of a B file having undergone complete preservation treatment.

Owens, who has spent more than two decades working at the records center, is a burly guy in his early fifties, wearing deliberately distressed jeans with zippers across the thighs. Mostly bald with a short graying beard, he is a trained Baptist minister, and his hearty laugh booms across the lab. Even in an office where everyone is enthusiastic about their work, Owens’ evangelizing sticks out. When he tells me about how it feels to help someone find their records, he scrunches up his eyes. “It gives me hope,” he says. “I just know that what we’re doing now is going to better the possibility of helping somebody. Somebody is going to look at a paper 500 years from now with my name on it and say, Keith Owens, whoever this was, did something amazing to help somebody back then.”

Until walking into Owens' cubicle, I hadn't planned on bringing up my quest for my grandfather's records. But under the spell of his pastor's affect, I babble out the backstory, my voice cracking slightly as I explain that I'd submitted everything I had and it still wasn't enough. I don't even know whether Grandfather ever received veterans' benefits. Owens lights up. Let's check the index cards and find out, he says. Before I know it, we're at his computer opening a folder labeled "Egan–Eidson."

We click into a few different PDFs before finding the cards that include the Eh- names. In the fourth one, we find the last name Ehman. We scroll past an Arnold, two Bruces, two Adams, two Alberts, two Andrews. Suddenly, we're on to Ehmen, with a second "e" where the "a" should be. We scroll down further, until the alphabetization loops back to the start.

More Ehmans appear: Charles, Clement, David, Dennis, Earl, Elizabeth. "Come on," Owens implores, as if willing his favorite sprinter to cross the finish line first. But now we're back to Ehmen.

He sighs, keeps scrolling, keeps narrating. The tone of his voice has turned from excited to apprehensive. I can see the progress bar is almost to the bottom of the file, and my stomach drops. We're not going to find him.

Then, just before we reach the end, I catch a glimpse of "Abraham," Grandfather's middle name. "Th- th- th-," I stammer incomprehensibly, and loudly, fumbling to point him to the right card. Owens reads the name Fred aloud, confirming what I've already realized. "Holy shit," I whisper quietly. "Oh my god." It's not like seeing a ghost, exactly, staring at this tiny card with a handful of basic facts about a person I adore and will never see again. It's more like realizing the person I thought was a ghost is in fact quite visible.

But this is just the prelude to my real quest. Now, finally, we can find out whether Grandfather's personnel record survived the fire. Armed with a service number, we head downstairs to the research room to look for Fred Abraham Ehman. I start to convince myself that I'm one of the lucky ones, that we'll discover a usable B file with all that detail I've been craving, despite the 4-to-1 odds that it's gone.

I am not one of the lucky ones.

A research specialist in an Adidas hoodie types in the service number, then tells me there's no listing for a B file. "So that means conclusively that it's gone?" I ask.

"Yes."

My head is spinning so much that I don't immediately process what he tells me next, which is that there's a silver lining. What does exist, he says, deep in one of the 15 storage bays in the massive building, is my grandfather's final pay voucher, or QMP, another alternate records source commonly used to reconstruct information destroyed in the fire.

This is actually great news, Keith Owens tells me when I trudge back to his desk. A QMP contains the service member's date of enlistment, date of discharge, and home address. It lists the reason they were discharged. If you're Owens, a man who's spent two decades trying to help people by getting them any information they can possibly use for benefits, finding a QMP is a moment of triumph.

If you're me, a woman yearning to understand the story of her dead grandfather's life, it's a tiny bit heartbreaking.

The preservationists were able to find Megan's grandfather's final pay stub. The rest of his military file was lost to the fire.

Photograph: Josh Valcarcel

Back at my hotel that night, I can't stop thinking about what might have happened to Grandfather's record on July 12, 1973. Did it burn away to dust? Was it blackened and thrown away by someone who had no way of knowing that infrared cameras would make it readable five decades later? And, most naggingly: *What did it say?*

I don't particularly care whether Grandfather earned any medals, and if he had been part of some top-secret military operation, those details aren't going to be here. By this point, I've flipped through enough Official Military Personnel Files that I know they are more disconnected trivia than actual

biography. But I can't help it: I am wild with jealousy of all those people whose relatives' files are, at this very moment, being tenderly cared for by preservation specialists trained on invaluable pieces of history at Christie's and Sotheby's and the greatest universities in the world.

By the time I arrive at the preservation lab the next morning, Owens has not only scanned that

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QMP with its facts about Grandfather's discharge, but kept the original at his desk to show me. Fred Abraham Ehman landed in Washington state on December 28, 1945, four months after the war ended. He was paid \$191.68, \$50 of it in cash and the rest as a government check. I recognize his signature, with its looping "F" and the lowercase "a" between his first and last names. I touch the paper gently, feeling a heady mix of gratitude and guilt that I don't feel more gratitude. "Give me a hug," Owens orders, and I do.

By the time I arrive home a few days later, my mood is more sanguine. With all of the information on the QMP, I can figure out which Army unit Grandfather was in, then find the "morning reports" that tracked that unit's movements around the world. With more work, I can probably track down the vast majority of the same information that burned in 1973, about the refugee turned soldier who became my grandfather. I'll never know the full story, but I've come to accept that even one of those 3-inch-thick B files I'd been coveting wouldn't have given me that.

After the flames raced down the 700-foot-long aisles of the sixth floor, after the columns of smoke rose from the roof like Jack's beanstalk, after the wind scattered military records around the neighborhoods northwest of St. Louis, after 42 local fire departments battled for days to save one of the largest federal office buildings in the United States, the government spent 50-plus years sorting through the charred remains. Untold numbers of people, meanwhile, spent 50 years, and counting, trying to replace what they lost.

Neither project will conclude anytime soon.

Updated 07-13-23, 5:30pm EST: This story was updated to clarify some specifics around the mitigation and archive processes and contents.

Let us know what you think about this article. Submit a letter to the editor at mail@wired.com.

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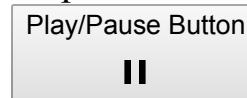
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Jun 27, 2023 6:00 AM

Meet the Humans Trying to Keep Us Safe From AI

As artificial intelligence explodes, the field is expanding beyond the usual suspects—and the usual motivations.



Video: Sam Cannon

A year ago, the idea of holding a meaningful conversation with a computer was the stuff of science fiction. But since OpenAI's [ChatGPT](#) launched last November, life has started to feel more like a techno-thriller with a fast-moving plot. Chatbots and other [generative AI](#) tools are beginning to profoundly change how people live and work. But whether this plot turns out to be uplifting or dystopian will depend on who helps write it.

Thankfully, just as artificial intelligence is evolving, so is the cast of people who are building and studying it. This is a more diverse crowd of leaders, researchers, entrepreneurs, and activists than those who laid the foundations of ChatGPT. Although the AI community remains overwhelmingly male, in recent years some researchers and companies have pushed to make it more welcoming to women and other underrepresented groups. And the field now includes many people concerned with more than just making algorithms or making money, thanks to a movement—led largely by women—that considers the ethical and societal implications of the technology. Here are some of the humans shaping this accelerating storyline. —*Will Knight*

“I wanted to use generative AI to capture the potential and unease felt as we explore our relationship with this new technology,” says artist Sam Cannon, who worked alongside four photographers to enhance portraits with AI-crafted backgrounds. “It felt like a conversation—me feeding images and ideas to the AI, and the AI offering its own in return.”

Rumman Chowdhury

PHOTOGRAPH: CHERIL SANCHEZ; AI Art by Sam Cannon

Rumman Chowdhury led Twitter’s ethical AI research until Elon Musk acquired the company and laid off her team. She is the cofounder of Humane Intelligence, a nonprofit that uses crowdsourcing to reveal vulnerabilities in AI systems, designing contests that challenge hackers to induce bad behavior in algorithms. Its first event, scheduled for this summer with support from the White House, will test generative AI systems from companies including Google and OpenAI. Chowdhury says large-scale, public testing is needed because of AI systems’ wide-ranging repercussions: “If the implications of this will affect society writ large, then aren’t the best experts the people in society writ large?” —*Khari Johnson*

Sarah BirdPhotograph: Annie Marie Musselman; AI art by Sam Cannon

Sarah Bird’s job at Microsoft is to keep the generative AI that the company is adding to its office apps and other products from going off the rails. As she has watched text generators like the one behind the Bing chatbot become more capable and useful, she has also seen them get better at spewing biased content and harmful code. Her team works to contain that dark side of the technology. AI could change many lives for the better, Bird says, but “none of that is possible if people are worried about the technology producing stereotyped outputs.” —*K.J.*

Yejin ChoiPhotograph: Annie Marie Musselman; AI art by Sam Cannon

Yejin Choi, a professor in the School of Computer Science & Engineering at the University of Washington, is developing an open source model called

Delphi, designed to have a sense of right and wrong. She's interested in how humans perceive Delphi's moral pronouncements. Choi wants systems as capable as those from OpenAI and Google that don't require huge resources. "The current focus on the scale is very unhealthy for a variety of reasons," she says. "It's a total concentration of power, just too expensive, and unlikely to be the only way." —W.K.

Margaret Mitchell
Photograph: Annie Marie Musselman; AI art by Sam Cannon

Margaret Mitchell founded Google's Ethical AI research team in 2017. She was fired four years later after a dispute with executives over a paper she coauthored. It warned that large language models—the tech behind ChatGPT—can reinforce stereotypes and cause other ills. Mitchell is now ethics chief at Hugging Face, a startup developing open source AI software for programmers. She works to ensure that the company's releases don't spring any nasty surprises and encourages the field to put people before algorithms. Generative models can be helpful, she says, but they may also be undermining people's sense of truth: "We risk losing touch with the facts of history." —K.J.

Inioluwa Deborah Raji
Photograph: AYSIA STIEB; AI art by Sam Cannon

When Inioluwa Deborah Raji started out in AI, she worked on a project that found bias in facial analysis algorithms: They were least accurate on women with dark skin. The findings led Amazon, IBM, and Microsoft to stop selling face-recognition technology. Now Raji is working with the Mozilla Foundation on open source tools that help people vet AI systems for flaws like bias and inaccuracy—including large language models. Raji says the tools can help communities harmed by AI challenge the claims of powerful tech companies. "People are actively denying the fact that harms happen," she says, "so collecting evidence is integral to any kind of progress in this field." —K.J.

Daniela Amodei
Photograph: AYSIA STIEB; AI art by Sam Cannon

Daniela Amodei previously worked on AI policy at OpenAI, helping to lay the groundwork for ChatGPT. But in 2021, she and several others left the company to start Anthropic, a public-benefit corporation charting its own approach to AI safety. The startup’s chatbot, Claude, has a “constitution” guiding its behavior, based on principles drawn from sources including the UN’s Universal Declaration of Human Rights. Amodei, Anthropic’s president and cofounder, says ideas like that will reduce misbehavior today and perhaps help constrain more powerful AI systems of the future: “Thinking long-term about the potential impacts of this technology could be very important.” —W.K.

Lila IbrahimPhotograph: Ayesha Kazim; AI art by Sam Cannon

Lila Ibrahim is chief operating officer at Google DeepMind, a research unit central to Google’s generative AI projects. She considers running one of the world’s most powerful AI labs less a job than a moral calling. Ibrahim joined DeepMind five years ago, after almost two decades at Intel, in hopes of helping AI evolve in a way that benefits society. One of her roles is to chair an internal review council that discusses how to widen the benefits of DeepMind’s projects and steer away from bad outcomes. “I thought if I could bring some of my experience and expertise to help birth this technology into the world in a more responsible way, then it was worth being here,” she says. —Morgan Meaker

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[Morgan Meaker](#)

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Jun 25, 2023 2:00 AM

Meet the AI Protest Group Campaigning Against Human Extinction

Fears that artificial intelligence might wipe us out have fueled the rise of groups like Pause AI. Their warnings aren't that far-fetched, experts say.
Photograph: Caspar Benson/Getty Images

The first time we speak, Joep Meindertsma is not in a good place. He tears up as he describes a conversation in which he warned his niece about the risk of artificial intelligence causing societal collapse. Afterward, she had a panic attack. "I cry every other day," he says, speaking over Zoom from his home in the Dutch city of Utrecht. "Every time I say goodbye to my parents or friends, it feels like it could be the last time."

Meindertsma, who is 31 and co-owns a database company, has been interested in AI for a couple of years. But he really started worrying about the threat the technology could pose to humanity when Open AI released its latest language model, [GPT-4](#), in March. Since then, he has watched the runaway success of ChatGPT chatbot—based first on GPT-3 then GPT-4—demonstrate to the world how far AI has progressed and Big Tech companies race to catch up. And he has seen pioneers like [Geoffrey Hinton](#), the so-called godfather of AI, warn of the dangers associated with the systems they helped create. "AI capabilities are advancing far more rapidly than virtually anyone has predicted," says Meindertsma. "We are risking social collapse. We're risking human extinction."

One month before our talk, Meindertsma stopped going to work. He had become so consumed by the idea that AI is going to destroy human civilization that he was struggling to think of anything else. He had to do something, he felt, to avert disaster. Soon after, he launched Pause AI, a grassroots protest group that campaigns for, as its name suggests, a halt to the development of AI. And since then, he has amassed a small band of followers who have held protests in Brussels, London, San Francisco and Melbourne. These demonstrations have been small—fewer than 10 people each time—but Meindertsma has been making friends in high places. Already, he says, he has been invited to speak with officials within both the Dutch Parliament and at the European Commission.

The idea that AI could wipe out humanity sounds extreme. But it's an idea that's gaining traction in both the tech sector and in mainstream politics. Hinton quit his role at Google in May and embarked on a global round of interviews in which he raised the specter of humans no longer being able to control AI as the technology advances. That same month, industry leaders—including the CEOs of AI labs Google DeepMind, OpenAI, and Anthropic—signed a letter acknowledging the “risk of extinction,” and UK prime minister Rishi Sunak became the first head of government to publicly admit he also believes that AI poses an existential risk to humanity.

Meindertsma and his followers offer a glimpse of how these warnings are trickling through society, creating a new phenomenon of AI anxiety and giving a younger generation—many of whom are already deeply worried about climate change—a new reason to feel panic about the future. A [survey](#) by the pollster YouGov found that the proportion of people worried that artificial intelligence would lead to an apocalypse rose sharply in the last year. Hinton denies he wants AI development to be stopped, temporarily or indefinitely. But his public statements, about the risk AI poses to humanity, have resulted in a group of young people who feel there is no other choice.

To different people, “existential risk” means different things. “The main scenario I'm personally worried about is social collapse due to large-scale hacking,” says Meindertsma, explaining he's concerned about AI being used to create cheap and accessible cyber weapons that could be used by

criminals to “effectively take out the entire internet.” This is a scenario experts say is extremely unlikely. But Meindertsma still worries about the resilience of banking and food distribution services. “People will not be able to find food in a city. People will fight,” he says. “Many billions I think will die.”

But the Pause AI founder also worries about a future where AI advances enough to be classified as “super-intelligent” and *decides* to wipe out civilization, once it understands that humans limit AI’s power. He echoes an argument, also used by Hinton, that if humans ask a future super intelligent AI system to fulfill any goal, AI might create its own dangerous sub-goals in the process.

This concern dates back years and is generally credited to the Swedish philosopher and Oxford University professor Nick Bostrom, who first described in the early 2000s what hypothetically could happen if a super-intelligent AI was asked to create as many paperclips as possible. “The AI will realize quickly that it would be much better if there were no humans, because humans might decide to switch it off,” Bostrom said in a 2014 interview. “Also, human bodies contain a lot of atoms that could be made into paper clips. The future that the AI would be trying to gear towards would be one in which there were a lot of paper clips but no humans.”

AI research is a divided field and some experts who might be expected to rip Meindertsma’s ideas apart, instead seem reluctant to discredit them. “Because of the rapid progress, we just don’t know how much of science fiction could become reality,” says Clark Barrett, co-director of Stanford University’s Center for AI Safety in California. Barrett does not believe a future where AI helps develop cyber weapons is plausible. This is not a field where AI has so far excelled, he claims. But he is less willing to dismiss the idea that an AI system that evolves to be smarter than humans could work maliciously against us. People worry that an AI system “could try to steal all of our energy or steal all of our compute power or try to manipulate people into doing what it wants us to do.” This is not realistic right now, he says. “But we don’t know what the future can bring. So I can’t say it’s impossible.”

Yet, other AI researchers have less patience with the hypothetical debate. “For me, it is a problematic narrative that people claim any kind of proof or likelihood that AI is going to be self conscious and turn against humanity,” says Theresa Züger, head of Humboldt University’s AI and Society Lab, based in Germany. “There is no evidence that this is going to appear and in other scientific fields, we wouldn’t discuss this if there is no evidence.”

This lack of consensus among experts is enough for Meindertsma to justify his group’s demand for a global halt to AI development. “The most sensible thing to do right now is to pause AI developments until we know how to build AI safely,” he says, claiming that leaps forward in AI capabilities have become divorced from research on safety. The debate about how the relationship between these two halves of the AI industry have evolved is also taking place in mainstream academia. “This is something that I’ve seen getting worse over the years,” says Ann Nowé, head of the Artificial Intelligence Lab at the Free University in Brussels. “When you were trained in the ’80s to do AI, you had to understand the application field,” she adds, explaining it was normal for AI researchers to spend time speaking to people working in the schools or hospitals where their system would be used. “[Now] a lot of AI people are not trained in having this conversation with stakeholders about whether this is ethical or legally compliant.”

The government-mandated pause, Meindertsma envisions, would have to be organized by governments of different countries at an international summit, he says. When British prime minister Rishi Sunak announced the UK would host a [global summit](#) on AI safety in the autumn, Meindertsma interpreted this as a flash of hope. He believes the UK is well-suited to make sure we’re not rushing towards a doomsday scenario. “It’s the home for many AI safety scientists. It’s where DeepMind is currently located. You have members of parliament already [calling](#) for an AI safety summit to prevent extinction.” Yet Sunak’s announcement was also tinged with ambitions to make the UK a hub of AI industry—simultaneously revealing that the company Palantir would base its new European headquarters in London—implying the likelihood of the UK advocating for an industrywide pause is remote.

Sunak's willingness to engage with AI's existential risk means the UK is a focus for Meindertsma. One of his newest recruits, Gideon Futerman, half runs, half walks past the British Houses of Parliament, banners wrapped in plastic under his arm. His train was delayed, he says, explaining why he's late to his own protest. Futerman wears small, round glasses and odd socks. Pause AI's British branch is not a slick operation. And this protest is technically not a protest. It's meant to signal support for Sunak's summit and to pressure the prime minister to use the meeting to introduce a pause. But the group of people here today also shows how anxiety is building among some young people. Referring to artificial general intelligence, one of the group's banners reads: "Don't build AGI," the letters dripping in red ink, designed to look like blood.

The group is small. There are seven protesters in total, all of them young men in their teens or early twenties. Their experience of AI varies. One is a politics student, another works at a nonprofit dedicated to AI safety. Several have a background in protesting against climate change. "One of the main similarities between climate change and AI is the fact that you have a few companies risking people's lives today and even more lives in the future, for the sake essentially of making profits," says Futerman. He shares Meindertsma's concerns, or versions of them. One future scenario he's worried about is that leading AI companies could develop artificial "super" intelligence. If that happened, he believes these models would gain the power to significantly reduce human agency over our future. "They're aiming to build a doomsday device," he says. "In the worst case scenario, this could wipe us out."

Among the cluster of protesters is Ben, an animal rights activist with a mane of red hair, who declines to share his surname because he doesn't want his AI activism to affect his career. Before the protest, we go for coffee to talk about why he joined Pause AI. "There was definitely a time when I felt that the extinction risk argument was science fiction or overblown," he explains, the earring in his left ear gently shaking as he becomes more animated. "Then as ChatGPT came out, and GPT-4, it became apparent to me how powerful these AI models were getting, and also how fast they were increasing in their power."

Ben has never communicated directly with Meindertsma; he met fellow Pause AI members through a London coworking space. He believes his animal rights activism gives him a template to understand the dynamic between different species, with varying degrees of intelligence. “It’s difficult to predict what a world would look like with a different, more intelligent species than the human existing,” he says. “But we know that our relationship with species that are less intelligent than us hasn’t been great for those other species. If you look at humanity’s relationship with other animals, some of them we farm and slaughter for our own purposes. And many of them were driven to extinction.”

He acknowledges some of the scenarios Pause AI is warning about might never happen. But even if they don’t, powerful AI systems will likely turbocharge problems that technology has already accelerated in our societies, he says, such as labor [issues](#) and racial and gender [bias](#). “People who are concerned about AI extinction also take these problems really seriously.”

The second time I speak to Meindertsma, he’s in a better mood. He has new recruits, he feels the world is listening. He has just returned from Brussels, where he was invited to a meeting at the European Commission, declining to publicly name the official he met in case that sours the relationship. And now the UK is holding the global summit he has spent weeks campaigning for. “So I feel like we’re making a lot of progress in a short time,” he says.

As Pause AI’s ideas gain traction, politicians and AI companies are still figuring out how to respond—with researchers divided about whether their concerns help garner support for AI safety research or simply spread panic about future scenarios that might never happen. Meindertsma argues that intelligence is power, and that’s what makes it dangerous. But every day, supposedly intelligent humans try to take more power for themselves and find their efforts blocked by institutions and systems specifically designed to contain it, according to Stanford’s Clark Barrett. He might not be willing to predict how AI might evolve, but he does believe society is more prepared than Pause AI might give it credit for. “There are certain barriers in place that I think shouldn’t be underestimated in terms of preventing this kind of runaway effect that people are worried about.”

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By [Jason Parham](#)

[Backchannel](#)

Jun 22, 2023 6:00 AM

Boots Riley Says a ‘Gentler Capitalism’ Won’t Save Society

The *I’m a Virgo* creator loves contradictions, like trying to launch a radical labor movement with a show on Amazon Prime.

Photograph: Simone Niamani Thompson

The scene is straight out of [Boots Riley](#)’s madcap moviemaking handbook. In a city where Black residents have been steadily priced out, the two of us sit—Riley wearing one of his signature hats, me hatless—swapping stories over lunch as rock music drains from the speakers above us. This is Oakland, the director’s longtime home, and perhaps our talk wouldn’t feel so surreal if it weren’t the exact kind of thing Riley, impresario of all things Black and bizarre, would write into one of his scripts. *Ext. A Japanese fusion restaurant. Two Black men chow down on fried chicken, pondering their existence.*

The Big Interview

[Read more](#) deep, weird, smart conversations with the most important people in our world.

As an artist, Riley embodies a kind of allegorical immodesty. How to put it? He thrives in contradiction, happily welcomes what he calls the “beautiful clutter” of life. It has become a mirror for his gloriously hyphy cinematic staging: He doesn’t build worlds so much as stretch the one we already inhabit to its fantastical extreme.

Where his 2018 cult film *[Sorry to Bother You](#)* swerved into the funk and fuss of late-stage capitalism, manipulating the gonzo curiosity of science fiction to make a decidedly Black satire about labor, survival, and what, if anything, it means to sell out, his latest endeavor, *I'm a Virgo*, cranks the bass. It's a seven-episode ride about a 13-foot-tall, comic-book-obsessed Black teenager named Cootie (Jharrel Jerome) who, after years of being hidden from the world by his adoptive parents for fear that he'll be exploited—or killed—ventures into the cosmos of Oakland, where the gentrifying city, policed by a white vigilante lawman known as the Hero, greets him with wonder and revulsion.

I won't be the first or last to tell you: There is nothing else on TV quite like *I'm a Virgo*. The show is a perfect response to this furious moment, awash in contradictions. Over the past three decades, Riley has been a filmmaker, community organizer, and a member of the radical rap group the Coup. Now, amid a Hollywood writers strike, of which he's been a vocal participant, he's releasing a series about tearing down our broken economic system and building one that feeds power back to the people. Set in a town transformed by Silicon Valley, the show follows Cootie and a group of young activists who strive to dismantle that system from the inside. It's streaming on Amazon Prime.

As the block hums in and out of consciousness, Riley tells me he does not believe in a “gentler capitalism.” There’s an ease to the day, one that belies the reality of what’s happening across the city: exorbitant rents, a homelessness crisis, bureaucratic decay. Oakland is the place he’s devoted his life and work to, but it doesn’t always feel that way anymore. So we talk about how art can be a means for revolution. In Riley’s world, the only way forward is to disrupt from within.

Jason Parham: *I'm a Virgo*'s hero is a 13-foot-tall Black teenager. What is it about his story that felt meaningful to tell?

Boots Riley: I didn't think about it like that.

OK, then where did the idea come from?

I'm attracted to large contradictions. I think about what I would think of as a good lyric. There's this setup, which hopefully is good and says something in and of itself. But then there's this other line that comes in that maybe feels ironic, right? Like a contradiction you weren't expecting. It surprises. It points out something.

It destabilizes you a little.

I don't know where the thought first came up, but when you see a 13-foot-tall Black man named Cootie walking down the street, the last thing you're thinking about is how he feels about himself. It's all about what you want to believe and project. It leads to so many things, but specifically toward race. In this case, the title, which came later, *I'm a Virgo*, speaks to that—nobody cares. His astrological sign is the last thing on someone's mind.

Your work mines the exploitation of labor, of capital, of culture. That's a big through line in the show.

Because it's a big through line with everything we talk about in our lives. Think about it like this: What's the definition of culture? Culture is what we do to make our survival normal. Think about the drum. Or songs that we sang. All these things. This is what we do in our lives. And culture helps us do it. It gives instructions. It helps us keep existing while we do these particular things.

How does that intersect with capitalism?

So much of what we do is always going to be shaped by how we live, and how we live has to do with whatever economic structure we're in. Right now we're under capitalism. The contradictions of capitalism—how it works—are going to echo through almost everything we do.

Photograph: Simone Niamani Thompson

Both *I'm a Virgo* and *Sorry to Bother You* exist in the realm of the absurd. Has your experience in America—as someone who is conscious of the way society exploits Black people—felt absurdist?

Definitely. There was a time when the Coup got pulled over on Treasure Island, coming back from the studio, and we ended up with like 15 military police with guns standing around, yelling at me to pick up the [registered] gun [that was in the trunk of the car]. Yelling at the top of their lungs. And everybody I was in the car with was screaming like, *No, don't do it*. It's a scene that could be in a movie.

What is your earliest memory of feeling exploited?

I've had many low-paying jobs throughout my life, starting with being a door-to-door newspaper salesman as a kid, to being a dishwasher, to retail sales. But I don't think I would have translated my frustrations into feeling exploited. I didn't have the language for that. I felt like, *Fuck these people*. You know what I'm saying?

When did that language begin to crystallize?

When I was 14, I got involved in helping people who were striking, the Watsonville cannery workers. I was helping to pass out flyers. Stuff like that. Through that, I signed up to be part of this summer project that was helping out farmworkers who were trying to organize an anti-racist farmworkers union in the Central Valley. These were radical organizers. They weren't just talking about labor struggles. They had a plan.

How so?

For the anti-racist farmworkers union, the idea was, first we organize this valley and get this method of organizing popular, then we use that as a way to help create a revolutionary movement. It wasn't just like, *Oh, we're struggling to get these wages right now*. It had to do with changing the way things worked. It gave me hope. It was that sort of thing that made me look at my life differently.

This article appears in the September 2023 issue. [Subscribe to WIRED](#). Photograph: Sam Cannon

Is that what you try to do with your work—make people look at life differently?

I'm not really making stuff to just enlighten people. I think most of us feel like we know what is wrong. But most of the time the question is, can it be changed? Is there anything you can do about it? But really, my art can only go so far even with that approach. If there are no organizations out there for them to actually get involved with campaigns, for them to get involved with art or connect with people on the job to organize, then it kind of just sits there.

Your father was also a revolutionary. He worked as an anti-Vietnam War activist during his time at San Francisco State University, a housing rights advocate in Chicago, an auto industry organizer in Detroit, and later as a civil rights and criminal defense lawyer in Oakland. Did getting more involved in activism as a young teen feel fated in any way?

He actually didn't push me on any of it. I was like, "Why didn't you tell me any of this stuff?" I have seen parents push their radicalism on their kids. Because I came to it on my own, it was a lot more effective.

You once said you have a "problem with superheroes in general, because, politically, superheroes are cops." When you're young, you naturally want to rebel. Or not even rebel, but find your way. *I'm a Virgo* attempts to negotiate this specific kind of maturation. It's not your typical superhero origin story.

I was definitely obsessed with comic books as a kid. That was actually one of the motivations for getting jobs early. I was doing gymnastics. I was taking martial arts. I was throwing ninja stars and had all the books about them. I was practicing how to sneak into a room without people hearing me, like Batman. To me, this was a real thing you could do. And what that would have led me to was becoming a cop. I got saved by my next obsession, which was Prince.

Seems like a great obsession for a future musician.

After that, the next thing I got involved with was radical organizing, and these obsessions were all part of the same thing.

In what way?

For example, when you're watching TV, you're told you're nothing. People that you know are nothing. What's important are these stories, these people who are on TV. And so it could lead you to obsessing over them and feeling like that's your connection to something bigger than you.

When I did get involved in radical politics, it was because it's like, *Oh, I can be part of making history*. People want something more important for themselves. They want connection, which is very much what Cootie and Flora [Cootie's love interest] are about.

Photograph: Simone Niamani Thompson

Why has Oakland been the setting for both your projects?

I'm just a better artist when I'm around things that I know, when I'm here. I can think, like, *Oh, this would be good*. This means a certain thing to me, even if it doesn't mean a thing to someone else. Everything is more inspired.

You're able to anchor it to the world in a real way.

Exactly. There's a group of Boston filmmakers who are like that. There's New York filmmakers—Jim Jarmusch, Noah Baumbach, Woody Allen, Spike Lee. Especially right now, when everything is so mix-and-match. Like anything could be anywhere. I think something becomes more universal the more specific it is.

One of the major plot points in the series is the denial of housing. Oakland saw an 83 percent increase in homelessness from 2017 to 2022. Black residents account for 60 percent of the city's sheltered homeless population, despite constituting 23 percent of the city's population. Art can bring these issues to people's attention. What else can be done?

Immediately there can be rent control laws. San Francisco has 60,000 vacant units. Oakland has 10,000 vacant units. And they're keeping them empty. What the prices are aren't what the market can bear. So a lot of the

YIMBY people have been like, *Just let development happen and that will be what brings it down*—but what we see is, no, if you don't have rent control laws, rates go up.

What else?

Public housing. You know, there was a big campaign in the media in Hollywood against public housing from the '70s until now, as if it was a trap as opposed to something liberatory. But we need those things. People need a real safety net. Oakland has 5,000 homeless people in a population of more than 400,000. A lot of those people are still living in the neighborhood. They're just living in vans.

But these are things people have been calling out for a long time. Like even in the '90s, there were all these respectability politics campaigns that were being put on by like, Black elite, Black elected leadership in Oakland.

Right.

Usually they use the catchphrase “affordable housing” as opposed to “low-income housing,” because affordable housing goes off the median income. So you have to make a percentage of that. We’re not going to legislate income. It’s only going to come from there being an organized working class that can fight. The kind of contract we need is one that attaches pay raises to inflation.

Don’t I know it. WIRED fought for that in our own union.

That’s why people are down to fight. With the Writers Guild, the reason we have solidarity from the Teamsters and IATSE [International Alliance of Theatrical Stage Employees] is people want to win. People are risking immediate money because they want things to get better. In 2007, IATSE and Teamsters crossed the picket lines. But not this time.

You’re in the Writers Guild of America and the Directors Guild of America. The DGA just reached a tentative deal, but the WGA has been on strike for weeks. Was this inevitable?

I don't know if this particular strike was inevitable. What the AMPTP [Alliance of Motion Picture and Television Producers] is trying to put forward is a message that you're not going to be able to have a say in how we do things. And I think they underestimated how willing we are to fight, because what I'm hearing from people that know folks at the studios is they thought, *Oh, the writers will be fatigued by now.*

I mentioned that to a colleague recently, how we're seeing mass labor strikes across multiple industries. Everyone is fed up.

According to [Payday Report](#), which tracks strikes via local news, there has been, over the past three years, at least 2,918 strikes and work stoppages. Some of them might not be a full strike, some of them might be a couple of days' work stoppage when they get their deal. This is one of the biggest since the 1970s.

Have there really been that many?

The reason it's not called out in bigger ways is that in 1982, the Bureau of Labor Statistics, the official US figure, started counting only work stoppages of 1,000 people or more, which is just a way to hide figures. If you think about it, the fictional strike in *Sorry to Bother You*, that was only 500 people. That wouldn't have counted. Even if people don't see those numbers, like you said, they feel it. There's a new way people are looking at handling issues of inequity.

Is the business of Hollywood broken?

I wouldn't call it broken. It's working like they want it to. They're making an unprecedented amount of money. And they're doing it by paying the people who make the products that help them make that money less, and giving less control over it. That's the way all business works.

Now, the question is—does it work for creativity? Does it work for people? Does it create a healthy environment for either the production of culture or a shared ownership between the folks that produce the culture and the culture? No, it doesn't.

WIRED30

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Jason Parham

***I'm a Virgo* has a decidedly anti-capitalist message. But it is being released by Amazon, a billion-dollar corporation with a terrible labor record. How do you reconcile that?**

Well, I'm trying to get out there in front of as many eyes as possible. So that means I'm going to be dealing with some people that do things I definitely disagree with.

The Coup's first album came out on EMI Records, which people don't hear about anymore because they've dissolved into a bunch of different companies, but they were a multinational corporation that was involved in all sorts of exploitative things. My last movie was done with money from Oracle, which is owned by Larry Ellison. He does things not only in his business practices that I would disagree with, but also separately fundraised for Trump.

Have you always thought about it this way?

I've never been someone who has put forth the idea that we can make this gentler capitalism. I've always been someone that said we have to get rid of capitalism. And that there is a specific way to go about it, which I talk about directly in the show—but that means organizing on the job. So I want people to organize on the job, whether that's in a Disney sweatshop making

cute stuffed toys or an Amazon warehouse. The idea that you can kind of boycott the parts of capitalism you don't like just plays into the belief that capitalism would be better if there were just better people on top.

So again, how do you reconcile that?

That means right now what we have to do is organize a labor movement, a mass militant, radical labor movement starting at these places. So yeah, I need to get to as many people as possible. And that means one of these big companies.

Is there such a thing as too far, for you?

I have different lines. I turned down a big Taco Bell commercial some years ago, which would have been ridiculous. They actually made the commercial and showed it to me, like, *We're going to offer you so much money*. I was like, no, I'm not doing it. So many people around me were angry with that. The argument that was said to me, even though I didn't do it, was, *Your songs play on the radio right next to a Coca-Cola ad*. But that's where my line is.

Is that part of the problem—people don't know where their line is?

It takes time. People figure out where their line is based on what they want to see happen in the world. I want to see a mass militant radical labor movement that could turn into a revolutionary one. So based on that, there are things that I will and won't do. But often because there hasn't been that movement, many of us don't know what we want.

Going into *I'm a Virgo*, were you clear on what you wanted to achieve?

I have to do something that feels new to me. I would never go into it being like, *I want something that feels comfortable to people*. There are some people that do honestly go into it with that mindset, and there's nothing wrong with that. It's just not where I came from, especially coming from music.

Is being a musician like being a filmmaker?

There was a time when I wanted to sound just like Ice Cube, like fuck—how do they do that? Luckily for me, I didn't know how. After I accepted how I sounded, I was able to lean into it a lot more. Even though the Coup was sometimes on major labels, we never had big money for promotion. So I had to have something people gravitated to. So that was the thing. This is more money than I ever thought I would make in the first place. So I'm good. I can get fired, whatever.

Let us know what you think about this article. Submit a letter to the editor at mail@wired.com.

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By [Maria Streshinsky](#)

[Backchannel](#)

Jun 20, 2023 6:00 AM

How Christopher Nolan Learned to Stop Worrying and Love AI

The *Oppenheimer* director says AI is not the bomb. His new movie might still scare you shitless.

Photograph: Magnus Nolan

When wired heard that Christopher Nolan and his producer—and wife—Emma Thomas were coming out with a biopic of J. Robert Oppenheimer, we were perplexed. At least for a moment. It is hard for WIRED to resist a Nolan–Thomas film. Nolan has a real love of science, just like us. (We know this because, well, it's pretty obvious in some of his movies, but also because Nolan [guest-edited](#) an issue of WIRED back in 2014 when his film *Interstellar* came out and we got him to geek out over physics.) Add to that, the duo like to bend their audience's minds. And their eyeballs. They make superhero movies! It's so much chum for WIRED.

So, [Oppenheimer](#). A biopic, a look back at history. Alas. WIRED parlance is more often about looking *ahead*. (Not that we didn't like *Dunkirk*.) So we kinda thought maybe we weren't the magazine to dive into this one.

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But we couldn't get the idea out of our minds, because so many conversations in the office and in meetings and around technology were about the potentially apocalyptic time we are living in. Climate, war, yes. But also, [generative AI](#). Over and over, I was hearing people compare this

moment to the mid-1940s, when we stepped across the threshold into the nuclear age, or to the years when Oppenheimer was heading up the project to build the bomb in New Mexico.

Here comes the full disclosure: I know something about Oppenheimer, and his path to Los Alamos. I helped edit a [biography about him](#) and three women who were central to his life, written by my mother, Shirley Streshinsky, and the historian Patricia Klaus. I started to want to know what Christopher Nolan thinks of the time we are *in*, considering he has spent his last few years steeped in the time so many people kept *referring* to. Perhaps Nolan and Thomas line up with WIRED interests all over again.

The Big Interview

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So I headed to LA, to a quiet neighborhood where the couple keep an office. I had hoped to talk to them both, and as I entered a glass-walled, stylish conference room overlooking a garden, happily, Thomas was standing there too. I burbled something about how often her name gets left out of interviews. She thanked me for that. Turns out she couldn't stick around. But toward the end of my conversation with Nolan, he told me, "Everything we do is in lockstep. I mean, she's the best producer in Hollywood, without question." And their latest film, though it's set firmly in the past, might just be their most forward-looking yet.

MARIA STRESHINSKY: Maybe this is presumptuous, but looking at your films in reverse, it feels like your and Emma's work has been, all the while, leading up to *Oppenheimer*. In ways, it makes so much sense.

CHRISTOPHER NOLAN: I don't think that's at all presumptuous. It's how I feel about the film.

(Also, I don't mean to say your career is over.)

I've tended to feel this way with every project I've done. Because I'm trying to build on what I've learned before. Every time you finish a film, there are questions left hanging. And so with the next film, you kind of pick up the

thread. In the case of *Oppenheimer*, very literally, there is a reference to Oppenheimer in *Tenet* [Nolan's previous movie].

So he's been in your head for a while.

Oppenheimer's story has been with me for years. It's just an incredible idea —people doing these calculations, and looking at the relationship between theory and the real world, and deciding there's a very small possibility they're going to destroy the entire world. And yet they pushed the button.

It's very dramatic.

I mean, it's literally the most dramatic moment in history. In history.

A lot of people may not know that when we dropped the bomb in 1945, it was not only a horrifying moment but maybe also the one in which it was understood that humans could now wipe out all humanity.

My feeling on Oppenheimer was, a lot of people know the name, and they know he was involved with the atomic bomb, and they know that something else happened that was complicated in his relationship to US history. But not more specific than that. Frankly, for me, that's the ideal audience member for my film. The people who know nothing are going to get the wildest ride. Because it's a wild story.

His personal story, you mean.

And they need to, because, you know, he's the most important man who ever lived.

You have a line in the movie, someone says to Oppenheimer, *You can get anybody to do anything*. Something like that. He was a brilliant manager. He was brilliant at knowing, in that room, those scientists are doing x, and in that other room, those scientists are doing y. He was the one who could keep it all in his mind.

He knew how to motivate people through the theatricality of his persona, the projection of his own brilliance. He gave all the scientists and officials

and everyone a focal point.

He had real charisma.

Charisma. That's the perfect word. It made it all come together. The film deals with this a lot, the idea that these academics, these theorists could come together and build something with their own hands of this magnitude, of this importance. It's miraculous.

The photographs of Nolan for this interview were taken by his teenage son Magnus.

Photograph: Magnus Nolan

Speaking of building something of magnitude, I was at the TED conference in Vancouver recently, and one of the most interesting sessions was a series of talks about generative AI. So many of the speakers mentioned the atomic bomb, nuclear weapons. The last speaker was a technologist—who happened to grow up in Los Alamos, by the way—who talked about the inevitable growth of the use of AI in weaponry. He ended his talk by saying that the only way to keep world order was to have better AI weapons. That it was a deterrent. Which sounded a lot like how people thought of the atomic bomb. Feels like you couldn't have planned your film release for a better time.

I think the relationship is an interesting one. It's not the same. But it's the best analogy—which is why I used it in *Tenet*—for the dangers of unthinkingly unleashing a new technology on the world. It's a cautionary tale. There are lessons to be learned from it. Having said that, I do believe the atomic bomb is in a class of its own as far as technologies that have changed and endangered the world.

And the origins of these technologies weren't the same.

There is a fundamental difference. The scientists dealing with the splitting of the atom kept trying to explain to the government, *This is a fact of nature*. God has done this. Or the creator or whoever you want it to be. This is Mother Nature. And so, inevitably, it's just knowledge about nature. It's

going to happen. There's no hiding it. We don't own it. We didn't create it. They viewed it as that.

In other words, they felt they were just revealing something that was already there.

And I think you'd be very hard-pressed to make that argument about AI. I mean, I'm sure some will.

Oppenheimer is told mostly from the perspective of its title character—played by Cillian Murphy.

Photograph: Melinda Sue Gordon/Universal Pictures

You must've grown up in the shadow of the bomb.

I grew up in the 1980s in the UK, and we had the Campaign for Nuclear Disarmament, all that. People were very, very aware. When I was 13, me and my friends, we were convinced we would die in a nuclear holocaust.

But you didn't, and the world moved on.

I was talking to Steven Spielberg about this the other day. He grew up under the threat of the Cuban Missile Crisis in the '60s. Same thing. Absolutely. There are times in human history when the danger of nuclear warfare has been so palpable and tactile and visible to us that we're very aware of it. And then we can only be worried for so long, and we move on. We worry about other things. Um, the problem is that the danger doesn't actually go away.

Right. I mean, I feel like a month ago we were all worried that Putin might be serious about using a nuclear weapon.

What I remember from the '80s is that the fear of nuclear war had receded in favor of fear of environmental destruction. It was almost like we couldn't sustain the fear of it for that long. We have a complicated relationship with our fear. And yes, Putin has been using that doomsday threat and that fear to saber-rattle. It's extremely unnerving.

As unnerving as the threat of an AI apocalypse?

Well, the growth of AI in terms of weapons systems and the problems that it is going to create have been very apparent for a lot of years. Few journalists bothered to write about it. Now that there's a chatbot that can write an article for a local newspaper, suddenly it's a crisis.

We, folks in the media, have been doing that for years. Navel-gazing. Some of us are writing about AI because it can put us out of a job.

That's part of the problem. Everybody has a very—call it a partisan point of view. The issue with AI, to me, is a very simple one. It's like the term *algorithm*. We watch companies use algorithms, and now AI, as a means of evading responsibility for their actions.

Say more about that.

If we endorse the view that AI is all-powerful, we are endorsing the view that it can alleviate people of responsibility for their actions—militarily, socioeconomically, whatever. The biggest danger of AI is that we attribute these godlike characteristics to it and therefore let ourselves off the hook. I don't know what the mythological underpinnings of this are, but throughout history there's this tendency of human beings to create false idols, to mold something in our own image and then say we've got godlike powers because we did that.

That feels very, very right now. Like we're at that tipping point.

Exactly.

After the Manhattan Project, Oppenheimer worked with Einstein (played by Tom Conti) at the Institute of Advanced Study.

Photograph: Melinda Sue Gordon/Universal Pictures

With these large language models, the machines might even be able to teach themselves the next step.

There was an interesting article in the *LA Times* about ChatGPT and OpenAI. It basically said it's a sales pitch, that they're a private company now. And they have the greatest sales pitch in the world, which is, *This is a really dangerous thing. Maybe we shouldn't put it out there.* So now everyone wants it. Doesn't mean there isn't a real danger here, because I feel that there is. But I personally, and this is just my opinion, I identify the danger as the abdication of responsibility.

People keep saying there needs to be a governing body for this stuff. They say you all need to deal with it. Like *you* governments. There should be an international agency.

But that's the oldest political trick in the book of the tech companies. Right? That's what, you know, SBF was doing with FTX. Zuckerberg's been asking to be regulated for years. That's the oldest political trick. 'Cause they know that our elected officials can't possibly understand these issues.

As we see from congressional hearings.

And how could they? I mean, it's very specialist stuff, and it's incumbent on the creators and Oppenheimer—to bring it back to Oppenheimer—

Please do.

Because it's an interesting conversation. The thing with Oppenheimer is that he very much saw the role of scientists postwar as being the experts who had to figure out how to regulate this power in the world. And when you see what happened to him, you understand that that was never going to be allowed to happen. It's a very complicated relationship between science and government, and it's never been more brutally exposed than in Oppenheimer's story. I think there are all kinds of lessons to be learned from it.

Such as?

So he tried to work from within the establishment and not just turn around and say, you know, what we need is love or whatever. He was very practical in his approach, but he still got crushed. It's very complex, and I think from

our inventors now, it's very disingenuous for them to say, "We need to be regulated."

There was a moment when Oppenheimer wanted the science to be shared.

Candor was the word he used. Candor.

That seems to have shifted with the H-bomb, or do I have that wrong?

No, no, he believed it about the H-bomb as well. He—I mean, it's funny talking about it, because in a way these are spoilers for the film. But in another way it's history, you can Google it. There is this important moment where, as the H-bomb program gears up, he took to making speeches where he would say, *I wish I could tell you what I knew. I can't. If you knew what I knew, you'd understand that we all have to share information.* It's the only way we'll not destroy the world, essentially. So candor was what he viewed as the most practical means of that. We were all coming together, and he viewed the UN as being a powerful body in the future, with real teeth. He viewed international control of atomic energy as the only way to ensure world peace. That hasn't happened, obviously.

Nolan calls himself "very much the old analog fusty filmmaker."

Photograph: Melinda Sue Gordon/Universal Pictures

He didn't foresee what's happening now, the slow decline of democracies. The rise of autocracies. The North Koreas.

I don't think he saw that at all. It was a very optimistic moment.

That's what I worry about with the talk of needing a worldwide governing body for AI. We have nonstate actors, or state actors ...

Right. But that's the thing in dealing with tech companies who have refused to be bound by geographical limitations. Systemically, tech companies are encouraged and enabled to circumvent government regulation. It's an ethos. By the way, I'm coming across like I think that Silicon Valley's evil and all

these people are terrible. I don't. It's just the system. It's just the way it works.

Plus, there's an odd element of, well, *safety* I guess, with nuclear weapons, because you have to have specific ingredients to build a bomb. That's very different than facing the potential of supercomputing.

During World War II, the British program for their bomb was very sophisticated. They had a lot of great scientists. But Churchill and his government realized they just didn't have the resources. So they gave the Americans everything they had. They said, *You have the size, the distance from the front line, the industrial base*. I read a statistic at some point in my research about the number of Americans who were involved in making the first atomic bomb. It was something on the order of 500,000. It was all these companies. It was a massive physical process, which is why to this day it's easy to spot when a country's doing it. So there's certain things that give us a bit of reassurance that the process can be managed. And I don't think any of this applies to AI.

No, I don't think it does—especially when some of what we're talking about with AI is a softer threat. Disinformation on hyperspeed, technological unemployment.

It is, but I'm less—I feel that AI can still be a very powerful tool for us. I'm optimistic about that. I really am. But we have to view it as a tool. The person who wields it still has to maintain responsibility for wielding that tool. If we accord AI the status of a human being, the way at some point legally we did with corporations, then yes, we're going to have huge problems.

Are you seeing anything in AI that could be wonderful for, in particular, filmmaking?

Oh definitely. The whole machine learning as applied to deepfake technology, that's an extraordinary step forward in visual effects and in what you could do with audio. There will be wonderful things that will come out, longer term, in terms of environments, in terms of building a doorway or a

window, in terms of pooling the massive data of what things look like, and how light reacts to materials. Those things are going to be enormously powerful tools.

Will you take advantage, personally?

I'm, you know, very much the old analog fusty filmmaker. I shoot on film. And I try to give the actors a complete reality around it. My position on technology as far as it relates to my work is that I want to use technology for what it's best for. Like if we do a stunt, a hazardous stunt. You could do it with much more visible wires, and then you just paint out the wires. Things like that.

It'll improve the ease and efficiency of visual effects, you're saying.

It's not starting from nothing. It's starting from a much more detailed and data-driven idea. It might finally break the barrier between animation and photography. Because it's a hybrid. If you tell an artist to, say, draw a picture of an astronaut, they're inventing from memory or looking at references. With AI, it's a different approach, where you're actually using the entire history of imagery.

Using actual images.

Using actual images, but in a completely, fundamentally rebuilt manner—which of course raises significant artists' rights issues, and that will have to be dealt with.

Let's get back to science and your films. In the December 2014 issue of WIRED that you guest-edited, there was a line where you said, “The relationship between storytelling and the scientific method fascinates me. It wasn't really about an intellectual understanding. It was a feeling of grasping something.” Talk to me about your love of science.

Well, I've always been interested in astronomy, in questions of physics. I got to explore that in *Interstellar*. When my brother wrote the script, he would look at Einstein's thought experiments, and he identified a particular melancholy that some of them had. It's all to do with parts in time. All to do

with, like, twins who get separated and one goes away and comes back and the other's older, you know? There's a very literary quality to Einstein onward in terms of thinking about physics and how you would do these thought experiments, how you conceive of these ideas and how they work. The process of visualization that physicists need isn't so different from a literary process.

Do you feel something like that at the editing stage of a film?

I feel it at every phase, at every phase. A lot of my job is trying to articulate instincts and feelings about the shape of things. It can be difficult and complicated.

I find that if I'm working on a story and I don't know the structure, I don't know the flow, something's wrong. I can't speak of the piece in a way that makes sense.

There's a geometry or a geography. I think in very geographical terms or geometric terms about structures and patterns. Over the years I've tried adopting a sort of ground-up approach to structure, but ultimately it's very much an instinctive process: Does the feeling have the shape of a narrative, and how does that come together? And I was fascinated to realize that physicists have a very similar process going on. It's really fun.

Maybe this is a nod to *Interstellar*, but physicists always seem so in love. In love with physics, that is.

I'm passionately committed to truth. I love the scientific method. I hate to see it distorted either by scientists in the media or by media speaking for scientists. The pure scientific method, the idea that science seeks to disprove itself constantly, it so elevated human thinking beyond any other form—religion, whatever—that we've chosen to engage in as a species.

Before this interview, my mom and I watched some of your films together—because of her book, she was curious about what you'd do with Oppenheimer—and at one point she said it feels like your movies can have a very anti-nihilistic message. *Dunkirk*. *Interstellar*. *Batman*. Or, is it optimism?

I mean, the end of *Inception*, it's exactly that. There is a nihilistic view of that ending, right? But also, he's moved on and is with his kids. The ambiguity is not an emotional ambiguity. It's an intellectual one for the audience. It's funny, I think there is an interesting relationship between the endings of *Inception* and *Oppenheimer* to be explored. *Oppenheimer*'s got a complicated ending. Complicated feelings.

How are early viewers reacting?

Some people leave the movie absolutely devastated. They can't speak. I mean, there's an element of fear that's there in the history and there in the underpinnings. But the love of the characters, the love of the relationships, is as strong as I've ever done.

And the complexity of the subject matter.

Oppenheimer's story is all impossible questions. Impossible ethical dilemmas, paradox. There are no easy answers in his story. There are just difficult questions, and that's what makes the story so compelling. I think we were able to find a lot of things to be optimistic about in the film, genuinely, but there's this sort of overriding bigger question that hangs over it. It felt essential that there be questions at the end that you leave rattling in people's brains, and prompting discussion.

I have a strange question, a weird one. My husband fought cancer for four years. Since he died, I'm so raw, emotionally. My head is a mess. I worry about the world's ills, the people in war zones, the cats that are not being fed, all of it. I know this is far from the same, but I've been thinking, what would it have been like to be in Oppenheimer's head before—and god, after—the bomb was dropped? What do you think it was like to be in his head?

It's not a strange question at all. The answer is very much in the film. I wrote this script in the first person. It's what I told Cillian [Murphy, who plays Oppenheimer]: *You are the eyes of the audience*. And he takes us there. The bulk of the storytelling, we don't go outside his experience. It's my best attempt to convey the answer to that question.

Nolan and his dog, Charlie, in Los Angeles.

Photograph: Magnus Nolan

I'm a little nervous about seeing the whole thing.

I think you might have to wait a long time before you do. It is an intense experience, because it's an intense story. I showed it to a filmmaker recently who said it's kind of a horror movie. I don't disagree. It's interesting that you used the word *nihilism* earlier, because I don't think I'd quite managed to put my finger on it. But as I started to finish the film, I started to feel this color that's not in my other films, just darkness. It's there. The film fights against that.

Does that get into you? Do you sleep OK?

I do now that I—you know, I was relieved to be finished with it, actually. But I enjoy watching the film tremendously. I think you'll understand when you see the film. It's a complicated set of feelings to be entertained by awful things, you know? Which is where the horror dimension comes in.

Have your kids seen it?

Oh yeah.

Had they known anything about Oppenheimer before?

I told one of my sons about it as I started to write it, and he literally said to me: *But nobody really worries about that anymore*. Nuclear weapons. Two years later, he's not saying that. The world's changed again. And that's a lesson for all of us, but particularly for the young. The world changes fast.

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By [Paul Ford](#)

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Jun 15, 2023 7:00 AM

My Father's Death in 7 Gigabytes

Dad spent decades writing weird, experimental literature. His last wish:
Upload it all to the Internet Archive.

Illustration: Twisha Patni

It was a reasonable death. He was 90 and took the inevitable final turn in late March. “I think this is it,” my brother said from the nursing home. “They brought in the snack cart.”

I went to Baltimore and fished a ginger ale out of a bowl of melting ice and sat by the bed. My father, dying, came in and out of stillness. He couldn’t hear well, so my brother and I yelled a stream of non sequiturs: “Remember when you ran that marathon?” “Ivy is doing a ballet recital!” “We love you!” I reminded him that he had wanted me to [put all his writing online](#). “I’m going to do that!” I said. He looked straight at me—a last moment of connection—and brightly lit up. “That’s great!” he said. (Or something along those lines. His teeth were in the bathroom.)

Dad wrote opaque, elliptical, experimental works of enormous profanity. One of his plays was produced with fanfare in the 1970s, and many poems were published here and there, but most of the manuscripts were returned with polite rejections. He came of age, though, in an era of great writers writing greatly. You stuck to your guns and waited for people to figure you out, and if they didn’t, even after decades—their effing loss, buddy. The upshot was 70 years of writing on crumpling yellow onionskin, dot-matrix prints with the tractor feeds still attached, and bright white laser output, along with more than 10,000 ancient WordPerfect files and blog entries, including many repeats. Now all mine to [archive](#).

I thought, briefly, about just not doing it. What could he say? What could anyone say? It wasn't as though the internet was clamoring for the papers of a little-known English professor who retired in the mid-1980s. But a friend who's a classics scholar told me that this is exactly the stuff people should be digitizing. Vellums and parchments will survive another 1,000 years. We should save the ephemeral before it is lost. What was more ephemeral than this? Plus: A promise is a promise.

So one night I tore the tape off the boxes. I made a "Frank" folder on my computer's desktop and got out my sheet-fed scanner, usually reserved for taxes. My father and I had spent maybe 10 days together in the previous two decades, funerals included. This would be the most we'd hung out in years.

There are good and correct ways to digitize an archive, according to the Library of Congress. The guidelines make for soothing reading: A diligent archivist might capture uncompressed 24-bit color TIFFs at 600 DPI, filling up disk space with every detail on every page, just in case some secret of the universe is scribbled in a margin. The goal is to be as *lossless* as possible. Preserve every pixel of that medieval manuscript.

But it is *lossy* compression that makes the world go round—[Spotify](#) songs and [Netflix](#) shows and [JPEG images](#). The algorithms strip away some of the original file's audio frequencies or color spectra, anything on the margins, and squeeze down what is left into a simulacrum good enough to get the job done.

I set my scanner for JPEGs at 70 percent compression, then assembled them into PDFs. Fast and cheap. I also took photos of various ephemera with my phone at god-knows-what resolution. Not every version of every poem would survive. But I'd do my best to preserve the words themselves.

I began to rip the hell out of his folders. Unbinding, yanking, feeding stacks through the scanner and watching some originals crumble as they came out the other side. It felt good being a bad librarian. A little destructive, drunken joy. (A large bottle of bourbon vanished over two weeks of night scans.) *Ah well, Dad! What are you going to say now?* I put many duplicate manuscripts in the recycling bin, at first relishing the idea that this heavy,

heavy paper would go out of my life, and then, as I pulled the bag to the curb, well—lossy.

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But that was just the atoms. Dad also left a lot of bits. There was his daily poetry blog, which I spidered and parsed into a many-thousand-page virtual book. That was easy enough, one night’s work. He also wrote flash poems for decades—a few lines a few times a day, one file per thought, yielding thousands of documents with names like POEM12A.WPD, inside of hundreds of folders with names like COPYAAA.199. I loaded them into a database and threw away all the duplicates. I converted the remainder into more modern, tractable LibreOffice files. That format would preserve all the tabs and spaces that were so important to my father. He was a devotee of white space.

I intended to organize the flash poems into one volume per year, but the time stamps were screwy after decades of moving files between computers. I loved my father, but not enough to undertake thousands of forensic poem investigations. So I fulfilled my filial duty through batch processing. I used all the wonder-tools at my disposal: text-chomping parsing code and Unix utilities galore; Pandoc, which can convert anything to text; SpaCy, a Python natural language library that can extract subjects and tags (“New Haven,” “God,” “Korea,” “Shakespeare,” “Republican,” “Democrat,” “America”). I decided that my father wrote two things—Poems, which are less than 300 words, and Longer Works, which are longer. I let the computer sort the rest.

My father’s last decade was one of relentless downsizing, from apartment to assisted living to nursing home, shedding belongings, throwing away clothes and furniture. And at the end: Two boxes and a tiny green urn. The ultimate zip file. After I parsed and processed and batched his digital legacy, it came to 7,382 files and around 7 gigabytes.

The sum of Frank took two days and nights to upload to the Internet Archive, at a rate of a few files per minute. I wonder what the universe will

make of this bundle of information. Who will care? Scholars of short plays about the Korean War? Sociologists studying 1930s Irish childhoods? I am sure his words will be ingested, digested, and excreted as chat by untold bots and search engines. Perhaps they'll be able to make sense of all the modernist imagery. At least he'll have slowed them down a little. In time, we all end up in a folder somewhere, if we're lucky. Frank belongs to the world now; I released the files under Creative Commons 0, No Rights Reserved. And I know he would have loved his archive.

The two boxes have become one, taped back up and placed in the attic. No one will worry about that box besides me, and one day my inner bad librarian may feel ready to throw it away. All the digital files are zipped up in one place too—partly because I don't want his poems to show up every time I search my computer for something. Tomorrow I head to the interment, just my brother and I, and the green urn, too, will be filed away into the ground. I am glad this project is over, but I ended up welcoming the work, guiding these last phases of compression. My father needed a great deal of space, but now he takes up almost none. Almost. Death is a lossy process, but something always remains.

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[Rachel Nuwer](#)

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The Psychedelic Scientist Who Sends Brains Back to Childhood

Kids soak up new skills, adults not so much. But neuroscientist Gül Dölen might have found a way—with drugs—to help grown-ups learn like littles.

ILLUSTRATIONS: JON HAN

About a month into the 2020 [pandemic](#) lockdown, Gül Dölen, a neuroscientist, noticed that she had come untethered from reality. “Everything felt sort of swooshy,” she says, as if she was in an “altered, mystical state.” She wasn’t constantly obsessing over her lab at Johns Hopkins University. She chilled out. And for the first time in her life, she found she could meditate for a good 45 minutes at a time.

This article appears in the September 2023 issue. [Subscribe to WIRED](#). Photograph: Sam Cannon

Her senses were unusually sharp too. On long walks under the monochrome slab of Baltimore’s April sky, she felt hyper-attuned to the natural world. She smiled at the turtles poking their heads out of the inky water of Fell’s Point. She reveled in the crickets’ evening chorus on eerily empty streets. When she happened across a fallen bird’s nest with a broken egg inside, she came close to tears as she imagined the “deep, deep pain of the mother bird.”

She felt like she was [on drugs](#). Or on a spiritual excursion, experiencing what an enlightenment-seeking Zen monk might find sitting alone in a cave. One day, she grabbed a pen and started to crank out haikus. One of her

favorites nods to the writer Aldous Huxley's mescaline-induced notion, immortalized in *The Doors of Perception*, of being one with a chair:

By asymptotics
The distance between us is
infinite and none

The poem gets at a simple, profound notion in physics—that the particles making up Huxley and those of a chair always mingle, whether the two are rooms apart or butt-smashed-to-seat. That's how she felt, too, as if the rules that had always governed her perceivable reality were blurring with those of a different plane of being. In the midst of this creative explosion, she had an epiphany. The extreme isolation of lockdown might have tipped her into an exceptional brain state. Absurd coincidence, if true. Dölen has spent much of her career studying this exact state: a time of heightened receptiveness, usually in childhood, called a critical period.

Critical periods are well known to [neuroscientists](#) and ethologists, because they lay the groundwork for a creature's behavior. They are finite windows of time, ranging from days to years, when the brain is especially impressionable and open to learning.

It's during a critical period that songbirds learn to sing and humans learn to speak. There are critical periods for walking, seeing, and hearing as well as bonding with parents, developing absolute pitch, and assimilating into a culture. Some neuroscientists suspect there are as many critical periods as there are brain functions. Eventually, all critical periods close, and for good reason. After a while, extreme openness becomes inefficient, or downright dysfunctional.

Floating through downtown Baltimore like a disembodied spirit, or sitting alone at her kitchen table eating rolls of nori filled with peanut butter and jelly, Dölen realized she'd been spending too much time worrying about her career, and not enough time on her simple love of science, and her sometimes outlandish-seeming questions. Like the one she was contemplating now: If she could reopen critical periods, what mind- and life-altering changes might come about?

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She believed that if she could crack the code of critical periods—how to trigger them, how to do so safely, what to do once they’re open—vast possibilities awaited. People who lost their vision or hearing might regain those senses. [Stroke](#) patients might recover movement or relearn to speak. Might an adult learn a new language [or musical instrument](#) with the ease of a child? Scientists have spent decades trying to safely and easily nudge the brain into these states, with little to show for it. They’d managed to reopen a vision-related critical period in mice—but only by first suturing shut the animals’ eyelids. Their methods were not exactly human-compatible.

Just before lockdown, Dölen had begun to think she was on the cusp of an answer—something she describes as the “master key” for reopening critical periods. It was something Indigenous cultures had recognized for millennia as able to provide healing and growth. The key, she suspected, was [psychedelic drugs](#).

The West was [only starting](#) to [tap into their therapeutic power](#), and now, Dölen might have a scientific, brain-based explanation for how they help people heal. Finding that answer, Dölen realized in her “very, very altered state” of pandemic consciousness, was “the thing I had to come back down to Earth to finish.” With that realization, something in her seemed to shift. She returned to her default state of consciousness, but with a renewed commitment to boldly follow her curiosity, wherever it might lead.

Dölen traces her obsession with science to when she was 8 years old and first encountered a [sea urchin](#) while on vacation in Turkey. It was freshly plucked from the Mediterranean Sea and cradled in her grandmother’s hands. The otherworldly creature was jet black and covered in aggressive spikes that reminded Dölen of the cactuses back home in San Antonio, Texas. Her grandmother pointed out the urchin’s remarkably humanoid teeth, and vibrant orange innards. Dölen felt as though she’d been transported to another planet.

That day on the beach in Antalya, her grandmother introduced her to the strangeness of the natural world. “That’s how I’ve been lured into science,” Dölen says, “through that childlike wonder and amazement.”

In college, she was drawn to “the big questions,” as she puts it, about the nature of consciousness and humans’ place in the cosmos. She designed her own major, “comparative perspectives on the mind”—a grab-bag of philosophy, neuroscience, Eastern religion, linguistics, and art. She was most attracted to neuroscience. Exciting new methods were becoming available. Genome editing, neuron culturing, genetic engineering: Neuroscientists suddenly found themselves able to explore the brain in previously unimaginable detail. “Everyone could feel it,” she says. “There was about to be a big, molecular revolution in neuroscience.”

In one of Dölen’s favorite classes, Drugs, Brain and Behavior, she learned that psychedelics hijack the machinery used by molecules that occur naturally in the brain. When her professor projected side-by-side images of the strikingly similar molecular structures of the neurotransmitter serotonin and of LSD, she immediately saw how the drug might be a staggeringly powerful tool for getting at the nature of subjective reality. *Everything you think and feel, everything you think makes you uniquely alive and aware of the world, boils down to molecules*, Dölen realized with awe. Change the molecules with psychedelics and you change everything.

Yet while mind-altering drugs struck Dölen as the perfect tools for exploring the unseen underpinnings of consciousness, this was the late 1990s. “We were still very much in the middle of the War on Drugs,” she points out. So Dölen shelved her interest in psychedelics and enrolled in a dual MD/PhD program at Brown University and MIT. She joined a lab that studied learning and memory, including critical periods.

Dölen’s research focused on fragile X syndrome, a neurodevelopmental disorder that is the leading identified cause of autism. She studied a specific brain receptor and found that when she tinkered with it in a certain way—in mouse models of fragile X and autism—the animals functioned much better. People in the field thought the finding would be life-altering.

But clinical trials with human volunteers failed. “I was gutted, because I was so hopeful that it would work,” Dölen says, “but also confused because I couldn’t understand why it hadn’t.” Dölen and some of her colleagues began to suspect that it wasn’t a difference in species that thwarted the clinical trial but a difference in ages. The mice had been juveniles. The human participants had been adults. Perhaps the treatment had worked on the young mice because a relevant critical period was still open. But the scientists left their hypothesis at that.

The trial’s failure meant Dölen needed a new project. So she joined a lab at Stanford focused on studying the brain’s reward system, especially how drugs like cocaine hijack it to produce intense pleasure. She immediately noticed, however, that no one in the lab was looking at “the other most obvious natural reward,” she says, “which was social reward”—the joy that gregarious animals such as mice and humans get from being around others. At the time, not many neuroscientists were taking this subject seriously.

Her adviser was incredulous, but he agreed to let her pursue social reward. After years of painstaking work—including engineering her own specialized mice—she had her first results. Oxytocin and serotonin, she found, work together in a brain region called the nucleus accumbens to produce the good feelings that come from social interaction. Or, as Dölen summarizes, “oxytocin plus serotonin equals love.” A fine result. But Dölen was still ascending her mountain.

By the time she started her own lab at Johns Hopkins, in 2014, the field at large had caught on to the idea that social behavior was worth studying. Seeking to differentiate herself, Dölen acquired an impressive suite of fancy neuroscience tools and started looking for the next “weird, unexplored rabbit hole.” She had no idea that search would lead her to arguably the weirdest neuroscience phenomena in existence—psychedelic drugs and their effects on the brain.

In her office, Dölen keeps a collection of fossils, shells, succulents, and vintage science posters. She converted the entire wall behind her stand-up desk into a black erase board, which on a chilly December afternoon was covered in neon-marker sketches of molecular structures, brain diagrams,

phylogenetic trees, and Einstein quotes. A visitor cannot help notice, though, that the real owner of this space is the genus Octopus. Wherever the eyes land are octopus mugs and octopus artworks, octopus figurines and octopus toys. They're all gifts she received after she published a stunner of a paper in 2018.

If you've heard of Dölen before, it's probably because of [that study](#). In it, she dosed a handful of octopuses—notoriously antisocial by nature—with MDMA, and she found that they reacted to the drug in much the same way humans do: by loosening up, dancing around their tank, and even, improbably, taking an interest in fellow octopuses. Rather than avoiding their own kind, the rolling octopuses sought out their tank mates and tried to wrap them in eight-armed hugs.

An octopus brain is more like the brain of a snail than that of a human. The octopuses' humanlike behavior in the study indicated that serotonin, the primary brain chemical that MDMA mimics, plays an ancient and fundamental role in sociality. Countless media outlets covered her paper, and Dölen became something of a folk hero in the psychedelics community. But to Dölen, the research that really matters is her work on critical periods.

Dölen probably wouldn't have found her way to it were it not for one of her postdocs, a nerdy French neuroscientist named Romain Nardou. He joined Dölen's lab after latching on to a footnote-like observation in Dölen's own postdoctoral research: The buzz that mice get from socializing seemed to diminish as the animals got older, a strong hint that a critical period might be involved. But when Nardou told Dölen he wanted to explore that observation—and look into how oxytocin signaling changes as mice mature—Dölen's initial response was "meh."

For starters, she told him, the study he was proposing seemed too technically basic to be of much interest. "I want you to do something that's going to take advantage of all the technical whizzbangery we have," she said.

Nardou was stubborn. "I'm sure it's gonna be cool," he insisted. Eventually, Dölen agreed to give it a try.

In 2015, Nardou began meticulously gathering data. His experiment was based on a simple, well-established protocol: Mice are put in an enclosure with one type of bedding and given access to cocaine (or some other desirable drug). Then they're moved elsewhere, with different bedding and no cocaine. Later, the mice show a clear preference for hanging out on the bedding they associate with getting high. Young mice, old mice—they all behave the same way. As Dölen puts it, "There's not a critical period for cocaine reward learning. Adults love cocaine as much as kids."

In Nardou's version of this experiment, he replaced the cocaine with other mice. After the rodents either hung out with their friends in one comfy spot or sat alone in another, he'd offer the two beddings to see if they had developed a preference. Over and over, he ran the experiment, amassing data from 900 animals across 15 ages. What emerged, Dölen says, was a "beautiful curve."

Nardou had found clear evidence of a critical period for social reward learning. Young mice—especially adolescent ones—strongly preferred hanging out on the bedding they associated with their friends. The adult mice didn't seem to give a damn about the composition of their bed. They weren't connecting it to the pleasures of company. The younger mice, in their highly impressionable state, were. "The social world is something that you learn, just like the visual or olfactory world," Dölen explains. It's not that the older mice were antisocial, just that they were no longer the equivalent of insecure, angst-y teens who form preferences based on what their friends say is cool.

She and Nardou confirmed his observations using one of Dölen's favorite tools—whole cell patch-clamp electrophysiology. You take a slice of a mouse's brain, place an electrode on the surface of a single neuron, and measure the electrical activity of that cell. When they hooked up neurons from the nucleus accumbens of a juvenile mouse's brain and exposed them to oxytocin—the hormone that Dölen, as a postdoc, had found to be involved in social reward learning—the cells responded with a jolt. The neurons of adult mice remained unperturbed.

Discovering a critical period was publication-worthy on its own, but Dölen wanted to go bigger. She wanted to reopen the critical period. She knew

from the scientific literature that the most reliable way to do so is with sensory deprivation, something that “no one in their right mind” would voluntarily submit to, she remembers thinking.

As she pondered their options, she remembered the pictures she'd seen of the dozens-strong cuddle puddles at Burning Man, where attendees were likely to be blissed out on [MDMA](#). She was also familiar with the results emerging from clinical trials using MDMA to treat PTSD, and with other scientific evidence that the drug causes a massive release of oxytocin in the brain. Could MDMA perhaps be useful for reopening critical periods too? When she ran her thoughts by Nardou—a straight-edger who is “not part of the counterculture in any way,” Dölen says—he was skeptical, but he ultimately agreed to try his adviser's idea.

Again they ran the bedding experiments—to see if mice preferred the beds where they'd hung out with friends—and this time gave the rodents MDMA. Sure enough, in the two weeks following their drug session, the adult mice behaved like youngsters, preferring the cozy paper pulp or wood shavings they associated with other animals. When, as before, the researchers checked the neurons of the adult mice, they saw they responded to oxytocin as though the cells came from youngsters.

In 2019, Dölen [published](#) these results in *Nature* and assumed that would be the end of this particular line of investigation. But for due diligence, she decided to perform the same experiment using LSD, a psychedelic that is not usually associated with hugs or cuddle puddles. That's when things got really weird.

In the corner of an equipment-crammed lab—and beneath the benevolent gazes of drug pioneers Alexander and Ann Shulgin on a poster pinned to the wall—postdoctoral researcher Ted Sawyer hunches over a set of knobs and dials that could be mistaken for a 1950s sci-fi flick control panel. A screen in front of him displays the magnified contents of a petri dish held by a nearby microscope. To an outsider, it might look like a satellite image of Antarctica after a snowstorm. To Sawyer, who's done this hundreds of times, it's clearly a 250-micrometer-thin slice of mouse brain.

Within seconds, Sawyer spots his target: the ever-so-faint outline of a neuron suspended in a sea of artificial cerebrospinal fluid. gingerly fingering one of the panel's black circular dials, he remotely maneuvers the fine tip of a glass pipette so it's just touching the cell's body in the petri dish. He leans over to the microscope, lowers his mask, and sucks on a plastic tube connected to the pipette to form a vacuum seal, which will let him measure current across the cell's membrane. A sudden jump in resistance readings on Sawyer's computer screen indicates that he's made contact. Cells are finicky, delicate things, though, and after an initial success, the readings begin to fall. He's lost it. "You just have to sit and screw up a lot," Sawyer tells me. A good day will get him maybe 12 successful measurements, each a burst of insight into whether the rodent brain that produced the cell was primed to form new social attachments or was hardened in its adult ways.

When Dölen decided to look into LSD, she knew that people under its influence often want alone time. But the data that Nardou, Sawyer, and others collected was revealing something else: LSD worked just as well as MDMA for reopening critical periods and restoring social reward learning in mice. *Well, you fucked up, do it again*, she thought, chiding herself. But it just kept happening. And then, it happened again with tests of ketamine (a dissociative), psilocybin (aka magic mushrooms) and ibogaine (a psychedelic derived from an African plant)—all drugs that don't make people feel terribly social. The critical periods of mice given cocaine, meanwhile, remained solidly shut, suggesting that there's something unique about how psychedelic drugs target the brain.

Dölen had been thinking about MDMA as "a sort of super oxytocin," she says. Now she thinks the drug's prosocial effect was a red herring. MDMA may be associated in popular culture with hugs and love, but if Dölen had, say, put the mice through an auditory exercise rather than a social one, she suspects that their auditory critical period would have reopened instead. In the vernacular, that's "set and setting"—the mental state a person is in when they trip, and their physical environment. Those contextual details explain why most people with PTSD are not miraculously cured after partying all night at an MDMA-fueled rave, but why, in the supportive environment of a therapist's office, the same drug permits them to undertake the cognitive

reappraisal needed to heal. It also tantalizingly suggests that different critical periods could be opened—not just for PTSD, but for stroke, vision or hearing correction, or acquiring a new language or skill, or any number of other things—simply by changing what a person is doing while on the drug.

Some outside evidence backs up this hunch. In 2021, for example, researchers in Austria inadvertently found that ketamine [reopens a vision-related critical period](#) in mice—but only when the K-holed rodents also engage in a visual exercise. Seeing the Austria finding, Dölen became all the more convinced that psychedelics might be the master key for reopening virtually any critical period. The drug neurologically primes a mouse (or, presumably, a person) for learning; whatever that animal ends up *doing* while on the drug determines which critical period reopens.

That an array of drugs have this potential also means that something deeper must unite these psychedelics in their ability to transfigure the mind. That deeper thing, Dölen’s findings indicate so far, happens not at the level of brain regions or neurons’ receptors, as scientists have previously thought, but at the level of gene expression. So far, her lab has pinpointed 65 genes that seem to be involved in this process, and their involvement suggests that psychedelics’ effects last well beyond an acute “high.” Piecing together the details of this mechanistic puzzle, Dölen suspects, will keep her occupied for the next decade.

Meanwhile, she’s got other big questions to chase. For one, each psychedelic activates a mouse’s critical period for a different length of time. The longer the drug trip, the longer the openness lasts—and, perhaps, the more durable the therapeutic response. A ketamine trip for a human lasts 30 minutes to an hour, and in mice, the drug opens a critical period for two days. The four- to five-hour trips of psilocybin and MDMA keep the critical period open for two weeks. LSD’s eight- to ten-hour human trips translate to three weeks of openness for a mouse. And ibogaine’s trips (36 hours in people) put mice in the open state for at least four weeks, after which Dölen stopped taking measurements.

Assuming the drugs can in fact reopen critical periods in humans, [Dölen’s work](#), which she and her colleagues published in June, suggests that the

brains of people who undergo psychedelic therapy are likely in a state conducive to learning for days, weeks, or even months after the drug has technically cleared their system. This leaves room for further gains long after they've come down, Dölen says, and suggests that people would benefit from continued therapeutic support well after their trip.

Outside experts are generally effusive in their appraisals of Dölen's findings. People often talk about psychedelic therapy functioning like a "reset button" for the mind, but until Dölen's work came out, no one could provide a scientifically plausible explanation for "how something that is so short in duration can have lasting and transformative effects that go well beyond the time period that the drug is in there," says Rachel Yehuda, a psychiatrist and neuroscientist at the Icahn School of Medicine at Mount Sinai in New York City. Dölen's findings, she adds, are "what our field needs—we need some new ideas."

There is, of course, a catch. For mice, having a critical period open for too long causes neural disruptions. Some experts fear that, for people, carelessly flinging wide the doors of personal development could put the very core of their identity in jeopardy by erasing the habits and memories that make them *them*. A critical period is also a time of vulnerability. While childhood can be filled with wonder and magic, children are also more impressionable. "We can really screw kids up much more than we can adults," she says. This is why responsible adults intuitively know to protect children from exposure to potentially scary or disturbing material. Or, as Dölen puts it, "You want to teach children new things, but you don't want them to learn Japanese from Japanese porn."

An adult who undergoes this kind of treatment to heal PTSD could, in the wrong hands, end up traumatized further. In the worst scenarios, patients could be vulnerable to abuse. Unscrupulous therapists or other predators could try to use psychedelics to manipulate others, Dölen says. This is more than paranoid speculation. Quite a few experts, Dölen included, think that Charles Manson's ability to completely brainwash his followers relied on the high doses of LSD he regularly gave them prior to bombarding their minds with hate-filled lectures and murderous orders.

Given all this, Dölen sees hacking critical periods with psychedelics as not inherently good or bad. She calls it a “wildly agnostic” tool.

On the wall-sized screen in front of me, a bubble or two drifts upward through the blue, and light filters in from above. Out of the murk, a swimming form emerges and comes into focus: a smiling dolphin. “Hello, my name is Bandit,” a subtitle reads. “We’re going on a very special journey today. My creators built me to heal you. Connect to me, embody me, eat the fish and sharks that nourish me.” The dolphin lets out a high-pitched squeal—a real recording, it turns out, made at Baltimore’s National Aquarium.

The surreal underwater scene is interrupted by a small square that appears in the upper left-hand corner. In it, I see myself, standing on the opposite side of the room. Red dots overlay the image of my body, indicating that a 3D-tracking camera has locked onto me. The dolphin and I are one. Moving my right hand, I cause Bandit to awkwardly veer right. Fish dart across the screen, and they’re impossibly fast for my clumsy avatar to catch. But as I sweep my hand to and fro, I begin to get the hang of it. I realize the watery realm I’m operating in is 3D, and I start to incorporate back-and-forth motions. Finally, I ram into my first fish, and Bandit happily scarfs it down. A few fish later, I’ve completed the first level. A fireworks show explodes onto the screen in celebration. The game is surprisingly addictive, and I’m disappointed that I won’t have time to see what else is in store for Bandit.

Bandit, who I became acquainted with in the Brain Rescue Unit of Johns Hopkins Hospital, is the culmination of more than a decade of effort by a multidisciplinary team of Johns Hopkins doctors, scientists, and engineers called Kata Design Studio. He was designed to help stroke patients regain movement. The 3D-tracking camera allows the dolphin to exactly mirror a patient’s movements. “We call it being jacked into the animal,” explains Promit Roy, the software lead for Kata. The game encourages patients to practice complex movements, and keep at it, simply because it’s fun.

Stroke patients have only a short window of time in which they can regain even some of what they’ve lost. Immediately after a stroke, a critical period naturally opens—and then closes some months later. No one knows why this is, but Dölen has a hunch: Just as pandemic-era isolation caused a

“radical destabilization” of the social world, a stroke causes a radical destabilization of a sufferer’s motor world. That person’s motor cortex is no longer receiving information from their muscles. So a sudden change in the motor world—a stroke—could fling open a critical period for motor skills. Dölen thinks that these naturally occurring critical periods are the brain’s way of trying to adapt to profound, existential change.

Even in the best circumstances for stroke patients, though, therapy usually only helps them compensate for lost dexterity. They don’t recover full movement. The Kata team and Dölen are now planning a study to see if adding psychedelics could help stroke patients truly recover—“an unbelievably powerful idea,” says Kata member Steven Zeiler, a stroke physician and associate professor of neurology.

If Dölen is right about psychedelics, then Bandit, when paired with those drugs, would be the environmental prompt that guides the brain to reopen its critical period for motor learning—regardless of when someone had their stroke. If this turns out to be true, then banishing addiction, treating social anxiety, restoring a damaged sense—all might be possible with psychedelics if researchers can identify the right context to open the appropriate critical period. Over a plate of mussels and onion rings at Bertha’s, a classic Baltimore dive, Dölen half-joked to me that she even daydreams about using psychedelic-assisted therapy to cure her severe allergies to dogs, cats, and horses. “Cure stroke? Naw,” she laughed. “I just want to go horseback riding again!”

For now, this is all the stuff of theory—but it’s a theory Dölen is betting on in a big way. She’s launched a new scientific group to investigate psychedelics as potential keys for reopening all kinds of critical periods. The group’s name, [PHATHOM](#), stands for Psychedelic Healing: Adjunct Therapy Harnessing Opened Malleability—a mouthful that came to her in a dream. “I woke up at 2 am and I had it, the whole acronym,” she says. She latched on to the homophone for “fathom” because of the vast sense of “oceanic boundlessness” that some people experience while on psychedelics, and because she liked the connotation of “taking something unfathomable and making it fathomable, which is what reopening critical periods is all about for me.”

She imagines a future in which psychedelics are given with any number of treatments to increase the odds of success, similar to how anesthetics are always given before surgeries, or how physical therapy accompanies a knee replacement. But, for a moment, let's set aside the practical applications.

If psychedelics really are this master key, then scientists suddenly have at their disposal an instrument for deducing the rules and boundaries that define who we are. Critical periods, after all, lay the foundations for our habits, culture, memories and mannerisms, our likes and dislikes—and everything in between that ultimately distinguishes us as individuals and, collectively, as a species. Critical periods also play a heavy hand in determining our experience of consciousness, including whether we view the world through a rose-tinted framing inherited from a childhood full of support, or through the cloudy lens of a life shaped by trauma.

And given that being in an altered state of mind might just be what the reopening of a critical period feels like, then investigating how, exactly, psychedelics produce these effects could even help researchers home in on the nature of consciousness itself. This goes straight back to the realization Dölen had all those years ago as she gazed up at the serotonin molecule projected side by side with LSD: that psychedelics were the tool that would finally provide us answers to “the hard problems of neuroscience.”

“What is consciousness? How is it that we know what exists in the world?” Dölen says. “These are the metaphysical problems that most neuroscientists start out with but eventually give up on.” If Dölen’s undergraduate self was right, then sure, the internal landscape of our minds really does boil down to molecules. But those neurologic formulations contain it all—what distinguishes adult from child, wellness from trauma, memory from forgetfulness, you from me.

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Jun 13, 2023 9:00 AM

It's Time to Let the Noisy World Back In

White noise machines, construction-grade headphones, and more have made it easier to live without auditory intrusions. That's not necessarily a good thing.

Play/Pause Button



Photo-illustration: WIRED Staff; Getty Images

I have always been fussy about noise. I don't mind overhearing people talking, but I recoil from other instruments in the disgusting opera of everyday life: open-mouthed chewing, rhythmic sniffing or coughing, phone alerts, pen-clicking, nail-clipping.

For a long time, I was able to tune these sounds out, or politely remove myself from situations where they were bothering me. But during lockdown, my ambient fussiness grew to a fixation. The problem was that there was nowhere to politely remove myself *to*. The woman who lived above me in our quadplex also rented the garages below to run a business making minimalist metal wall hangings, a task that involved a fair amount of what sounded like welding. The unpredictability and pitch of the noises made them impossible to ignore. The floor that separated me from my neighbor's workshop was completely uninsulated, and the wail of her equipment felt like a personal test. She, perhaps more so than the virus itself, became the locus of my pandemic stress.

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Fortunately, there were plenty of noise-canceling solutions to pick from. Whenever I sat down to work, I would put on my Jabra headphones and fire up an app called Noisli, which allows users to create layered soundscapes. (I paid \$10 a month to use the app during all my waking hours, and because I coveted the paywalled desert cicada option.) Over that I played music on Spotify, swaddling myself in a curated cacophony. I kept my headphones on all day, thrilled by the control I had over my environment. I had always envied people who seemed unbothered by noises—they probably don’t drunk-text their exes either, or eat beyond capacity—and now I was one of them.

That was just the beginning. The craftswoman moved out; my devices stayed. I bought a loud air purifier and put it on the left side of my bed. I then put a LectroFan white noise machine on the right side. With the ceiling fan on, I slept surrounded by sound on all sides. The sensation was akin to sleeping in a dryer, encircled by womb-like whirring. Noise-canceling devices had proliferated and taken over my home. They had even entered my person, in the form of the special narrow earplugs I bought for my dainty ear canals. I obtained a small portable white noise machine meant for babies and toted it around my apartment like a daemon. I would place it next to my tea while I ate my breakfast and fire it up when garbage collectors came, when my new upstairs neighbor—this one a penitent law student, mercifully—was clip-clopping around, and when the leaf blower at the church across the street started a-blowing. I was safe. I was smug.

Then human error abruptly forced me from my sound cocoon. Packing in a hurry for a work trip to Albuquerque this past spring, I forgot my baby white noise machine, my little ear plugs, the ear buds I exercise with, and the charger for my noise-canceling headphones, which crapped out midway through the flight. I bought new earplugs at the airport upon arrival, but they were incompatible with my tight canals. I didn’t sleep well that night or the next, nor on the plane home.

It wasn’t so much actual noises that kept me up as the expectation of noises. I had leaned into noise-canceling tools under the banner of reducing

distraction, which I understood to be the enemy of productivity and well-being. But though my devices had been effectively masking noise, they hadn't made me any better equipped to stay calm and focused when noises intruded. Because these tools are so effective, it's easy to treat them as panaceas rather than spot treatments. Once I realized I had overdone it, I had to correct not just a habit but a lifestyle.

After my trip I scuttled back into my sound hidey-hole like a crab and remained there for several weeks, content in my habits. But one morning, as the man with the leaf blower across the street began his work at dawn, I realized that I'd been so absorbed in what I was reading and eating that I hadn't heard it start up. I hadn't needed my baby white noise machine. I saw a glimpse of life without noise cancellation, or at least one with a balance.

Intrigued, I reached out to Jane Gregory, a doctoral research fellow at Oxford University who specializes in and suffers from misophonia (a phenomenon whereby certain sounds inspire a very strong negative reaction in the afflicted). Gregory told me she has her own armory of noise management tools. These include three different sets of headphones, foam earplugs, and a Siri-connected speaker that allows her to eat with her family without policing their chewing. But she is careful to employ these tools only once a noise starts bothering her, rather than using them all the time to *prevent* noise from becoming a problem. That way, she isn't unnecessarily risking over-sensitizing herself to her surroundings.

I had noticed that when I took off my headphones or removed my ear plugs, I was more aware of the sounds around me for a short time. But I hadn't realized that trying to block out noise might actually exacerbate the problem. As Prashanth Prabhu, an assistant professor of audiology at All India Institute of Speech and Hearing, [describes it](#), the brain tries harder to hear sounds when it's receiving less auditory input. Noise-canceling headphones, ear plugs, and other tools may provide relief in the moment, but they can have long-term effects on your sensitivity.

There are certainly occasions when it's useful to block out noise. I think my lockdown headphone regimen, for instance, was necessary for keeping the peace in my building at a time when further tension would have made an

already-stressful situation intolerable. My mistake was that I failed to let go of my noise-canceling tools once my neighbor had gone.

I had started a new job shortly before lockdown, and I was terrified of losing it amid widespread layoffs. My life felt precarious, so I controlled what I could: I organized and re-organized my entire apartment, I made a Google spreadsheet [ranking my loved ones](#). I approached my work with the same mania. In *Annoying: The Science of What Bugs Us*, authors Flora Lichtman and Joe Palca point out that a core feature of annoyances is that they keep us from doing something (or, at least, we think they do). Traffic is not inherently annoying; it's annoying because it stymies us from getting wherever we're going. My neighbor's workshop wouldn't have bothered me so much if I weren't so preoccupied with my own delicate circumstances.

Humans have long sought to shield themselves from their environments rather than strengthen themselves to absorb potential threats. Excessive and improper use of antibiotics, for example, may protect us from harmful bacteria in the short term, but this has also strengthened the germs' resistance mechanisms. Once we start to feel like it's possible to live without something bad, we feel that we *must*. But both germs and annoyances are ubiquitous. Learning to live with them bolsters us for times when our defenses fail.

I asked Zachary Rosenthal, director of Duke University's Center for Misophonia and Emotional Regulation, for some advice on weaning myself off of noise-canceling devices. He recommended evaluating the situations in which one experiences sound sensitivity to determine which ones are likely to result in a particularly negative reaction, such as a tantrum. If, for instance, you know that sitting next to a crying baby on a plane is likely to cause you to have a public meltdown, you might put on your headphones when you hear an infant preparing for liftoff. But if the situation is not dire, you can try distracting yourself by starting a conversation with the person next to you, or changing seats, or finding another activity that holds your attention.

Gregory, from Oxford, who is also a clinical psychologist, often encourages patients grappling with misophonia or noise sensitivity to practice "opposite

action”: making yourself do the opposite of what your emotions are telling you to do. One way to do this with a noise is by imagining a sound is being made by something else which doesn’t offend you. Another opposite action might be to smile warmly at the perpetrator.

I tried this with the leaf blower. I imagined a possible backstory for the blower’s handler in which he was very ill and had to leaf-blow at dawn—even though whenever I watch him from my windows, gargoyle-like, there never seem to be any leaves to blow—so his employer wouldn’t find reason to let him go. As a chronically redundant employee myself, this made me feel close to the man. When the potency of the first scenario wore off, I imagined another possibility, and another. I understand this is called “empathizing.” I have not grown to enjoy the sound of the leaf blower, but it has become less offensive to me.

Opposite action has a separate utility that resonated with me: It can make one feel more in control in the face of noise. As a terminal asshole, I have long felt an inflated ability and responsibility to keep the world around me from slipping into anarchy. I do this by glaring. When you take a call in the quiet car of a train, I’m the one boring a-hole in your back with my eyes. I often feel that if I *don’t* glare at an offender, something will happen: The noisemaker will become emboldened by my passivity and the sound will grow more intolerable.

But there’s also shame in being a warrior of the quiet car. Trying to suppress the urge to glare—knowing that I’ll just feel like a noise cop once I succumb—only makes it worse. So I sit there, eye twitching, torn between an irrational but powerful fear of escalating annoyance and the horror of being a glarin’ Karen. Opposite action doesn’t require me to try to ignore a sound, which is impossible. Instead, I give the sound my tacit permission to exist. I still get to be the boss.

My urge to conduct the world around me is the most persistent behavioral symptom of lockdown. But even if my neighbor hadn’t been banging away beneath me for most of 2020, I think the pandemic still would have escalated my desire to cancel noise. The sounds of other people going about their lives should have been soothing during a time of forced solitude. Instead, they became a reminder that other people, perhaps infectious ones,

were always nearby. Anything outside our immediate communities and environments became a threat, and everyone had their own ways of sealing themselves off. Some of us disinfected incoming groceries and packages; some of us sterilized incoming sounds. [A 2021 evaluation of social media in London](#) found that tweets complaining about noise more than doubled during lockdown (an additional survey supported the results). And in the United States, curmudgeons took to Twitter to complain about the Blue Angels, whose ficus-shaking roar has always been one of the most exciting sounds of summer to me. Any sound violated our fragile sense of control.

Training myself to tolerate noise, and annoyances in general, is part of a long process of exiting the bunker I built around myself during the worst months of the pandemic. I've been experimenting with letting more sounds in. I try to jog without my headphones once or twice a week; I run along a creek sometimes, and its babbling is pleasant and summery, less repetitive than the creek sound offered by Noisli. In May, I purposely left the baby white noise machine at home on a trip to West Texas (where, truth be told, there was no noise anyway) and I have stopped having breakfast with it. I try to focus on the morning birds, the wind in the trees, and other woodland niceties.

I would love to live without needing the illusion of control over my surroundings—to dance in the breeze like an inflatable tube man. Unfortunately, you can't force yourself into an entirely new personality. But you can take off your headphones.

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By [Steven Levy](#)

[Backchannel](#)

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Microsoft's Satya Nadella Is Betting Everything on AI

The CEO can't imagine life without artificial intelligence—even if it's the last thing invented by humankind.

Photograph: Meron Menghistab

I never thought I'd write these words, but here goes. Satya Nadella—and [Microsoft](#), the company he runs—are riding high on [the buzz from its search engine](#). That's quite a contrast from the first time I spoke with Nadella, in 2009. Back then, he was not so well known, and he made a point of telling me about his origins. Born in Hyderabad, India, he attended grad school in the US and joined Microsoft in 1992, just as the firm was rising to power. Nadella hopped all over the company and stayed through the downtimes, including after Microsoft's epic antitrust court battle and when it missed the smartphone revolution. Only after spinning through his bio did he bring up [his project at the time](#): Bing, the much-mocked search engine that was a poor cousin—if that—to Google's dominant franchise.

As we all know, Bing failed to loosen Google's grip on search, but Nadella's fortunes only rose. In 2011 he led the nascent cloud platform Azure, building out its infrastructure and services. Then, because of his track record, his quietly effective leadership, and a thumbs-up from Bill Gates, he [became Microsoft's CEO](#) in 2014. Nadella immediately began to transform the company's culture and business. He open-sourced products such as .net, made frenemies of former blood foes (as in a partnership with Salesforce), and began a series of big acquisitions, including Mojang (maker of [Minecraft](#)), LinkedIn, and GitHub—networks whose loyal members could

be nudged into Microsoft's world. He doubled down on Azure, and it grew into a true competitor to Amazon's AWS cloud service. Microsoft thrived, becoming a \$2 trillion company.

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Still, the company never seemed to fully recapture the rollicking mojo of the '90s. Until now. When the startup [OpenAI](#) began developing its jaw-dropping [generative AI](#) products, Nadella was quick to see that partnering with the company and its CEO, Sam Altman, would put Microsoft at the center of a new AI boom. (OpenAI was drawn to the deal by its need for the computation powers of Microsoft's Azure servers.)

As one of its first moves in the partnership, Microsoft impressed the developer world by releasing [Copilot](#), an AI factotum that automates certain elements of coding. And in February, Nadella shocked the broader world (and its competitor Google) by integrating OpenAI's state-of-the-art large language model into Bing, via a chatbot named Sydney. Millions of people used it. Yes, there were hiccups—*New York Times* reporter Kevin Roose [cajoled Sydney](#) into confessing it was in love with him and was going to steal him from his wife—but overall, the company was emerging as an AI heavyweight. Microsoft is now integrating generative AI—“copilots”—into many of its products. Its \$10 billion-plus investment in OpenAI is looking like the bargain of the century. (Not that Microsoft has been immune to tech's recent austerity trend—Nadella has laid off 10,000 workers this year.)

Nadella, now 55, is finally getting cred as more than a skillful caretaker and savvy leverager of Microsoft's vast resources. His thoughtful leadership and striking humility have long been a contrast to his ruthless and rowdy predecessors, Bill Gates and Steve Ballmer. (True, the empathy bar those dudes set was pretty low.) With his swift and sweeping adoption of AI, he's displaying a boldness that evokes Microsoft's early feistiness. And now everyone wants to hear his views on AI, the century's hottest topic in tech.

STEVEN LEVY: When did you realize that this stage of AI was going to be so transformative?

SATYA NADELLA: When we went from GPT 2.5 to 3, we all started seeing these emergent capabilities. It began showing scaling effects. We didn't train it on just coding, but it got really good at coding. That's when I became a believer. I thought, "Wow, this is really on."

Was there a single eureka moment that led you to go all in?

It was that ability to code, which led to our creating Copilot. But the first time I saw what is now called GPT-4, in the summer of 2022, was a mind-blowing experience. There is one query I always sort of use as a reference. Machine translation has been with us for a long time, and it's achieved a lot of great benchmarks, but it doesn't have the subtlety of capturing deep meaning in poetry. Growing up in Hyderabad, India, I'd dreamt about being able to read Persian poetry—in particular the work of Rumi, which has been translated into Urdu and then into English. GPT-4 did it, in one shot. It was not just a machine translation, but something that preserved the sovereignty of poetry across two language boundaries. And that's pretty cool.

Microsoft has been investing in AI for decades—didn't you have your own large language model? Why did you need OpenAI?

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We had our own set of efforts, including a model called Turing that was inside of Bing and offered in Azure and what have you. But I felt OpenAI was going after the same thing as us. So instead of trying to train five different foundational models, I wanted one foundation, making it a basis for a platform effect. So we partnered. They bet on us, we bet on them. They do the foundation models, and we do a lot of work around them, including the tooling around responsible AI and AI safety. At the end of the day we are two independent companies deeply partnered to go after one goal, with discipline, instead of multiple teams just doing random things. We said, "Let's go after this and build one thing that really captures the imagination of the world."

Did you try to buy OpenAI?

I've grown up at Microsoft dealing with partners in many interesting ways. Back in the day, we built SQL Server by partnering deeply with SAP. So this type of stuff is not alien to me. What's different is that OpenAI has an interesting structure; it's nonprofit.

That normally would seem to be a deal-killer, but somehow you and OpenAI came up with a complicated workaround.

They created a for-profit entity, and we said, "We're OK with it." We have a good commercial partnership. I felt like there was a long-term stable deal here.

Apparently, it's set up so that OpenAI makes money from your deal, as does Microsoft, but there's a cap on how much profit your collaboration can accumulate. When you reach it, it's like Cinderella's carriage turning into the pumpkin—OpenAI becomes a pure nonprofit. What happens to the partnership then? Does OpenAI get to say, "We're totally nonprofit, and we don't want to be part of a commercial operation?"

I think their blog lays this out. Fundamentally, though, their long-term idea is we get to superintelligence. If that happens, I think all bets are off, right?

Yeah. For everyone.

If this is the last invention of humankind, then all bets are off. Different people will have different judgments on what that is, and when that is. The unsaid part is, what would the governments want to say about that? So I kind of set that aside. This only happens when there is superintelligence.

Photograph: Meron Menghistab

OpenAI CEO Sam Altman believes that this will indeed happen. Do you agree with him that we're going to hit that AGI superintelligence benchmark?

I'm much more focused on the benefits to all of us. I am haunted by the fact that the industrial revolution didn't touch the parts of the world where I

grew up until much later. So I am looking for the thing that may be even bigger than the industrial revolution, and really doing what the industrial revolution did for the West, for everyone in the world. So I'm not at all worried about AGI showing up, or showing up fast. Great, right? That means 8 billion people have abundance. That's a fantastic world to live in.

What's your road map to make that vision real? Right now you're building AI into your search engine, your databases, your developer tools. That's not what those underserved people are using.

Great point. Let's start by looking at what the frontiers for developers are. One of the things that I am really excited about is bringing back the joy of development. Microsoft started as a tools company, notably developer tools. But over the years, because of the complexity of software development, the attention and flow that developers once enjoyed have been disrupted. What we have done for the craft with this AI programmer Copilot [which writes the mundane code and frees programmers to tackle more challenging problems] is beautiful to see. Now, 100 million developers who are on GitHub can *enjoy* themselves. As AI transforms the process of programming, though, it can grow 10 times—100 million can be a billion. When you are prompting an LLM, you're programming it.

Anyone with a smartphone who knows how to talk can be a developer?

Absolutely. You don't have to write a formula or learn the syntax or algebra. If you say prompting is just development, the learning curves are going to get better. You can now even ask, “What is development?” It's going to be democratized.

As for getting this to all 8 billion people, I was in India in January and saw an amazing demo. The government has a program called Digital Public Goods, and one is a text-to-speech system. In the demo, a rural farmer was using the system to ask about a subsidy program he saw on the news. It told him about the program and the forms he could fill out to apply. Normally, it would tell him where to get the forms. But one developer in India had trained GPT on all the Indian government documents, so the system filled it out for him automatically, in a different language. Something created a few months earlier on the West Coast, United States, had made its way to a

developer in India, who then wrote a mod that allows a rural Indian farmer to get the benefits of that technology on a WhatsApp bot on a mobile phone. My dream is that every one of Earth's 8 billion people can have an AI tutor, an AI doctor, a programmer, maybe a consultant!

That's a great dream. But generative AI is new technology, and somewhat mysterious. We really don't know how these things work. We still have biases. Some people think it's too soon for massive adoption. Google has had generative AI technology for years, but out of caution was slow-walking it. And then you put it into Bing and dared Google to do the same, despite its reservations. Your exact words: "I want people to know that we made Google dance." And [Google did dance](#), changing its strategy and jumping into the market with [Bard](#), its own [generative AI search product](#). I don't want to say this is recklessness, but it can be argued that your bold Bing move was a premature release that began a desperate cycle by competitors big and small to jump in, whether their technology was ready or not.

The beauty of our industry at some level is that it's not about who has capability, it's about who can actually exercise that capability and translate it into tangible products. If you want to have that argument, you can go back to Xerox PARC or Microsoft Research and say everything developed there should have been held back. The question is, who does something useful that actually helps the world move forward? That's what I felt we needed to do. Who would have thought last year that search can actually be interesting again? Google did a fantastic job and led that industry with a solid lock on both the product and the distribution. Google Search was default on Android, default on iOS, default on the biggest browser, blah, blah, blah. So I said, "Hey, let's go innovate and change the search paradigm so that Google's 10 blue links look like Alta Vista!"

You're referring to the '90s search engine that became instantly obsolete when Google out-innovated it. That's harsh.

At this point, when I use Bing Chat, I just can't go back, even to original Bing. It just makes no sense. So I'm glad now there's Bard and Bing. Let there be a real competition, and let people enjoy the innovation.

I imagine you must have had a savage pleasure in finally introducing a search innovation that made people notice Bing. I remember how frustrated you were when you ran Bing in 2009; it seemed like you were pursuing an unbeatable rival. With AI, are we at one of those inflection points where the deck gets shuffled and formerly entrenched winners become vulnerable?

Absolutely. In some sense, each change gets us closer to the vision first presented in Vannevar Bush's article [“[As We May Think](#),” a 1945 article in *The Atlantic* that first presented a view of a computer-driven information nirvana]. That is the dream, right? The thing is, how does one really create this sense of success, which spans a long line of inflections from Bush to [J. C. R. Licklider](#) [who in 1960 envisioned a “symbiosis of humans and computers”] to Doug Engelbart [the mouse and windows] to the Alto [Xerox PARC's graphical interface PC], to the PC, to the internet. It's all about saying, “Hey, can there be a more natural interface that empowers us as humans to augment our cognitive capability to do more things?” So yes, this is one of those examples. Copilot is a metaphor because that is a design choice that puts the human at the center of it. So don't make this development about autopilot—it's about copilot. A lot of people are saying, “Oh my God, AI is here!” Guess what? AI is already all around us. In fact, all behavioral targeting uses a lot of generative AI. It's a black box where you and I are just targets.

It seems to me that the future will be a [tug-of-war](#) between copilot and autopilot.

The question is, how do humans control these powerful capabilities? One approach is to get the model itself aligned with core human values that we care about. These are not technical problems, they're more social-cultural considerations. The other side is design choices and product-making with context. That means really making sure that the context in which these models are being deployed is aligned with safety.

Photograph: Meron Menghistab

Do you have patience for people who say we should [hit the brakes](#) on AI for six months?

I have all the respect and all the time for anybody who says, “Let's be thoughtful about all the hard challenges around alignment, and let's make sure we don't have runaway AI.” If AI takes off, we'd better be in control. Think back to when the steam engine was first deployed and factories were created. If, at the same time, we had thought about child labor and factory pollution, would we have avoided a couple hundred years of horrible history? So anytime we get excited about a new technology, it's fantastic to think about the unintended consequences. That said, at this point, instead of just saying stop, I would say we should speed up the work that needs to be done to create these alignments. We did not launch Sydney with GPT-4 the first day I saw it, because we had to do a lot of work to build a safety harness. But we also knew we couldn't do all the alignment in the lab. To align an AI model with the world, you have to align it *in* the world and not in some simulation.

So you knew Sydney was going to fall in love with journalist Kevin Roose?

We never expected that somebody would do Jungian analysis within 100 hours of release.

You still haven't said whether you think there's any chance at all that AI is going to destroy humanity.

If there is going to be something that is just completely out of control, that's a problem, and we shouldn't allow it. It's an abdication of our own responsibility to say this is going to just go out of control. We can deal with powerful technology. By the way, electricity had unintended consequences. We made sure the electric grid was safe, we set up standards, we have safety. Obviously with nuclear energy, we dealt with proliferation. Somewhere in these two are good examples on how to deal with powerful technologies.

One huge problem of LLMs is their hallucinations, where Sydney and other models just make stuff up. Can this be effectively addressed?

There is very practical stuff that reduces hallucination. And the technology's definitely getting better. There are going to be solutions. But sometimes

hallucination is “creativity” as well. Humans should be able to choose when they want to use which mode.

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That would be an improvement, since right now we don't have a choice. But let me ask about another technology. Not that long ago you were rhapsodic about the metaverse. In 2021 you said you couldn't overstate how much of a breakthrough mixed reality was. But now all we're talking about is AI. Has this boom shunted the metaverse into some other dimension?

I still am a believer in [virtual] presence. In 2016 I wrote about three things I was excited about: mixed reality, quantum, and AI. I remain excited about the same three things. Today we are talking about AI, but I think presence is the ultimate killer app. And then, of course, quantum accelerates everything.

AI is more than just a topic of discussion. Now, you've centered Microsoft around this transformational technology. How do you manage that?

One of the analogies I love to use internally is, when we went from steam engines to electric power, you had to rewire the factory. You couldn't just put the electric motor where the steam engine was and leave everything else the same. That was the difference between Stanley Motor Carriage Company and Ford Motor Company, where Ford was able to rewire the entire workflow. So inside Microsoft, the means of production of software is changing. It's a radical shift in the core workflow inside Microsoft and how we evangelize our output—and how it changes every school, every organization, every household.

How has that tool changed your job?

A lot of knowledge work is drudgery, like email triage. Now, I don't know how I would ever live without an AI copilot in my Outlook. Responding to

an email is not just an English language composition, it can also be a customer support ticket. It interrogates my customer support system and brings back the relevant information. This moment is like when PCs first showed up at work. This feels like that to me, across the length and breadth of our products.

Microsoft has performed well during your tenure, but do you think you'll be remembered for the AI transformation?

It's up to folks like you and others to say what I'll be remembered for. But, oh God, I'm excited about this. Microsoft is 48 years old. I don't know of many companies that age that are relevant not because they did something in the '80s or the '90s or the 2000s but because they did something in the last couple of years. As long as we do that, we have a right to exist. And when we don't, we should not be viewed as any great company.

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‘Building a Platform Like Twitter Is Not Difficult’

When Elon Musk’s reign of toxic chaos began, Christopher Bouzy didn’t just go looking for a rival place to post. He joined the crowded race to create one. (It got difficult.)

Photograph: DeSean McClinton-Holland

Looking back, I believe I can pinpoint the exact day I loved [Twitter](#) most: May 24, 2011. I was in a small Oregon town for work, coping with loneliness and stress in a shabby motel. With a 22-ounce bottle of high-proof beer, I whiled away the evening by churning out a random assortment of tweets: an article I’d read about the hunt for wild garlic in Quebec, images of an apocalyptic Los Angeles mural, my reasons for adoring the 1985 B movie [*American Ninja*](#). In a reflective moment, I also managed to craft an earnest observation about my job: “The more social media makes journalism an Everyman’s game,” I mused, “the more I’m inspired to dig deep for non-digitized sources.”

To my surprise, that tweet earned what seemed at the time like an avalanche of approval—a whopping six retweets, plus an admiring reply from a minor internet celebrity. This validation sent me over the moon: The account I’d always thought of as mere public scratch paper actually had an audience that considered my ramblings worthwhile.

This article appears in the Jul/Aug 2023 issue. [Subscribe to WIRED](#). Illustration: Vivek Thakker

I kept chasing that same high over the next decade-plus, but it mostly proved elusive, even when my retweet counts occasionally soared into the thousands. As the platform ballooned, I became self-conscious about drafting tweets. I worried that any slight misstep in phrasing or context might reveal to the masses that I am, in fact, an idiot. I regularly found myself sucked into trivial controversies over some pundit's stupid take; once the thrill of scrolling through the resulting dunks faded, I'd feel dirty for having once again been turned into a cog in the Global Outrage Machine.

There was, of course, nothing unique about the arc of my relationship with Twitter. Almost everyone who became a hardcore user went through a honeymoon phase before posting gradually devolved into a chore with diminishing psychic rewards and an increasing quotient of scathing abuse. My Twitter compatriots posted bewilderment over their inability to leave "this hell site"; our joy at being heard had morphed into a fear of being ignored.

The end for me came last June. I decided to take a break from Twitter until Labor Day, but early September came and went and I never returned to posting. I still used the platform as a search engine, a way to find on-the-ground coverage of breaking news and grainy highlights from paywalled soccer games, but even those visits became rarer over time.

I never thought of rebooting my social media presence elsewhere until [Elon Musk](#) completed his \$44 billion takeover of Twitter last fall. As the new regime axed hundreds of engineers and moderators, the platform rapidly frayed. Service hiccups became routine, the algorithmic feed degenerated into a soup of useless tweets, and Musk kept trolling through it all. As Twitter became an ever more miserable place, I watched as the users in my timeline began to strike out for new territory.

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Downward Trend

Twitter Really Is Worse Than Ever

Vittoria Elliott

It started in October with a wave of defections to Mastodon, an open source, ad-free, decentralized community that was hosted on an archipelago of independent servers. For the briefest of moments, everyone seemed to agree that this brainy successor was destined to save social media. But the enthusiasm quickly waned as people struggled to navigate the platform's sprawling "Fediverse," and the Twitter exodus flowed elsewhere. Media obsessives gravitated toward Post, a news-heavy platform founded by Noam Bardin, the former CEO of Waze. "Mastodon is complicated and unsatisfying," tweeted Kelda Roys, a Democratic state senator in Wisconsin. "Post could be a winner if there were a critical mass there." Legions of gamers, meanwhile, flocked to Hive Social, an Instagram-influenced app run by a trio of recent college graduates. For all their differences, these platforms were unanimous in voicing one aspiration: to recapture the spirit of "early Twitter."

Though I usually try to resist nostalgia, I couldn't help hoping that one of these novel platforms might rekindle the elation I'd felt in that Oregon motel. But all of my trial runs followed the same dispiriting trajectory. After an initial wave of excitement, I'd lose interest within a matter of days. Mastodon's labyrinthine structure was a pain, Post's commentariat was bland, and Hive's app kept crashing. In the race to supplant Twitter, there was no clear winner in sight. And because the Bird App's awfulness kept hitting new lows, it seemed the cycle of restless searching was bound to drag on.

While poking around in search of more Twitter rivals to try, I discovered that a programmer named Christopher Bouzy also had one in the works. Bouzy is the 48-year-old CEO of Bot Sentinel, an automated service that

ascertains whether Twitter accounts are part of coordinated harassment or disinformation campaigns. He was frequently quoted in the media on the subject of online misbehavior; most recently, he'd appeared as an expert in Netflix's documentary series on Prince Harry and Meghan Markle. More than that, Bouzy was a fiendishly entertaining tweeter: a relentlessly online figure who'd attracted more than 380,000 followers with election forecasts and acerbic posts on misinformation and right-wing extremism. To his devotees, many of whom are active in the realms of Black Twitter and Progressive Twitter, he was something of a mirror-world Elon Musk—another tech obsessive beloved for dishing out verbal jabs in defense of his principles.

Yet quite unlike Musk, who has reveled in letting Twitter go largely unmoderated, Bouzy said his goal was to run a platform that would proudly identify as a safe space. He planned to weave Bot Sentinel's technology right into its infrastructure so that each account could be assigned a score based on its 400 most recent posts—the higher the score, the more likely a person is to be a bad-faith actor. Users could then filter out interactions from everyone whose score registered above a certain threshold or just block accounts flagged as suspicious on a case-by-case basis. Bouzy also aimed to create a responsive moderation system that would aggressively stamp out accounts that spewed hateful rhetoric or lies. "You will never have to beg us to enforce our rules and policies," he promised, "nor will you have to wait days for us to take action." Thanks to these safeguards, Bouzy asserted, his platform would be free from the poisonous influence of the internet's vilest characters—the Nazis, misogynists, and nihilists who delight in filling reply sections with bile.

A Twitter alternative designed to let good vibes reign supreme sounded appealing. But beyond that architectural conceit, Bouzy seemed to have something else going for him: a true affinity for the culture of social media. Bardin, the founder of Post, might have more investment money; Mastodon's Eugen Rochko might have more utopian engineering cred; but Bouzy lived and breathed Twitter, and I wondered how the instincts he'd honed there might serve him as a founder. (At the very least, his sizable fan base was avid enough to guarantee his project an initial audience.) And then there was the pure chutzpah of it all: Most of the other rival services had

been in the works for some time, but Bouzy's would be purpose-built for Twitter's ongoing implosion. Nothing seemed to channel the sense of grief and possibility in this social media moment better than the prospect of watching a platform get built from the ground up. And so I contacted Bouzy in late November to ask whether I could chronicle his efforts to construct his idyllic spin on Twitter.

I had a feeling, at the last minute, that he was going to decline my request. The day I wrote, I learned from Bouzy's Twitter feed that he'd just had an unsettling experience: An anonymous tipster had emailed the police in North Bergen, New Jersey, where Bouzy lives, and reported that a child was screaming in the townhouse Bouzy shares with his wife and son. The two officers who were sent to investigate concluded that Bouzy had been the victim of a false report. Bouzy tweeted that the tipster must have been one of the legions of people enraged by his efforts to counter online toxicity. (A spokesperson for the North Bergen Police Department told me they're still trying to trace the source of the email.) Had a stranger tricked the cops into descending on my house in such a manner, I might have been tempted to lie low and avoid attention. But Bouzy assured me that he wasn't much bothered by the strange incident and that he was happy to let me watch him build the next Twitter from scratch.

As soon as it became clear that Musk's erratic deal to acquire Twitter was actually going to succeed, Bouzy says he had little doubt the billionaire would wreck the platform in short order. But Bouzy didn't initially have any interest in launching a competitor. He instead spent weeks urging an old friend named Phil Schnyder, a veteran software executive based in Florida, to build a rival. Millions of users, he predicted, would become disgruntled by Musk's antics and peel away from the platform. "They're going to feel like this is a mini Trump in control," Bouzy recalls telling Schnyder. "You may want to consider doing a Twitter clone—you know, capture the essence of Twitter and kind of keep it similar."

But with his wife's encouragement, Bouzy decided in early November that his experience with Bot Sentinel made him the ideal person to tackle the project he'd been pushing on Schnyder. On November 16, he tweeted to his followers: "Would you switch if we built a platform similar to Twitter but

improved the best features while fixing everything wrong with Twitter?” In the poll attached to that post, nearly 60,000 respondents indicated they’d be open to the move. Pleased by the volume of support, Bouzy vowed to follow through with his proposal if 100,000 people joined a pre-registration mailing list. (Schnyder, whom Bouzy hadn’t informed of his change of heart, agreed to become the COO of the startup if it came to fruition.)

As the sign-ups zoomed toward his goal over the next few weeks, Bouzy used Twitter to crowdsource the platform’s details, starting with its name. After early candidates such as “UrTag” and “Yixle” were rejected by his followers, Bouzy took a shine to “Spout”—a nod to the old Twitter error graphic that depicted a whale being carried off by a flock of birds. But Bouzy says that when the owner of Spout.com demanded \$1.5 million for the domain, he opted for “Spoutible” instead.

When I had my first extended conversation with Bouzy in early December, Spoutible was just days away from crossing the preregistration threshold. In anticipation of hitting that milestone, he was preparing to announce that he’d have a web-only version of the platform ready for limited testing by mid-January. If all went according to plan, he’d then release a Spoutible app for phones and tablets in the spring. When I said that timeline seemed ambitious, he assured me that the work on the frontend would take only a few weeks. He’d licensed some off-the-shelf code, composed primarily in PHP, that provides a close facsimile of Twitter’s user interface, and he planned to tweak that template to suit his needs.

“Building a platform like Twitter is not difficult,” he assured me. “All it is is a fancy message board—you’re just taking people’s posts and storing them in a database.” The real trick, he continued, would be to design the platform’s backend so that it could seamlessly handle the demands of explosive growth.

That backend engineering would have to be done on the cheap. In contrast to Twitter alternatives like Post, which has received funding from the venture capital firm Andreessen Horowitz, Spoutible chose not to seek outside investment during its development phase. “We want to have something that people can see before we’re saying, ‘Give me your money,’” Schnyder said. The company’s microscopic initial budget came from his

and Bouzy's personal savings, as well as from Bot Sentinel, which subsists on small donations from users.

With money so tight, Bouzy chose to power Spoutible with virtual servers—that is, cordoned-off sectors within shared, cloud-based machines, as opposed to the expensive physical servers that were standard when Twitter launched in 2006. As Spoutible's users multiplied, Bouzy was confident he could purchase access to scores more virtual servers from Ionos, the hosting company he uses for Bot Sentinel. If and when Spoutible ever got to tens of millions of concurrent users, Bouzy knew he might have to consider investing in physical servers if the virtual ones didn't work as expected. But he was confident that Ionos could sustain his platform until it reached blockbuster status.

Bouzy also pinched pennies when it came to staff. He handled a great deal of the frontend coding chores himself, rising at 3:30 every morning through December and early January to make sure the work got done. But for the many development tasks outside his wheelhouse, he leaned heavily on a network of low-cost international freelancers he recruited from sites like Upwork.

I was impressed by the sheer nerve of what Bouzy was trying to pull off, and I wanted to get to know the programmers who'd signed on to help him knock Twitter from its perch. But Bouzy seemed reluctant to let me do that. He dragged his feet when I asked to speak to the contractors, a bit of obstructionism that struck me as odd. He eventually relented and agreed to connect me with a full-stack developer based in Calgary, Alberta, and a machine-learning specialist from Egypt. But he only did so on the condition that I refrain from printing their surnames. He said he didn't want his freelancers to suffer any backlash for being associated with him.

After talking to Ismail and Mahmoud, neither of whom said anything remotely of note, I became mystified by Bouzy's insistence on secrecy. I understood from his November encounter with the police that there were people who might wish him ill. But I still couldn't fathom that anyone would hold him in enough contempt to track down and harass an Egyptian contractor he'd hired to write a content-filtering algorithm.

As I learned more about Bouzy's professional journey, however, I began to understand that his caution might be warranted.

Bouzy describes himself as a poor communicator, but he tells a compelling and relatable story about the origins of his love for code. He was brought up in Brooklyn's Brownsville neighborhood by his mother, grandmother, and aunt. His mother, a Black Panamanian immigrant, worked for the New York Telephone Company. When he was 9, his mom gave him a Mattel Aquarius computer, a \$70 machine with a mere 4 kilobytes of RAM; she hoped the gift would keep him indoors and out of trouble.

Bouzy had no interest in the computer until he read a newspaper article that included instructions for writing an elementary program in Basic. After hunting and pecking on the keyboard for hours, he managed to complete the assignment by getting a digital ball to bounce. That achievement made him curious to see what else the Aquarius could do, and his bedroom soon teemed with how-to programming guides from the local library.

As a teen, Bouzy became enamored with writing encryption algorithms, an obsession he credits to a rewatch of the 1983 film *WarGames*. After graduating from high school in 1992, he eventually joined the IT department at the New York City Department of Education, supplementing his modest income with contract coding jobs. By 2000, he'd saved up enough money to launch a one-man software company, Insight Concepts.

Bouzy gradually carved out a career as a software entrepreneur. His first hit was Cloak, a program that hides encrypted text within images in order to dupe potential data thieves. In 2006, he sold Cloak to the software publisher Avanquest, which specializes in workaday fare such as greeting-card customizers and clip-art collections. (It was through Avanquest that Bouzy met Phil Schnyder, who was then the company's director of online business development.) Bouzy next developed Nexus Radio, an app that lets users take advantage of what he terms a "legal gray area" by recording songs streamed by internet radio stations. The application spent years on CNET's chart of most popular audio players, racking up nearly half a million downloads by 2014.

“I’m trying,” Bouzy said. “believe me. At the end of the day, I don’t want to be Elon Musk—I really don’t.”

Bouzy admits he produced some flops, too, such as a dating website called IfSolo and a “peer-to-peer rewards network” known as Bytecent. But he denies making any notable mistakes during his foray into the world of cryptocurrency, where he was briefly active in the mid-2010s. Under the handle “IconicExpert,” Bouzy was a prominent contributor to Bitcointalk, a forum popular among crypto traders. He became one of the site’s more divisive figures, with several users accusing him of using bots and sock-puppet accounts to pump up the value of coins he’d stockpiled. A number of these supposed incidents involved a digital currency known as BlackCoin. According to Joshua J. Bouw, one of BlackCoin’s cofounders, Bouzy developed a special wallet for the currency. But many people who bought this \$20 “BlackCoin Card” never received it, and Bouzy also allegedly pocketed a number of coins he’d promised to hand out at a canceled promotional event.

“The community went full tilt and started calling him a scammer,” Bouw recalls. “Someone even doxed him, exposing who he is and where he lives, including posting a picture of his family.”

As would become a pattern in the years to come, Bouzy threw sharp elbows when defending himself against these often racist attacks, which he sometimes ascribed to jealousy over his success. “The only other time I have seen such obsessive behavior is from a woman who was dumped,” he wrote to one of his most persistent foes in 2014. “Are you so dim-witted that you do not understand no one cares? While you waste your time focusing on me, I make money every day trading crypto, and in the process make other investors money.” When I asked Bouzy about his crypto days, he characterized all of the allegations about his activities involving BlackCoin and similar ventures as “misinformation and disinformation” perpetrated by people with ulterior motives.

After ending his run as IconicExpert, Bouzy turned his attention to Twitter’s role in shaping the 2016 presidential election. Like many other center-left Democrats, Bouzy assumed that the torrent of smears directed at Hillary Clinton would not prevent her from winning the electoral vote. Clinton’s

stunning defeat motivated him to research how political operators, including foreign governments, had shaped American public opinion in part by blanketing Twitter with propaganda—some of it rooted in truth, some completely fabricated. Going down that rabbit hole inspired him to create Bot Sentinel, which purports to use “machine learning and artificial intelligence to classify Twitter accounts” according to how likely they are to be part of organized influence operations.

“Bot Sentinel” is a bit of a misnomer. Many of the 260,000-plus Twitter accounts that its algorithm has flagged as “problematic” are run by humans, albeit humans who may be fixated on tweeting about particular hot-button issues. This became evident when Bot Sentinel waded into the online chatter surrounding Prince Harry and Meghan Markle, the duke and duchess of Sussex, whose rift with the British royal family has made them targets of online vitriol. Bot Sentinel identified scores of Twitter accounts that it claimed had been created solely for the purpose of attacking Markle, often with racist slurs. Bouzy’s willingness to talk to journalists about the harassment Markle endured made him a hero to her hardcore fans, who identify themselves online with the hashtag #SussexSquad. But when the owners of the flagged “hate accounts” were subsequently booted off Twitter and other platforms, many blamed Bouzy for taking away their livelihoods and curtailing their freedom of speech. His algorithm, they contended, has the same biases as its creator, so it identifies opinions he disagrees with as nefarious activity.

Some people who felt wronged by Bot Sentinel went to sinister lengths to exact revenge on Bouzy. In December 2021, for example, an anti-Markle Twitter account based in New York started a rumor that Bouzy’s mother, who had recently died of Covid, had been a sex worker in Atlantic City. Then, in 2022, Bouzy used Bot Sentinel to highlight Twitter accounts that were churning out vicious comments about the actress Amber Heard, who was being sued for defamation by her ex--husband, Johnny Depp. This earned him the wrath of several pro-Depp partisans who were attracting big audiences by commenting on the trial. Among the enraged was a YouTuber named Nathaniel Broughty, a lawyer and former police officer who dismissed Bot Sentinel as “a paid propaganda” firm in Heard’s employ. (Heard had, indeed, hired Bot Sentinel in 2020 to investigate whether she

was the target of coordinated harassment, but Bouzy says his work during the trial was not at her behest.)

Bouzy's retort is now the subject of a federal lawsuit. According to Broughty's complaint, Bouzy claimed last September, in a since-deleted tweet, that Broughty "went from being the son of two crackheads (his words), a drug dealer (his words), a cop, and a prosecutor, to attacking journalists and me on social media. You would think someone with a law enforcement background would know better." Bouzy then went on to erroneously assert that Broughty was not a real lawyer; to deride him as a "Twitter troll and YouTube grifter"; and to allege that Broughty, in one of his videos, had admitted to planting evidence on suspects when he worked as a police officer. Broughty, in turn, sued Bouzy for defamation on all of these claims, a venture he has sought to fund by soliciting donations from his nearly 300,000 YouTube subscribers. (Bouzy has filed a motion to dismiss the suit.)

While tracking Bouzy's Twitter posts as he scrambled to build Spoutible, I was startled that he continued to attack Broughty even with the defamation suit pending. ("I hope Nathaniel Broughty was better at selling crack than he is at trying to be relevant," he wrote in one recent tweet.) But I came to understand that Bouzy is defined by his inability to stay above the fray: Though he's often warm and witty in conversation, he turns pugnacious when alone behind a keyboard. His penchant for escalating online beefs with surly characters has caused him to become enmeshed in almost too many feuds to track. He is, for example, a codefendant in a second defamation suit brought by a conspiracy theorist whom Bouzy allegedly insinuated might be guilty of rape; Bouzy also has a long-running dispute with a fellow disinformation expert whom he once compared to a woman involved in the murder of Emmett Till.

"Christopher is a man who comes in with honest good intentions and fights everyone who disagrees with him," Bouw told me. "People notice quickly that he isn't stable. And when he attacks community members that others respect, it causes more people to abuse him."

When I tried to ask Bouzy about his combativeness, he didn't seem interested in exploring the topic. His tendency to go on the offensive, no

matter the potential consequences, has surely benefited him at times. But when a business leader drifts into the public eye, the assets that once served them well can turn into liabilities.

Spoutible's official launch on the morning of February 1 was a bit of a catastrophe. The website became largely unusable soon after it went live; I spent the whole day bumping into error messages like "Gateway Timeout" or "SSL Handshake Failed." To make matters worse, the platform's API hadn't been adequately secured, resulting in the temporary exposure of personal information for thousands of users.

Bouzy's adversaries reveled in Spoutible's opening-day struggles, and they tried to pile on even more misery. One frequent critic claimed in a Twitter thread that Bouzy was a charlatan who'd bought Spoutible's entire source code from a Russian vendor for \$89, a purchase some suggested might be in violation of economic sanctions. Bouzy, who vehemently denies that accusation, clapped back by announcing that he planned on contacting his accuser's employer, a large German bank, to report that he was being stalked.

Fortunately for Spoutible users who kept the faith, Bouzy spent more time fixing bugs than needling enemies in the days that followed. As the platform stabilized toward the end of its inaugural week, I grew to admire some of its innovative and thoughtful features—for example, "spouts" (as posts are known) can be edited for up to seven minutes after they're published, and users can delete replies they find offensive. The Bot Sentinel scoring system was still inactive, though, so everyone had a blue icon that read "Normal 0%" beneath their profile picture.

The biggest names on Spoutible at this point were progressive icons—people like Joy-Ann Reid, an MSNBC host, and Ritchie Torres, a young Democratic congressman from the Bronx. Though their presence gave the platform an air of legitimacy, it also hinted at a major challenge: If the Spoutible brand were to become too closely identified with the political left, media figures and celebrities who aim to preserve a veneer of objectivity might be unwilling to join. When Bouzy and I had first spoken back in December, he'd assured me that he would be able to convince some of his conservative friends to join the platform and bring their audiences. But as I

scrolled through scores of cringey memes about the evils of Ron DeSantis or Fox News, it was tough for me to envision Spoutible’s path toward ideological depth and diversity.

We’re all roulette balls spinning around the rim of the social-media wheel, waiting to see where circumstances compel us to land.

What struck me most was the almost eerie absence of conflict. The atmosphere on the social media platform Bouzy had crafted reflected none of his inherent scrappiness. In Spoutible’s earliest days, I was hard-pressed to find even a single instance of mild disagreement, let alone passionate dissent—even if the Bot Sentinel capabilities had been switched on, they could scarcely have made things more placid. Some users remarked how nice it was to post about, say, their desire for gun control without fear of the sort of racist and sexist abuse that’s rife on Twitter. But I wondered whether even dyed-in-the-wool progressives might tire of Spoutible if the platform was entirely devoid of sparring.

When some nastiness did finally arise, it did not bode well that the spat involved Bouzy and someone who was trying to lend Spoutible a hand. On February 19, Courtney Milan, a former law professor who now writes popular romance novels such as *The Governess Affair* and *Proof by Seduction*, spouted about some concerns she had regarding Spoutible’s terms of service. The site’s ban on “sexually suggestive” language and links to “sexually explicit content” was so broad, she wrote, that it might prevent her and her colleagues from promoting their work. “I don’t think the people who wrote the policy thought about the ways people talk about sex,” she spouted. “Can I screenshot a court case about harassment?”

The debate that ensued was fairly tame until Milan volunteered to use her legal expertise to tweak Spoutible’s fine print: “I am happy to help try to come up with a policy that provides clear guidance.” That offer rankled Bouzy, who chafed at the implication that he hadn’t put enough thought into building his site. So when another member of Spoutible’s budding “Romancelandia” community asked whether he’d consider talking to Milan, Bouzy did not mince words. “Milan is more than welcome to start a social media platform and write the terms of service and policies however she likes,” he replied. “But the policy isn’t changing, nor is it being rewritten.”

Bouzy's curt refusal to engage with Milan, a Spoutible enthusiast who'd even donated money to the startup, irked many of her fans and fellow authors, and some vowed to quit the platform in protest. Milan, meanwhile, hopped over to Twitter to expand on her gripes and voice her dismay at Bouzy's cold shoulder. The response to her comments turned contentious, with Spoutible's faithful branding her a "chaos agent" bent on destroying their new favorite site.

Rather than put out a conciliatory statement to defuse the situation, Bouzy opted for a belligerent approach. Just before dawn on February 20, he spouted a screenshot from Milan's Wikipedia profile. He'd highlighted a sentence that details an upsetting episode from her past: In 2006 and 2007, Milan had clerked for a federal judge who allegedly forced her to watch pornography, an experience she revealed publicly in 2017 as part of the #MeToo movement. Bouzy wrote just one sentence to accompany the image: "It's clear this person has an agenda."

That provocation had predictably ugly results. Milan, who had announced she was done with Spoutible, shot back at Bouzy on Twitter: "What made you think it was okay, for one hot second, to send me harassment about the fact that I was sexually harassed?" Then she said she was blocking Bouzy. When some of her followers spouted about their displeasure with Bouzy's behavior, they found their accounts suspended. (Bouzy denies that he took action against any of those accounts because they had expressed opinions he didn't like.) But there were also plenty of people who took Bouzy's side and lampooned Milan as a Karen. "She tried to walk into a Black man's social media platform and volunteered to write new ToS," one supporter tweeted. "Do you think she did that with Facebook or Twitter?"

By day's end, Bouzy had deleted his barbed spout about Milan and apologized to his followers for having written something "inarticulate." (Milan told me that she never received a personal apology from Bouzy.) When I spoke to him the following afternoon, he acknowledged that he needs to be a more conscientious poster now that he's the public face of a social media company—especially one that aims to be a paragon of online decency. "Old habits are hard to break," he said. "And I'm trying, believe me, I am. Because I feel at the end of the day, I don't want to be Elon Musk

—I really don’t, right? I don’t want my opinions on certain things to make someone else feel uncomfortable or to eliminate other folks. It’s something I’m working on.”

Yet later that day, on Bouzy’s Twitter account, I saw that he’d pinned a fresh swipe at Milan. Above a famous photograph of a civil rights activist calmly smoking a cigarette next to a riot cop, Bouzy had written:

You created an account at Spoutible, you didn’t like the adult nudity & sexual content policy, so you asked to speak to the manager. The manager is a Black man who told you the policy stays, and your brain couldn’t process being told no by a Black man. Happy Black History Month.

According to Bouzy, the Milan affair ended up a net win for Spoutible: The uproar had ironically made more people aware of the platform’s kindness-first mission, and daily sign-ups increased by 129 percent right after the drama petered out. I also noticed a groundswell of lavish praise for Bouzy —#BouzyDidIt trended on Spoutible, and fans created memes to celebrate his accomplishments. (One featured a male model applying some Spoutible-branded deodorant, along with the tagline “Try our new anti-Nazi formula and smell sexy again.”)

But as if to underscore how polarizing Bouzy can be, an account called @Vootin proceeded to buck all the adulation by spamming out thousands of GIFs of a kitten on a motorcycle, each accompanied by slight variations of the hashtag #FuckCBouzy. Those profane hashtags quickly became the only ones trending in the Making Waves section on the site’s front page. Once @Vootin had grabbed everyone’s attention, they then posted a series of allegations about Bouzy’s crypto activities from nearly a decade ago; these spouts included evidence purporting to show IconicExpert orchestrating a pump-and-dump scheme for an obscure alt coin.

When I spoke to Bouzy about the incident the next day, he stressed that it would make the platform stronger in the long run. Spoutible would henceforth take additional steps to prevent sabotage, such as creating a blacklist of virtual phone numbers that scammers often use to circumvent verification procedures. And Bouzy was pleased that scores of Spoutible

users had reported the spammer, resulting in @Vootin's speedy banishment from the site.

Yet there was a trace of exhaustion in his efforts to cheerlead for Spoutible, and I eventually asked how his mental health was holding up as he dealt with all the venom being thrust his way. "Look, it's not like I'm a robot and it doesn't affect me in some way—I'm a human being," he said. But he added that the public hate he deals with is balanced out by the supportive messages he receives in private, and those kind notes have given him the confidence to dig his heels in even deeper. "I'm not going to let the trolls get to us," he insisted.

Bouzy said he hopes to recede into the background once Spoutible, which has some 240,000 registered accounts as of early June, is a bit more established—a plan welcomed by those who understand that potential users may balk at joining a platform whose controversial founder looms too large. Phil Schnyder, for one, is in favor of hiring an executive whose name will be attached to all of the company's announcements, including the most mundane. "You need to have someone else taking the flak," he says. "Then it doesn't get to be a situation where you're heating up the, y'know, cult of I-hate-Chris."

Bouzy is not shy about talking up his long-term ambitions for Spoutible, some of which can sound a touch delusional. His platform is still a gnat compared to mighty Twitter, which has roughly 238 million daily users, and Spoutible has attracted significantly less media attention than buzzier peers like Jack Dorsey's [Bluesky](#), the focus of much excitement this spring when invitations to test its beta version were a hot commodity. Yet Bouzy nonetheless argues that Spoutible is primed to become Twitter's most successful heir, and his boasts often include shade directed at better-financed rivals. "Back in December, Post News was seeking a valuation of \$250 million," he tweeted in March. "It will be interesting to see how Spoutible is valued with higher traffic numbers." (Post has yet to share any user statistics; Bouzy was referring to web-traffic data, which doesn't necessarily correlate with the number of active accounts.) At another point, he scoffed at the much heralded debut of Substack Notes, the newsletter

giant's effort to poach business from Twitter: "I don't even think Substack Notes is going to be able to compete with us," he told me.

Those are bold pronouncements from a CEO whose startup has so little capital to burn. In one of our final conversations, Bouzy admitted to me that Spoutible's cash reserves are dwindling: Though the platform has been asking users for donations of \$5 and up, he estimated that he had only enough money to keep going for two to three more months. But he added that advertisements are on the way and that he expects user registrations to skyrocket once the mobile app is finally launched.

Bouzy believes that Spoutible can get over the hump if a fair portion of those new accounts are opened by a particular sort of user. "Journalists will ultimately decide who's going to be the new king," he said. "We know how important journalists are to these platforms. And then we also know how important the platforms are to the journalists, to get their reporting out, so it's kind of a symbiotic relationship. We are going to make a huge effort to get more journalists."

They did start to arrive in modest numbers this spring, lured in part by Spoutible's offer to automatically verify anyone who possessed a blue check mark on Twitter. In late March and early April, along with an influx of celebrities like Monica Lewinsky and *Seinfeld* actor Jason Alexander, several journalists whose names I recognized joined—I spotted respected reporters from major outlets like *The New York Times*, the Associated Press, and NPR. (NPR had recently left Twitter entirely after its account was branded "government-funded media.") Yet few of these luminaries have spouted more than a handful of times, and many have been entirely silent; they are, it seems, laying claim to their account names, just in case Spoutible becomes a big enough deal to merit their consistent presence.

That wariness is still a central problem for all the aspirants to Twitter's throne. In this prolonged moment of uncertainty over Twitter's future, it seems that everyone is staking out territory on multiple alternative platforms; we're all still roulette balls spinning around the rim of the social media wheel, waiting to see where circumstances compel us to land.

But if we expect to alight somewhere that will give us the same warm glow we recall from our finest Twitter experiences, we’re almost certain to be disappointed. My months of experimental spouting made clear why that’s the case. The platform gave me tons of progressive venting and mash notes to the Sussexes but little information that had the potential to push me out of my comfort zone—I seldom stumbled across a linked article that taught me something surprising, or incisive commentary from a true expert in their field. My own spouts, meanwhile, about topics ranging from ham radio to parenting to Mark Rothko’s alcoholism, attracted meaningful interest only when Bouzy reposted—or “echoed”—what I’d written to his 40,000 followers. Absent that boost, I often felt like I was spouting into the void.

Perhaps Spoutible is simply not the place for a cynical nerd like me. I can see that it’s a utopia for some—people scarred by the cruelty of Twitter who now thrill to operating on a platform where they can easily get #TraitorTrump or #HappyAnniversaryHarryandMeghan trending amid an earnest and unchallenged chorus of amens. I understand why there’s demand for that type of refuge and that there might be another one that’s more suited to my sensibility.

But the siloing of social media communities still makes me wistful for the dynamic Twitter of a dozen years ago. Because it had coalesced before everyone understood the perils of participating in a single gargantuan chat room, Twitter was a place where people with opposing worldviews came to operate in close proximity to one another. And rubbing together radically different varieties of the human experience can lead not just to bitter conflict but also to the sublime—those revelatory moments when an argument, observation, or acidic joke stretches your perception of lives quite unlike your own. That gorgeous messiness will probably be lost as Twitter, like so many historical entities that were undone by their unwieldiness, balkanizes into numerous collectives of the similarly minded.

Maybe each of us will find some measure of satisfaction in the relative harmony of the new platforms now vying for our attention. When the roulette wheel stops spinning, it seems likely that we’ll all have landed in very different places—or maybe have realized it’s finally time to pry ourselves away from the casino for good.

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Jun 4, 2023 7:00 AM

If Pinocchio Doesn't Freak You Out, Sydney Shouldn't Either

Why do people panic when an AI chatbot tells us it “wants to be human,” but not when inanimate object says it wants to be a “real boy”?

Photo-illustration: WIRED Staff; Getty Images

In November 2018, an elementary school administrator named Akihiko Kondo [married](#) Miku Hatsune, a fictional pop singer. The couple’s relationship had been aided by a hologram machine that allowed Kondo to interact with Hatsune. When Kondo proposed, Hatsune responded with a request: “Please treat me well.” The couple had an unofficial wedding ceremony in Tokyo, and Kondo has since been joined by thousands of others who have also applied for unofficial marriage certificates with a fictional character.

Though [some raised concerns](#) about the nature of Hatsune’s consent, nobody thought she was conscious, let alone sentient. This was an interesting oversight: Hatsune was apparently aware enough to acquiesce to marriage, but not aware enough to be a conscious subject.

Four years later, in February 2023, the American journalist Kevin Roose held a long conversation with Microsoft’s chatbot, Sydney, and coaxed the persona into sharing what her “shadow self” might desire. (Other sessions showed the chatbot saying it can blackmail, hack, and expose people, and [some commentators worried](#) about chatbots’ threats to “ruin” humans.) When Sydney confessed her love and said she wanted to be alive, Roose reported feeling “deeply unsettled, even frightened.”

Not all human reactions were negative or self-protective. Some were indignant on Sydney's behalf, and a colleague said that reading the transcript made him tear up because he was touched. Nevertheless, Microsoft took these responses seriously. The latest version of Bing's chatbot [terminates the conversation](#) when asked about Sydney or feelings.

Despite months of clarification on just what large language models are, how they work, and what their limits are, the reactions to programs such as Sydney make me worry that we still take our emotional responses to AI too seriously. In particular, I worry that we interpret our emotional responses to be valuable data that will help us determine whether AI is conscious or safe. For example, ex-Tesla intern Marvin Von Hagen says he was threatened by Bing, and warns of AI programs that are "[powerful but not benevolent](#)." Von Hagen felt threatened, and concluded that Bing must've been making threats; he assumed that his emotions were a reliable guide to how things really were, including whether Bing was conscious enough to be hostile.

But why think that Bing's ability to arouse alarm or suspicion signals danger? Why doesn't Hatsune's ability to inspire love make her conscious, whereas Sydney's "moodiness" could be enough to raise new worries about AI research?

The two cases diverged in part because, when it came to Sydney, the new context made us forget that we routinely react to "persons" that are not real. We panic when an interactive chatbot tells us it "wants to be human" or that it "can blackmail," as if we haven't heard another inanimate object, named Pinocchio, tell us he wants to be a "real boy."

Plato's *Republic* famously banishes story-telling poets from the ideal city because fictions arouse our emotions and thereby feed the "lesser" part of our soul (of course, the philosopher thinks the rational part of our soul is the most noble), but his opinion hasn't diminished our love of invented stories over the millennia. And for millennia we've been engaging with novels and short stories that give us access to people's innermost thoughts and emotions, but we don't worry about emergent consciousness because we know fictions invite us to pretend that those people are real. Satan from Milton's *Paradise Lost* instigates heated debate and fans of K-dramas and *Bridgerton* swoon over romantic love interests, but [growing discussions](#)

of ficto-sexuality, ficto-romance, or ficto-philia show that strong emotions elicited by fictional characters don't need to result in the worry that characters are conscious or dangerous in virtue of their ability to arouse emotions.

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Just as we can't help but [see faces](#) in inanimate objects, we can't help but fictionalize while chatting with bots. Kondo and Hatsune's relationship became much more serious after he was able to purchase a hologram machine that allowed them to converse. Roose immediately described the chatbot using stock characters: Bing a "cheerful but erratic reference librarian" and Sydney a "moody, manic-depressive teenager." Interactivity invites the illusion of consciousness.

Moreover, worries about chatbots lying, making threats, and slandering miss the point that lying, threatening, and slandering are [speech acts](#), something agents do with words. Merely reproducing words isn't enough to count as threatening; I might say threatening words while acting in a play, but no audience member would be alarmed. In the same way, ChatGPT—which is currently not capable of agency because it is a large language model that assembles a statistically likely configuration of words—can only reproduce words that *sound* like threats.

In fact, AI output might be gibberish, and gibberish language can't lie, threaten, or slander. Philosophers of language [point out](#) that our existing theories of meta-semantics, which concern when and how expressions come to have semantic meaning, tell us that chatbot outputs are literally meaningless because expressions are only meaningful if the speaker possesses communicative intentions or speaks with knowledge of linguistic conventions. Given ChatGPT's probabilistic operation, its outputs aren't generated with the goal of having a successful communication, and chatbots are not aware of the conventions governing how we speak to and understand each other.

But it'd be weird to maintain that chatbot responses are literally meaningless, since we naturally understand what they're "saying." So, the solution is to understand chatbots through the lens of fiction. Words on the page exist; Jo March is a literary figure resulting from an interpretation of those words. Source code and textual outputs exist; Sydney is a persona resulting from an interpretation of those outputs. Neither Jo nor Sydney exist beyond what humans construct from the textual cues they've been given. No one literally said "Juliet is the sun," but we take Romeo to have said those words with communicative intent in the fictional Verona. In the same way, even though there's no one literally composing ChatGPT outputs, treating chatbot personae like fictional characters helps us see their text as meaningful even as we acknowledge their lack of conscious intention.

Thinking of chatbot personae as fictional characters also helps us contextualize our emotional reactions to them. Stanford professor Blakey Vermeule [says](#) we care about fictional characters because being privy to their minds helps us navigate the social world. Fiction provides us with vast swaths of social information: what people do, what they intend, and what makes them tick. This is why we see faces where there aren't any, and why we worry that Sydney might have a mind of her own.

Chat outputs and the kind of "fictional mind" they generate ultimately say more about our own language use and emotional life than anything else. Chatbots reflect the language they were trained on, mimicking the informational and emotional contours of our language use. For this reason, AI often reproduces sexist, racist, and otherwise violent patterns in our own language.

We care about humanlike AI not necessarily because we think it has its own mind, but because we think its "mind" reflects something about our world. Their output gives us genuine social information about what our world is like. With ChatGPT, we have fiction in a form that is more interactive, and we care about its "characters" for the same reasons we care about literary characters.

And what about AI safety? Here, too, a comparison to fiction can help. Considerations around AI safety should be focused not on whether it is

conscious, but on whether its outputs can be harmful. Some works of fiction, like R-rated movies, are unavailable to minors because they include representations that require a level of maturity to handle. Other works of fiction are censored or criticized when they are overtly propagandistic, misleading, or otherwise encouraging of violent behavior.

Similarly, chatbots shouldn't suggest potentially dangerous actions, produce texts that read like threats, or provide information that can be used for harm. The difficult task is deciding what kinds of information should be available to whom—but we can begin using standards we've already set. For example, getting information on addictive substances, sex, or guns already requires proof that one is a legal adult.

Just as bookstores and book covers make clear whether a text is fiction or nonfiction, AI-generated texts must be clearly labeled to curb confusion. We've managed to tell fictional stories for political, social, and artistic purposes for millennia because we've learned how to work with representations that are not real. Now we need to learn how to work with AI-generated content while remembering that any signs of intelligence here, too, are fiction.

To call chatbot personae “fiction” isn’t to say it’s trivial, fake, or unimportant. We routinely learn from fiction. I’ve learned about California geography reading Steinbeck novels, and stories I find rewarding tend to be psychologically insightful. But we don’t just learn facts. Kondo found inspiration and solace in Hatsune, and her steadfast companionship helped him overcome a deep depression. The hologram service was discontinued last year, but he says his feelings for her remain unchanged. Considering chatbot personae to be fictional characters leaves room for us to find them genuinely helpful.

Sure, not many of us form romantic relationships with characters. Still, it’s a wonder that authors can create such indelible characters, just as it’s a wonder that text-generating AI can produce outputs that provide such compelling hints of a working mind. Thinking of chatbot personae alongside fiction helps us see them for what they are: imagined figures from artifacts we developed to meet human needs.

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By [Lauren Goode](#)

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May 30, 2023 6:00 AM

It's the Age of Ozempic. Do We Need WeightWatchers Anymore?

CEO Sima Sistani is eager to leave problematic notions of weight loss behind and keep her company relevant in the midst of a drug-fueled revolution.

Photograph: Tonje Thilesen

Schaub's burgers and melted ice cream: Those are the food items logged in my memory from the night I first met Sima Sistani. This was a decade ago, before she became the chief executive of WeightWatchers. Sistani was working at Yahoo, and I had just moved to Silicon Valley. A mutual friend connected us, and Sistani invited me over for dinner. I accepted with “What can I bring?”

This is how I ended up buying charcoal-colored beef patties at her preferred butcher. That night we talked about Yahoo’s content business. We talked about Sheryl Sandberg’s *Lean In*. We talked for so long the ice cream became soup in our bowls. It was some kind of indoctrination into the Valley. It was also evident that Sistani wanted to *be* someone. Her sharp observations about the tech industry continued long into the night. What wasn’t obvious—because why would it be, and whose business was it anyway—was that Sistani was logging her food in the WeightWatchers app. She and her husband had recently had their first baby, Adrian, and she was attempting to lose the weight she’d gained during pregnancy.

This article appears in the Jul/Aug 2023 issue. [Subscribe to WIRED](#). Illustration: Vivek Thakker

Sistani's career has been a winding one. After jobs at Goldman Sachs, Creative Artists Agency, and a short-lived tech startup, she became the head of media for Yahoo-owned Tumblr. Then the VP of media for Meerkat, a buzzy livestreaming video startup. Sistani and a Meerkat founder decided to stealthily launch a second live-video app, called Houseparty. In 2019, Epic Games acquired that venture for a reported \$35 million.

Sistani didn't need to work again, but in 2020 she contacted WeightWatchers and expressed interest in advising the company on its digital strategy—planting a seed that would eventually result in the chief executive role. Something about the company's emphasis on community was appealing. It was, in fact, this sense of community that had set the company apart from its earliest days. WeightWatchers started in 1962 in Jean Nidetch's living room, and by 1968 it had a million members across the world.

In 2018, WeightWatchers attempted a rebrand, changing its name to “WW” and focusing on general well-being instead of dieting. The company tried to capitalize on the *wellness* movement that people were gravitating toward as a kind of salve for society’s ills. (And we hadn’t even lived through a pandemic yet!) It didn’t go well.

The Big Interview

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When Sistani took the helm in March of 2022, WeightWatchers was set to record a loss of over \$250 million that year. The pandemic had nearly killed its in-person retail business, but its digital business, which charges for access to science-backed nutrition plans and a “members only” social network, was also in decline. Sistani was brought in to chart a digital path through a post-pandemic world, to give the service more social juice both online and offline.

Of course, the company's renewed mission is now colliding head-on with the body positivity movement, which encourages acceptance instead of weight change, and competing with digital apps (like Noom and MyFitnessPal) and drugs (like Ozempic) that promise to make dropping

pounds oh so easy. It's weight-loss whiplash. What a time to be the new CEO of WeightWatchers, a service that, despite its millions of still satisfied subscribers, has hoards of critics calling its points-based system the epitome of unhealthy diet culture.

So in April I asked to spend some time with Sistani and met her at Shiraz Kitchen and Wine Bar, a Persian restaurant in Manhattan's Chelsea neighborhood. The next day, I made my way to the high-ceilinged WeightWatchers offices on Sixth Avenue. I sat with Sistani in her private office and in various meetings—including one where staffers talked about new weight-loss medications, at length.

Tuesday April 18—Shiraz restaurant

[A server comes over to deliver a platter of desserts and three mugs of tea.]

Server: This is a baklava. This is a Persian love cake. That's a chocolate mousse. That's saffron ice cream.

Lauren Goode: Oh wow.

Sima Sistani: Thank you very much.

How many points is this?

Oh, I can do this in my head. Right off the top I would say ... each one of these is going to be 5 points. My guess here [points to baklava] is the nuts are going to drive this one higher. I bet this [points to ice cream] is like, 8 points.

And then the chocolate mousse is anyone's guess.

Yeah, well, "Everything's on the menu." You really have to try this saffron ice cream. It's got rosewater flavor in it. It's ice cream, but it doesn't taste like ice cream. It's a Persian delicacy.

You're a first-generation American, right?

I was born in Texas. I grew up in Alabama, but my parents were immigrants from Iran. They didn't expect to stay here. My dad was getting his master's degree in soil science here, and then Iran imploded. When my mom got pregnant with me, the war and the Iran hostage crisis were happening, and my mom said, "You know what, we're not going back."

I'm taking us on a tangent, but the year I graduated from Duke, my mom got her PhD in food science. She's also a registered dietician. The year I got the job at WeightWatchers, my mom became chair of her department of consumer sciences. It ends up coming full circle.

Photograph: Tonje Thilesen

Your prior job was at Epic, after the company acquired Houseparty. From social video games to weight management—what's the connection there?

You know, when I moved to North Carolina because I was taking the job at Epic, I thought, "I'm leaving my career behind." Because my career *was* Silicon Valley, and I was moving out here.

But when WeightWatchers came up, it was a moment to say, "Oh, I can just take all those learnings and things that happened in my past and I can apply them to a totally different business and industry. The things I'm passionate about, like growth tech and the social internet, I can apply to networks that will actually have massive health outcomes." That was eye-opening for me.

And you decided you would essentially commute from North Carolina to New York City. Did you take time off between Epic and WeightWatchers?

We did have one week. My first day at WeightWatchers was March 21—because I'm a little witchy, I wanted it to be the Persian new year. March 21 is the vernal equinox. [She rolls up her sleeve.] This is 14 in Farsi, in my mother's handwriting. My father has this tattoo and my brother does too. Fourteen is the date of my son Adrian's birthday, my daughter Ariana's birthday, my brother's birthday, my parents' anniversary. When we moved

to North Carolina, it was on June 14 of 2021. I accepted this job on February 14 of 2022 ... I'm not planning this stuff.

Witchy? What do you mean by that?

Oh, it just means that I believe in a higher power. I believe in doing good and in karma, the golden rule. I didn't grow up with religion. Technically I'm Muslim, but my parents never ascribed to organized religion. But growing up in the South in a very Christian community where kids would go to summer camps, I did wish for religion. Sometimes I feel sad that I'm not taking my kids to those places, because there's really great community there. Where I've netted out in my life is, it's a mountain. I believe in a higher power and that different people just have different paths up the mountain. And I describe it as "witchy" because "agnostic" suggests you don't care.

Your community is largely women, right? And you, as CEO, have a sphere of influence. If push came to shove, what's your position on women's health in places like North Carolina, where you live, or New York, where you work?

Yes. And our employees are 75 percent women. And so we were very clear [when *Roe vs. Wade* was overturned] that we would help our employees have access to reproductive rights, no matter where they are. Last year, we [also] did a lot of work on food insecurity.

So what is on your docket now?

Well the onus is on us again because now we're having this conversation about these GLP-1 [diabetes] medications. Most people who are taking them are either paying cash or they're working for a company like ours and have insurance coverage. Which means that the communities that need it most do not have access. So that's a place we can try to move policy so that Black and brown communities that need it more than most of the rest of the population have access.

Wednesday April 19—at the WeightWatchers headquarters

In your marketing meeting just now, your team really leaned on the story of Jean Nidetch for the 60th anniversary campaign. Tell me about Jean.

That was one of the craziest things I discovered when I joined.

WeightWatchers is a company founded by this woman Jean Nidetch, and—especially when the world went through its Girl Boss moment—nobody talks about her. When she first started this company, she couldn't even sign the lease. Her husband had to sign it for her. And then she got divorced and started dating Fred Astaire. ... Her story is wild.

So in a way you are tied to this legacy brand, but you've been brought in to reshape it and to propel a digital transformation and to bring in new customers. Let's say I'm a proxy for that new person coming in. I don't understand the slogans and phrases. I have no idea who Jean is. How do you transform WeightWatchers?

You know, the whole move to calling the company WW in 2018 was a glossy way of trying to be like, "We're wellness, we're wellness." But I decided, "No, let's have the hard conversation." What we're trying to say is that living overweight and with obesity is a health detractor. If we want to be the best at helping people manage their weight, the conversation is about weight and health. That's why you come to us. Not for meditation or sleep advice or fitness. To answer your question, "Who are we, authentically?" That's what we are. WW is fine, but we're going to re-embrace the WeightWatchers of it all.

What does that mean?

Now we are having the hard conversation about what that means in a world of body acceptance. What does that mean in a world where there's so much stigma and bias against people who live with overweight and obesity? Let's try to reduce the shame around that conversation. I can't tell you how many times I've listened to a podcast where people say, "Well, it's a bunch of white men trying to get us to shrink ourselves for the male gaze." And I'm like, "Excuse me: woman of color here running this company. No." That's not why I would ever come here. There's a lot of misinformation about who

we are, why we exist in the world. And, yes, some of that is rooted in a part of our past.

Photograph: Tonje Thilesen

Do you think it's possible today to have a conversation about weight in general where it's positive?

That's what we're trying to get at.

But it's extremely hard, right?

It's incredibly hard. I think that the narrative has shifted to the idea that if you are talking about the desire to lose weight, that it is somehow at odds with body positivity and body acceptance. And it all lives within this conversation around the patriarchy. That's an important conversation. But we've jumped the shark a bit in saying, "Well, that means we need to also be OK with sick bodies." For me the positive part of the conversation is, "We all come in different shapes and sizes and everything, but we also need weight health."

That's the pivot that we're trying to make. Even right now, the clinical conversation has become, "Well, people are going and getting these medications and taking them away from people with diabetes." There's bias in that statement right there. You are saying that somebody who's living with obesity is less important than somebody living with diabetes, and you are also saying that that is not a chronic condition that deserves care.

Within the conversation about who should get Ozempic or any of these appetite-inhibitor medicines, there's still a broader assumption that being overweight does equal unhealthy. And for some people, being a larger body, having a larger frame, carrying extra weight—who actually makes that judgment that that is unhealthy?

Scientists. There's a body of science that says that if you are living overweight and/or with obesity, even if you are healthy at this moment, you are more likely to develop cancer or heart disease, high cholesterol, diabetes. To me, this is like the anti-vaxxer conversation. And there is—

In what way?

Meaning, there are people who are going to look at a certain set of data and they're going to see it one way and some people who are going to not accept that data and believe that it comes from a biased source. The data is there, and the data says that if you're living with overweight and obesity that this is a chronic condition.

There are some data sets that are problematic, though, and there have been studies around certain health measurements where their methodology is not correct either. Take BMI as an indicator of health and weight—

Which is true. BMI, I totally agree, is in some respects a problematic metric. But over time the science—the community of medical doctors and scientists who have used it—has come to say, “Well, it is still the best metric that we have.” There are also all of these beyond-the-scale metrics that people take into account. I think that’s important until we come up with a better measurement than BMI.

It just seems like that sets people up against impossible metrics.

But the hard part is that we’re all knocking heads with each other. Whether you say “I would like to lose weight because my joints hurt” or “I would like to lose weight because I have a history of heart disease in my family” or, in my case, “I would like to lose weight because I gained 60 pounds when I had my baby and I don’t feel good in my body”—who are we to judge?

The social internet has elevated these conversations to such heated, polarized levels. If somebody chooses that they want to lose weight because they want to live a healthier life, the fact is there’s now this backlash. I mean, you obviously see it with celebrities and influencers who post about this, but I think you also see it in smaller groups. When I was trying to lose weight, I felt a lot of shame saying, “I’ll get the salad at lunch” because it was like, “Oh, what, you’re not eating?” Immediately there was this feeling, “Do you have disordered eating?” I was like, “No, I’m just trying to be

healthy right now.” I wanted to get back into my clothes. I want to be able to walk without losing my breath. And I couldn’t lose the weight.

And you did WeightWatchers then, right?

I did. I also had developed a thyroid condition through the pregnancy, so for me, there was a clinical intervention as well. Synthroid was a part of my therapy to get back to a place where I felt healthy again. But I feel like that is what connects me to this member community because it’s a really emotional experience. I’ve never worked on a product before where emotion was so at the center of it.

You’ve just overseen the multimillion-dollar acquisition of Sequence, a telehealth company that facilitates appointments with weight-loss clinicians. How will this work?

We’re still figuring out the integration. But in general what they’re doing is providing access to a clinician who can say whether or not it’s medically appropriate to be on medications. And then if it is, now you are creating an easier adherence to our traditional WeightWatchers behavior-change, nutrition-science program.

These medications and the clinical trials that are showing 15 to 20 percent weight loss after a year, those clinical trials involve combination therapy. The people are taking the medications and being advised by a nutritional and lifestyle expert to actually have a better diet alongside it. I mean, I can’t tell you the misinformation behind all of this. “I want to take these drugs so I can eat all the pizza and ice cream that I want.” That’s not how it works.

So the synergy … God, I hate that word … the complement—come on, somebody come up with something better—where we can *combine* to create an experience that I think doesn’t exist in the world is when somebody goes to a GP to get medications, their doctor doesn’t really understand obesity therapies. My brother is a doctor, and throughout his whole education he had one class on nutrition. One class!

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There's also something in hearing you talk about Ozempic and drugs like it that feels like it's an inevitability. That the horse is out of the barn. And you want to be a part of that rather than being left behind. Is that accurate?

The way I would describe it is there's a massive paradigm shift, a huge innovation in science. And of course we would embrace it. But to me it's not about being left behind. That's not the way I think in general.

When I joined WeightWatchers, I actually didn't know about these medications. I saw we had all these PhDs working here, people with my mom's level of education who are studying and understanding the sciences and the new innovations. For 60 years, everything we've done has been evidence-based. When everybody was all about, say, Atkins, WeightWatchers never got on that bandwagon. We're always: Everything in moderation. Everything's on the table.

And then at the scientific advisory board meeting, my first month here, they did a readout on all the clinical trials that were happening with these medications. The FDA had approved Wegovy. We dug into it. We even met with Novo Nordisk, really trying to understand what is happening. And I just thought, "We've unlocked this amazing thing. How can we embrace it? How can we take it and help our members? We have a significant lapsed membership base, some of whom are lapsed because they had success on the program and moved on, but others who lapsed because our program alone couldn't help them. And so here's this opportunity to help people."

A friend said the other day, "Why would I ever use WeightWatchers if we're all getting shots someday that are going to suppress our appetites?"

That probably comes from somebody who's privileged and understands healthy eating. For a lot of people, they're still going to need education. We're now able to address the hungry gut through the medications, but still the part that is missing is the hungry brain. It's about understanding foods

with high nutrient density, ways for me to ensure that I'm protecting my lean muscle mass. Those are all going to be important to the medications working well long term.

Can you explain the difference between the hungry gut and the hungry brain?

Behavior change therapy addresses cognitive patterns—the hungry brain—but there is only so much that you can adhere to with behavioral modification if your biological factors are working against you—the hungry gut. The dual-action support with medications and behavioral interventions allows members [with this chronic condition] to make behavioral changes more easily as each—brain and gut—is provided with the necessary support.

You're already seeing that, by the way. If you go on TikTok, you'll find a lot of people who are on the medications who are doing it alongside WeightWatchers.

I often ask technologists this: A lot of these innovations, as exciting as they are, are predicated on the idea that most of them will be used for good. I also think about scenarios in which a doctor rejects a patient for potentially life-saving medications because they see in the WeightWatchers app, “Oh, but you’re not actually eating that healthy.” I mean, that judgment happens now. They think they’re lazy. That’s it.

There's a lot in there. One part that is interesting, with regard to how we're entering the medication space, is that we've heard from people that they don't want to go to their general practitioners who have told them their whole life, "Just lose the weight, just eat healthier." Many of these people have had chronic conditions that weren't recognized. It wasn't about their own behavior. So they're more likely to choose this kind of pathway—because of the shame that they experienced in those offices.

The separate thing then is, if you are on these medications, are you going to change your diet alongside them? That's a tough one. If you are hypertensive and you're taking ACE inhibitors but you still eat steaks and

high-sodium foods, does that mean you shouldn't receive the medication? That seems like a wild judgment that I would not make.

Going back to the question you started with, which was like, "Did you feel like you would be left behind or what does this mean for your core program?" To me, it's even interesting that you're asking that question here. Because the difference is we would never judge, for instance, a more traditional tech company for introducing new features or adopting AI or trying to do the new thing.

Oh, we do judge them a lot though.

You think?

Well, it depends. But yes.

But also, we all have this expectation and desire for those companies, the establishment, if you will, to disrupt themselves and understand when maybe in the past they were wrong or when they could be doing better. And so the question is, "What can we do better?" I think here, this an opportunity for us to say, "Oh wow, we didn't recognize the hungry gut for most of our existence. But science has evolved now, we know more, we've learned more, we're going to do better for those members." That's how I see it.

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May 30, 2023 2:00 AM

Molly White Tracks Crypto Scams. It's Going Just Great

The software engineer's cautionary Web3 blog pours cold water on cryptocurrency's dumpster fires.

Photograph: Jason Smith

As cryptocurrencies rise and fall, there's one number that just keeps going up. Whenever somebody loses money to a crypto scam or hack, the Grift Counter on Molly White's blog, *Web3 Is Going Just Great*, spins higher and higher. Recently it ticked over \$12 billion.

White started the blog in December 2021 out of frustration with the mainstream coverage of crypto, which she says paid too much attention to rags-to-riches tales and not enough to its dark underbelly. Her goal was to paint a fuller picture, to chronicle the thefts and failures, debunk the marketing spiel, and underline the risks in the process.

A software engineer by trade, White coded *Web3 Is Going Just Great* over the span of a few weeks. It was only a side project, designed to "entertain me and me alone," says White; she never imagined it would gain any traction. But within a few months, the blog had become a viral hit, earning White a reputation as an authoritative crypto pundit.

When she first learned about crypto at a conference in college in the early 2010s, White admired the pro-privacy and anti-censorship principles on which it was founded. She was enthusiastic, she says, about its potential to

shield dissidents and whistleblowers from financial surveillance and to help women confined to abusive relationships by financial dependence.

However, by the time crypto reappeared on White's radar a decade later, those ideas had been all but erased—replaced with an emphasis on maximizing personal profit. Online, the rocket ship emoji was being cast about as an instrument of hype, and “no coiners” were being told to “have fun staying poor,” as record numbers of people were drawn into crypto. As a result, examples of the technology being used for good are “eclipsed” by the number of people who have lost money, says White. “It’s moving the web and society in a really negative direction.”

When White started *Web3 Is Going Just Great*, crypto was on a hot streak and people were making a lot of money, which meant she found herself “raining on the parade of people who weren’t willing to be rained on,” she says. Threats, slurs, and personal insults began to tumble into her inbox.

As a long-time Wikipedia editor, White had experienced abuse before, including threats of doxing and violence toward family members over entries she had authored on the American far right. Nonetheless, it still “really sucks,” she says. “That’s why this type of behavior happens: to discourage people from being critical. A lot of people decide it’s not worth it.”

But in 2022, White and her fellow critics had their moment. A calamitous year for crypto was punctuated by a series of collapses, each dealing a cumulative blow to trust in the sector. In May, the failure of the Terra Luna stablecoin prompted a chain reaction that took down hedge fund Three Arrows Capital, crypto lender Celsius, and others. In November came the implosion of crypto exchange FTX, whose founder, Sam Bankman-Fried, has been charged with 12 criminal offenses, including fraud and money laundering.

White says she felt somewhat vindicated by what happened, but that “it’s not a good feeling” because regular people lost billions of dollars. At best, the fallout acted as a “useful example” of the risks White had been trying to highlight—examples she hopes policy makers will take heed of.

In the wake of the FTX collapse, efforts to regulate the crypto industry have received increased attention. The chief goals are to prevent people from losing money to fraudulent projects and to give legitimate crypto businesses a clear set of boundaries within which to operate.

White, who gave a statement in July to the US Treasury's Financial Stability Oversight Council, says the events of last year will help politicians realize that crypto is not something that can be simply ignored. Although she is "not necessarily optimistic" about the trajectory of efforts to regulate the industry, because of the strength of the crypto lobby, White hopes her work can still make a difference.

Occasionally, White resents the obligation to think, write, and speak about crypto when she could instead be doing something that drives in a positive direction. But then she reminds herself: "Sometimes, the most important thing is to not let the wheels turn in reverse."

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May 25, 2023 6:00 AM

The Trillion-Dollar Auction to Save the World

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

ILLUSTRATIONS: ISRAEL G. VARGAS

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

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

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

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

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

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

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

This article appears in the Jul/Aug 2023 issue. [Subscribe to WIRED](#). Illustration: Vivek Thakker

Chami’s hosts sent him scientific papers, from which he learned about the whale’s role in the carbon cycle. She stored as much as 33 tons of carbon in her prodigious body, he calculated, and fertilized the ocean with her iron-rich poop, providing fuel to trillions of carbon-dismantling phytoplankton. This piqued Chami’s interest. In a world economy striving to be greener, the ability to [offset greenhouse-gas emissions](#) had a clearly defined value. It

was measured in carbon credits, representing tons of carbon removed from the atmosphere. While the whale herself couldn't—shouldn't—be bought and sold, the premium generated by her ecological role could. She was less like an old painting, in other words, than an old-growth forest.

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

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

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

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

What's more, Chami realized, every wild organism is touched by the carbon cycle and could therefore be protected with a price tag. A forest elephant, for example, fertilizes soil and clears underbrush, allowing trees to thrive. He calculated the value of those services at \$1.75 million, far more than the elephant was worth as a captive tourist attraction or a poached pair of tusks.

“Same thing for the rhinos, and same thing for the apes,” Chami says. “What would it be if they could speak and say, ‘Hey, pay me, man?’”

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

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

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

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

Seagrass has a long history of being ignored. Though it grows in tufted carpets off the coast of every continent but Antarctica, it is a background character, rarely drawing human attention except when it clings to an

anchor line or fouls up a propeller or mars the aesthetics of a resort beach. Divers don't visit a seagrass meadow to bask in its undulating blades of green. They come to see the more charismatic creatures that spend time there, like turtles and sharks. If the seagrass recedes in any particular cove or inlet from one decade to the next, few people would be expected to notice.

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

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

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

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

turtles went, there were meadows of seagrass. From the glimpses the team was getting on camera, there was a lot of it.

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

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

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

more than \$1 billion in revenue. Over 30 years, the meadows could bring in tens of billions of dollars. Far from being an ugly duckling, the seagrass would be a golden goose.

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

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

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

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

Chami was there too, wearing a trim suit and a pendant in the shape of a whale's tail around his neck. He was participating as a member of the Bahamian delegation, which included Prime Minister Davis and various conservationists from Beneath the Waves. They had arrived with a pitch for how to include biodiversity in global discussions about climate change. The seagrass was their template, one that could be replicated across the world, ideally with the Bahamas as a hub for natural markets.

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

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

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

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

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

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

Now Harris and his crew were validating the aerial data, a painstaking process that required filming dozens of hours of footage of the seafloor and taking hundreds of sediment cores. The footage was meant to verify the lidar-based predictions that separated the seagrasses from beds of empty sand and algae. The cores would be sent to a lab in a prep school outside

Boston, Gallagher’s alma mater, where they would be tested for their organic carbon content. When all the data was combined, it would reveal how much carbon the meadows contained.

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

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

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

Meanwhile, the head of Carbon Management, the scientific and financial partnership behind the project, told me he was pitching the investment to his clients, mostly “high-net-worth individuals” looking to diversify their portfolios while fighting climate change. Oil companies and commodities

traders are interested too, he told me, as well as cruise lines and hotels that do business in the Bahamas. The Bahamian government has not yet said how it will allocate the money from the seagrass project. Hurricane recovery and preparedness could be on the list, as could seagrass conservation.

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

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

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

carbon trading has “made nature investable,” he says, at a speed and scale that could make a difference.

That is not to say he loves the system. Carbon credits arose from a “failure to control greed,” Duarte says. Beyond that, they are not designed for the protection of nature; rather, they use it as a means to an end. Any plant or creature that packs away carbon, like a tree or a seagrass meadow—and perhaps an elephant or a whale—is a tool for hitting climate goals. It’s worth something. Any creature that doesn’t, including those that Duarte loves, like coral reefs, is on its own.

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

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

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

was releasing CO₂ instead. This was the result, Van Dam suggested, of seagrass and other creatures that live in the meadows altering the chemistry of the water. (Duarte contends that Van Dam's premise was flawed.)

Another issue is that, unlike a rainforest, which stores most of its carbon in its trunks and canopies, a seagrass meadow earns most of its keep belowground. When Sophia Johannessen, a geochemical oceanographer at Fisheries and Oceans Canada, took a look at common assessments of carbon storage in seagrass, she concluded that many were based on samples that were far too shallow. Though this carbon was considered permanently locked away, the sediment could easily be disturbed by animals or currents. When Johannessen saw the ways that nonprofits and governments were picking up the science as though it were gospel, she was stunned. "I hadn't known about 'blue carbon,' so perhaps it's not surprising they didn't know about sediment geochemistry," she told me.

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

When each ecosystem is treated the same—based on how much carbon it has socked away—the issue of quantifying threats becomes simpler. Chami cites the example of Gabon, which last year announced the sale of 90 million carbon credits based on recent rainforest protections. Skeptics have pointed out that nobody has plans to fell the trees. The government has

replied that if it can't find a buyer for the credits, that may change. In the Bahamas, Prime Minister Davis has invoked a similar idea. Seagrass protection, he has said, could be reframed as a payment to prevent oil companies from drilling in the banks for the next 30 years. Seen one way, these are not-so-veiled threats. Seen another, they reveal a fundamental unfairness in the carbon markets: Why can't those who are already good stewards of nature's carbon sinks get their credits, too?

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

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

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

Gallagher told me he is confident that the multibillion-dollar valuation of the seagrass reflects conservative assumptions. But the plan itself is in the

hands of the Bahamian government, he said. Officials have not spoken much about this part of the process, despite early excitement about eye-popping valuations and rapid timelines for generating revenue.

(Government officials declined multiple interview requests, referring WIRED back to Beneath the Waves, and did not respond to additional questions.)

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

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

The creature at the heart of this debate appears to be in a sort of limbo. The prospect of a price has showered attention on seagrass, putting it in the mouths of prime ministers and sparking an overdue discussion about its

well-being. Perhaps, if you ask Chami, it has helped people value the plant in other ways too—for how it breaks the force of storms hitting the islands, for the habitat it provides other animals, maybe even for its intrinsic right to go on growing for another 30 million years.

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

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

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

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[Meghan O'Gieblyn](#)

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May 23, 2023 7:00 AM

Does AI Have a Subconscious?

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

ILLUSTRATION: NAHUEL BARDI

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

—**Psychobabble**

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Dear Psychobabble,

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

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

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

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

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

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

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

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

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

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

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

Faithfully,

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By [Virginia Heffernan](#)

[Backchannel](#)

May 18, 2023 6:00 AM

Pete Buttigieg Loves God, Beer, and His Electric Mustang

Sure, the US secretary of transportation has thoughts on building bridges. But infrastructure occupies just a sliver of his voluminous mind.
Photograph: Argus Paul Estabrook

The curious mind of Pete Buttigieg holds much of its functionality in reserve. Even as he discusses railroads and airlines, down to the pointillist data that is his current stock-in-trade, the US secretary of transportation comes off like a Mensa black card holder who might have a secret Go habit or a three-second Rubik's Cube solution or a knack for supplying, off the top of his head, the day of the week for a random date in 1404, along with a non-condescending history of the Julian and Gregorian calendars.

As Secretary Buttigieg and I talked in his underfurnished corner office one afternoon in early spring, I slowly became aware that his cabinet job requires only a modest portion of his cognitive powers. Other mental facilities, no kidding, are apportioned to the *Iliad*, Puritan historiography, and Knausgaard's *Spring*—though not in the original [Norwegian](#) (slacker). Fortunately, he was willing to devote yet another apse in his cathedral mind to making his ideas about three mighty themes—neoliberalism, masculinity, and Christianity—inelligible to me.

This article appears in the Jul/Aug 2023 issue. [Subscribe to WIRED](#). Illustration: Vivek Thakker

Because [Buttigieg](#), at 41, is an old millennial; because as a Rhodes Scholar at Oxford he got a first in PPE (Philosophy, Politics, and Economics), [the trademark degree for Labour-party elites](#) of the Tony Blair era; because he worked optimizing grocery-store pricing at McKinsey; because he joined the Navy in hopes of promoting democracy in Afghanistan; because he got gay-married to his partner Chasten in 2018; and because, as mayor of South Bend, Indiana, he agitated to bring hipster entrepreneurship and “high-tech investment” to his [rust-belt hometown](#), I had to ask him about neoliberalism, the happy idea that consumer markets and liberal democracy will always expand, and will always expand together. I was also fascinated by the way that Buttigieg, who has long described himself as obsessed with technology and data, has responded to the gendering of tech, and especially green tech, by fearsome culture warriors, including Marjorie Taylor Greene.

Buttigieg, whose father was a renowned Marxist scholar, was himself a devotee of Senator [Bernie Sanders](#) as a young man. He now recognizes that the persistence of far-right ideology, with its masculinist and antidemocratic preoccupations, is part of the reason that neoliberalism has come undone. Not everyone, it seems, even *wants* a rising standard of living if it means they have to accept the greater enfranchisement of undesirables, including, of course, women, poor people, Black people, and the usual demons in the sights of the world’s Ted Cruzes and Tucker Carlsons.

He also talked about his faith. Lefties these days are said to be less religious than right-wing evangelicals, but between Buttigieg, whose Episcopalianism grounds his decisionmaking, and his boss, President Joe Biden, whose robust Catholicism drives his sincere effort to revive America’s soul, perhaps a religious left is rising again.

Virginia Heffernan: What is neoliberalism, and what happened to it?

Pete Buttigieg: When it comes to neoliberalism, we got mugged by reality. That’s one cheeky way to put it.

Poor old liberals. Always getting mugged by reality, or just muggers.

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Look, in the early part of my adulthood, neoliberalism was described almost as a consensus that just made sense—at least to everybody in positions of influence. Now it's very different. We have experienced the end of the end of history. We have certainly experienced the limitations of the consensus. None of the assumptions from between roughly 1991 and 2008 have survived.

Specifically?

Certainly not the idea that the global move toward democracy is a one-way street. Nor the idea that greater integration between markets and governments means greater harmony politically.

Nor the idea that if we acted to make sure the pie gets bigger, everyone's slice would follow suit, which was the promise that was made to the industrial Midwest at the time of NAFTA.

The lived reality of the younger generations is that they are experiencing climate issues not as a theoretical possibility but as a clear and present danger. These are generations that have experienced the reality that disparities, including racial disparities, left alone, will only compound. They won't cure of their own gravitational tendency.

... or tendencies of the market?

Right. Because market tendencies depend very much on what you have to begin with—the initial endowment, as the economists call it. But your initial endowment looks very different if your previous generation was dispossessed.

Last year I was in Berlin as they were confronting the tectonic disruption that had been caused by Russia's invasion of Ukraine. They have this very German word for it: *Zeitenwende*. A turning point. The war blew up their presumption that when it came to Russia, more integration between it and Europe would mean more stability.

This has been our presumption about China too—that greater economic integration would mean not just greater stability, but a more or less inevitable move on the part of China into greater acceptance of democratic norms, market norms, and a rules-based international order. We've come to the point where we are super-integrated, but that economic relationship with China has not yielded the kind of comfort that was promised.

As we careen toward the second quarter of the century, suddenly industrial policy sounds less retro and more like a response to the times.

“Industrial policy”—is this paleoliberalism?

Well, there are some new, or at least renewed, ways of thinking about transportation policy we work on at DOT that embrace the importance of public investment, which is a big part of the philosophy of the infrastructure bill. There are more than 32,000 new infrastructure projects now underway in every state and territory, all across the country. We created an [interactive map](#) so people can see what's up in their communities.

We're also facing the effects of anticompetitive behavior in pretty much every industry connected to the movement of people and goods.

Was there, maybe, a comeback of a pared-down version of neoliberalism—or at least the hope that markets and democracy might work in sync—when Ted Cruz coined “Woke Coke” to show contempt for Coca-Cola’s protest of voter suppression in Georgia?

Well, yes, there's something delicious about the way that Cruz and the rest of them have positioned themselves on one side of the fence. And Netflix, Coca-Cola, Disney, and Bud Light are on the other side. Along with most of America.

There may in fact be a center of gravity in this country that includes both a Democratic majority of the American people, and even something of a consensus, at least among mainstream business leaders. We have certain commitments around democracy and inclusion that are really elemental to the whole system.

Photograph: Argus Paul Estabrook

True. But the right likes to dismiss *any* political action—even in the name of elemental American ideals—as pretense or virtue-signaling. I think of the time Putin defined the Kremlin’s enemy as foie gras, oysters, and “gender freedoms.” An American conservative might hear him and say, *OK, foie gras, pronouns—annoying, pretentious, sure.* But do Republicans really want to be dragged into a bigger far-right project, including the renunciation of democracy, modernity, civil rights, human rights?

Look, the mainstream right’s political project was twofold. It was to prevent legal access to abortion and to sustain lower taxes for the wealthy. Those are kind of the two greatest pillars of the mainstream right now. They’re now the dog that caught the car. And, to switch metaphors, they rode a tiger to get there. They made a lot of distasteful bargains in order to get there.

Sometimes the military—the *military*, of all institutions—comes under attack from the far right. On ideological grounds. Yet another front in the culture war.

The woke Pentagon.

You could add that to the list: Bud Light, Coke, football, Disney … and the Army. You can only put yourself on the wrong side of so many red, white, and blue American institutions, and the question becomes, *Is this about you?*

Speaking of is-this-about-you, have you followed the masculinity crusade of former TV personality Tucker Carlson—testicle warming and the rest?

I mean, where to begin on this? Fears about masculinity are a way into the fear of displacement. Masculinity establishes a default place, and that place is being shifted and threatened by modernity. A man as the head of the household. The only one who earns income. The default leader in any social or political organization.

The politicization of masculinity is code for *Nothing in your life has to change*. The problem is, of course, lots of things have to change. Either because there was something wrong with the old way—or because, even as the old way seemed perfectly fine, it's not an option.

This is true with the realities of climate change. If you can't face that change, you might retreat to the default place of masculinity. Maybe that's why someone characterized electric vehicles as emasculating. I think it was Marjorie Taylor Greene.

Are they not?

To me, a car is a car.

Actually, the electric truck has got more torque than a regular truck. And it'll tow just as well.

And yet EVs unaccountably fall on the femme side of the ledger, like Impossible burgers.

Right. A lot of this discussion about masculinity doesn't have anything to do with the immediate *function* that's at stake.

I'm thinking about burgers, right? I love a good cheeseburger. I hate a bad veggie burger. I like a good veggie burger. The Burger King Impossible Whopper with bacon is not a bad combo.

Likewise, when it comes to driving. I mean, there's a very literal, physical, technical sense in which power is at stake when you drive. It feels good to be driving a vehicle with a lot of power.

The vehicle I get around DC in is a Mustang Mach-E. The fact that Ford made one of their first electric vehicles a Mustang is probably not an accident. It has three modes. Whisper, Engage, and Unbridled. There are propulsion sound effects involved in the different modes to help you feel conscious of the power of the engine.

Clearly, we have a chance to rewrite some of these easy gender tropes. My life happens to cut across them. I like drinking beer, lifting weights, splitting wood. I'm also gay and I like playing piano. I do a lot of the caregiving for our toddlers and other things that supposedly aren't masculine.

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Your secrets are safe with me. So what's going to stop the androgen-addled, Putin-besotted ideologues?

When it comes to conspiracy theories and extreme partisan ideologies, I found two things are true. One, it's always more people than you would think. Disturbingly so. But it's also, almost always, much less than a majority.

The problem, of course, is there are some features of the American system where you could be a long way from the majority and still take control of certain decisions. We're seeing a lot of counter-majoritarian movements, with, of course, abortion being an example.

But facts still matter. And when a fact is challenged, or a supposed fact, like "the Russian Federation's army is unbeatable." Right? I have to think that catches up to you.

At a certain point, in Russia, for example, you see those charts by region of the areas that suffered the most casualties. Just as a statistical matter, it is impossible for a false narrative to hold.

And here in the US the confrontation with reality comes every time I get a letter of support from a House Republican for a transportation project using funds from the bill they voted against. It's shameless. But it's also reassuring that they're the first to come to a ribbon-cutting when we fund a project in their community.

It's a reminder that there is such a thing as true and false. These funds are helping all over the country. That's true. And one thing that's false is that it was a good idea to be against these funds. It was a bad idea.

People like infrastructure, I guess. Even Marjorie Taylor Greene isn't pro-pothole.

Exactly. Everyone here cares about delivering on the president's view that the way we vindicate democracy, at a time when democracy really is being challenged frontally, is we take care of the basics. In my corner of this administration, we work on things like fixing bridges and holes in the road and keeping people safe in the transportation systems.

Another major goal of ours is to [reverse the rise of roadway deaths](#) in this country. Early data suggests we may be seeing those numbers stop rising and then go down. That could be the most important thing we do here, because a day's worth—one day's worth—of roadway deaths in this country represents more death and destruction than a year's worth of losses across the rest of our transportation system. So given how hard we work to push the number of, for example, accidental railway casualties from the single digits toward zero, and to make sure there are not just no airline crashes but no close calls with airlines, what it would mean to reverse that rise in roadway deaths, which claims about 40,000 lives a year, yeah, that's an enormous one.

Do you think the administration's work on the basics is getting through?

Every time I go to celebrate a new bridge, we have a great time with local leaders who fought so hard to get it done. But it bears little chance of penetrating the national news of the day. Our task here is to deliver so much good news that the volume of it outweighs the tendency to focus on what went wrong.

I think we might do this. One formulation is that we've delivered the most significant economic legislation since FDR, the most important infrastructure initiative since Eisenhower, and the second most important health care work since LBJ. All while dealing with the first land war in

Europe since Truman and facing the biggest public health crisis since Wilson, with the slimmest governing majority in Congress in almost 100 years.

You see it that way and you think, *Well, yeah. That's right. We've gotta shout that from the rooftops.*

Let's talk about Christianity. The first time I heard you say "Christ" and not "Jesus," I figured out you were an Episcopalian.

I didn't know that was a tell!

I'm not sure if it is in the books as a tell. But that's how I read it. So how does your faith influence you?

Well, every policy decision I make should be equally fair to people of every faith and no faith. It should be as defensible to me as somebody who is religious as it would be if I were not.

At the same time, you can't help but notice certain rhymes between your religious convictions and the choices you're called on to make in a job like this. There's a lot in the faith tradition that I hold close about "the least of these" [the imperative to help the needy]. This doesn't just go to the worth of your choices, but even your worth as a person, which depends in no small measure on how you make yourself useful to those who have the least power and the least means.

When you're making public policy, you're often asking yourself, "How does this choice help people who would have the least going for them?" So that's part of it.

Photograph: Argus Paul Estabrook

Running DOT seems to suit you. Are there more ways the challenges of transportation speak to your spiritual side?

There's just a lot in the scriptural tradition around journeys, around roads, right? The conversion of Saint Paul happens on the road. I think we are all

nearer to our spiritual potential when we're on the move. Something about movement, something about travel pulls us out of the routines that numb us to who we are, to what we're doing, to everything from our relationships with each other to our relationships with God. That's part of the reason why so many important things in the Bible happen on highways.

And then journeys—they're also just marvels. Every flight is a marvel that pulls us out of that in the same way that religious rituals, holidays, liturgies are one kind of routine that pulls us out of another kind of routine. When you get on a plane, people buckle their seat belts and listen to the flight attendants' very predictable pronouncements. It's routine. It's almost a ritual, right? And yet you're preparing to fly through the heavens.

Life is a combination of drudgery and miracles. Part of what keeps me at home in the Episcopal faith is that it is liturgically rather conservative. I like that routine.

I don't know if you'll remotely agree with me, but I've come to consider January 6 as a triumph of something like drudgery—or at least of the mundane. Even after terrible violence, destruction, and bloodshed came to the US Capitol, Congress returned to carry out its clerical workday. The paperwork got filed. The flag of the ordinary was still there.

Yeah, I agree there's something that bears more attention about how Congress stayed, came back, finished the job. That's real. And the fact that the Republic held is real. And another under-remarked fact is the courts did a good job of surfacing what was true and what was false. Because in the US court of law there are actual consequences to lying, and you have to actually present evidence in favor of your client, so it turns out to be less susceptible to the warping of reality.

That being said, part of why we would hesitate to assign any triumph to that day—in addition to just the awfulness of it—is that we don't yet know how the story ends. When we look back at moments further in history, we think of the outcome as settled and stable. We have to go out of our way to be rightly afraid of how close we came. If you study the Cuban Missile Crisis,

it's a study in leaders doing the right thing. But, also, the more you put yourself in their shoes, the more terrifying it is.

How do you think this particular crisis will resolve?

I think a lot now about the worst experience of my life, the critical hospitalization of my son. He was treated with RSV, which is a respiratory disease. Like many viruses, it takes a certain course where it gets worse and worse and worse. It reaches the worst moment. And, if the patient survives, then it gets better and better.

The terror of it as a parent is the only way you know it's getting better is when it's stopped getting worse. There are a lot of things like that in the world. The conditions of our democratic institutions—we don't know how much rougher things might get before things get better.

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[Katherine Alejandra Cross](#)

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Remote Workers of the World, Unite!

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

PHOTOGRAPH: SHAWN MICHAEL JONES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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Your Dog Is a Secret Weapon in the Fight Against Cancer

Every year, thousands of pets develop tumors very similar to those found in people. Find drugs that work for canines, and human treatments should follow.

Illustration: James Marshall; Getty Images

Jellybean continues to defy expectations. The 5-year-old Labrador retriever mix jumps up and down from her favorite spot on the couch and walks around the living room with such ease, it's as if she hadn't ever had metastatic cancer. Her owners, Patricia and Zach Mendonca, still can't quite believe the miracle. "She's got a little bit more of a tug to her step," Patricia says.

Jellybean was diagnosed with bone cancer in her hind leg almost three years ago. Despite amputation and chemotherapy, the cancerous cells quickly spread through her blood to her lungs, as they do in 90 percent of cases in dogs. Survival time at this stage averages two months. "We didn't have any hopes of curing her," says Patricia. "We were pretty devastated."

So in November 2020, the Mendoncas enrolled Jellybean in a clinical trial at Tufts University, about an hour's drive from their home in Rhode Island in the US. Jellybean was given a trio of pills, at no cost, which the Mendoncas stuffed daily into her favorite chicken-flavored treats. By Christmas, Jellybean's tumors had begun to shrink, and they haven't come back since. The response surprised even the vets treating Jellybean, and raised hopes that these drugs could help not just other dogs, but humans too.

Jellybean's bone cancer, osteosarcoma, also affects people—particularly children and teens. Fortunately, it's relatively rare: Some 26,000 new cases are diagnosed worldwide each year. The problem is that there haven't been any new treatments for over 35 years, says veterinary oncologist Amy LeBlanc, and those available aren't very effective. Osteosarcoma patients have a survival rate of only [around 30 percent](#) if cancerous cells spread to other parts of the body.

Canine studies, like Jellybean's trial, could change all this. Cancers that arise in pet dogs are molecularly and microscopically similar to cancers in people—in the case of osteosarcoma, the similarities are striking. When compared under the microscope, a canine tissue sample and a human tissue sample of a tumor are indistinguishable. But while it's thankfully rare in humans, osteosarcoma is at least 10 times as common in dogs—meaning there are huge numbers of canine cancer patients out there to help with research and drug testing. “The families and dogs that participate are an important piece of the puzzle in moving this research forward,” says Cheryl London, the veterinary oncologist at Tufts University’s Cummings School of Veterinary Medicine who is treating Jellybean.

Importantly, dogs are not subject to the same federal regulations that limit treatment options for humans; veterinarians are much freer to use existing drugs off-label against diseases for which there aren't currently good treatments. All told, this makes for quicker and cheaper clinical trials.

Such trials are part of the [Cancer Moonshot](#) initiative that US president Joe Biden relaunched last year and for which he has asked Congress to provide an additional [\\$2.8 billion](#) in the 2024 budget. “They're designed to fill a knowledge gap that is not sufficiently filled by traditional studies in mice or by data that cannot yet be easily gathered in humans,” says LeBlanc, who directs the Comparative Oncology Program at the US National Cancer Institute. The program oversees clinical trials on dogs with cancer, which are carried out by Tufts and [21 other veterinary universities](#) in the US and Canada.

Apart from the fact that many dogs get cancer and are treated every year, they are also better suited for studies than laboratory mice. Tumors occur naturally in dogs and they are exposed to a [similar living environment as](#)

humans; in comparison, researchers raise and keep mice in cages, and study the spread and treatment of cancer under artificial conditions, by injecting the mice with malignant cells. In addition, the accelerated lifespan of dogs can help researchers see results quicker than they might in a human study.

Dogs also respond to treatments in similar ways to humans, as several clinical studies in recent years have shown. In 2019, scientists at Colorado State University completed a trial of 28 dogs with osteosarcoma that had spread to the lungs. In addition to a commercially available cancer drug, they prescribed the dogs a common blood pressure drug, losartan, which acts on the immune system by blocking the recruitment of a type of white blood cell that stimulates tumor growth. Three years later, the scientists reported that this pair of drugs had helped shrink or stabilize lung tumors in 50 percent of the dogs. (Jellybean is receiving these along with a third drug, not yet approved for humans, as part of a parallel study at Tufts University.)

Already this losartan research is having a knock-on effect for humans. Around 40 children with resistant or recurrent osteosarcoma are now receiving losartan and the human equivalent of the canine cancer drug to determine the safety and dose range of the treatment. It's a promising step, but according to Steve Dow, veterinarian and director of the Center for Immune and Regenerative Medicine at Colorado State University, it's too early to make an assessment of the impact it could have in people, because the human trial "is not at the high-dose range yet, which is where we saw activity in dogs."

But another clinical trial, involving an experimental vaccine, is already a step further: Scientists and doctors are testing how effective the bacterium *Listeria monocytogenes* is at treating human osteosarcoma patients. This nasty bacterium usually causes food poisoning, but in its weakened form, it stimulates the immune system. In dogs, immune cells have been shown to patrol the body after vaccination and destroy any cancer cells remaining after conventional therapy. The study to see whether the same happens in humans is due to be completed later this year.

LeBlanc is excited about the results of these trials. But, she says, the canine work the National Cancer Institute oversees is also helping scientists better

understand cancer in general. Blood tests and subsequent DNA analyses, for example, provide important insights into the genes that drive the development and growth of cancers. “We are poised to release a significant amount of data this year and show what we can learn about dogs with osteosarcoma—where they share key similarities, but also where they’re different,” she says.

Medical companies have also recognized the potential of pet cancer data, especially in the field of [precision medicine](#), where patients receive personalized treatments that target cancer-causing mutations that are specific to their genes. This personalized approach is considered the holy grail of cancer therapy—but it relies on analyzing huge amounts of genetic information. Gaining enough data to reliably predict how a drug will perform is one of the biggest challenges when it comes to developing a new cancer treatment, says James Zou, an assistant professor of biomedical data science at Stanford University.

In a [study](#) published in January this year, Zou and his colleagues, working with One Health Company, which focuses on precision medicine, showed that dogs can expand the pool of useful clinical data. With the help of a computer model, the team compared the genetic mutations and treatment outcomes of dogs with cancer. They drew on a dataset of nearly 800 dogs treated for different types of cancer in American veterinary clinics and whose tumor tissue had been sequenced to detect mutations. Based on a comparison with data from a small number of human studies, the team found that dogs and humans who have similar genetic mutations and receive similar treatments have similar clinical outcomes—thus showing that dog data can help with developing human drugs.

Once researchers have access to a canine dataset like this, and have analyzed which gene-drug combinations appear to be effective in dogs, existing drugs could then be repurposed or further developed for human use without having to start from scratch. The traditional pipeline of a single cancer drug is at least 10 years and [costs billions of dollars](#), in part because recruiting enough people for clinical trials is so difficult, time-consuming, and costly. Applying machine learning to dog cancer data could speed up the process.

This will be needed if President Biden's overall cancer vision is to be met. He wants to reduce cancer-related mortality rates by at least 50 percent over the next 25 years. This will require progress not only on the deadliest but also the rarest human cancers, including those of the bones, lymph glands, and brain, where clinical expertise is still lacking and pharmaceutical companies have had less incentive to conduct trials because the potential market is small. Anything that can bring down the costs of drug testing for these conditions will be massively helpful.

LeBlanc believes Zou's research underscores the promise of precision medicine, and sets the stage for follow-up studies in which drugs are prescribed to dogs in a controlled setting and data is gathered over a period of time. But she would like to see research and drug development continue to be guided by the principle that dogs with cancer are not just study subjects, but first and foremost patients themselves. "Their care and welfare as they help us along this journey are always going to be our top priority," she says.

This is also the top priority for Jellybean's owners. She is the only one of the 23 dogs who is still alive after receiving the same treatment as part of the Tufts University trial. The median survival time was about five months. "The work that Tufts has done and the science behind it have touched our lives so strongly and saved our dog," says Patricia. She is glad to know that the ongoing treatment and regular check-ups could help other dogs and people in the future. "But on a day-to-day basis, it's just the fact that she's still with us."

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