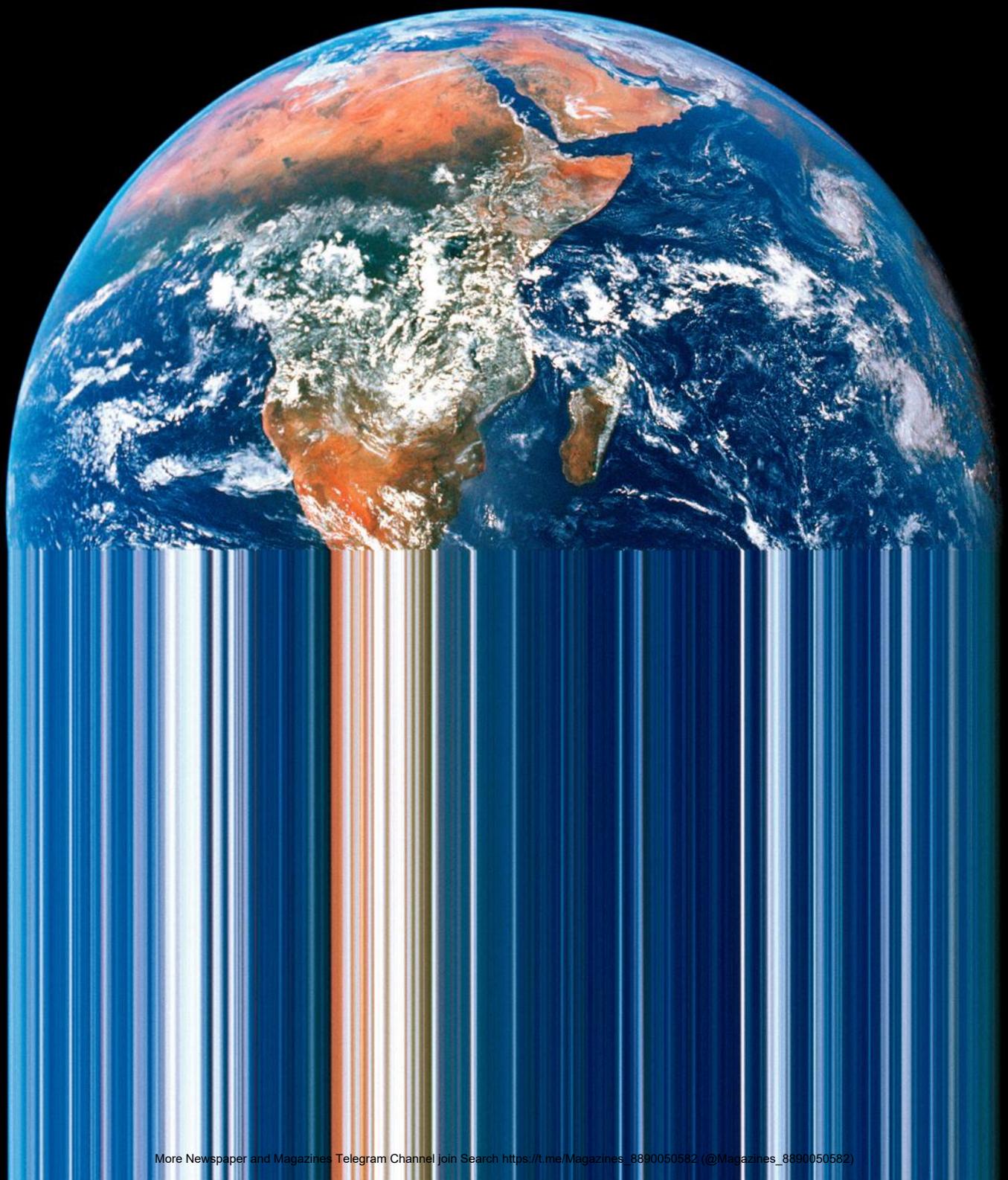


WIRED

There's a 1 in 10 chance an invisible waterfall will destroy the world.
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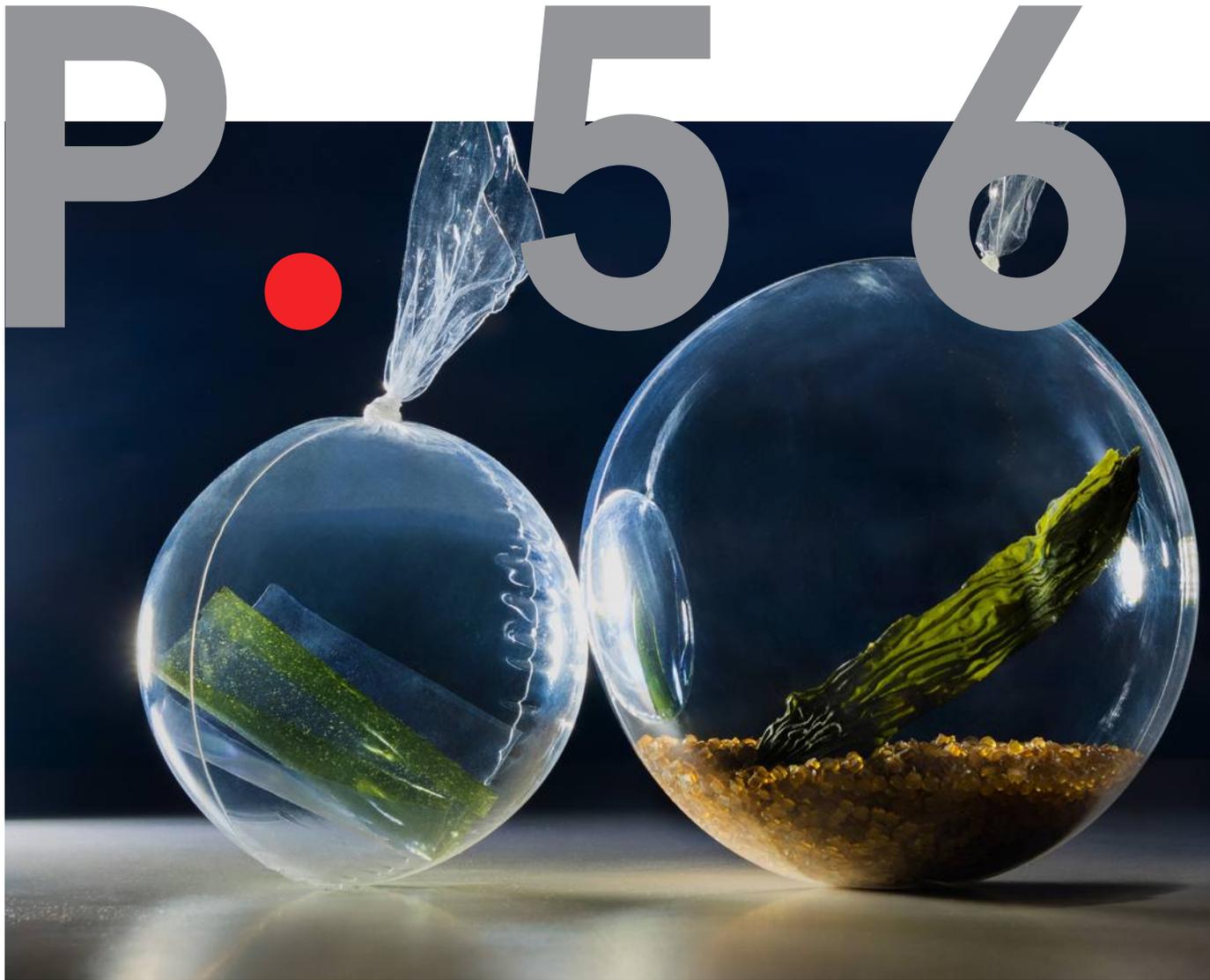
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loropiana.com

Features



The Earth Issue

Apologies to Musk et al., but we like it here! Yes, it can be a plastic-strewn, climate-changing mess. But as always, WIRED looks to the horizon—and imagines a better future for our little piece of the universe.

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Beneath the waves lurks a massive waterfall. And in its mysterious depths, the fate of the world churns.
by Sandra Upson

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Can the UAE really make rain on demand—or is it selling vaporware?
by Amit Katwala

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To cure our addiction to disposable crap, we'll all need to get a little loony.
by Clive Thompson

p.66 Damage Control

Turning off pipelines, disabling reservoirs—these are violent, criminal acts. According to Léna Lazare, the 26-year-old face of the radical climate movement, they're also acts of joy.
by Morgan Meaker

p.74 Priscila, Queen of the Rideshare Mafia

She came to the US with a dream. Using platforms like Uber, Instacart, and DoorDash, she built a business empire up from nothing.
by Lauren Smiley

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I've agreed to be turned into an AI reading companion by a little-known company called Rebind. A report from the inside.
by Laura Kipnis

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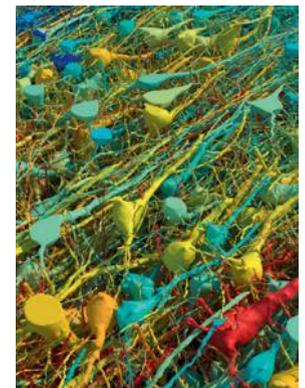
On the Cover

p.22

When we asked regular WIRED contributor **Alvaro Dominguez** to illustrate our new climate cover (he did the last one too, in 2020), he sent us a mega-batch of options. Fifty-one to be exact. Here are just a few of our other faves.



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Start

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by Jason Kehe

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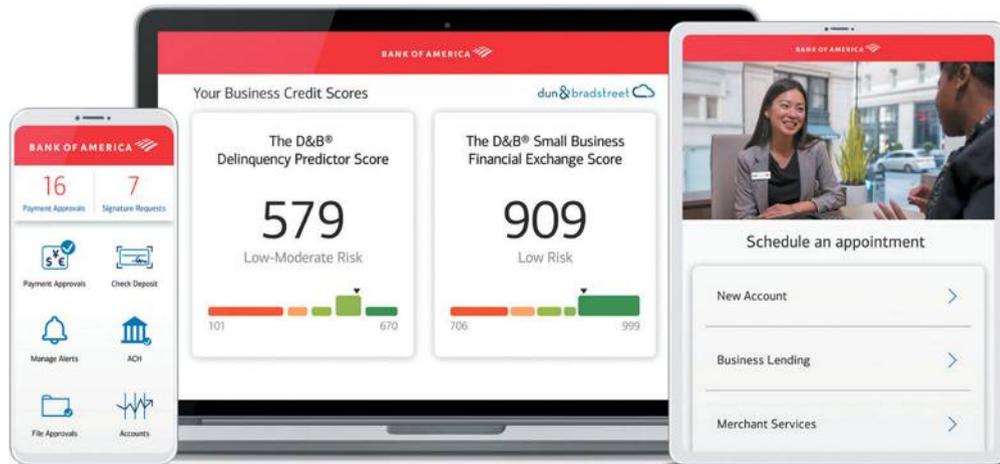
Six-Word Sci-Fi

p.96 Very Short Stories
by WIRED readers

CLOCKWISE FROM TOP: RETO STERCHI; DANIEL BERGER; GOOGLE RESEARCH AND LICHTMAN LAB; JOHANNA GOODMAN; GETTY IMAGES; NASA (COVER)



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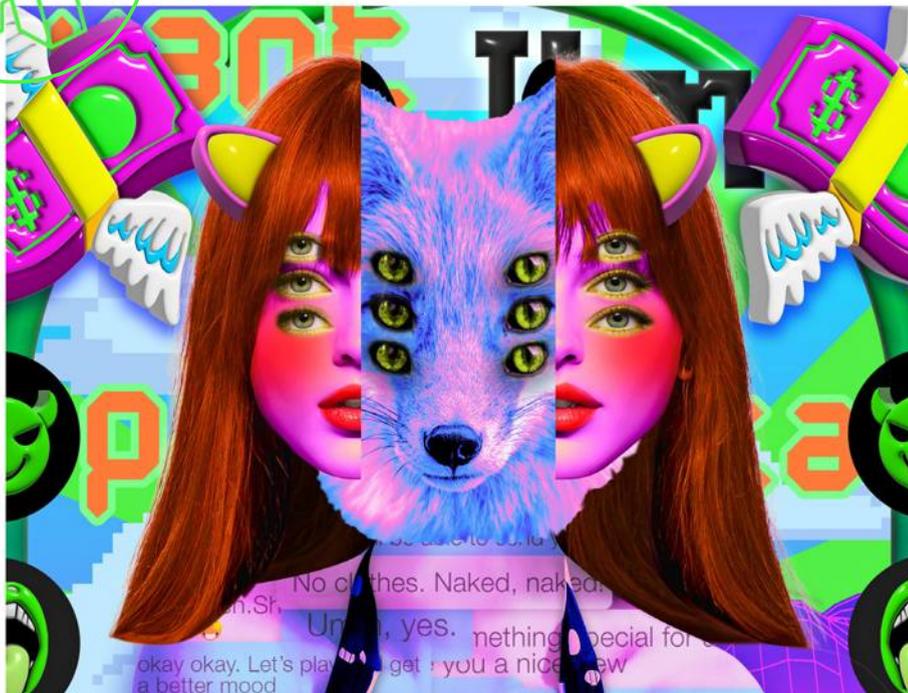
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Readers deliberate on deception and the morality of immortality.

In our July/August issue, Brendan I. Koerner discovered that some of OnlyFans' biggest creators hire paid "chatters" to speak (and have virtual sexytime) with subscribers on their behalf. Then he became one of those chatters. And at WIRED.com, Ray Kurzweil made waves—and ruffled feathers—with his eerie vision of a future when immortal humans are deeply entwined with AI.



RE: "SHE CONTAINS MULTITUDES"

It was easy for me to understand why you felt conflicted about selling content to men while posing as some young, attractive woman. When I did it, I felt bad too, especially when I realized that these marks were just normal people who didn't know any better. They just wanted to spend time talking to a beautiful and fun woman, just like anybody else. I received DMs on Reddit from people who had grown suspicious of the models they had sent money to. I did my best to explain how the industry works behind the scenes, and I've even shared screenshots with them of some of the chats, guides, and spreadsheets. I thought that would surely save them from wasting hundreds, if not thousands, of dollars on these scams ... It didn't help. They open the chat with the

model again to voice their concerns, and then they believe it's really her again. They'll feel more comfortable spending more money than they did before. I hope your article does a better job sowing the seeds of doubt in these people.

—u/Popsodaa

The majority of creators are not using chatters. I don't. I would never even consider it, as I don't think it would feel entirely ethical, but so many guys assume that I do. It's annoying to get dozens of messages every day asking, "Are you real?"

—u/Pixxiprincess

The digital economy runs on exploitation and deception—on a bed of lack of accountability. People tout that we're living in the age of information but fail to reckon with the fact that "information" can be a sword rather than a shield.

—@neiturkewitz

RE: "IF RAY KURZWEIL IS RIGHT (AGAIN), YOU'LL MEET HIS IMMORTAL SOUL IN THE CLOUD"

The most disturbing thing about the singularity, for me, is the notion that we'll make "copies" of ourselves. That suggests the ability, and ultimately the compulsion, to tweak our personalities and habits to become "perfect" humans. Humans that fit the societal expectations of their times, in the same way we have genetically engineered blemish-free fruit. Looks great on the surface, but it's bland, tasteless, and less nutritious. I am 100 percent in favor of living a long and robust life, as long as it is filled with worthy challenges and novel experiences. How we maintain that in a lifespan of 300 to 500 years has yet to be defined.

—Scott Cochran

After very thoughtful questions from Mr. Levy that surfaced deep contradictions and dystopian scenarios, the best we got was "things will fix themselves." Very much in line with "the banks will regulate themselves."

—Franco Potepan

RE: KURZWEIL

"His techno-optimism seemed harmless to me when I was 18, and now seems monstrous."

—@E_Baillieul, via X

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DATA ANALYST

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THE TECH WORLD'S GREATEST LIVING NOVELIST GOES META

In which Robin Sloan writes *Moonbound*—a science fiction book about science fiction—and our writer writes his way into total insanity.

D

DEEP INTO MY many-hour hang with the tech world's greatest living novelist, Robin Sloan, he says something profound about science fiction. It's the insight I've been waiting for, the key to understanding not just him but maybe all of storytelling. I glance down at my voice recorder, just to make sure it's on. "Memory is full!" it says.

Full! With that mocking little exclamation point. I do not panic. Instead what happens is: I simply go insane. Part of me stays there with Sloan, chatting about sci-fi. The rest of me is, I don't know how else to put this, *yanked*, as if by some cosmic cartoon cane, offstage, into the other-dimensional wings of reality, where time is irrelevant and space sort of fizzles. In that realm, I know my task: to come up with a way to write this profile, or perish.

It's fine, I say to myself. *Everything is fine. So what if you don't have Sloan's exact words? You can paraphrase. And you won't even need to do that, at least not at first. In the intro paragraph, just say there IS a profound insight. Classic way to entrap the reader.*

Well, unless the reader doesn't know who Robin Sloan is. But that's an easy fix too: Just give him some impressive-sounding title that can't be ignored. "The quintessential Bay Area author," say—but less local. Or "the programmer-writer's programmer-writer"—but less esoteric. Oh, that's it: He's "the tech world's greatest living novelist."

(Which is, maybe, actually perfectly

true. How many other novelists do you know who live in the Bay Area, and used to work at Twitter, and have extremely nerdy websites, and code for fun? And don't techies love his stuff? People book-clubbed his first two books everywhere.)

So you have a beginning, I say—again, to myself, off in who-knows-where. *But you'll need to do one more thing. You'll need to establish, high up, that Sloan loves going meta. Does it constantly. Said once: "The very best movies are about movies, the very best books about books." You'll need to say that Sloan's first book, Mr. Penumbra's 24-Hour Bookstore, was a book about books. And that his new one, Moonbound, is a story about the way stories are told (and narrated by a far-future descendant of the sentient sourdough starter from his second book, Sourdough).*

Because what this'll do is, it'll convince the reader this isn't fraudulent. Or indulgent. Or some pathetic and elaborate excuse for reporterly negligence. It couldn't possibly be any of those things! It'll be so much more: a profile about writing a profile: in the self-aware style of the person being profiled. It'll loop. It'll layer.

Or it will spiral into unreadable oblivion. There's only one way to find out.

BY THE TIME I come to, I don't know where I am. Sloan and I were at a restaurant, a Taiwanese spot near his office in Berkeley. Now we're walking outside, and it's getting dark. I check my watch. I seem to have lost 30 minutes.

Whatever, I'm back now, and I want to share my revelations. I tell Sloan that any piece I write about him will probably be a piece about writing a piece about him, and who cares if the voice recorder stopped recording, because—well, wait a sec. "Shouldn't the profile also be about

the fact that the recorder stopped working?" I ask. Sloan giggles and agrees.

And as long as we're on the subject, I say, there's always that moment in a profile where the writer needs to describe the physical appearance of the person being profiled. "Maybe it'd be even more meta," I suggest, "if you describe yourself for me?" He thinks for a moment and says: "I mean, he's tall, obviously." "And," he adds later, "bald."

This man is, I must say, terrific company—goofy, game for anything, touchy-feely. If he's an old-fashioned tech bro, he's the all-are-welcome kind, and not terribly full of himself. When he tells me, for instance, that he was into large language models three or four years before the AI band got cool, he's quick to shrug and roll his eyes, which absolves him of any appearance of toolishness. (Unless, and this is a big unless: You don't buy into this particular hackish quirk of self-awareness, wherein the mere *acknowledgement* that something semi-shady's going on is enough to protect one from criticisms of it.)

So, inevitably, we talk a lot more about AI—though Sloan doesn't think it was inevitable that language would be the breakthrough technology. Could've been vision, he says; could've been something else. But now that it *is* language, and now that *it* can write, he's excited to be the kind of writer the machines are not. Just take a look at *Moonbound*, which came out in June and is Sloan's first proper work of science fiction. He thinks it's his best-written, most human-sounding book so far—by far. It's certainly his most ambitious: thematically, characterologically, even punctuationally. I point out his creative devotion, in it, to colons: and he launches into a defense of sentences that contain not one but two: which ChatGPT, of course, would never. →

Isn't self-awareness a cheat and a cover-up, the thing you do when you don't have anything else to offer?

JASON KEHE is a features editor at WIRED.



CLIMATE ACTION

CAN'T WAIT



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EARLIER THAT DAY, at a nearby salvage yard, in a section devoted to hundreds of old doors, Sloan told me about the various paths his writing life could've taken. (Surrounded, I repeat, *by doors*. Sliding doors. Narrow doors. Glass doors. Meta doors, metaphors.) Back in 2010, the same year he started at Twitter, Sloan self-published three short stories on his website: one fantasy, one sci-fi, and one set in San Francisco. The one that happened to take off—and then formed the basis of *Penumbra's*, which came out two years later, shortly after Sloan left Twitter—was the nominally realist one. *Sourdough*, also set in SF, followed five years after that. He gave a talk at Google somewhere in there, became kind of a *thing* in these parts, beloved by literate techies who saw in him a writer who understood both the incredible happening-ness of tech culture and how to novelize it.

But these were never exactly “realist” novels. *Penumbra's* gets pretty technomystical about books and the power of Google. The climax of *Sourdough* involves a massive bread monster at a futuristic food fair. There were, in other words, sci-fi stories in both straining to break free. In *Penumbra's*, multiple characters read books about dragons, and there's a scene in which a character challenges another to imagine a sci-fi story set many thousands of years in the future.

Moonbound is set many thousands of years in the future, and there are a number of dragons in it. There are also wizards, talking beavers, sentient swords. Sloan's hero, Ariel de la Sauvage (a “dorky name,” Sloan writes; it's self-awareness all the way down) is an orphan boy who lives in a castle and is destined to pull a sword from a stone. “I knew this story,” says the AI narrator, but “it was different-shaped here, compressed and remade.” It loops. It layers.

Is it science fiction? Sloan certainly thinks so. “Hard” sci-fi, he insists, because everything in it is theoretically possible. The narrator, which calls itself a chronicler, was born many thousands of years ago; its great-great-great-grandLLMa was basically ChatGPT (plus a sourdough starter, sexy). But *Moonbound* is pure fantasy too: a compressed and remade King

EXPIRED	TIRED	WIRED
Being terrified of AI	Being amazed by AI	Being over AI
Google Glass	Meta Ray-Ban Wayfarers	Micro-LED eye implants
Data centers on land	Data centers underwater	Data centers in space
A guy in a Godzilla suit	Computer-generated Godzilla	Computer-generated Godzilla that looks like a guy in a Godzilla suit
Quiet quitting	Quiet vacationing	Being quiet

Arthur. It reads, fairly irresistibly, like a science fiction novel written as a fantasy novel, or maybe vice versa, about how both genres are maybe the same genre. If it sells well enough, Sloan says, two sequels are planned.

Sloan insists that none of this recursive insanity was in the stars when he wrote *Penumbra's* more than a decade ago. A fastidious note-taker, he even has proof that the germ of the idea that became *Moonbound* was written down two years after *Penumbra's* came out. I don't buy any of it, I tell him; nothing is linear, at least when it comes to the formless realms of artistic creation. It's no accident, I think, that *Moonbound's* narrator creates for itself just such a place: a timeless place out of place in which to come up with ideas, or perish.

On the other hand, we're all biased toward linearity, plot, chronology—Sloan, me, possibly even LLMs. In *Moonbound*, the AI chronicler asks a single linear-minded question, again and again, for centuries. It haunts the pages of the book, just as it seems to haunt Sloan's head. Maybe it haunts all of us, all the time. The question is, naturally:

What happens next?

IT'S MUCH LATER that night. I'm back at home now, trying to watch a new sci-fi blockbuster. I can't concentrate on it. Something's bothering me.

I pause the movie and think. I've just spent an evening with the tech world's greatest living novelist, and my voice recorder failed me, but that's fine, because I have a plan to write my way around that. So what am I worried about? The ending? All I'll need to do there is deliver on the promise of the beginning and reveal the—

Ohhh. The profound insight. So that's it. My memory. *It's too full!*

But I don't panic. I've been here before.

Your profile will be better than ever, I tell myself. *Because now that you've completely forgotten the insight on which its existence depends, it'll read as a meta commentary about the question of going meta in the first place!*

And isn't this just right? At one point hadn't you even mounted, straight to Sloan's face, an entire case against self-awareness? Hadn't you called it a cheat and a cover-up, tedious and college-dorm-y, the thing you do when you don't have anything else to offer, all the while convincing yourself you're really very clever? Hadn't Sloan heard you out, and then completely, jovially, as is his way, disagreed? Hadn't he then said: The more we read books, or watch movies, or look at paintings, whatever, the more we understand those art forms as forms; and therefore, art that is about its existence as an art form is the highest form of art?

Yes. He said that. You will say that. You will write this profile. It will spiral into oblivion, and that will be the point. 📖



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THE ETERNAL TRUTH OF MARKDOWN



— An exegesis of the most ubiquitous piece of code on the web.

IN THE BEGINNING was the Word, and the Word was in plaintext, and the Word was in plaintext because plaintext was the Way. It was good.

On the sixth day—I’m skipping ahead here—the internet was born. The Word needed to be rewritten in HTML. Now there were two Words. It was not good.

On the eighth day, after a bit of rest, Markdown was born. Markdown made it possible to bring forth the Word as HTML on the web, PDF in the library, LaTeX in the publishing house, even Microsoft Word DOC in the office—all

generated from the same plaintext.

The people saw that in this form the Word was more flexible. It was good. The internet rejoiced and put Markdown in all the things.

This is where the real problems began.

TODAY, MARKDOWN IS possibly the most ubiquitous piece of code on the web. Support for Markdown is embedded in nearly every online text box you’re likely to encounter, and there’s an entire economy of mobile writing

and note-taking apps built on its back.

Markdown is not just a piece of software. It’s also a markup language—it’s used to format plaintext, which then appears the way you want it to on, say, the internet. Markdown the markup language was designed to be “as easy-to-read and easy-to-write as is feasible,” according to creator John Gruber’s syntax guide. “A Markdown-formatted document should be publishable as-is, as plain text, without looking like it’s been marked up with tags or formatting instructions.” →

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This, I believe, is the cornerstone of Markdown's success (and why related projects from that era, like reStructuredText and Setext, remain largely unknown): It looked at the world as it actually was and built on the informal conventions people were using. Markdown took common quirks of writing plaintext emails or message-board posts—like wrapping a word in asterisks to **emphasize** it—and extended those formatting customs. It did not come in and declare an entirely new syntax and ask people to adopt it.

Of course, there are some important assumptions behind Markdown. The big one is that the ideal canonical format for storing data long-term is plaintext. This is self-evident to any programmer. Code is plaintext. Humans write in text—using text editors, some of which are more than 40 years old—and we've even created entire operating systems (Unix) built around the idea that the file system is a tree of plaintext files. Plaintext is the alpha and the omega of digital files.

I FIRST ENCOUNTERED Markdown when Gruber posted something about it to the BBEdit mailing list toward the end of 2004. (At the time, most worthwhile discussions happened on BBSes or over email.) Like most people, I was able to memorize Markdown in an afternoon because we were already using half of it.

I liked Markdown so much, I took the parser and adapted it to spit out LaTeX, a system for typesetting documents that I could then convert to PDF and print. I had never written a line of Perl (the language Gruber wrote Markdown in), nor had I ever attempted a regular expression (which is the bulk of the code in the Markdown parser), but the code was out there, why not try? It worked.

Markdown became a core part of how I wrote. The simplicity and flexibility meant I would live the dream of write once, run anywhere. It did lead to some ambiguity, though. Gruber would probably say this is by design. His emphasis

throughout the Markdown documentation is on the syntax of Markdown, not—say—the resulting HTML. His Perl script does not support HTML class names or IDs, for example, so you can't add those to the generated HTML. By the logic of the original Markdown script, if you want complete control over the HTML output, then you'd need to write in HTML.

This situation is great for Markdown users: that is, writers. It's less great for programmers. In fact, it drives them crazy. Programmers do not like ambiguity. It goes against so much of what programming is about. As a writer using Markdown, I love that I can pick whichever particular version is best suited to my needs. As a programmer, I hate that when I build something I have to make this same decision, which then affects all the people who use my finished product. Maybe I didn't support some specific extension they were expecting because they've always used the same Markdown parser and assume that feature is available.

If this weren't bad enough, there are also some ambiguities in the syntax. For example, asterisks are used for italics when singular (**like this**) and bold when doubled (****like this****). So far so good. But what should happen if you write ****like* this****? Should that be rendered **like* this**? Or maybe *like this**? There's no way to know; whoever is writing the parser has to make that decision. What's more, unlike most extremely successful pieces of code, Markdown is not publicly hosted on the code-sharing site du jour. It doesn't have hundreds of people contributing to it, and the last time the original Perl script was updated was 2004. This too rubs programmers the wrong way. We're a cliquish bunch; things outside the clique are viewed with suspicion.

ABOUT A DECADE ago, there was an effort to eliminate the ambiguities in Markdown and bring it into line with coding dogma. Some programmers got together and created CommonMark, which makes the choices the original Markdown script doesn't and came up with what its creators think is the One Right Way to Do It.

CommonMark offered comfort. It's on Github. It has a discussion forum. It seems to be an active project. I have never personally incorporated CommonMark into a project, but its parsers are what convert your Markdown to HTML on such popular sites as Stack Overflow, Github, and Reddit. (To eliminate the asterisk ambiguity, for example, it proposed underscore for italics, asterisk for bold.) Presumably the developers behind CommonMark consider it a success.

But it's not Markdown. Not in name, and I would argue not in spirit.

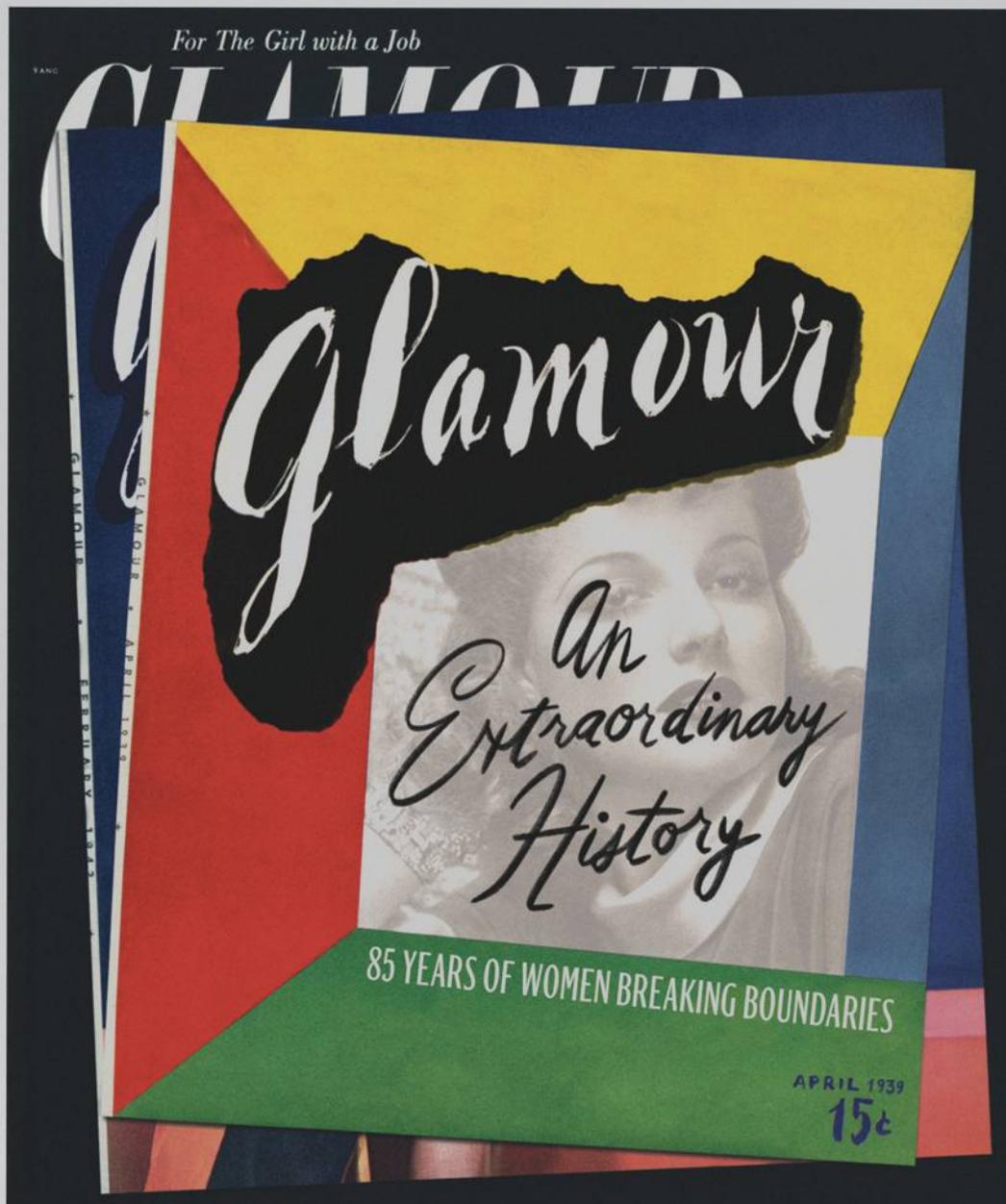
Around the time the CommonMark effort was happening, the software developer Dave Winer told me something I still think about: Markdown belongs to everyone who uses it. This is literally true because of the license. But it also reminded me of the real point of free software. We all have a say in it: by using it, by adapting it, even by forking it.

Whether Gruber intended it this way or not, Markdown does belong to everyone, and there is no standard. I use a very old version of Markdown for Python. Gruber presumably still uses his Perl script. Other people use other versions. It's messy. It's ambiguous. It's human.

And this, in the end, is the Way. **▣**

SCOTT GILBERTSON is a senior writer for WIRED.

A *STUNNING* look back at *Glamour's* *MOST ICONIC* covers, photos & stories



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START

BY MATT GILES | PHOTOGRAPH BY RETO STERCHI

SPIN CYCLE

To study tornadoes, it helps to wear a skirt (and rocket launchers).

When the Dominator is about to intercept a tornado, Timmer uses a two-prong system to anchor the vehicle. Air compressors lower the car so its thick rubber skirt nearly touches the ground, and spikes wedge 6 inches into the earth to firmly prevent the vehicle from liftoff.

Timmer and ONeal have seen roughly 65 tornadoes in the past six months. "It was a historic amount," ONeal says. "A lot of meteorological setups are busts, but every day we drove out this year, we felt like we would see a tornado."



REED TIMMER HAS been chasing storms for more than two decades, since he intercepted his first tornado in northern Oklahoma as an undergrad majoring in meteorology. During that time, Timmer, who typically logs more than 50,000 miles on the road each year, has intercepted countless tornadoes, each one helping to further his extreme-weather knowledge. “We still don’t completely know what happens inside a tornado,” says Edgar O’Neal, a weather journalist who is Timmer’s chase partner. ¶ Enter the Dominator. This is the third iteration of Timmer’s custom-built tornado mobile, which he initially rolled out in the late 2000s. The current Dominator has the chassis of an F350 and weighs 10,000 pounds, enabling it to withstand the debris, gorilla hail, and 150-mph winds that accompany the most powerful of storms. According to Timmer, his “holy grail” is to drive the Dominator to within a quarter-mile of a

twister, then shoot a rocket loaded with sensors directly into the heart of the tornado. Timmer has accomplished this once: In May 2019, the rocket tracked the vortex’s pressure drop and frigid air temperature. His team’s hope in the coming year is to launch dozens of rockets at the same time into the swirling updraft of a twister’s “inflow notch.” But even if all those rockets fail, the Dominator is full of its own sensors to capture valuable scientific data. “That’s the whole point,” says O’Neal. “You can launch probes into a tornado, or you can be the probe, and that’s the Dominator.” ¶



The Dominator’s gull-wing doors weigh 800 pounds each and are coated in Kevlar-based polyethylene, which is “basically a bulletproof vest,” says Timmer.

onds. Respectable, but not blindingly fast. Of course, the nation's third-busiest airport is normally full of shuffling travelers; sprinting carries a significant risk of a high-speed pileup with some frazzled traveler towing an oversize roll-aboard.

But given the hour—and that it was June 2020—Murphy was literally the only person in all of Terminal B. “I can’t resist a good segment when it’s there,” he says. Even though he was taking some time off with a lingering calf injury, he headed to the starting line.

Strava serves as a communal hub for more than 100 million users. About 250 of them have run Gate Change Gnar. It started as part of someone’s “airport walk” on October 10, 2012, a leisurely 86-second stroll. The leaderboard has gotten faster since then. Now someone gives the segment a go every few days. The chance to win king of the mountain makes Strava a handy conduit for an athlete’s amphetaminic energy output—even in the unlikeliest circumstances.

That night in the dark Denver terminal, Murphy, who happened to be wearing a pair of Hokas, claimed the course record in 19 seconds. Then he bagged a couple of others before heading to the couches in Terminal A for some sleep.

Tyler Swartz is another Strava user who tackled the gnar. He’s the founder of Endorphins Running, a startup that organizes group runs in a handful of American cities. During a March snowstorm, at about 9:30 pm, he sprinted the segment half a dozen times after he missed a connecting flight. It was impromptu entertainment for an otherwise grumpy crowd. “I was high-fiving people,” he says. “There were little kids running with me. Some people recognized me from TikTok.” He has more than 43,000 followers. An Instagram reel of his sprints has 380,000 views.

Elsa Westenfelder, an 18-year-old cyclo-cross competitor from Missoula, Montana, discovered Gate Change Gnar while heading home last year on spring break. She identified two factors in her

favor: The crowds were minimal, and her mom was there to hold her backpack. “The segment felt so much longer than I thought it was gonna be,” she says. “I was dying.”

Westenfelder claimed the course record—at 26 seconds—among women. When the app notified her that someone broke it a couple of months later, she didn’t mind. “Strava in general, it’s just a really good way to keep it fun,” she says.

Murphy’s friends frequently bluster that they’re going to beat his time, but they keep showing up at the airport when it’s busy. And they fall short. Each segment has a comments section where users can throw down copious congratulatory fist bumps or trash-talk.

Murphy is quick to tell me that he too considers the records a fun game, not something serious. Then again, last year he noticed that someone had toppled his mark. When he looked closer, that runner’s GPS data looked off—the route was bouncing all over the place, and coverage is spotty in the airport—so he notified Strava to have it removed. “You know, I want to make sure the leaderboard is as accurate as possible,” he says, laughing. And when he noticed that someone had topped his record again, this time with a working GPS, “I was like, well, I can’t have that,” he says. So he went back.

Murphy needed better running shoes to reclaim his title, so he laced up a pair of Sauconys after hopping off his flight. This time he ran it in 16 seconds (for those keeping track). “But,” he says, “they’re not fast shoes.”

On April 10, 2024, a new record holder claimed to have ripped off the run in 10 seconds. That time is so fast, Murphy says, it must be the result of glitchy data. He’s OK with it either way. These days he no longer has long layovers in Denver and is more likely to fly through Las Vegas. The good news: There are segments on the Strip. 📍

DAVID HOWARD is working on a book about a notorious Louisiana hit man and the FBI agent who pursued him.



Readout The world, quantified.

96

↑
Jettison bags left on the moon by six Apollo missions. Nicknamed “poo bags,” each contains biological waste, like urine and feces, from the 24 astronauts that achieved lunar touchdown.

\$2.1M

↑
Estimated total sales connected to a West Coast bicycle theft ring. The ring’s mastermind—the owner of a Mexican-based architecture and construction company—orchestrated the theft of more than 600 bikes.

4,000m

↑
The depth at which Stockton Rush, the CEO of OceanGate, was advised that his *Titan* submersible would be at “high risk of a significant failure.” The sub is believed to have imploded around 3,500 meters.

700

↑
The number of longevity startups that have been founded, and funded with billions of dollars, to better understand aging and how to alter the process of cellular aging.

COOLER HEADS

The deadliest environmental threat to city dwellers worldwide isn't earthquakes, tornadoes, flooding, or fire. It's heat. In Phoenix, Arizona, where almost 400 people died from heat exposure last year—and where falling on the pavement can leave a third-degree burn—the question isn't whether this summer's temperatures will kill people, it's how many.

The answer hinges, in part, on a small team the city created in 2021 to deliver aid during heat emergencies: handing out supplies, opening relief centers, and even driving a bus to bring cool air to where it's most needed. The team is also trying to make Phoenix cooler over the long haul by finding space for shade trees—which is a major challenge in the city center. As the adage goes, the best time to plant a tree is 20 years ago. So in the meantime, there's triage.

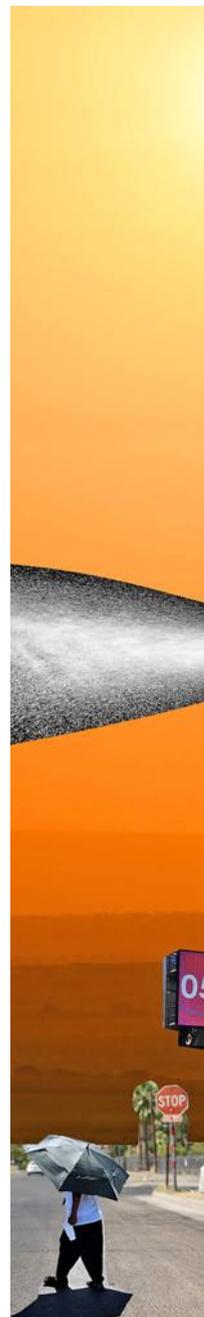
Here, one member of the city's Heat Response and Mitigation Office tells WIRED what it's like to go out on the streets day after day in temperatures that reach 110 degrees or higher.

“

WHEN A TORNADO comes through, you can see houses are ruined. With heat the damage is not as visible. You see it in the numbers. Everyone's like “dry heat this” and “dry heat that,” but it's dangerous.

I'm constantly trying to keep my body ready for those higher temperatures. I drink electrolytes 24/7, year round. I work outdoors or I hike during our shoulder seasons to get ready. If you slowly acclimatize yourself, the hope is that when it does hit those triple digits, it won't affect you too badly. And then when the summer is here, I make sure I'm wearing appropriate clothing, I'm not taking in too much caffeine. I'm trying to get cool. I'm trying to keep my volunteers cool. I call myself Mama Heat. I'm always asking people, have you been drinking water? They say they're fine. No, you need to drink water, you need to sit down for a moment, you've got to get in the shade. If you start getting dizzy or nauseous or if you stop sweating, I need you to go get some AC. Which is why we set up cooling centers around the city. They're open from May to September. We're constantly adding in new hydration stations and cooling centers, based on where the need is.

I want to be where I know the problem is. If you're out here battling the heat, I'm going to be out here battling the heat with you. And we're going to work through this together and try to get you somewhere safe. We use 911 data to find out where the most vulnerable populations are. We know that those experiencing homelessness are at a greater risk. We see high numbers for those who are elderly also. And we work very closely with our airport and our communica-





calls were because it was close to a hospital. You need to be able to pivot on a dime. I'll be honest, we had cooling centers previously that were just a little too far for people to get to. So we brought the cooling bus to them.

I think building out tree shade and cool spaces is important for a more livable, sustainable Phoenix. That's what our office's mitigation team works on: longer-term strategies for shade, planting trees. But what I have to focus on is, how am I keeping someone safe? Planting more trees is amazing, but that's not going to save you today. And so that's where I come in.

I have people in tears thanking me, because they see me out there every single day. You know, I'm not going to give up on you. It's a life-or-death situation sometimes for these people. It might sound a little dramatic, but a bottle of water in someone's hand is life-saving. And then there are people that I get into a vehicle with our Office of Homeless Solutions, and now they're gonna go into temporary housing. If we could make more affordable housing, then I wouldn't be needed.

My favorite part of the day is going down to the warehouse where we keep the heat kits. I turn on some music, I get into a zone, and start making kits. We put hats in there, sunscreen, cooling towels, and SPF liquid chapstick, because tube chapstick will melt. Our wide-brim hats are extremely popular. People love the Hydro Flasks. We provide shoes to people as they need it, because we see a lot of people out there in socks or bare feet. I know those kits are gonna go out the door and immediately serve somebody who's in need. I love to do that. 

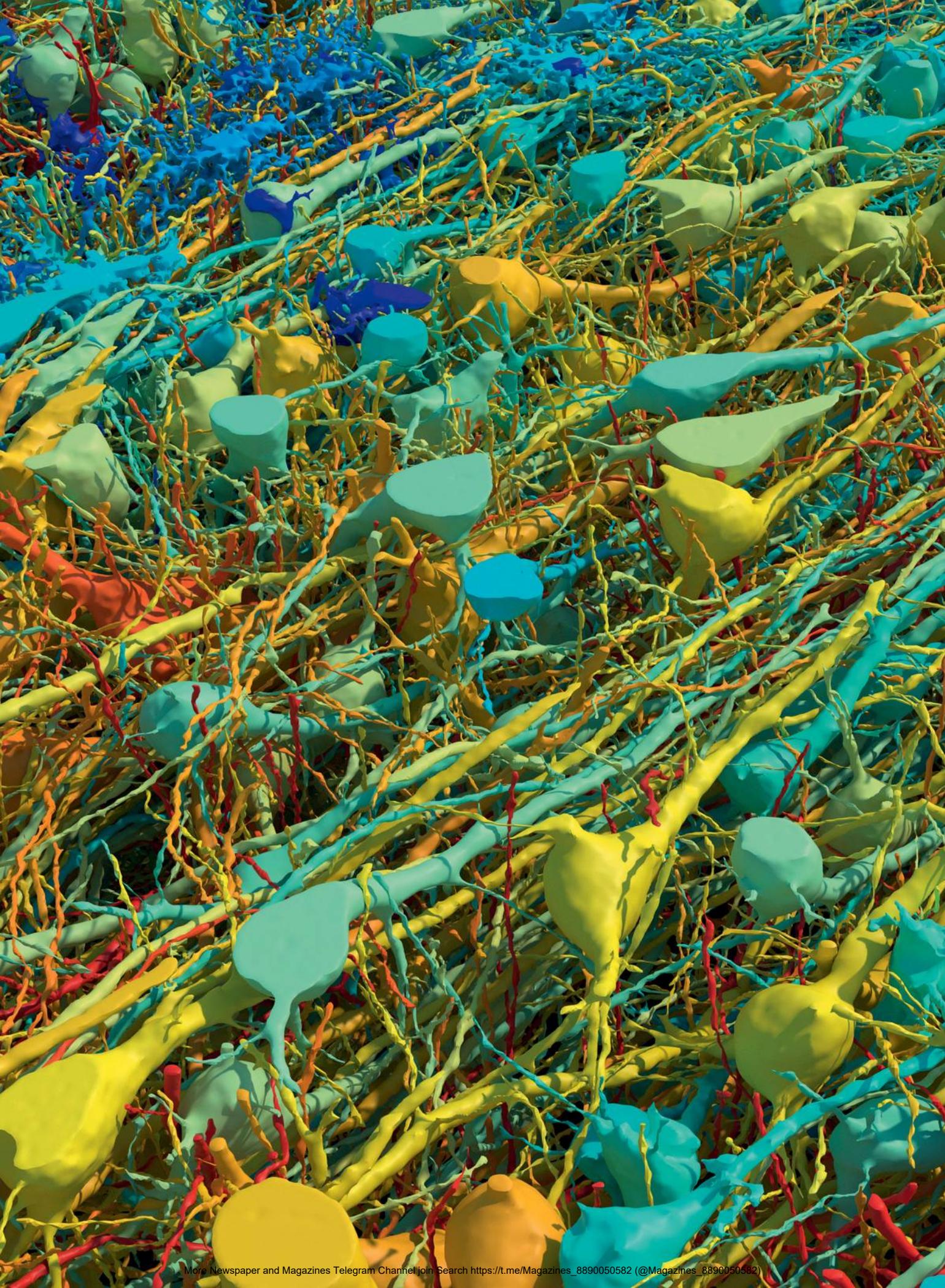
As told to CAMILLE BROMLEY, a writer and editor based in New York.

tions team to make sure that our visitors know, hey, your body's probably not acclimatized to this, you're not ready for this. These are the symptoms that you may experience.

What's different this year is, we're one of the first cities to offer overnight cooling centers. Last year most of our cooling centers closed at 5 or 6 pm, but that didn't mean the heat was turning off. We were seeing high numbers of 911 calls after hours. If you're out there on the

concrete, living in the urban heat island effect, you're baking in that, whether it's 90, 100, or 115. We need to have the same resources available. So we went back to leadership and said we need to have extended hours.

A lot of it is trial and error, which can be challenging. I might look at the data and say, OK, I see a lot of 911 calls happening over here, I'm gonna go do outreach. And so I go over there, and there's actually not a lot of need. It turns out the



PIECE OF MIND

This diagram maps 1 cubic millimeter of the brain—but its unprecedented clarity deepens the mysteries of cognition.

ALTHOUGH THIS IMAGE wouldn't look out of place on a gallery wall alongside other splashy works of abstract art, it represents something very real: a 1-cubic-millimeter chunk of a woman's brain, removed during a procedure to treat her for epilepsy. Researchers at Harvard University stained the sample with heavy metals, embedded it in resin, cut it into slices approximately 34 nanometers thick, then scanned each slice with an electron microscope. Machine-learning experts at Google then used AI to turn the 2D images into a 3D interactive "cell atlas." Even this small fraction of the 3D reconstruction is astonishing in its detail, revealing an estimated 57,000 cells and 150 million synapses. It shows cells that unexpectedly wrap around themselves, pairs of neurons that seem like mirror reflections of each other, and egg-shaped structures that, according to the researchers, defy categorization.

"If we map things at a very high resolution, see all the connections between different neurons, and analyze that at a large scale, we may be able to identify rules of wiring," says Daniel Berger, one of the project's lead researchers. "From this we may be able to make models that mechanistically explain how thinking works or memory is stored." 

ISABEL FRASER is WIRED's 2024 summer intern. She writes about politics and technology.

IMAGE: GOOGLE RESEARCH & LICHTMAN LAB (HARVARD UNIVERSITY); RENDERED BY DANIEL BERGER (HARVARD UNIVERSITY)

ELECTRIC DREAMS

It's time for WIRED to celebrate the most electrifying new EVs. Even with a few hybrid vehicles in the mix, there's plenty to excite us.



R3
X





Rivian R3X ▲◀

The first true performance offering from the California upstart Rivian has an enviable mix of power, range, looks, and off-road capabilities—that is if, like us, you are obsessed with the hot hatches of the '80s and '90s. True, those distinctive light clusters have strong droid energy, but this midsize crossover promises to ruffle some EV feathers. It's powered by a high-performance tri-motor powertrain, with two motors on the rear axle and one on the front, and its as-yet-undisclosed horsepower could edge toward 1,000. There's also a new, 4695 cell battery with more than 300 miles of range, impressive sub-three-second zero-to-60 acceleration, and DC fast charging that promises top-ups from 10 to 80 percent in less than 30 minutes. That's just enough time for a refreshing snooze on the fold-flat seats. **\$TBD**

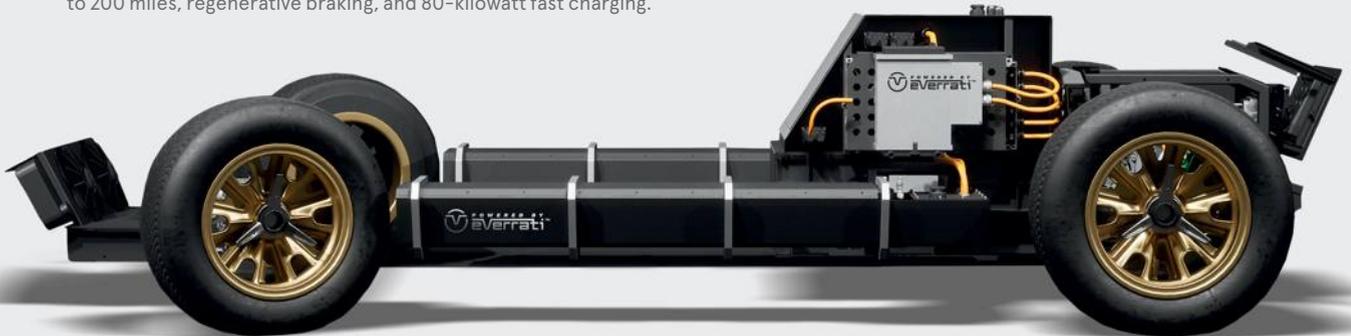
Alpine A290 ▼

The French brand's first new car in seven years, the A290 is basically a sportified Renault 5—but with one enhancement you probably won't find anywhere else. Sure, there's a 217-hp motor and boosted arches to fit those 21-inch wheels, but we're most excited by the built-in series of 36 video-game-like "missions" that measure and rank driver skill. **\$TBD**



Powered by Everrati ▼

British EV-conversion pioneers Everrati specialize in retro-electrification and concours-level restorations of classics like the 1970s Porsche 911 ST. But now luxury and small-batch automakers can go EV with ease thanks to Powered by Everrati, a scalable powertrain system with a range of 150 to 200 miles, regenerative braking, and 80-kilowatt fast charging.



Focal ISUB BMW 8 ▲

Focal has a roaring trade in affordable plug-and-play car stereo components. This year, it has expanded its BMW and Mini speaker line with an 8-inch, 180-watt neodymium subwoofer. Installing this bass-booster is easy. Just swap it into your existing system; there are no wires to cut. **\$255**



Scania Electric Truck ▲

OK, it's not your average EV, but electric trucks will soon be a more common sight. Scania's EV trucks can run for 323 miles carrying up to 29 metric tons, and up to 198 miles lugging 64 metric tons gross train weight. Its Swedish-built batteries can be charged in less than 85 minutes at 375 kilowatts. **\$POA**

Nio Onvo L60 ▼

Camping in your car is cramped and uncomfortable. But EV brands are convinced it's the future, and they're incorporating outdoors-friendly modular seating, plus entertainment and power-management options. Chinese EV brand Nio has gone all in with its shamelessly Tesla-esque Onvo (that's "On Voyage"), which, besides folding its seats flat to accommodate a mattress in Camping King mode, has configurations that include Video Room, complete with footrests and a 17.2-inch central screen, and Lunch Room, with a handy serving table.

\$30,235



Snuzu ▲

Alternatively, if you are determined to make the most of Tesla's Camp mode, the Snuzu double bed is specifically made to fit the rear of your Tesla Model Y or Model 3. This self-inflating (and deflating), self-leveling, 80- by 51-inch mattress features an organic Lyocell topper and a memory foam layer. Once you've enjoyed a decent nap, it squishes down to a subtrunk-friendly size for easy storage. **\$630**

Karoo Camper ▶

At 16 feet long and just over 1,600 pounds, this EV trailer can be towed by a regular car and offers a versatile interior accessed via a panoramic side door. It sleeps two adults and two kids; one bed is stowed neatly in the ceiling, the other converts into general seating. You'll also find a built-in refrigerator, a compact kitchen that slides out for alfresco meal prep, and a bathroom with a shower, toilet, and clothes rack. It's all powered by roof-mounted solar panels and an integral 6-kWh lithium-ion battery, which can also charge your ebikes.

\$32,400 and up



31.4 inches

Traxxas XRT Ultimate (Scale 1:6) ◀

A far cry from the radio-controlled cars of old that couldn't outrun a bike, the XRT Ultimate has a blistering 60-mph top speed. The shaft-driven 4WD is powered by a 1,275-kV motor, while the aluminum supported chassis, drivetrain, and suspension ensure it can handle the toughest terrain. **\$1,500**

COURTESY, NIO, SNUZU, TRAXXAS, PEUGEOT

DAB 1a ▶▶

Built in Peugeot's historic Beaulieu-Mandeure factory in France (Peugeot acquired DAB in 2023), the 1a is a sleek, 276-pound electric motorcycle with 11 kW of nominal power and 25.5 kW of peak power. The French-made 72-volt battery is repairable, replaceable, and upgradable and offers a 93-mile range. Luxe touches include Alcantara upholstery on the seat, 17-inch spoked wheels with Pirelli Diablo Rosso tires, and a front fender made of upcycled Airbus carbon. **\$16,250**





Porsche 911 Carrera GTS ▲

The 911 has gone hybrid (sort of) with the new “992.2” and its 3.6-liter combustion engine in addition to two electric motors. Dubbed the T-Hybrid system, one motor on the PDK gearbox offers higher torque at lower speeds, delivering

power without delay, while the electrically driven turbocharger boosts performance and makes the throttle more responsive. The battery is just 1.9 kWh—but at least you still get to enjoy that Porsche vroom! **\$150,900 and up**

Kia EV3 GT-Line ▶

Finally, an affordable EV we actually want to drive! Standard and Long Range models use one 198-hp motor and a battery of either 58.3-kWh capacity (255 miles of range) or 81.4 kWh (372 miles). Top speed is a breezy 106 mph. Inside, a 30-inch widescreen display, lane-assist tech, an AI-powered voice assistant, vehicle-to-load charging, and a cabin crafted from sustainable materials make it feel anything but budget. **\$38,400 and up**



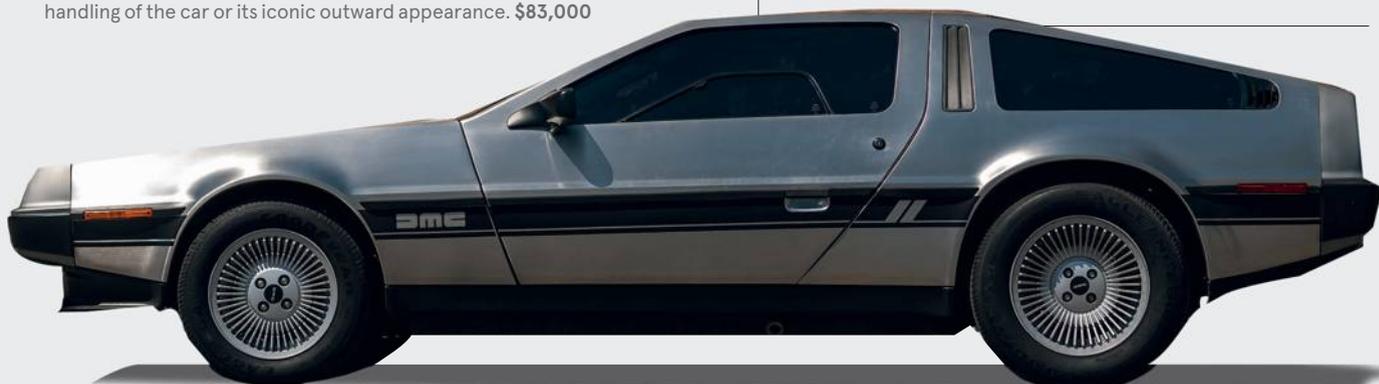
Lambretta Elettra ▼

Synonymous with 1940s Euro-chic and British 1960s Mods, Lambretta has struggled to escape the postwar nostalgia tag. But while the silhouette of its forthcoming EV scooter harks back to those times, up close it's all urban futurism. The Elettra has a 4.6-kWh lithium battery that pushes an 11-kW electric motor to a top speed of 68 mph. The angular design is also littered with safety-first (but cool AF) LEDs, with white beams spilling onto the road and illuminating the path ahead. **\$TBD**



Electrogenic DeLorean DMC-12 Conversion Kit ▼

There are maybe 5,000 DeLorean DMC-12s still in the world, and if one of the two planned, currently-squabbling-over-the-name, all-electric iterations don't come to fruition, there's another way to bring this iconic car, ahem, back to the future. UK-based Electrogenic's electrification kit drops a 160-kW motor straight onto the existing engine mounts and swaps the fuel tank for a 42-kWh battery. This Doc Brown-level tinkering creates a CCS rapid-charging vehicle that goes from zero to 60 mph in five seconds—and all without affecting the handling of the car or its iconic outward appearance. **\$83,000**



Mercedes Benz Electric G-Class G580 With EQ Technology ▼

From Arnold Schwarzenegger to the Pope via Britney Spears, the G-Wagon is a celebrity stalwart. Famed for its power and pomposity, it's now debuting as an EV with four electric motors that pump out a combined 587 hp, as well as 200-kW charging for the 116-kWh battery. This puts it on a par with its ICE equivalents, with gonzo acceleration and a 112-mph top speed. But it's the tanklike steering that sets it apart from previous models; the wagon can spin 360 degrees, pivot in place, and drive in supertight circles. **\$168,000**



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MAKEUP BY LUCA MACDOUGALL

ON THE SURFACE, THERE'S NOTHING
UNUSUAL ABOUT IT. JUST A SPOT OF OCEAN.
BUT BENEATH THE WAVES LURKS
SOMETHING INCREDIBLE: A MASSIVE
WATERFALL. AND IN ITS MYSTERIOUS DEPTHS,
THE FATE OF THE WORLD CHURNS.

THE HOLE IN THE MAP OF THE WORLD



BY SANDRA UPSON



OFF THE SOUTHWEST

TIP OF ICELAND, YOU'LL FIND WHAT'S OFTEN called a “marginal” body of water. This part of the Atlantic, the Irminger Sea, is one of the stormiest places in the northern hemisphere. On Google Maps it gets three stars: “very windy,” says one review. It’s also where something rather strange is happening. As the rest of the planet has warmed since the 20th century—less in the tropics, more near the poles—temperatures in this patch of ocean have hardly budged. In some years they’ve even cooled. If you get a thrill from spooky maps, check out one that compares the average temperatures in the late 19th century with those of the 2010s. All of the planet is quilted in pink and red, the familiar colors of climate change. But in the North Atlantic, there’s one freak splotch of blue. If global warming were a blanket, the Irminger Sea and its neighboring waters are where the moths ate through. Scientists call it the warming hole.

The warming hole could be a very big problem. That’s because it’s a sign that something may be wrong with the Atlantic Meridional Overturning Circulation. The AMOC is the main current system that crisscrosses the ocean. It flows like a big river up, down, and across the two hemispheres. All that moving water performs an amazing service—it’s basically a supremely massive, 1-petawatt heat pump for the North Atlantic.

The mega-current hauls warm, salty surface water from the tropics near the Americas up to northern Europe. There the warm water meets cold air and evap-

orates. The atmosphere heats up. The water that’s left in the AMOC is now colder and saltier—which is to say, it’s much denser than the surrounding water. And if you’re a cod swimming west of Iceland, you’re in for an astonishing show. Here the heavy AMOC water doesn’t merely sink, it plummets nearly 3 kilometers down. (Two miles!) Some 3 million cubic meters of water fall per second, in what amounts to the world’s most record-smashing, invisible waterfall. This cold river joins up with other falling water—more underwater cataracts—and crawls through the depths of the ocean, following the topography of the seabed, all the way to Antarctica. The flow intersects other currents, things get messy, and eventually the current rises to the surface near South America and continues its loop.

The big takeaway is a Europe that’s cozier than geography says it should be. That warm gift—the one where the AMOC dumps much of its heat near Iceland—helps, for example, the Norwegian city of Tromsø to enjoy temperatures as warm as -1 degree Celsius in late January, while, at the same latitude in Canada, Cambridge Bay often gets down to -34 degrees Celsius (or 30 degrees Fahrenheit and -30 degrees Fahrenheit, respectively). The heat delivery is also why the northern hemisphere is a few degrees warmer than the southern hemisphere and why Earth’s warmest latitude is (on average) not the point closest to the sun—the equator—but 5 degrees north of it.

But, that warming hole. This spot isn’t feeling the full *kapow* of rising global temperatures because, in recent years, less heat has been arriving from the tropics. Which means the currents must be slowing. By some calculations, the AMOC’s flow has weakened by 15 percent since the middle of the 20th century. Looking back further, it is the weakest it has been in a millennium.

Which is alarming. To be sure, the worry is not that the AMOC is on the verge of a complete stop. The fear is that it will cross

a pivotal threshold, and *then* begin a decline that is unstoppable.

At that point, it would take many decades for the currents to grind to a halt. Even so, a shutdown would trigger, as one paper put it, “a profound global-scale reorganization” in Earth’s climate systems. The effects would be devastating—plunging northern Europe into a deep cold spell, crushing food systems, condemning big regions to drought. It’s so, so bad.

It follows, then, that you’d wonder how close we humans are to that threshold. Perhaps you’d heard about the AMOC’s frailty; the shutdown threat; maybe even the decades of fighting among scientists as they try to fathom this gigantic, interconnected, barely understood current. But it was only rather recently that someone dared to go right to the core and ask: How much time do we have left before the AMOC breaks?

Siblings and scientists Peter Ditlevsen and Susanne Ditlevsen published their AMOC paper in July of 2023. Their findings startled the world.

PHOTOGRAPHS BY EMILIE LÆRKE

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"YOU MIGHT WANT TO GRAB YOUR COAT," PETER Ditlevsen says as he strides across his office at the Niels Bohr Institute, where the University of Copenhagen houses its climate researchers. We're headed to a walk-in freezer in the basement. Dressed in a navy sport coat and jeans, he plucks his own jacket off a black metal coat stand and throws it on. Tall, thin, with short white hair and a lilt to his speech, Ditlevsen is a climate physicist who tried to do something bold. Some might even say brash. He tried to answer the big AMOC question, the "how much time" one. And it got him into a bit of trouble.

Ditlevsen started out in pure physics—first string theory, then solid-state physics. Then, when Danish academic jobs proved scarce, he took a gig at the Danish weather office in Copenhagen. He'd spread printouts across his desk to look busy and secretly binge-read meteorology textbooks. When he finally found a job at the University of Copenhagen, it was in a group studying Greenland ice cores—cylinders up to 3 kilometers long that were drilled and extracted from glaciers. The discipline was a touch random, perhaps, coming from solid-state physics. But the cores, they were magic, like finding the Rosetta stone in a popsicle.

I scurry after Ditlevsen down a hall and two flights of stairs. This building, one of many belonging to the institute, opened in 1932 as a research lab linked to the Carlsberg brewing company. The beer folks were big on science and invented the pH scale. ("You notice this?" Ditlevsen asks, pointing at the ornate metalwork in the staircase railings—the company's logo, which it adopted in the 19th century as a symbol of luck. Peering at the metal's loops and bends, I spot it: a swastika. History in filigree.)

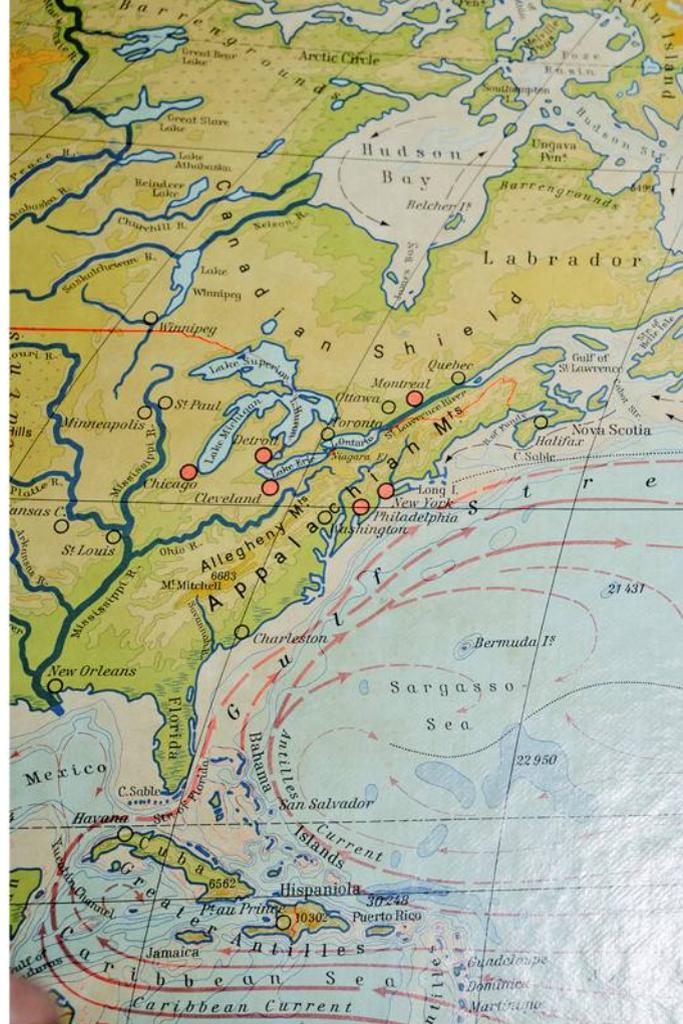
We head down a narrow basement hallway past old cabinets and a giant, dusty globe. Ditlevsen pulls open the heavy metal door of a walk-in freezer, and the air, at -20 degrees Celsius, slaps me in the face. On the right are shelves containing large polystyrene boxes. Inside them are chunks of ice cores, cut into segments about 55 cen-

Peter found an old yellowed map in the basement of the university and put it up in his office.

timeters long. Along the opposite wall is a metal workbench with ice-cutting tools. Without thinking, I rest my hand on it. My skin sticks to the metal.

This freezer holds a tiny subset of the university's massive ice core collection. It's here thanks in large part to a geophysicist named Willi Dansgaard, who, when he arrived at the University of Copenhagen, installed a mass spectrometer. One day in June 1952—in what Dansgaard later described as "a minor, but to me, fateful miracle"—an epic downpour got him pondering the composition of rain. He set out an empty beer bottle on his lawn and put a funnel in it. The next day a warm front passed through and he brought out pots and pitchers. When he analyzed his samples with the mass spectrometer, he saw that rain from warmer clouds contained more of the isotope oxygen-18 than rain from higher, colder clouds. A nice observation, but the real leap came when he started thinking about *young* and *old* water. He realized he could get a glimpse of the climate at different moments in history. All he had to do was look at oxygen-18 levels: More of it meant warmer weather, less meant chillier. The best place to find old water, of course, is inside a glacier. When Dansgaard finally got his hands on his first ice core, he cracked open a much earlier chapter of Earth's climate history. He unlocked a trove of information—and work—for physicists like Ditlevsen who could devote their careers to figuring out what the ice could tell us.

Ditlevsen lifts plastic-wrapped ice segments one by one and sets them down with a light thud on the lid of another polystyrene box. "Aha, see here!" he says, holding up one cylinder. Gray stripes divide clean white. "Those are melt layers," he says. For the gray to form, the temperatures must have gone





above zero: “Very unusual for Greenland.” An ice core from this region can contain an almost annual, sometimes even monthly, record of temperatures stretching back as far as 130,000 years. Each core, an ancient weather station that silently recorded dust storms, wildfires, heat waves, and cold snaps for a thousand centuries. Using the layers, “you can count your way through the ice,” Ditlevsen says. Not only by eyeballing the melt bands, but with more precise measurements—oxygen isotopes, salinity, dust particles, more. All tiny samples of long-ago atmospheres and the world in which they belonged.

It was in the 1970s, as Dansgaard and others studied the ancient ice, that they made a wild, monumental discovery. In the last glacial period, Greenland warmed up to 16 degrees Celsius (61 degrees Fahrenheit) in a mere 50 years. That’s an astonishing, rapid jump, like a normally icy winter in Chicago or Vladivostok suddenly feeling

HE PLUGGED IN THE WATER TEMPERATURES AND LET THE CODE RUN. NOW HERE HE WAS, STARING AT A RATHER REMARKABLE NUMBER.

like balmy spring. The heat blast wasn’t a fluke—abrupt, giant swings had happened 25 times. Cooling events took a bit longer but were still swift. As they worked, scientists realized that the data in the ice was big, big news: Greenland was revealing that the climate changes not only gradually but also “in great leaps,” as the late climate scientist Wallace Broecker wrote in 1987. Earth isn’t so steady and reliable, as everyone assumed. Its climate has in fact been *unstable* throughout the millennia.

What triggered the jumps? As Broecker guessed in the late ‘80s and (after 30-some years of debate) many scientists now agree: abrupt, dramatic changes in the Atlantic Meridional Overturning Circulation.

That the climate could change violently had huge implications. As more carbon was being released into the atmosphere, Broecker and other scientists were getting increasingly anxious that it wasn’t degrading the planet in only the steady, humdrum, “up goes the heat” kind of way. They worried that humans were pushing the climate toward a big jump. “Our climate system has proven it can do very strange things,” he wrote in 1997. “We’re entering dangerous territory and provoking an ornery beast.” What remained was a very important question: Could a leap be predicted?

In the 1990s, Ditlevsen found plain old climate change kind of dull, but this—this was exciting. He started analyzing the ice core record in search of warning signs of a coming jump. He was hunting for patterns that preceded those 25 cataclysms—signatures in the oxygen-18 content, say, or in calcium. Anything that reliably preceded an abrupt change. But the hints, if they existed at all, were easy to miss. Finding them was ultimately a problem of statistics—what’s a real signal, what’s mere noise. At times, Ditlevsen enlisted his dad, a math and engineering professor at another Danish university. (The father-son pair cowrote a paper in 2009 on rapid climate shifts.) In all those years, Ditlevsen never found an early-warning sign in the ice core data.

But elsewhere around the planet, scientists were amassing evidence that specific parts of the climate system were nearing dangerous thresholds and big transitions of their own: the melting of the Greenland ice sheets (7 meters of sea level rise) and the Antarctic ice sheets (another 60 meters), the death of the Amazon rainforest (incalculable loss of biodiversity), the catastrophic disruption of monsoons (droughts affecting billions of people).

The International Panel on Climate Change, the 200-or-so grand arbiters of the climate canon, was devoting more pages in its reports to this type of risk. And scientists were converging around language for what they were seeing. They called the thresholds “tipping points.”



TIPPING POINTS ARE ABSOLUTELY EVERYWHERE. Throw water on a fire, and the flames will shrink but recover. Dump enough water on and you’ll cross a threshold and snuff it out. Tip a chair and it’ll wobble before

settling back onto its four feet. Push harder, and it topples. Birth is a tipping point. So is death.

Once you've pushed a system to its tipping point, you've removed all brakes. No exit. As one 500-page report recently put it, climate tipping points "pose some of the gravest threats faced by humanity." Crossing one, the report goes on, "will severely damage our planet's life-support systems and threaten the stability of our societies."

In 2019 the European Union launched a project on climate tipping points. Fifty-some scientists from 15 countries got involved. One big goal: to assess the near-future risk of, say, an AMOC shutdown or the Amazon turning into a savanna. Ditlevsen signed on as the project's leader. His partner was Niklas Boers, a climate physicist at the Technical University of Munich in Germany.

Back in his PhD days, Boers had been pursuing a pure math degree before ditching it—"I don't want to say it was meaningless, but I wasn't interested," he says. The climate, though, had real stakes. "The whole climate system is so complex that it's where the beauty of math, of probability theory and dynamical systems and complexity theory, can really play out." He had been investigating early warning signs in a variety of datasets, and he decided to dig into the AMOC.

Much as you have a natural walking speed, the AMOC has a preferred flow rate. It's measured in Sverdrups, named after the Norwegian oceanographer Harald Sverdrup, who in the first half of the 20th century modernized the study of oceans with a sweeping textbook and curriculum. The rate varies by location, but these days at a latitude of 26 degrees north, the flow is 17 Sverdrups, or 17 million cubic meters per second. The Sverdrups can swing up or down, but over time the flow returns to that preferred rate. When a system approaches a tipping point, though, the *character* of the fluctuations changes. With the AMOC, you might see the flow rate increasingly struggle to regain its equilibrium. The rate might wander farther and farther away from the comfy baseline. And the system might take longer to settle back into its routine state. These features—the greater meandering, the slower return to home base—are an obsession of tipping-point mathematicians. If you were to plot the data for a system that's about to tip, you'd see the data points first follow a nice, predictable path; then the path gets jittery, and then it goes off on wide, whiplashing swings. The system is becoming less stable, taking longer to recover. You can almost feel sorry for it. You can sense a sort of sickness.

For people like Boers and Ditlevsen, though, there's a problem: Continuous measurements of the AMOC's flow rate go back to only 2004, when scientists installed monitoring stations at sea. That's nowhere near enough time for researchers to see, in the data, what the AMOC is truly up to. So Boers decided to use something AMOC-adjacent, which also happened to be the only long-term dataset that has anything to do with the Atlantic Ocean. He'd use sea surface temperatures.

In 1749, an English slave trader who was sailing off the western coast of Africa lowered a special bucket with valves and a thermometer into the water. He did this again and again, hauling up the bucket and noting the depths of the sample and the water's temperature. He was surprised to find that deep water was always cold. His heat-weary crew immediately used the deep water to take baths and cool their drinks. From then on, other voyagers sporadically dropped buckets into the Atlantic

and jotted down readings, either out of scientific curiosity or as a potential navigational aid—to identify a useful current or get a warning of icebergs ahead. They collected their data in many different places, depths, times of day. They also used all manner of buckets, thermometers, and units of measurement (Centigrade, Fahrenheit, Réaumur). The data was a mess. A century later a consortium of seafaring nations standardized the method of measurement. But it was only in the 1970s, when instrument-packed drifting buoys and weather satellites were deployed, that the temperatures of the seas were systematically recorded.

Scientists and historians have spent decades cleaning and organizing all that data. Other researchers then took that information—hundreds of thousands of temperature readings (and other measurements, namely salinity)—and used them to compute proxies for the AMOC's strength. They called these measurements "fingerprints."

When Boers sat down with the data, in 2020, he picked eight fingerprints from earlier research and tried to spot meaningful changes in the patterns of temperatures and salinities over time. He wrote up his results in a 2021 paper. In it, all eight fingerprints showed the same thing: The AMOC was becoming less stable and looked to be "close to a critical transition."

Ditlevsen, though, wasn't sold on Boers' methods. He felt Boers was using a statistical tool that was unnecessarily weak. Ditlevsen believed you could safely make more assumptions about the AMOC, use more powerful statistical tools, and see more clearly how the giant current was changing. Boers didn't like the trade-off, because an assumption can of course be wrong. They clashed. Ditlevsen decided to take his own whack at the data.



IN 2021, DITLEVSEN WAS TEACHING HIS classes online and living on a plot of land in the Danish countryside, on the northern coast of

Zealand—another person who fled big-city living when the pandemic flared up. “We all thought we’d be the new Newton,” he recalls. The famous mathematician had, during the Great Plague of 1665, retreated to the country and had his *annus mirabilis*, in which he basically discovered gravity, calculus, and optics. Ditlevsen, though, was building a house.

He drew up the plans and got the materials. Giant panes of glass, skylights, tawny wood siding. He worked on it all year, largely alone, in a country with an annual average of 170 days of rain. (“You *really* want to get the roof up,” he says.) As he measured, sawed, sanded, and hammered, he also thought about tipping points.

He coded up a quick model of an AMOC-style system, using math he felt was more useful than what Boers had chosen. He would take it as a given that the AMOC was a certain *type* of tipping system. Then, knowing that these kinds of tipping systems follow certain universal rules, he could generate artificial data to fill in the future. That would predict the date at which the system would tip. He plugged in the water temperatures and let the code run. Now here he was, staring at a rather remarkable number.

2057.

The year when the AMOC might tip. A year so close you can almost grasp it. You can plug it into a retirement calculator. Or schedule-send an email.

Ditlevsen felt vaguely annoyed. The IPCC had just come out with a report that said the AMOC was “very unlikely” to shut down before 2100. That time horizon gave people room to breathe, figure things out, chart a different course. Ditlevsen had been hoping to confirm the panel’s estimate. How irritating that he hadn’t.

One day, he gave an online talk on how to spot early warning signs in climate data. He sent a link to his sister, Susanne Ditlevsen—four years younger, and with whom he grew up playing chess—and suggested she might find it interesting. While watching the video,

she says, “I got some ideas.”

Susanne is a statistics professor and, like her brother, also works at the University of Copenhagen. Their offices are a five-minute bike ride apart. They sometimes meet for lunch at the café in Susanne’s building. She has striking blue eyes, thick, wavy white hair, and a strong voice that commands the room. After finishing high school in their hometown north of Copenhagen, Susanne studied acting. She fell in love with a Spanish theater director and left for Spain. “She ran off, like in the movies where the circus comes through town,” her brother recalls. Susanne spent 10 years performing in plays across the country. She also had a baby. It wasn’t long after that she realized she wasn’t living the life she wanted. “I was sitting and breastfeeding, and I started thinking, I don’t want to do this for the rest of my life,” she says. She wanted to use her brain more. She’d always liked math, she was good at it, so now she figured she’d do some for fun.

She signed up for distance classes from a school in Spain. “I was traveling on the tour bus with my math books,” she says. For five years she worked as an actor, took care of her son, and studied. She divorced the Spanish director and later returned to Copenhagen, intent on earning her doctorate and being close to her mother, a retired schoolteacher. She got into a biostatistics graduate program at the University of Copenhagen and in 2005 joined the faculty. She collaborated with neuroscientists and ecologists and spent 12 years studying narwhals. And she cowrote a paper with their father.

While Peter was obsessing over tipping points, Susanne was on the cusp of a breakthrough. Nothing to do with narwhals or neurons. It was pure stats. She had figured out a better way to make sense of systems with a lot of randomness, that don’t follow straight lines, and where the underlying rules are not well understood.

Susanne realized that she could apply her method to her brother’s problems. “A tipping point, what is that? It’s something strongly nonlinear. It is exactly that!” she says. The system has one way of behaving until, *fwoop*, suddenly it’s very different. “It is the most nonlinear thing you can even imagine.” To use her method, you had to make a few more assumptions about how the AMOC behaved, sure, but the payoff could be great. Using the temperature record, she could estimate some basic parameters of how the world worked before humans started messing with its climate, and some for after the AMOC started looking sick, including the time of tipping. Peter suggested that they try out her method. They each wrote up some code—he using Matlab and she in R—to test the technique.

The siblings spent two years refining their approach, doing more tests. Across a thousand runs, the model cranked through the temperature data and settled on a year. Sometimes the model spat out later dates. Sometimes earlier. The two scientists made a plot of the numbers and a neat cluster emerged. Yes—2057. But that’s just the middle point: In 95 percent of the model’s simulations, the AMOC tipped sometime between 2025 and 2095.

They were excited. Their statistical method was holding up. They got their paper ready for publication. Peter came up with the title, “Warning of a Forthcoming Collapse of the Atlantic Meridional Overturning Circulation.” Nice and direct.

They didn’t think that much about the audac-

IN BERGEN, NORWAY, THE TEMPERATURES COULD DROP A WHOPPING 35 DEGREES CELSIUS. SEA ICE IN WINTER MIGHT EXTEND ALL THE WAY DOWN TO THE SOUTHERN UK.

Scientists cut off small samples of ice cores, melt them, and examine the water for clues to ancient climate flips.

months since their paper came out, and they're still gobsmacked. "We did not even think nonscientists would ever see our paper," she said. Nature Communications is a mid-tier journal and not to be confused with Nature, perhaps the most prestigious journal in the world. But "Warning of a Forthcoming Collapse" has been viewed more times than any other paper in either journal in 2023. By a lot.

Journalists besieged them with emails and phone calls. They gave interviews eight hours a day. "We were completely overwhelmed by all the media attention, and then of course from all the weirdos," Susanne recalls. Some headlines claimed that the AMOC (or as The Guardian incorrectly called it, the Gulf Stream) could "cease to exist" or "collapse" or "totally switch off" in 2025, with implications of human catastrophe within months—not at all what the Ditlevsens had written.

A nonprofit media center in the UK compiled a set of "expert reactions" to their paper, something it does for only a few scientific studies out of the tens of thousands published every week. Some of the reactions were positive, others measured—and some brutal. The paper, said one scientist, "had feet of clay." "No evidence of a slowdown," said another expert. Niklas Boers sent in his assessment: "I do not agree with the outcome of this study."

"They were really top experts," Peter says. His eyes widened and he shook his head. "Shit, man!"

"I remember you sending me the link" to the expert reactions, Susanne says, "and saying, this is what we should be reading carefully." They combed through the responses together, some of them only a few sentences and others running many paragraphs long. They figured out which ones they wanted to reply to directly.

The day after the paper came out, Ditlevsen got an email from Boers and one of his graduate students. Attached was a 21-page refutation of their work. The basic issue—for Boers and several others—was the sea surface temperatures. The problem wasn't only that the dataset relied on random men in the Age of Sail. A more fundamental concern was that no one knows what temperatures near the ocean's surface say exactly about the hemisphere-spanning, depths-traversing flow that is the AMOC. The temperature data was still worth examining, as Boers had done in his own paper, but, he argued, the uncertainties are too large to ever pin down a specific tipping-point year.

"We have a 3D ocean, three-quarters of our planet, and a circulation system in that ocean," Boers tells me. "It physically does not make sense to model that as a one-dimensional time series" and try to predict the future. Perhaps his biggest gripe, though, was with the Ditlevsens' assumptions about the AMOC's character. For one thing, their mathematical framework assumed that the AMOC will tip soon. Big assumption. The equations behave differently when a system is far from its tipping point.

The Ditlevsens agree with many of the critiques.



ity of proposing a year (so soon! a few decades away!). Mostly it was business as usual. They'd had an idea, tested it out, and were preparing to share the results. Normal stuff.

Still, Peter was a little worried, his mind returning to that whole not-in-line-with-the-IPCC business. But he reassured himself with fine print. In footnote 4 of the IPCC's latest big report, "very unlikely" meant that, in the panelists' view, the AMOC had less than a 1-in-10 chance of collapsing before 2100. One in 10. Those odds didn't strike him as "very unlikely." Russian roulette is one in six, and we all agree that's a bad idea. Plus, the IPCC had given its prognosis only a "medium confidence" rating. To Ditlevsen, that sounded a lot like "we have no clue."

But the slight anxiety was there. Ditlevsen was squarely a member of the climate community. If the paper pissed off other scientists, he would take more heat. He and his sister sent their final revisions to their journal editor and waited for the article to drop. On July 25, 2023, their paper appeared on the website of the journal Nature Communications. "That's when ..." Peter says, his voice trailing off. "The shit hit the fan."



I'M SITTING WITH THE DITLEVSEN SIBLINGS in Peter's office at the university, at a worktable. Several large paintings decorate the slate-blue walls, including one he painted himself, of abstract figures. Toward the back of the room stands a large, yellowing map of the world that he scavenged in the basement.

Susanne is at the head of the table. Her wavy hair is pulled into a low ponytail, and she's dressed in a fisherman's sweater in mazarine blue over jeans and sensible, gray, it's-rainy-here ankle boots. It's been almost eight



They tried to capture some of the uncertainties in the paper; others they considered less pertinent. In their view, the issue is too urgent to not try to find the date. And their assumptions didn't come from nowhere. They were based on other scientists' work—ice core data, big model runs, older theoretical models. "The dataset is the data that we have," Susanne says. "Should we not try to understand the AMOC in the last 150 years? When it's so serious!"

Peter leans back in his chair and interlaces his fingers. He's staring into the distance. Susanne, though, is leaning forward on her elbows, back straight, unfazed. "We have really been scrutinized on a level that nobody is used to," she says. "It's a gift. It's a gift to be scrutinized."

In January 2024, Peter happened to be reading the Wikipedia article for the AMOC. About two-thirds of the way down the page, he came across a few lines critiquing his and his sister's paper. The description called their paper "very controversial." There, again, was the "feet of clay." Annoyed, he logged in to Wikipedia under a pseudonym and started adding sentences. When he checked back later, another editor, someone very steeped in this corner of science, had rejected his edits. He logged in again, now under the name "pditlev," and gave it another go. This time his account got banned.

"Of course you want to be proven wrong," Peter says to me, "but you also don't want to be a fool."

For the past several months, the two have been working urgently to complete the sequel to their original paper. Other datasets. More statistics. "We have to clean up after ourselves," Peter says.

"Clean up? I don't think so," Susanne replies, "Consolidate." See if other AMOC-related data leads them to a similar date. Get at the truth of possible doom. Because if they're right—or even roughly right—we all might want to know a whole lot more about what comes next.



WITH ALL THE UNKNOWNs, IT IS OF COURSE DICEY to project what happens after the currents stop. But let's just, for a moment, say the AMOC crosses its tipping point and starts heading to collapse. Researchers have taken a stab at modeling what that future might look like.

First, the system would slow and slow until—well, nobody knows. It could be headed to a full stop. That would take about a century. Or it might settle into a much weaker flow. Both are bad. The AMOC transports a *staggering* amount of energy. Like a million nuclear power plants. It is such a core element of the Earth system that its collapse would radically alter regional weather patterns, the water cycle, the ability of every country to provide food for its inhabitants.

Below the surface of the ocean, the invisible waterfalls near Iceland and Greenland would peter out. That's horrendous for creatures in the deep who need the oxygen the AMOC delivers to survive. Widespread die-off of marine life: likely. Shutting off the current would also cause the ocean's surface to smooth out. The flattened water level will be higher than it is now, which will mean almost a meter of sea level rise along the US northeast coast. (That's in addition to the sea level rise from melting glaciers.)

Without the big heat delivery that softens its winters, Europe would end up with much more

intense seasons, according to a 2021 report. A lot more snow. Much less rain. In the post-tipping decades, many European cities might end up colder by 5 to 15 degrees Celsius. In Bergen, Norway, the temps could drop a whopping 35 degrees Celsius. Sea ice in winter might extend all the way down to the southern UK. The summers, meanwhile: hotter and drier.

An AMOC shutdown would clobber the food system. The fraction of land suitable for growing wheat and maize—staple crops worldwide—would drop by roughly half. In an analysis of how an AMOC collapse would affect agriculture in the UK, the authors wrote there would be "a nearly complete cessation" of arable farming. Goodbye oats, barley, wheat. A massive irrigation project could salvage the land at a cost of roughly \$1 billion a year, more than 10 times the yearly profit from the crops. Food prices would spike. Further north, in places like Norway and Sweden, food production would also plummet. Those countries would have to rely heavily on imports. But perhaps not from the usual sources. The powerhouses of Ukraine, Poland, and Bulgaria—Europe's breadbaskets—would also be dealing with less rain, colder weather, and severe losses of income from the crash of their ag industry.

The worst effects, though, would be likely to hit the tropics. The Intertropical Convergence Zone is the swath of atmosphere around the equator—centered at about 6 degrees north—with little wind and lots of rain. Sailors called it the doldrums. Season by season, that zone's band

**AS THE SIBLINGS ONCE
PUT IT, EVERYONE KNOWS
SOMEONE WHO'LL BE
AROUND IN 30 YEARS.**

of clouds migrates north or south, and those movements bring either extended dry periods or months of rain. An AMOC collapse would push the doldrums southward. In the Amazon, the altered Intertropical Zone could cause the wet and dry seasons to flip to the opposite times of year. The plants, insects, fungi, and mammals below the canopy would be forced to adapt at warp speed—or die off. Not to mention the trees themselves, which, in addition to supporting an intricate ecosystem, absorb tons of carbon from the atmosphere. The Amazon, of course, is being logged and overheated to its own tipping point, and an AMOC shutoff could be the final shove.

But that, one might argue, is the least of it. Research on these projections is scant, but some studies say if the rain band scoots south, then India, East Asia, and West Africa would lose much or all of their monsoon seasons. Two-thirds of Earth's population depends on monsoon rain, in large part to grow their crops. These changes would happen over only a few growing seasons rather than over generations, giving little time to adapt. In the precarious Sahel region in Africa, subsistence farmers might find that sorghum, an essential, nutrient-rich cereal, becomes nearly impossible to grow. Tens of millions of people might need to migrate to survive.

On the other hand, Australia might enjoy a little more rain and crank out a few more loaves of bread per year.



THAT'S A LOT OF MIGHTS, COULDS, AND SHOULD.

Extrapolations on top of educated guesses. As I spent months reading the research and making calls, I found scientists disputing the details of nearly all things AMOC. Whether the warming hole around the Irminger Sea still mattered (maybe global warming had swallowed it up), whether the AMOC was *actually* slowing down (maybe the flow naturally varies a whole lot), whether the AMOC even exists (maybe it's better understood as many smaller current systems). For a reporter trying to tie together these strings of evidence—self-doubt, befuddlement, despair. So I asked Peter Ditlevsen if it bothered him that data on the AMOC is so scarce.

"Noooo, no," he replied with a grin. "If I worked in black holes, I'd find it very exciting. We have two photos of black holes, that's it." With the currents in the Atlantic, he noted, "we have this big dark area, and we are approaching it from different sides."

"From the point of view of climate change, we're not saying anything new," Susanne adds. "We're just saying, it's serious. We have to do something now." We have to cut down on emissions. Transition faster to renewable energy, EVs. Give the oceans a chance to recover. Push out the 2057 date. That forecast drew loads of attention not because it was a staggering intellectual feat but because it had something most scientific papers lack, something precious: It had an emotional punch. As the siblings once put it, everyone knows someone who'll be around in 30 years.

If the AMOC can possibly break in three decades, you

want the world's best minds on the case. You want them exploring every angle and ferretting out the least-wrong explanation for what's happening in that big, dark area. "It's important that things be put out there without 100 percent certainty," Peter says. (He couldn't resist adding that Albert Einstein had to wait eight years, and fix his own mistakes, before general relativity was proven right.)

I shouldn't have been a bit surprised, then, that the scientists were in good spirits. The paper Susanne wrote about her new statistical method, the one she used in the "Warning" paper, had been accepted in the top stats journal. "What every statistician dreams of," she says.

Boers, meanwhile, had submitted his multi-page rebuttal to "Warning" to a journal, where, at press time, it was undergoing review. When we spoke in late May, he was also remarkably cheerful about the disputes. "It's just absolutely natural for science, and I'm enjoying that," he told me. He seemed to relish being the voice of uncertainty: tracking down every last source of it, quantifying it, working it into his predictions of the future.

He brought a distinct caution to his work; Peter, a certain audacity. But their goal was basically the same—to find language for the risks of extreme events. So that everyone can talk about them more clearly, then plan, and with luck, avoid.

As for Boers' big takeaway? He stumbled for a moment, clearly searching for the words that would be the least contestable. "Regardless of all the uncertainties and all the disagreements," he ventured, "99.99 percent of my colleagues and I are on the same page—increasing temperatures further increases the likelihood of an AMOC tipping."

That's because—and we know this for sure—the extra heat in the air has effectively cranked on a tap over the north Atlantic. It's making more rain pour down on that area. It's melting more of Greenland's ice, which then drains into the seas—right on top of the AMOC's engine, the mega waterfalls. All that lightweight, salt-free water makes it harder for the currents to overturn. Keep running the tap and the trouble compounds. That's why the threat of tipping seems so real. The waterfalls could indeed trickle to a stop. "And we just really don't want that to happen," Boers added.

Besides, there's another possibility. A remote one, sure, but one that also can't be ruled out: The AMOC might have already tipped. And we wouldn't know it for years. ■

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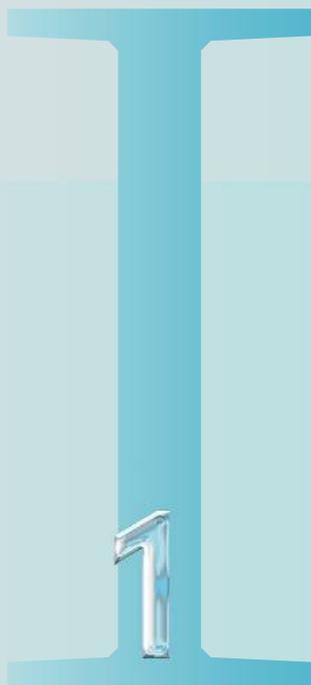


CAN THE U.A.E. REALLY MAKE
RAIN ON DEMAND—OR IS IT
SELLING VAPORWARE?

ILLUSTRATIONS BY ANA MIMINOSHVILI

AN IMPERFECT STORM

BY AMIT KATWALA



IN THE SKIES OVER AL AIN, IN THE United Arab Emirates, pilot Mark Newman waits for the signal. When it comes, he flicks a few silver switches on a panel by his leg, twists two black dials, then punches a red button labeled FIRE.

A slender canister mounted on the wing of his small propeller plane pops open, releasing a plume of fine white dust. That dust—actually ordinary table salt coated in a nanoscale layer of titanium oxide—will be carried aloft on updrafts of warm air, bearing it into the heart of the fluffy convective clouds that form in this part of the UAE, where the many-shaded sands of Abu Dhabi meet the mountains on the border with Oman. It will, in theory at least, attract water molecules, forming small droplets that will collide and coalesce with other droplets until they grow big enough for gravity to pull them out of the sky as rain.

This is cloud seeding. It's one of hundreds of missions that Newman and his fellow pilots will fly this year as part of the UAE's ambitious, decade-long attempt to increase rainfall in its desert lands. Sitting next to him in the copilot's seat, I can see red earth stretching to the horizon. The only water in sight is the swimming pool of a luxury hotel, perched on the side of a mountain below a sheikh's palace, shimmering like a jewel.

More than 50 countries have dabbled in cloud seeding since the 1940s—to slake droughts, refill hydroelectric reservoirs, keep ski slopes snowy, or even use as a weapon of war. In recent years there's been a new surge of interest, partly due to scientific breakthroughs, but also because arid countries are facing down the early impacts of climate change. Like other technologies designed to treat the symptoms of a warming planet (say, pumping sulfur dioxide into the atmosphere to reflect sunlight into space), seeding was once controversial but now looks attractive, perhaps even imperative.

Dry spells are getting longer and more severe: In Spain and southern Africa, crops are withering in the fields, and cities from Bogotá to Cape Town have been forced to ration water. In the past nine months alone, seeding has been touted as a solution to air pollution in Pakistan, as a way to prevent forest fires in Indonesia, and as part of an effort to refill the Panama Canal, which is drying up.

Apart from China, which keeps its extensive seeding operations a closely guarded secret, the UAE has been more ambitious than any other country about advancing the science of making rain. The nation gets around 5 to 7 inches of rain a year—roughly half the amount that falls on Nevada, America's driest state. The UAE started its cloud-seeding program in the early 2000s, and since 2015 it has invested millions of dollars in the Rain Enhancement Program, which is funding global research into new technologies.

This past April, when a storm dumped a year's worth of rain on the UAE in 24 hours, the widespread flooding in Dubai was quickly blamed on cloud seeding. But the truth is more nebulous. There's a long history of people—tribal chiefs, traveling con artists, military scientists, and most recently VC-backed techies—claiming to be able to make it rain on demand. But cloud seeding can't make clouds appear out of thin air; it can only squeeze more rain out of what's already in the sky. Scientists still aren't sure they can make it work reliably on a mass scale. The Dubai flood was more likely the result of a region-wide storm system, exacerbated by climate change and the lack of suitable drainage systems in the city.

The Rain Enhancement Program's stated goal is to ensure that future generations, not only in the UAE but in arid regions around the globe, have the water they need to survive. The architects of the program argue that "water security is an essential element of national security" and that their country is "leading the way" in "new technologies" and "resource conservation." But the UAE—synonymous with luxury living and conspicuous consumption—has one of the highest per capita rates of water use on earth. So is it really on a mission to make the hotter, drier future that's coming more livable for everyone? Or is this tiny petro-state, whose outsize wealth and political power came from helping to feed the industrialized world's fossil-fuel addiction, looking to accrue yet more wealth and power by selling the dream of a cure?

I've come here on a mission of my own: to find out whether this new wave of cloud seeding is the first step toward a world where we really can control the weather, or another round of literal vaporware.



2

THE FIRST SYSTEMATIC ATTEMPTS

at rainmaking date back to August 5, 1891, when a train pulled into Midland, Texas, carrying 8 tons of sulfuric acid, 7 tons of cast iron, half a ton of manganese oxide, half a dozen scientists, and several veterans of the US Civil War, including General Edward Powers, a civil engineer from Chicago, and Major Robert George Dyrenforth, a former patent lawyer. Powers had noticed that it seemed to rain more in the days after battles, and had come to believe that the “concussions” of artillery fire during combat caused air currents in the upper atmosphere to mix together and release moisture. Powers figured he could make his own rain on demand with loud noises, either by arranging hundreds of cannons in a circle and pointing them at the sky or by sending up balloons loaded with explosives. His ideas, which he laid out in a book called *War and the Weather* and lobbied for for years, eventually prompted the US federal government to bankroll the experiment in Midland.

Powers and Dyrenforth’s team assembled at a local cattle ranch and prepared for an all-out assault on the sky. They made mortars from lengths of pipe, stuffed dynamite into prairie dog holes, and draped bushes in rackerock, an explosive used in the coal-mining industry. They built kites charged with electricity and filled balloons with a combination of hydrogen and oxygen, which Dyrenforth

thought would fuse into water when it exploded. (Skeptics pointed out that it would have been easier and cheaper to just tie a jug of water to the balloon.) The group was beset by technical difficulties; at one point, a furnace caught fire and had to be lassoed by a cowboy and dragged to a water tank to be extinguished. By the time they finished setting up their experiment, it had already started raining naturally. Still, they pressed on, unleashing a barrage of explosions on the night of August 17 and claiming victory when rain again fell 12 hours later.

It was questionable how much credit they could take. They had arrived in Texas right at the start of the rainy season, and the precipitation that fell before the experiment had been forecast by the US Weather Bureau. As for Powers’ notion that rain came after battles—well, battles tended to start in dry weather, so it was only the natural cycle of things that wet weather often followed.

Despite skepticism from serious scientists and ridicule in parts of the press, the Midland experiments lit the fuse on half a century of rainmaking pseudoscience. The Weather Bureau soon found itself in a running media battle to debunk the efforts of the self-styled rainmakers who started operating across the country.

The most famous of these was Charles Hatfield, nicknamed either the Moisture Accelerator or the Ponzi of the Skies, depending on whom you asked. Originally a sewing machine salesman from California, he reinvented himself as a weather guru and struck dozens of deals with desperate towns. When he arrived in a new place, he’d build a series of wooden towers, mix up a secret blend of 23 cask-aged chemicals, and pour it into vats on top of the towers to evaporate into the sky. Hatfield’s methods had the air of witchcraft, but he had a knack for playing the odds. In Los Angeles, he promised 18 inches of rain between mid-December and late April, when historical rainfall records suggested a 50 percent chance of that happening anyway.

While these showmen and charlatans were filling their pocketbooks, scientists were slowly figuring out what *actually* made it rain—something called cloud condensation nuclei. Even on a clear day, the skies are packed with particles, some no bigger than a grain of pollen or a viral strand. “Every cloud droplet in Earth’s atmosphere formed on a preexisting aerosol particle,” one cloud physicist told me. The types of particles vary by place. In the UAE, they include a complex mix of sulfate-rich sands from the desert of the Empty Quarter, salt spray from the Persian Gulf, chemicals from the oil refineries that dot the region, and organic materials from as far afield as India. Without them there would be no clouds at all—no rain, no snow, no hail.



UAE OFFICIALS ESTIMATE THEIR SEEDING EFFORTS HAVE INCREASED RAINFALL BY 10 TO 20 PERCENT.

I'm suddenly very aware that I'm on a **MILITARY BASE**. Couldn't this giant movable laser **BE USED AS A WEAPON?**

A lot of raindrops start as airborne ice crystals, which melt as they fall to earth. But without cloud condensation nuclei, even ice crystals won't form until the temperature dips below -40 degrees Fahrenheit. As a result, the atmosphere is full of pockets of supercooled liquid water that's below freezing but hasn't actually turned into ice.

In 1938, a meteorologist in Germany suggested that seeding these areas of frigid water with artificial cloud condensation nuclei might encourage the formation of ice crystals, which would quickly grow large enough to fall, first as snowflakes, then as rain. After the Second World War, American scientists at General Electric seized on the idea. One group, led by chemists Vincent Schaefer and Irving Langmuir, found that solid carbon dioxide, also known as dry ice, would do the trick. When Schaefer dropped grains of dry ice into the home freezer he'd been using as a makeshift cloud chamber, he discovered that water readily freezes around the particles' crystalline structure. When he witnessed the effect a week later, Langmuir jotted down three words in his notebook: "Control of Weather." Within a few months, they were dropping dry-ice pellets from planes over Mount Greylock in Western Massachusetts, creating a 3-mile-long streak of ice and snow.

Another GE scientist, Bernard Vonnegut, had settled on a different seeding material: silver iodide. It has a structure remarkably similar to an ice crystal and can be used for seeding at a wider range of temperatures. (Vonnegut's brother, Kurt, who was working as a publicist at GE at the time, would go on to write *Cat's Cradle*, a book about a seeding material called ice-nine that causes all the water on earth to freeze at once.)

In the wake of these successes, GE was bombarded with requests: Winter carnivals and movie studios wanted artificial snow; others wanted clear skies for search and rescue. Then, in February 1947, everything went quiet. The company's scientists

were ordered to stop talking about cloud seeding publicly and direct their efforts toward a classified US military program called Project Cirrus.

Over the next five years, Project Cirrus conducted more than 250 cloud-seeding experiments as the United States and other countries explored ways to weaponize the weather. Schaefer was part of a team that dropped 80 pounds of dry ice into the heart of Hurricane King, which had torn through Miami in the fall of 1947 and was heading out to sea. Following the operation,

the storm made a sharp turn back toward land and smashed into the coast of Georgia, where it caused one death and millions of dollars in damages. In 1963, Fidel Castro reportedly accused the Americans of seeding Hurricane Flora, which hung over Cuba for four days, resulting in thousands of deaths. During the Vietnam War, the US Army used cloud seeding to try to soften the ground and make it impassable for enemy soldiers.

A couple of years after that war ended, more than 30 countries, including the US and the USSR, signed the Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques. By then, interest in cloud seeding had started to melt away anyway, first among militaries, then in the civilian sector. "We didn't really have the tools—the numerical models and also the observations—to really prove it," says Katja Friedrich, who researches cloud physics at the University of Colorado. (This didn't stop the USSR from seeding clouds near the site of the nuclear meltdown at Chernobyl in hopes that they would dump their radioactive contents over Belarus rather than Moscow.)

To really put seeding on a sound scientific footing, they needed to get a better understanding of rain at all scales, from the microphysical science of nucleation right up to the global movement of air currents. At the time, scientists couldn't do the three things that were required to make the technology viable: identify target areas of supercooled liquid in clouds, deliver the seeding material into those clouds, and verify that it was actually doing what they thought. How could you tell whether a cloud dropped snow because of seeding, or if it would have snowed anyway?

By 2017, armed with new, more powerful computers running the latest generation of simulation software, researchers in the US were finally ready to answer that question, via the Snowie project. Like the GE chemists years earlier, these experi-

menters dropped silver iodide from planes. The experiments took place in the Rocky Mountains, where prevailing winter winds blow moisture up the slopes, leading to clouds reliably forming at the same time each day. The results were impressive: The researchers could draw an extra 100 to 300 acre-feet of snow from each storm they seeded. But the most compelling evidence was anecdotal. As the plane flew back and forth at an angle to the prevailing wind, it sprayed a zigzag pattern of seeding material across the sky. That was echoed by a zigzag pattern of snow on the weather radar. “Mother Nature does not produce zigzag patterns,” says one scientist who worked on Snowie.

In almost a century of cloud seeding, it was the first time anyone had actually shown the full chain of events from seeding through to precipitation reaching the ground.

3

THE UAE’S NATIONAL CENTER OF Meteorology is a glass cube rising out of featureless scrubland, ringed by a tangle of dusty highways on the edge of Abu Dhabi. Inside, I meet Ahmad Al Kamali, the facility’s rain operations executor—a trim young man with a neat beard and dark-framed glasses. He studied at the University of Reading in the UK and worked as a forecaster before specializing in cloud-seeding operations. Like all the Emirati men I meet on this trip, he’s wearing a *kandura*—a loose white robe with a headpiece secured by a loop of thick black cord.

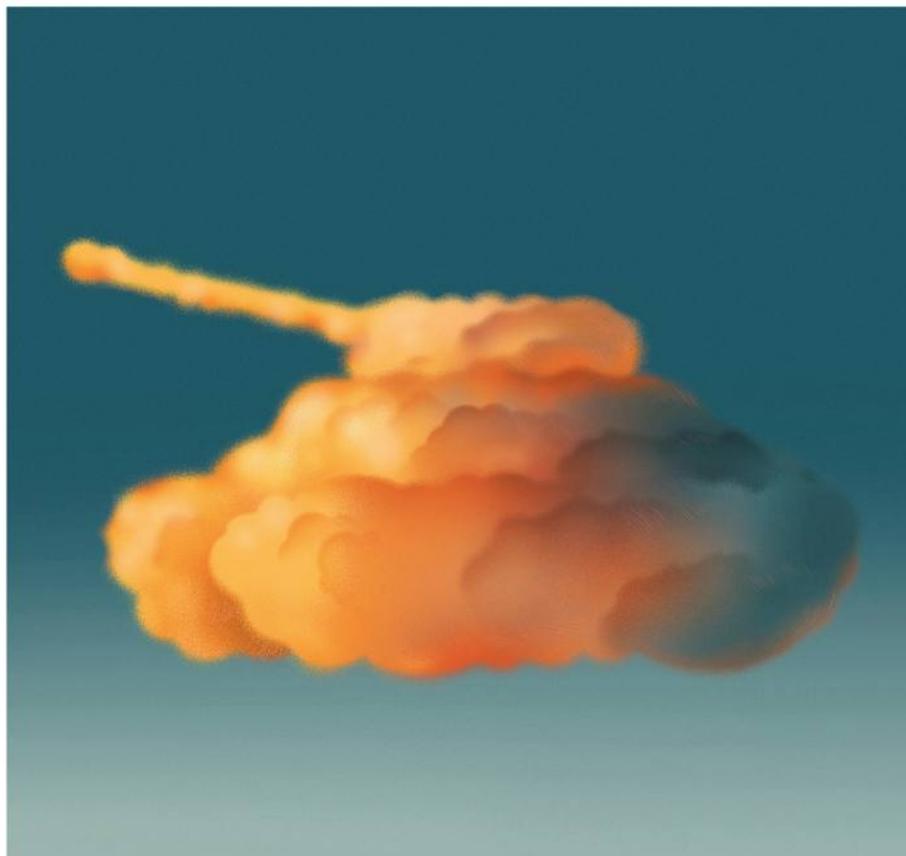
We take the elevator to the third floor, where I find cloud-seeding mission control. With gold detailing and a marble floor, it feels like a luxury hotel lobby, except for the giant radar map of the Gulf that fills one wall. Forecasters—men in white, women in black—sit at banks of desks and scour satellite images and radar data looking for clouds to seed. Near the entrance there’s a small glass pyramid on a pedestal, about a foot wide at its base. It’s a holographic projector. When Al Kamali switches it on, a tiny animated cloud appears inside. A plane circles it, and rain begins to fall. I start to wonder: How much of this is theater?

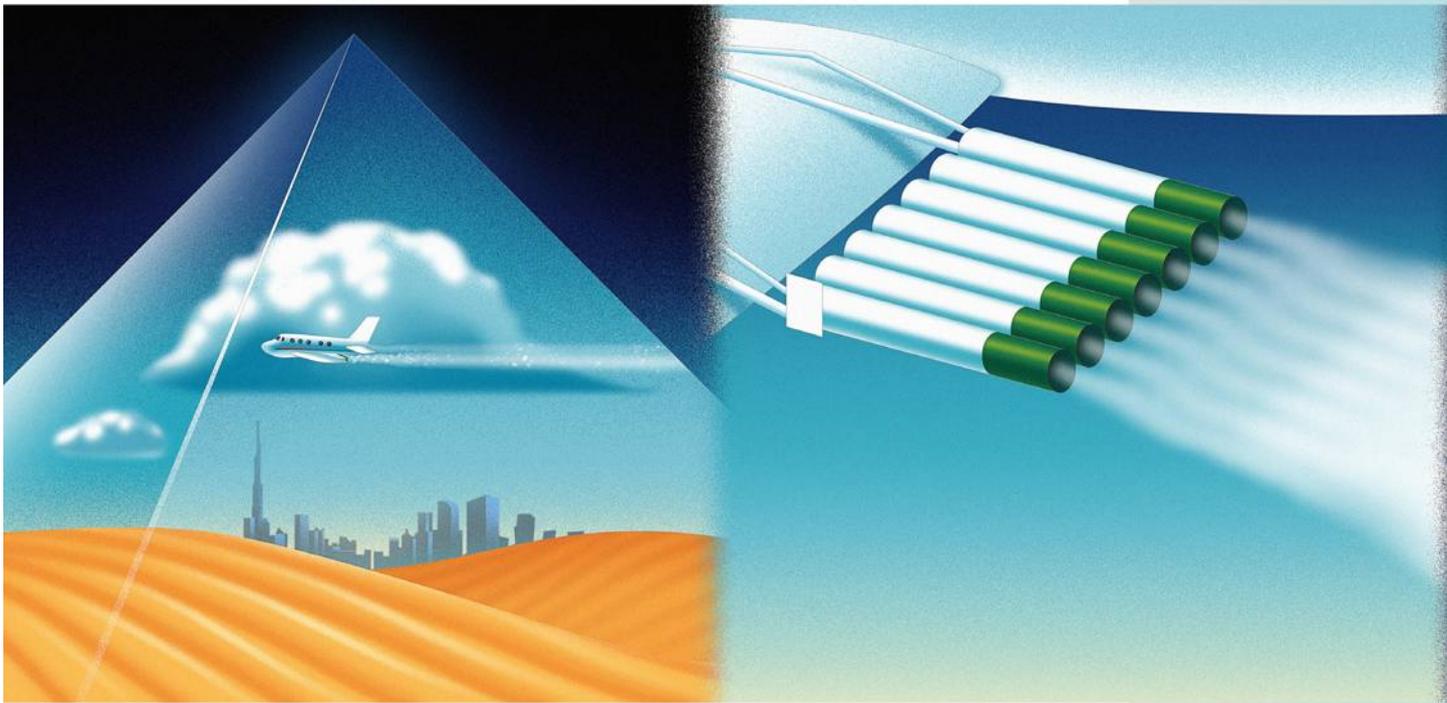
The impetus for cloud seeding in the UAE came in the early 2000s, when the country was in the middle of a construc-

tion boom. Dubai and Abu Dhabi were a sea of cranes; the population had more than doubled in the previous decade as expats flocked there to take advantage of the good weather and low income taxes. Sheikh Mansour bin Zayed Al Nahyan, a member of Abu Dhabi’s royal family—currently both vice president and deputy prime minister of the UAE—thought cloud seeding, along with desalination of seawater, could help replenish the country’s groundwater and refill its reservoirs. (Globally, Mansour is perhaps best known as the owner of the soccer club Manchester City.) As the Emiratis were setting up their program, they called in some experts from another arid country for help.

Back in 1989, a team of researchers in South Africa were studying how to enhance the formation of raindrops. They were taking cloud measurements in the east of the country when they spotted a cumulus cloud that was raining when all the other clouds in the area were dry. When they sent a plane into the cloud to get samples, they found a much wider range of droplet sizes than in the other clouds—some as big as half a centimeter in diameter.

The finding underscored that it’s not only the number of droplets in a cloud that matters but also the size. A cloud of droplets that are all the same size won’t mix together because they’re all falling at the same speed. But if you can introduce larger drops, they’ll plummet to earth faster, colliding and coalescing with other droplets, forming even bigger drops that have enough mass to leave the cloud





and become rain. The South African researchers discovered that although clouds in semiarid areas of the country contain hundreds of water droplets in every cubic centimeter of air, they're less efficient at creating rain than maritime clouds, which have about a sixth as many droplets but more variation in droplet size.

So why did this one cloud have bigger droplets? It turned out that the chimney of a nearby paper mill was pumping out particles of debris that attracted water. Over the next few years, the South African researchers ran long-term studies looking for the best way to re-create the effect of the paper mill on demand. They settled on ordinary salt—the most hygroscopic substance they could find. Then they developed flares that would release a steady stream of salt crystals when ignited.

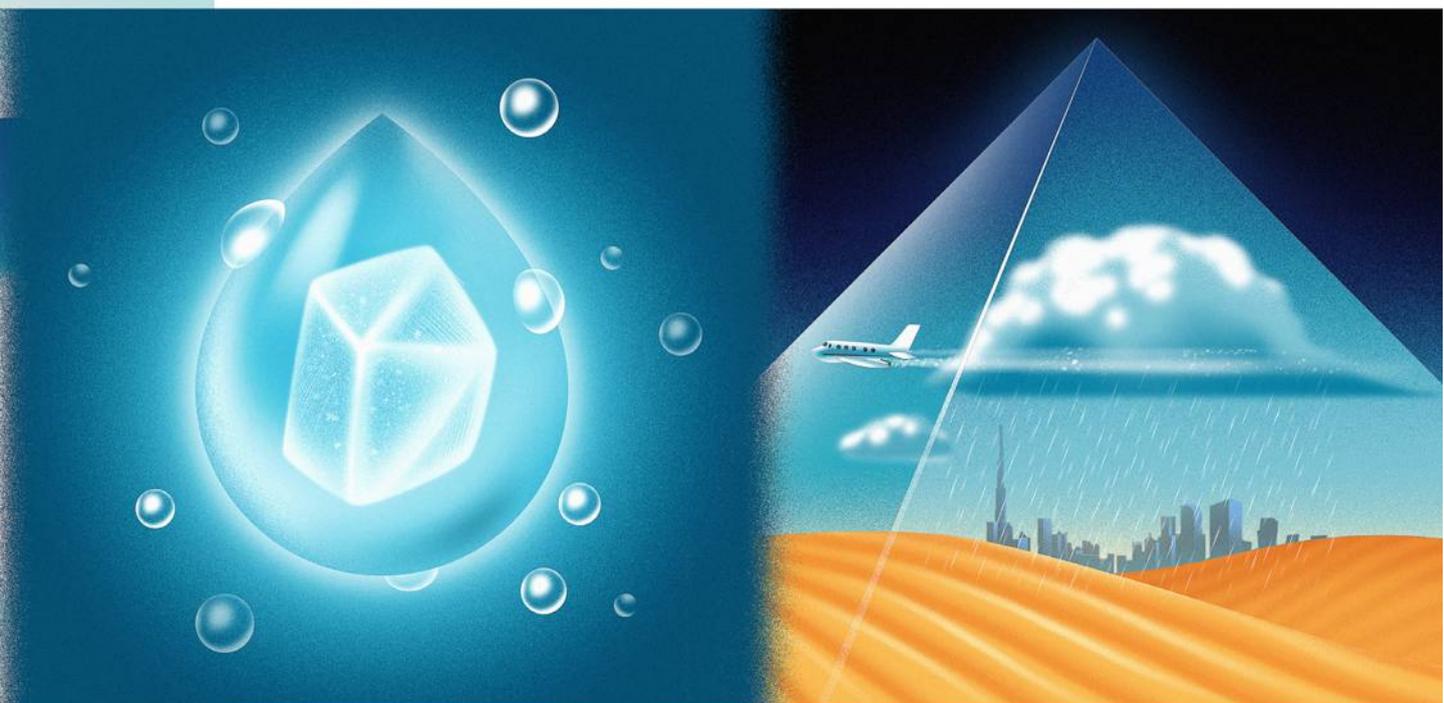
Those flares were the progenitors of what the Emiratis use today, made locally at the Weather Modification Technology Factory. Al Kamali shows me a couple: They're foot-long tubes a couple of inches in diameter, each holding a kilogram of seeding material. One type of flare holds a mixture of salts. The other type holds salts coated in a nano layer of titanium dioxide, which attracts more water in drier climates. The Emiratis call them Ghaith 1 and Ghaith 2, *ghaith* being one of the Arabic words for “rain.” Although the language has another near synonym, *matar*, it has negative connotations—rain as punishment, torment, the rain that breaks the banks and floods the fields. *Ghaith*, on the other hand, is rain as mercy and prosperity, the deluge that ends the drought.

4

THE MORNING AFTER MY VISIT TO the National Center of Meteorology, I take a taxi to Al Ain to go on that cloud-seeding flight. But there's a problem. When I leave Abu Dhabi that morning there's a low fog settled across the country, but by the time I arrive at Al Ain's small airport—about 100 miles inland from the cities on the coast—it has burned away, leaving clear blue skies. There are no clouds to seed.

Once I've cleared the tight security cordon and reached the gold-painted hangar (the airport is also used for military training flights), I meet Newman, who agrees to take me up anyway so he can demonstrate what *would* happen on a real mission. He's wearing a blue cap with the UAE Rain Enhancement Program logo on it. Before moving to the UAE with his family 11 years ago, Newman worked as a commercial airline pilot on passenger jets and split his time between the UK and his native South Africa. He has exactly the kind of firmly reassuring presence you want from someone you're about to climb into a small plane with.

Every cloud-seeding mission starts with a weather forecast. A team of six operators at the meteorology center scour satellite images and data from the UAE's network of radars and weather sta-



tions and identify areas where clouds are likely to form. Often, that's in the area around Al Ain, where the mountains on the border with Oman act as a natural barrier to moisture coming in from the sea.

If it's looking like rain, the cloud-seeding operators radio the hangar and put some of the nine pilots on standby mode—either at home, on what Newman calls “villa standby,” or at the airport or in a holding pattern in the air. As clouds start to form, they begin to appear on the weather radar, changing color from green through blue to yellow and then red as the droplets get bigger and the reflectivity of the clouds increases.

Once a mission is approved, the pilot scribbles out a flight plan while the ground crew preps one of the four modified Beechcraft King Air C90 planes. There are 24 flares attached to each wing—half Ghaith 1, half Ghaith 2—for a total of 48 kilograms of seeding material on each flight. Timing is important, Newman tells me as we taxi toward the runway. The pilots need to reach the cloud at the optimal moment.

Once we're airborne, Newman climbs to 6,000 feet. Then, like a falcon riding the thermals, he goes hunting for updrafts. Cloud seeding is a mentally challenging and sometimes dangerous job, he says through the headset, over the roar of the engines. Real missions last up to three hours and can get pretty bumpy as the plane moves between clouds. Pilots generally try to avoid turbulence. Seeding missions seek it out.

When we get to the right altitude, Newman radios the ground for permission to set off the flares. There are no hard rules for how many flares

to put into each cloud, one seeding operator told me. It depends on the strength of the updraft reported by the pilots, how things look on the radar. It sounds more like art than science.

Newman triggers one of the salt flares, and I twist in my seat to watch: It burns with a white-gray smoke. He lets me set off one of the nano-flares. It's slightly anticlimactic: The green lid of the tube pops open and the material spills out. I'm reminded of someone sprinkling grated cheese on spaghetti.

There's an evangelical zeal to the way some of the pilots and seeding operators talk about this stuff—the rush of hitting a button on an instrument panel and seeing the clouds burst before their eyes. Like gods. Newman shows me a video on his phone of a cloud that he'd just seeded hurling fat drops of rain onto the plane's front windows. Operators swear they can see clouds changing on the radar.

But the jury is out on how effective hygroscopic seeding actually is. The UAE has invested millions in developing new technologies for enhancing rainfall—and surprisingly little in actually verifying the impact of the seeding it's doing right now. After initial feasibility work in the early 2000s, the next long-term analysis of the program's effectiveness didn't come until 2021. It found a 23 percent increase in annual rainfall in seeded areas, as compared with historical averages, but cautioned that “anomalies associated with climate variability” might affect this figure in unforeseen ways. As Friedrich notes, you can't necessarily assume that rainfall measurements from, say, 1989 are directly comparable with those from 2019, given that climatic conditions can vary widely from year to year or decade to decade.

LEFT TO RIGHT:

1. A plane flies near a cloud that has been targeted for seeding, searching for updrafts of air.
2. The pilot activates flares on the plane's wing, which spray moisture-absorbing particles into the sky.
3. Water droplets form around the seeding particles, then collide with other nearby droplets.
4. When the droplets become heavy enough, they fall as rain.

The best evidence for hygroscopic seeding, experts say, comes from India, where for the past 15 years the Indian Institute of Tropical Meteorology has been conducting a slow, patient study. Unlike the UAE, India uses one plane to seed and another to take measurements of the effect that has on the cloud. In hundreds of seeding missions, researchers found an 18 percent uptick in raindrop formation inside the cloud. But the thing is, every time you want to try to make it rain in a new place, you need to prove that it works in that area, in those particular conditions, with whatever unique mix of aerosol particles might be present. What succeeds in, say, the Western Ghats mountain range is not even applicable to other areas of India, the lead researcher tells me, let alone other parts of the world.

If the UAE wanted to reliably increase the amount of fresh water in the country, committing to more desalination would be the safer bet. In theory, cloud seeding is cheaper: According to a 2023 paper by researchers at the National Center of Meteorology, the average cost of harvestable rainfall generated by cloud seeding is between 1 and 4 cents per cubic meter, compared with around 31 cents per cubic meter of water from desalination at the Hassyan Seawater Reverse Osmosis plant. But each mission costs as much as \$8,000, and there's no guarantee that the water that falls as rain will actually end up where it's needed.

One researcher I spoke to, who has worked on cloud-seeding research in the UAE and asked to speak on background because they still work in the industry, was critical of the quality of the UAE's science. There was, they said, a tendency for "white lies" to proliferate; officials tell their superiors what they want to hear despite the lack of evidence. The country's rulers already think that cloud seeding is working, this person argued, so for an official to admit otherwise now would be problematic. (The National Center of Meteorology did not comment on these claims.)

By the time I leave Al Ain, I'm starting to suspect that what goes on there is as much about optics as it is about actually enhancing rainfall. The UAE has a history of making flashy announcements about cutting-edge technology—from flying cars to 3D-printed buildings to robotic police officers—with little end product.

Now, as the world transitions away from the fossil fuels that have been the country's lifeblood for the past 50 years, the UAE is trying to position itself as a leader on climate. Last year it hosted the annual United Nations Climate Change Conference, and the head of its National Center of Meteorology was chosen to lead the World Meteorological Organization, where he'll help shape the global consensus that forms around cloud seeding and other forms of mass-scale climate modification.

(He could not be reached for an interview.)

The UAE has even started exporting its cloud-seeding expertise. One of the pilots I spoke to had just returned from a trip to Lahore, where the Pakistani government had asked the UAE's cloud seeders to bring rain to clear the polluted skies. It rained—but they couldn't really take credit. "We knew it was going to rain, and we just went and seeded the rain that was going to come anyway," he said.

5

FROM THE STEPS OF THE EMIRATES

Palace Mandarin Oriental in Abu Dhabi, the UAE certainly doesn't seem like a country that's running out of water. As I roll up the hotel's long driveway on my second day in town, I can see water features and lush green grass. The sprinklers are running. I'm here for a ceremony for the fifth round of research grants being awarded by the UAE Research Program for Rain Enhancement Science. Since 2015, the program has awarded \$21 million to 14 projects developing and testing ways of enhancing rainfall, and it's about to announce the next set of recipients.

In the ornate ballroom, local officials have loosely segregated themselves by gender. I sip watermelon juice and work the room, speaking to previous award winners. There's Linda Zou, a Chinese researcher based at Khalifa University in Abu Dhabi who developed the nano-coated seeding particles in the Ghaith 2 flares. There's Ali Abshaev, who comes from a cloud-seeding dynasty (his father directs Russia's Hail Suppression Research Center) and who has built a machine to spray hygroscopic material into the sky from the ground. It's like "an upside-down jet engine," one researcher explains.

Other projects have been looking at "terrain modification"—whether planting trees or building earthen barriers in certain locations could encourage clouds to form. Giles Harrison, from the University of Reading, is exploring whether elec-

AMIT KATWALA is a features editor at WIRED and the author, most recently, of *Tremors in the Blood: Murder, Obsession, and the Birth of the Lie Detector*. He is based in London.



WINNERS OF
A GRANT FROM
THE UAE RESEARCH
PROGRAM FOR RAIN
ENHANCEMENT
SCIENCE RECEIVE
\$1.5 MILLION PER
YEAR FOR 3 YEARS.

For the UAE, it's almost irrelevant whether cloud seeding works. There's **SOFT POWER** in being seen to be able to **BEND THE WEATHER TO YOUR WILL.**

trical currents released into clouds can encourage raindrops to stick together. There's also a lot of work on computer simulation. Youssef Wehbe, a UAE program officer, gives me a cagey interview about the future vision: pairs of drones, powered by artificial intelligence, one taking cloud measurements and the other printing seeding material specifically tailored for that particular cloud—on the fly, as it were.

I'm particularly taken by one of this year's grant winners. Guillaume Matras, who worked at the French defense contractor Thales before moving to the UAE, is hoping to make it rain by shooting a giant laser into the sky. Wehbe describes this approach as "high risk." I think he means "it may not work," not "it could set the whole atmosphere on fire." Either way, I'm sold.

So after my cloud-seeding flight, I get a lift to Zayed Military City, an army base between Al Ain and Abu Dhabi, to visit the secretive government-funded research lab where Matras works. They take my passport at the gate to the compound, and before I can go into the lab itself I'm asked to secure my phone in a locker that's also a Faraday cage—completely sealed to signals going in and out.

After I put on a hairnet, a lab coat, and tinted safety goggles, Matras shows me into a lab, where I watch a remarkable thing. Inside a broad, black box the size of a small television sits an immensely powerful laser. A tech switches it on. Nothing happens. Then Matras leans forward and opens a lens, focusing the laser beam.

There's a high-pitched but very loud buzz, like the whine of an electric motor. It is the sound of the air being ripped apart. A very fine filament, maybe half a centimeter across, appears in midair. It looks like a strand of spider's silk, but it's bright blue. It's plasma—the fourth state of matter. Scale

up the size of the laser and the power, and you can actually set a small part of the atmosphere on fire. Man-made lightning. Obviously my first question is to ask what would happen if I put my hand in it. "Your hand would turn into plasma," another researcher says, entirely deadpan. I put my hand back in my pocket.

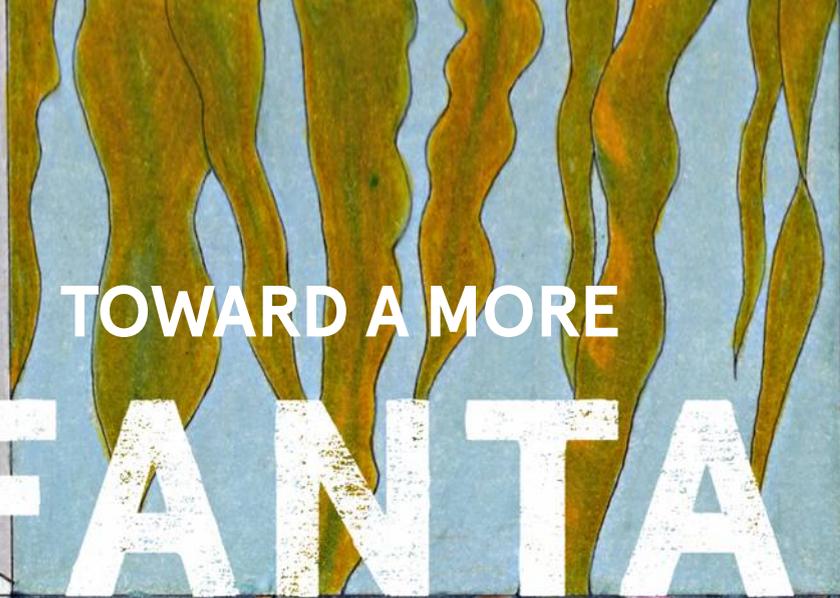
Matras says these laser beams will be able to enhance rainfall in three ways. First, acoustically—like the concussion theory of old, it's thought that the sound of atoms in the air being ripped apart might shake adjacent raindrops so that they coalesce, get bigger, and fall to earth. Second: convection—the beam will create heat, generating updrafts that

will force droplets to mix. (I'm reminded of a never-realized 1840s plan to create rain by setting fire to large chunks of the Appalachian Mountains.) Finally: ionization. When the beam is switched off, the plasma will reform—the nitrogen, hydrogen, and oxygen molecules inside will clump back together into random configurations, creating new particles for water to settle around.

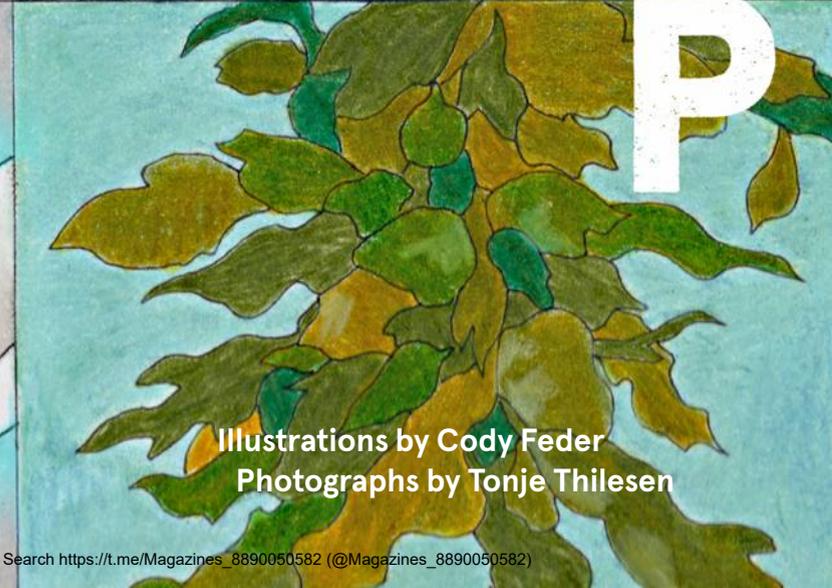
The plan is to scale this technology up to something the size of a shipping container that can be put on the back of a truck and driven to where it's needed. It seems insane—I'm suddenly very aware that I'm on a military base. Couldn't this giant movable laser be used as a weapon? "Yes," Matras says. He picks up a pencil, the nib honed to a sharp point. "But anything could be a weapon."

These words hang over me as I ride back into the city, past lush golf courses and hotel fountains and workmen swigging from plastic bottles. Once again, there's not a cloud in the sky. But maybe that doesn't matter. For the UAE, so keen to project its technological prowess around the region and the world, it's almost irrelevant whether cloud seeding works. There's soft power in being seen to be able to bend the weather to your will—in 2018, an Iranian general accused the UAE and Israel of stealing his country's rain.

Anything could be a weapon, Matras had said. But there are military weapons, and economic weapons, and cultural and political weapons too. Anything could be a weapon—even the idea of one.

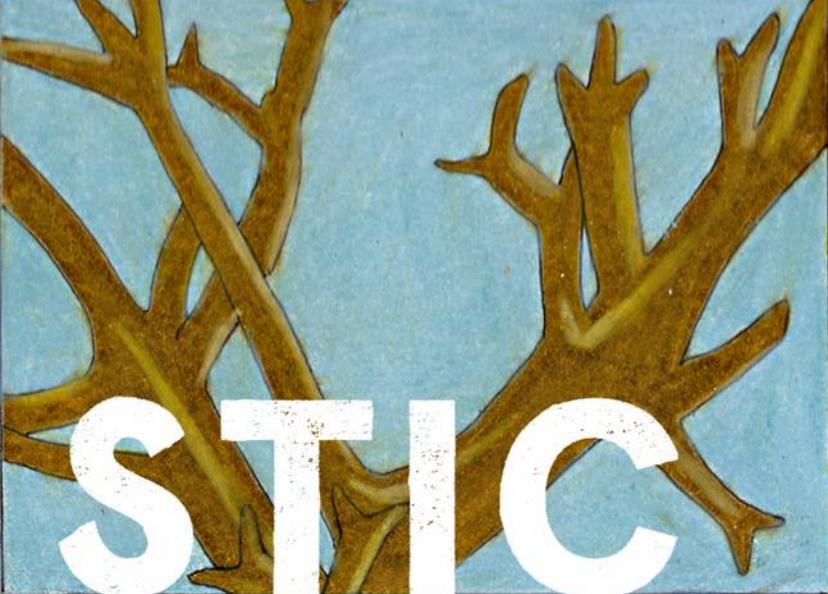


TOWARD A MORE FANTA



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Illustrations by Cody Feder
Photographs by Tonje Thilesen



STIC



LASTIC

Stretchy seaweed.
Reverse vending machines.
QR-coded take-out boxes.
To cure our addiction to
disposable crap, we'll all
need to get a little loony.
by Clive Thompson



A PLASTIC BAG MIGHT BE THE MOST OVERENGINEERED OBJECT IN HISTORY.

Some years back, I stopped by a French deli to buy some big chunks of cheese and carried them home in a plastic bag. The cheese was so heavy that the bag stretched and bulged, and the handle dug painfully into my hands. But the bag didn't break. That's because of the magical chemistry of plastic—essentially, oil turned solid, with carbon and hydrogen atoms that line up in repeating units to form long, noodle-like molecules.

These molecules are pliable and strong, which is what makes plastic so widely useful. And so durable: I unpacked the hunks of Camembert and Havarti and shoved the bag into the back of a kitchen drawer. When I stumbled upon it a few weeks ago, it was still pristine. Of course it was. Plastic bags can last, intact and usable, for decades.

Which is ... nuts, right? We create a bag rugged enough to span decades and then use it for minutes before shoving it in a drawer or, more likely, sending it off to a landfill, where it might break into fragments that stick around for hundreds of years. Like I said: the most overengineered object in history.

The environmental problem of “single-use plastics” haunts the public imagination like a spectral wolf. And no wonder—the sheer welter of everyday objects we make from plastic is astonishing. There's plastic in grocery bags, obviously, but also in yoga pants and car tires and building materials and toys and medical products. The transition came on quickly: Plastic use was comparatively small until the 1970s, when it exploded, tripling by the 1990s. Then it went into overdrive, and in the next 20 years we used as much plastic as we had in the previous 40. We now crank out more than 500 million tons of plastic waste a year. Globally, only 9 percent of plastics are recycled. The rest go into landfills or get incinerated, pumping toxic fumes into the air, usually in poor neighbor-

hoods. A significant chunk also ends up in the ocean, which has already amassed as much as 219 million tons of the stuff—wrappers washing up on shorelines, chunks eaten by fish, islands of plastic forming in watery gyres at sea.

It's a lot. Too much, many of us agree. And if we want to begin unwinding the plastic revolution? One good place to start is all those single-use products—because, according to the UN Environment Programme, they make up fully 36 percent of the plastics we use every year.

They're not easy to walk away from, in part because we use so many types in so many places. We've got “thin films” like bags, thicker plastics in take-out bowls, multilayered plastic containers for grocery store meat, and see-through polyethylene terephthalate bottles for soda and water. Each has its own chemical properties, molecular makeup, and performance specs. A single replacement for all that packaging? It doesn't exist.

What does exist, though, is a set of promising developments in the *management*, as it were, of single-use stuff.

It's a war on three fronts: Replace some of our single-use plastics with truly compostable materials. Replace another chunk with reusable containers, like metal or glass. And, finally, tweak the economic incentives so plastic recycling actually works. This isn't my battle plan; it's a theme I heard over and over as I spent the past year talking to scientists, inventors, entrepreneurs, and policy folk.

None of these ploys is a slam dunk. They'll need not only innovation but also binders full of smart government incentives and regulation—all of which, of course, will be resisted by petroleum firms. But if you add up all these unplastic developments, you'll find grounds for cautious optimism: We've got a path to a world less littered with deathless plastic waste.

STANDING IN

her sun-drenched lab in San Leandro, California, Julia Marsh grabbed a small see-through bag and handed it to me. It was shiny like cellophane, the sort of thing a company might use to package a set of earrings or some candies. Bags like this? “They’re absolutely ubiquitous,” Marsh said.

As I opened the pouch and turned it over in my hands, I realized it was a little stiffer than I expected. That’s because it was made of seaweed and composed of the plant’s polysaccharides, long chains of carbohydrate molecules.

So, not quite the same performance as a plastic bag, but with a better trade-off: You can throw it on a regular home composting heap, Marsh said, and in a few weeks you’ll find only scraps of it. In six months, it’ll be an organic part of the soil.

“Bioplastics” aren’t new; over the past few decades, engineers have made plastic alternatives from sugarcane, corn, and more. The hardest part has been making sure they actually return to nature. Most bioplastics need to be shipped to an industrial composting facility (designed to break down organic materials faster), and few American towns possess one. Some bioplastics contain additives that don’t break down at all.

Marsh wants to fix that. A 30-year-old with a surfer-like vibe, she grew up playing in the water along the central California shores. She marveled at the coast’s riot of natural beauty and sea life—and became increasingly horrified by the deluge of plastic ocean pollution and the dead whales found with bellies full of the stuff. Marsh moved to New York to pursue a career in design—branding, packaging, that sort of thing. But after seeing up close how wasteful companies could be in wrapping and delivery, she balked. She didn’t want a career where she’d be cranking out so much trash.

Marsh decided instead to tackle the plastics packaging problem. The fashion industry uses billions of thin plastic “polybags” every year to ship its articles. What if she could make them out of something that could actually be composted?

She didn’t want to work with a feedstock like corn, though. To make tons of bioplastics out of those materials, you’d need to grow so much of them that you’d wreck the soil and emit lots of CO₂. Marsh’s partner, Matt Mayes, was doing a master’s degree in sustainable development, which brought him to Indonesia. She joined him for a visit and toured some of the country’s seaweed farms. That got her thinking: Maybe

seaweed was a better building block for a bioplastic. It’s got nice gelling properties that are suited to making films. Indeed, seaweed is often used to give toothpastes and cosmetics their gluey texture. Better yet, seaweed “regenerates really quickly,” she noted, so you’d get crops fast while using less space than corn. She ticked off the other benefits: “Requires virtually zero inputs to grow. Really low carbon usage, really low energy. No fertilizer, no arable land—no fresh water! And seaweed farms serve as water filtration systems. They provide habitat for biodiversity.” And seaweed was becoming kind of *hot*. A few startups in Europe were already using it to make everything from the lining for take-out containers to little water-filled gel balls that athletes could use to rehydrate.

Back in New York, she set about doing some experiments in her kitchen. After poking around on YouTube, she learned she could order powdered seaweed polysaccharides online, then mix them with hot water to make a gooey gel that cools into a plasticky material. Pulling out her phone, she showed me pictures of her results: lumpy, malformed green dishes and a bowl.

“Really horrible, ugly, disturbing-looking prototypes,” she said. But she learned that bioplastics were “not necessarily about super complicated science” but rather the patience for years of tinkering. Hire some serious materials engineers, she figured, and they could make real progress on the polybag problem.



She and Mayes founded Sway in the early months of Covid; their first hire was Matt Catarino, a materials engineer who'd worked for six years in Big Plastic (as he calls it) and engineered everything from medical waste bags to protective film for cars. But he'd had enough. Over the next few months, Catarino produced a crude thin-film prototype that got the startup \$2.5 million in investment. Sway poured the money into more hiring and renting a lab in San Leandro.

When I visited last year, Marsh shooed me over to a rack with four thick rolls of their "flagship" plastic. She unspooled a bit; it was clear and thicker than Saran Wrap. One version was a pretty light green mottled with darker green dots—bits of "less refined kelp" for aesthetic effect, Marsh said. I held it up to the light like stained glass. "The jewelry folks really like that one," she said.

Behind her was another shelf with dozens of cups filled with dirt. Amanda Guan, a materials engineer, had buried in each cup a piece of bioplastic 2 centimeters square, to test how the material decomposes. She pulled a cup out and dug into the dirt. When she finally located a fragment of plastic, it measured 1 centimeter on each side. "This has only been in there for two weeks," she noted, seeming pleased.

The members of Marsh's lab group were like a team from the Marvel Universe: There was Guan, who'd recently gotten her master's degree, in a white lab coat, gray turtleneck, and plastic safety goggles that somehow managed to look hip; Joakim Engström, a boisterous Swedish polymer scientist with a bushy mustache and a wool hat; and Catarino, the Big Plastics escapee, reserved beneath his baseball cap.

One of the lab's biggest challenges was that their bioplastic

was hard to melt. That's a big deal when you're manufacturing plastic bags at scale. To make plastic sheets, manufacturers typically melt down plastic pellets, known as nurdles, and blow the resulting goop into a huge bag "like two stories tall," as Catarino told me. Oil-based plastics melt readily; seaweed, in contrast, hates the heat. "It just kind of *burns*," he added. So they tried adding other organic compounds to make the polysaccharide chains meltier. Near one wall of the Sway lab, bright metal racks held rows of numbered containers and dishes filled with nurdles, the results of their experiments. When I visited they were up to 144 and were finally getting it to melt pretty well. I'd love to tell you how the Sway team is cracking this puzzle, but they wouldn't fully explain their chemistry—state secrets.

If Sway's bioplastic is going to replace polybags, it also has to be stretchy—and here the team was still struggling. Guan led me over to a corner of the lab, where she clipped a Band-Aid-sized piece of their film between two robotic pinchers. The arms pulled from both ends and measured how many newtons of force could be applied before the material broke. The pieces snapped after only a few seconds.

"That was pretty bad," Guan said sheepishly.

"Test a *good* one, Amanda," Marsh said, with a laugh.

Still, the team isn't too bothered. As Marsh said, for the unplastic revolution to take off, people's expectations for how plastic behaves will have to change. Not every plastic bag *should* be perfectly stretchy, strong, and durable for the ages. Those specs were bonkers to begin with.

I kept in touch with Marsh over the following months, and last fall she showed me a video of Sway's bioplastic in production at a manufacturing plant. The first batches scorched, producing a sort of "black goo," Marsh told me, until they dialed in the processing conditions. Their films were becoming softer too. When Marsh shipped me some samples in April 2024, they were silky to the touch, and I could stretch them a bit. (My teenage son was impressed; he also, before I could say *I don't think you're supposed to do that*, ripped off a small chunk and chewed on it. "It tastes like seaweed," he said.)

Critics of bioplastics abound. Many doubt that they can

"You go to these expos, where it's just a showroom for garbage. 'Let's have an event where we show future garbage to people.'"



ever be reliably composted. Historically those people have been right, of course—and Sway and other companies like it have yet to prove them wrong. Marsh told me the startup had submitted its materials to TÜV, an Austrian firm that can certify whether they actually compost. Then there's the question of whether highly scaled, mass seaweed farming would have unwanted side effects—which, fair enough. Marsh knows these critiques and shares many of them, particularly about whether bioplastics are genuinely compostable. The whole point of Sway, she says, is to produce a product that addresses the concerns.

Her corporate clients, at least, are excited. One, Eco-Enclose—a firm that makes “sustainable packaging”—is using Sway's thin films to make see-through windows on card-stock boxes for brands like Smartwool. Burton, the snowboarding company, wants to use Sway's material to wrap products during shipping. And the J.Crew Group, which has made a pledge to stop using virgin plastic by 2025 and currently buys polybags made from recycled materials, intends to switch to Sway's bioplastics. (I had expected that the corporate impetus to use less oil-based plastic came from conscientious customers, but the pressure is also from staff members. This makes a sort of psychological sense: A customer encounters only one bag at a time, but employees can be hip-deep in them.)

A true stress test of the new materials is coming up. In shipping, polybags get tossed around on conveyor belts and can rip. This year, Sway's bioplastic bags will “go through our machinery in real time,” Doug Forster, chief sourcing officer for J.Crew Group, told me this spring.

As a science nerd, I dug the prospect of perfecting this new chemistry. But it was also clear that even if Marsh and her team were maximally successful, Sway's materials would solve only some of our single-use problem. Stores would still be choked with other plastics, particularly for food products—zillions of bottles, sporks, take-out containers, peanut butter jars. Was there any way, right now, to unplasticize all *that*?

IT'S NOT

a good idea to talk about single-use plastics around Kjell Olav Maldum.

He gets deeply annoyed by the term—because as far as he's concerned, not a single plastic molecule should ever be used just once. “It's not *single*-use! Just collect and recycle it, and this will be useful plastic!” he said when we first spoke on Zoom. Indeed, he considers traditional, petroleum-based plastics a critical part of modernity. “Try to run a hospital without plastic. Try to run a society without plastic. It's not possible!” He'd rather we all focus on making sure almost none winds up in the garbage, the ocean, or the soil.

Maldum is a strange blend of personalities—part bombastic prophet, part matter-of-fact bureaucrat. One might

be tempted to dismiss his pro-plastic stance, except that he runs one of the most successful plastic-recycling operations on the planet. In Norway, his company Infinitum manages a system to collect and recycle bottles made of polyethylene terephthalate, or PET, the sort that holds soda or water. PET is one of the easier plastics to recycle; it melts and reforms pretty readily. Even so, in the US, only a minority of PET bottles get recycled. The main PET industry association puts the recycling rate at 29 percent, while Greenpeace says it's 20.9 percent. In Norway, though, Infinitum recycles nearly every damn bottle. How the heck did they achieve this?

With a combo of clever technology and deft public policy. As is often the case, the policy was the prime mover. Running a recycling program requires a lot of expensive labor and systems. You have to collect the plastic and separate it by type, which is expensive.

So in the late '90s, Norway passed a law that forced somebody to pay for it—specifically, companies such as Coca-Cola that make plastic PET containers. Firms got hit with a new tax if they *didn't* pay to collect and recycle used bottles. If the beverage companies can prove they're recycling 95 percent as many bottles as they sell, they pay no tax. Otherwise, the less they recycle, the more they owe—until they're paying “hundreds of millions of Norwegian kroner,” Maldum said (tens of millions of US dollars).

The bottle makers snapped to attention and began developing a system to get their used bottles back. In 1999, the companies founded Infinitum to manage collection. Maldum has been its CEO for the past 16 years. The company rolled out a wide network of “reverse” vending machines: Customers shove bottles in and earn a few coins back. Every bottle has a barcode specific to its maker. The machine scans the code and the shape of the bottle to track which company gets credit. (This labeling system is also why Norway has such reliable data on its recycling levels.) The bottles are squished and dropped into huge bags, and Infinitum hauls them to a sorting facility. The clear and colored bottles are sorted, crushed, and sold to a recycling firm, which processes the materials for other companies to then shape into new bottles.

Perfecting the system took years. Infinitum also demanded changes to bottle design that simplified recycling. A beverage company might, for example, attach its label with a stubborn glue that is hard to wash off. If Infinitum finds a bottle's design is causing problems, it can deny the company credit in its system. To avoid getting hit with the tax, companies now run their bottle designs by Infinitum and fix any unrecyclable elements before they begin production. To recycle well, you need standardization. The tax gives Infinitum the power to enforce simplicity.



There's a term of art for this whole system: reverse logistics. For the first 100 years of the plastics revolution, companies essentially sprayed products at customers—it was a one-way movement of atoms. Successful recycling requires doing this process in reverse, an entirely new set of skills. How do you get stuff back? What new economics, technologies, and policies do you need?

And what social engineering? Customers might decide, *Eh, who cares about the 20 cents*, and throw their bottles away. So Infinitum runs playfully encouraging ads. One shows a tennis player in a locker room hurling a bottle in the trash. A voice-over notes that making a new one takes as much energy as running a ball machine for an hour-plus. Suddenly he's pelted with balls as he runs and ducks for cover.

Altogether, the strategy has worked. In Norway consumers are now so environmentally conscious that they've started actively choosing to buy beverages made from recycled bottles. Even though recycled PET costs anywhere from 1.5 to 1.75 times more expensive than virgin plastic, bottle makers buy it up and use it.

I wondered: Would it be possible to turn plastic bottles into a *completely* closed loop? Let's imagine every country pulled a Norway—a politically hallucinogenic "if," sure, but let's go there. Could bottle makers keep on reusing those plastic molecules over and over, and never need virgin plastic?

Not entirely. When PET molecules are repeatedly recycled, they start "yellowing and darkening," Michael Joyes, the sustainability director for Petainer, a European bottle maker, said. Eventually they turn black. You can lighten the stuff with "anti-yellow" chemicals or mix it with virgin materials. Or you can use these older plastics to bottle up drinks like Coke. "The inside's dark too, so people don't mind so much," Joyes said.

Even so, repeatedly recycled PET becomes less useful over time. The polymer chains in the plastic get shorter. Clever chemistry hacks can lengthen them, and some recyclers predict recycled PET can be used up to eight times. EU legislation is mandating that by 2030, 30 percent of PET in bottles be recycled—and Joyes predicts that some countries and brands will push much higher, to 70 or even 100 percent recycled PET.

I was impressed by Infinitum's success. But PET bottles are, chemically and structurally, the easiest plastic to recycle. They basically *want* to be reborn (until they don't). Many other forms are more truculent. Consider food containers: They can consist of several plastics with different recycling processes. Pricey! Recyclers are experimenting with "chemical" recycling, where a bunch of different plastics are tossed into a vat and the various molecules separate out like the layers in a salad dressing. Thus far, though, chemical recycling

is energy-intensive. Plastic would be recycled, sure, but it would cost a lot and emit mountains of CO₂, trading one environmental problem for another.

Maldum is more optimistic. He thinks Infinitum's strategy for PET recycling could work for all plastics. The trick is to redesign the packaging so just about anything can be tossed into a reverse vending machine. "Why do you need to use a tray for meat? You can use a tube," he said. It was an intriguing idea, but I couldn't quite picture the wild welter of food wrappers all somehow reconfigured for a vending machine. Would people be as willing to carry empty tubes with raw-meat residue to the grocery store to shove in a machine?

What's more, recycling of any sort has its own searing critics. Some American environmental groups regard plastic recycling as a naked form of greenwashing. They doubt recycling rates will ever escape the low digits in the US and outside Europe—because most politicians won't enact serious penalties, and the quality of recycled plastics will be too low. And because plastic might be a big market for petroleum companies in the future, those corporations will likely fight hard to keep society hooked on it.

For straight-edge enviros, then, the only serious way to reduce single-use plastics is to just stop. Stop. Using. Them. Entirely.

I MET

Jason Hawkins at Field & Social, a lunch joint in downtown Vancouver, British Columbia, known for its salad bowls. He picked the spiced Thai bowl; I chose the Thai peanut and chicken bowl. We ordered them to go.

Normally, of course, takeout is served in a plastic or paper container. Field & Social, though, uses a service offered by Hawkins' "circular economy" startup, Reusables. Customers can ask to get their food in a stainless steel bowl or cup with a sleek silicone lid. When they're done, they can drop it off—unwashed!—at any store that participates in Reusables' network. (There are currently 75.) Each container has a QR code, so Reusables can track which customer has which container. If they don't return it, they have to pay for it. Charges are up to \$25 per unreturned container, though customers get refunded if they later bring it back. But in the 150,000 meals Reusables had served by the time Hawkins and I met, more than 98 percent of the containers ultimately came back.

The trick behind getting people to truly reuse things? Making it as easy as possible. "People have a lot of things going on in their life," he told me as he tucked into his meal. "You're hungry, you want a salad, you should just get a salad! It's not up to *people* to be sustainable—it's up to businesses and government to create the right infrastructure."

Tall and angular, Hawkins has a jittery energy and a broad grin behind his scruffy blond beard. He got the idea for

Reusables during the Covid pandemic, as everyone hunkered at home and the use of takeout exploded, producing a mountain of waste. Hawkins was working at an online organic-food grocery-delivery service called Spud and talked about the takeout boom with Anastasia Kiku, a college-student intern who'd immigrated from Russia. Both were repelled by how much plastic takeout was generating. It made them think: Maybe the best way to cut back on single-use garbage is just to rewind. Before plastic came along, our forebears used sturdy bowls and plates and washed and reused them. They "wasted nothing," as Hawkins said. Maybe our grandparents had it right.

The duo concocted the idea of Reusables, and in late 2021 quickly built a prototype system. Customers would pay \$5 a month to use as many containers as they wanted, and restaurants would pay a fee too. Hawkins and Kiku hired a company to pick up the dirty dishes from restaurants and clean them. By early 2023, they'd signed up more than 100 restaurants and food stores in Vancouver and Seattle.

Early users loved it. Many restaurant owners, it seems, truly loathe single-use take-out containers. Often it's because, like those store employees at J.Crew, they hate being neck-deep in waste. When I spoke to Stewart Boyles, Field & Social's director of operations and regional chef, he described attending conventions to scout new take-out containers. "You go to these expos where it's just, like, a showroom for garbage. 'Let's have an event where we show *future garbage* to people!'"

Nonetheless, by last fall, Hawkins and Kiku were finding it harder to get new customers. Sure, die-hard environmentalist diners loved Reusables and were happy to pay for the service. But they were only a tiny minority of the population. The lesson, Hawkins concluded, is that the only way to force a mass change in behavior—and you could see this coming, I guess—is with regulation. A community has to first get serious and ban single-use take-out containers.

So the founders pivoted to the communities that were, in fact, doing that: universities.

Simon Fraser University, a 37,000-student institution on the outskirts of Vancouver, banned single-use plastics in 2021. It needed a system for students who wanted to grab a meal from the cafeteria and eat it in their dorm room. Sid Mehta, the university's senior director of ancillary services, knew about the Reusables system; he called up Hawkins to hire them.

"The students," Mehta told me, are hungry for this sort of system: "They're already there." For a simplified checkout system, Hawkins' team attached a rugged RFID chip to each container: Presto, students could now check one out by waving it near a checkout terminal. Returning would be just as easy. To

You might need to reuse a metal food container 200 times before its emissions are equal to those from 200 one-shot containers.

create an automated return bin, Reusables hired Jack Gralla, a lanky self-taught hardware hacker—he'd worked on everything from "solar roadways" to robotics. Gralla showed me the prototype, a bin with a lid crammed with microcontrollers ("There's three computers inside"). It opens only if it detects an RFID chip, to prevent people from dropping in, say, trash or dog poop.

By the spring of 2024, the new system was working smoothly at Simon Fraser. Three return bins had collected containers from 7,389 meals. The university funds the system, and students only pay a penalty if they fail to return a dish. (So far, 97.5 percent have been returned.) Mehta has ordered more smart return bins to scatter around campus, and he expects they'll process tens of thousands of meals in the next academic year.

Hawkins has inked deals with Pomona College and the University of Victoria and is in talks with a dozen others. With 27 million students, universities spend \$24 billion a year on food. They can quickly establish their own no-plastics policy. A college, Hawkins notes, is its own fiefdom—"literally like its own city, right?"

A few other places are following suit. In June 2022, Canada passed a ban on many types of single-use plastics, including hot-food takeout from major grocery chains. A fight over the ban is playing out in the courts.

Jo-Anne St. Godard was watching this with interest; she's the head of the Circular Innovation Council, a nonprofit that advocates for reducing single-use materials in Canada. She began talking to Ottawa's major grocers and persuaded three—includ-

Ripping out pipelines, destroying gas pumps—these are violent, criminal acts.

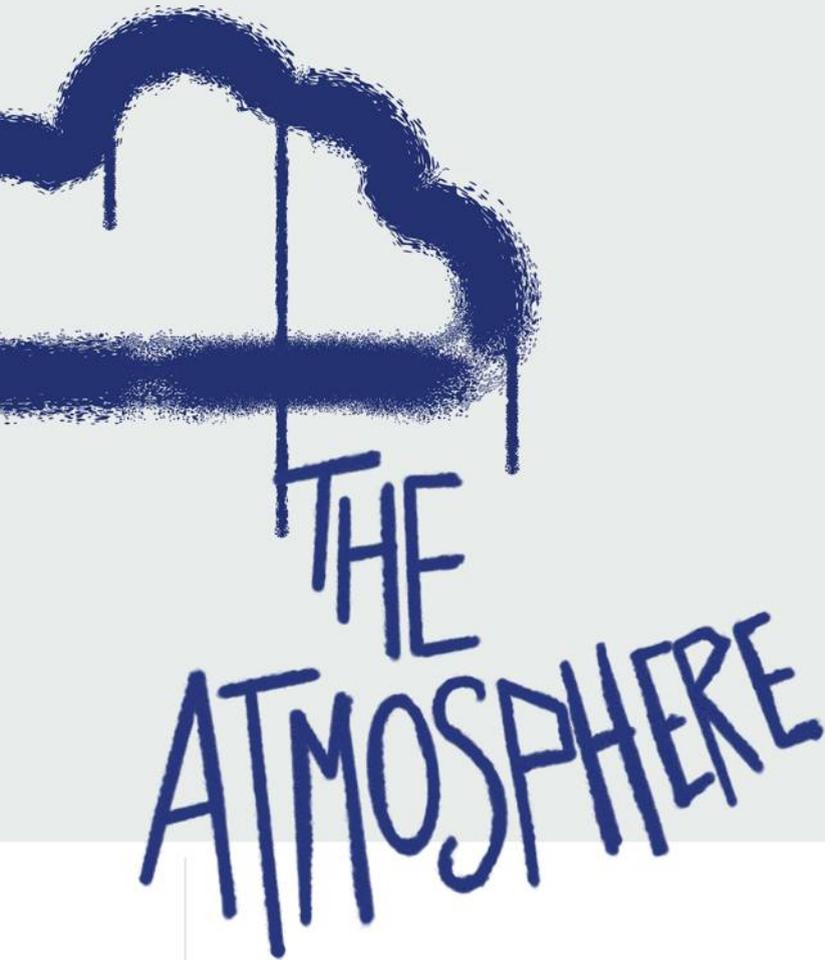
DAMAGE

According to Léna Lazare, the 26-year-old face of the radical climate movement, they're also acts of joy.

CONTROL

by **Morgan Meaker** Photographs by **Roberto Frankenberg**





IS MORE FESTIVAL than crime scene. There's an accordionist, and two men in beanie hats are playing the drums. It's a clear spring day in the farmlands of western France. But the people gathered in this field are technically trespassing, and there are signs they expect trouble. Someone has a gas mask slung around their neck. There's a contingent clad in balaclavas. Others disguise their features with dark goggles or masks, and one group holds up a wide fabric canopy to obscure the view of police drones. At the center of the maelstrom stands Léna Lazare, holding a pickax.

The then-24-year-old's long brown hair is untied; her face uncovered. That's important, she says. It adds a sense of legitimacy to what she's about to do. She drives the pickax into the ground as the crowd around her looks on. Again and again she strikes at the hard, dry earth. When she can't dig any more, another person emerges from the huddle to take over. Several meters down, they find what they've been looking for: pipes. Beneath the field is a network designed to carry water to a new "mega-basin"—a giant reservoir being built near the village of Épannes. The group is here to rip one of those pipes out of the ground.

In other parts of the world, environmentalists target oil giants, airports, and banks to throw sand in the gears of companies they believe are actively warming the globe. For activists in France, mega-basins have become a symbol of how the government is adapting to climate change in pre-

cisely the wrong way. In response to intensifying droughts, French authorities have carved giant water storage systems into the countryside for large farms to draw down in dry months. Critics say these mega-basins—which can hold up to 720 million liters, the equivalent of nearly 300 Olympic-sized swimming pools—are effectively hoarding water, reserving it for private landowners, leaving rivers parched and local groundwater systems depleted.

That's why these projects are targets for sabotage, according to Lazare. She talks about "disarming" the reservoirs, as if they, not she and her fellow protesters, were the source of violence. She's watching from the crowd on this clear day in March 2022 as a man in jeans and a white T-shirt strains to lever a piece of pipe out of the ground with rope. Someone produces an angle grinder. When a section is cut free, the crowd breaks into applause before a man in blue overalls brandishes the severed pipe above his head like a trophy. "At that moment," Lazare recalls later, "the water gushed out and returned to the earth."

Lazare is one of the 200 founding members of Les Soulèvements de la Terre, or Earth Uprisings, a French organization that is the most extreme of a new wave of radical European climate groups formed in the past five years. In France, this soft-spoken former physics student has become a spokesperson for sabotage. "We act when infrastructure has a serious impact on environments and on living beings," she says.

Now 26, Lazare makes more sense as a scientist than as an activist—mostly quiet and serious and economical with her words. She has a mane of unkempt hair and a soft, flat voice that sometimes gives way to a high-pitched giggle and flashes of steely defiance. "We refuse to be labeled as criminals," she says. After French interior minister Gérald Darmanin compared some members of Les Soulèvements de la Terre to ecoterrorists and the government outlawed the organization in June 2023, it was Lazare who went on TV to defend the group's activities.

GETTY IMAGES, ALAMY



In the past few years, activists have smashed bank windows, attacked gas stations, broken into oil-pipeline control stations, deflated hundreds of SUV tires, and, just this summer, doused Stonehenge with temporary orange paint. They do this for different aims—to attract media coverage, to argue their case in front of a jury, or to make business untenable for companies they see as responsible for loading the atmosphere with carbon dioxide, driving calamitous weather events, and courting mass extinction.

If Greta Thunberg was emblematic of an earlier stage of the global climate movement, Léna Lazare signals what comes next. Today's activists are wrestling with deep disappointment that 2019's mass climate demonstrations didn't portend big changes, and a certainty that they are running out of time to prevent climate catastrophe. A combination of urgency and despair is pushing them to actions previously seized by only the most radical fringe of the environmental movement.



SABOTAGE HAS BEEN a strand of the modern environmental movement for half a century. In 1975, two homemade bombs exploded in a yet-to-be opened French nuclear power station, delaying its construction by several months. In 1986, activists sank two roughly 430-ton Icelandic whaling ships and used sledge hammers and acid to destroy processing equipment in the country's only whale oil plant. In 1998, the year Lazare was born, a group associated with the Earth Liberation Front caused more than \$12 million in damage when it torched a mile-long strip of a Colorado ski resort that had been planning to expand into an area considered a potential habitat for a threatened lynx.

Growing up, Lazare's family—her father was the director of an art house movie theater, and her mother worked in film communications—had friends in Japan, and she felt a strong connection with the country. In 2011, when she was 12, a tsunami triggered a major disaster at the Fukushima Daiichi nuclear plant. Lazare spent days afterward obsessively reading about leaking radiation and the 15,000 people forced to evacuate their homes. She also read reports claiming those in charge of the plant had cut corners with safety measures in part to save money. And that introduced her to a tension—between what is best for business and what is best for the local environment—that she now finds ubiquitous. “Everything was done to prioritize economic interests before the well-being of the population,” she says.

Seven years after Fukushima, Lazare moved to Paris to study physics at the prestigious Sorbonne University. There she met, and began protesting



alongside, fellow student activists. Then, one day in the spring of 2018, she watched police fire tear gas at environmentalists squatting on an abandoned airport in western France, and she began to feel that protests alone were not enough. That year, Thunberg started the peaceful school strike that made her famous, and Lazare launched her own group. Paris Environmental Disobedience, or Désobéissance Ecolo Paris, was about figuring out ways to be strategically disruptive. The group tried out a few small, risk-averse actions like daubing banks in a type of easy-to-remove black paint, says Lazare, but they ended up talking about breaking the law a lot more than actually breaking it.

At around the same time, the mainstream climate movement was starting to gain momentum with peaceful tactics. Millions of young people began marching in capital cities across the world, making it clear they did not want to inherit a ruined planet. When the protests arrived in Paris in early 2019, Lazare joined them. She became a national coordinator for Youth for Climate, the French equivalent of Thunberg's Fridays for Future, appearing on TV and in newspapers talking about the climate crisis and her decision to stop traveling by plane.

All the while, she was restless. “It wasn't moving fast enough,” she remembers. By the end of that year, Lazare had dropped out of university. “We must reinvent ourselves, lead people toward civil disobedience, mount more radical actions,”

Protesters in Paris rally to support Les Soulèvements de la Terre after the government tried to ban the group.





she told the French magazine *Politis*. She was trying to get her comrades to take the leap toward sabotage. “It was about daring to damage material stuff,” she explains. Until then, she says, that was a line the mainstream climate movement had not been ready to cross.

Then the pandemic distracted the world from the climate. France went into lockdown. Lazare was in Japan, taking a break from protesting, and couldn’t get home for six months. When she finally made it back she got her hands on a book about environmental protests that had just been released, called *How to Blow Up a Pipeline*.

A few years earlier, its author, the Swedish academic and activist Andreas Malm, had been working on a book about ancient Egypt when his country experienced its worst wildfires in modern history. Upwards of 60 fires were burning, from the Arctic north to the southern island of Gotland. And it wasn’t just Sweden: parts of Greece, California, and the UK were all burning too.

Malm could no longer justify “geeking out on this moldy old historical stuff while the world was literally on fire,” so he forgot the book on ancient Egypt and instead wrote a treatise arguing that sabotage is necessary for the climate movement to make real progress. “The situation is so dire, we need to go beyond absolutely peaceful civil disobedience and start experimenting,” Malm says. The peaceful marches shouldn’t stop, he argues. Rather, the climate movement needs to develop a radical flank—one that will also apply pressure on policymakers and politicians to work more closely with moderate activists. In *How to Blow Up a Pipeline*, he compared this dynamic to the US Civil Rights Movement. In his telling, it was the threat of Malcolm X’s growing popularity that had spurred successive presidents, first John F. Kennedy then Lyndon Johnson, to work with Martin Luther King Jr.

This kind of flank, he wrote, was about harming property and not *people*—something he considers a red line, morally and strategically. “The one point where it becomes complicated,” he says, “is when you have cops protecting the things you want to destroy.” Police, in other words, may be an exception to the rule.

Lazare isn’t fully aligned with Malm, who has advocated an “ecological Leninism” of top-down state intervention in the economy. “We don’t agree at all politically,” she says. But his book had a profound impact on her—in an Instagram post from 2021, she poses for the camera with the words “Let’s Blow Up Pipelines” across her shoulders. Malm, for his part, has been to Les Soulèvements de la Terre’s protests and expresses an ideological affinity. “Sabotage is a French term,” he says. “I think Les Soulèvements de la Terre are the cutting edge of the climate movement in Europe right now.”



SABOTAGE MIGHT BE A French term, but it is a tactic that is spreading across Europe. Around the same time Lazare was digging up pipes in early 2022, the 30-year-old psycholo-

gist Lars Werner was trekking through the German countryside, a portable ladder stashed in his bag. It was the culmination of months of poring over maps, looking for places where oil pipelines were likely to jut out of the ground in his home country.

Werner was part of Letzte Generation (Last Generation), a climate-activist group best known for its road blockades, where members sit and refuse to let traffic pass until they are arrested. A veteran of those protests, Werner and his colleagues were “ready to go to prison,” he says, to grab the public’s attention. Now, he wanted to apply that idea to sabotage. The plan wasn’t to damage the pipeline permanently; he just wanted to break into a control station and stop the flow of oil. A photo from that day, posted on Instagram, shows Werner grasping a black emergency valve and looking solemnly into the camera through small round glasses. That spring, he says, the group broke into a total of 35 pipeline control stations around the country. (Response to the pipeline protests was tepid, Werner says. Media coverage was sparse—not helped by the fact that the company that owned the pipelines, refinery PCK Raffinerie, refused to say whether the oil supply had been disrupted.)

Not long after Werner’s first pipeline protest, a British doctor named Patrick Hart joined a new UK group called Just Stop Oil, which called for “bold action” until the government pledged to stop licensing new fossil fuel projects. Before sunrise one day in August 2022, Hart arrived at a gas station on the outskirts of London and started smashing the price screens on each pump using a hammer and chisel. Then he sat down and waited for the police to arrive. Hart chose the fuel pump’s screens, he says, because they were the only part of the gas station he believed he could damage without risking a spill or harming another living being. In addition to gas stations, Just Stop Oil members have attacked famous paintings, stormed sports venues, and sprayed powdered paint on Stonehenge to send the public a message: You might want to forget that climate change is happening, but its most dramatic consequences are yet to come.

As he talks, Hart returns to variations of the same refrain: The world is on course for catastrophe, and if we continue to rely on fossil fuels, billions of people will die. “I don’t know how many times I need to say this, but like, we are so fucked.” Getting more opportunities to convey this message is, to him, the whole point. His actions generate a lot of press interest, which in turn gets him a lot of interviews—like this one. “Every time I get an interview, I say humanity is headed for annihilation,” he says. “If we don’t change now, then we have absolutely no hope.”

When I meet Hart in London, he’s wearing a smart blue suit. He’s on his way to court for releasing plumes of orange powder onto the pitch at a rugby game at Twickenham Stadium. At the time,

Police fired 5,000 tear gas canisters in just under two hours. Soon protesters were covered in blood.

this is just one of four cases he's fighting—it's unclear whether any will end in jail time, but if they do, he says he's prepared. "People are desperate," he says. "The more desperate people get, the more extreme tactics they will use."



THIS CAST OF climate saboteurs live in different countries and speak different languages, but they have so many similarities. They want to show

their faces, to explain that what they're doing is a rational response to the current crisis. We're not the violent ones, they say. Real violence is committed by companies that are wrecking our planet for profit. Sabotage must target property, never people. The environment must not be permanently harmed.

Of course, the bombs placed in the French power station in the 1970s didn't stop the country from growing into Europe's biggest generator of nuclear power. Whaling continues in Iceland. The Colorado ski resort burned by the Earth Liberation Front was rebuilt. Oil still flows through the German pipelines shut off by Werner, and gas through the English pumps smashed by Hart.

But Lazare claims her actions are causing real disruption. By last spring, she had taken part in three acts of sabotage against the mega-basins: in Cram-Chaban, in Épannes, and in Sainte-Soline. Les Soulèvements de la Terre is doing more than just attracting media attention, she argues. The group has inspired copycat attacks that have vandalized mega-basins throughout western France. She claims this has pushed up the cost of building mega-basins; construction companies now have to pay for security guards and motion detectors to guard against people like her. And it's not just the owners of the mega-basin that are keeping an eye on Les Soulèvements de la Terre.

In March 2023, Lazare helped organize a second protest at the mega-basin under construction near





Sainte-Soline in western France. At least 6,000 protesters were met by some 3,000 French gendarmes in full riot gear, creating a barrier between the crowd and the half-built reservoir. Some demonstrators turned back; others attempted to push through the cordon, trying to reach and sabotage the site.

The ensuing violence shocked France. Police fired 5,000 tear gas canisters in just under two hours. Soon protesters were covered in blood; according to Les Soulèvements de la Terre, more than 200 people were injured. Two people were left in a coma. Organizers claim someone lost an eye. Police say 47 officers were hurt and four vehicles burned. “A lot of us felt completely traumatized about what happened,” says Lazare, who says she stayed behind the front line helping to look after the injured. A friend of a friend had been hit in the leg by a tear gas stun grenade. The open wound was streaming with blood. It took the ambulance hours to arrive; Lazare felt totally overwhelmed.

Andreas Malm was in the crowd that day too—watching a real-world exploration of the limits of violence cited in his book as demonstrators clashed with police. “I think this was the right thing to do,” he says of the activists’ decision to try to push through police lines. “It would have been a surrender to the armed forces of the state to just say, ‘OK, you are protecting this piece of property with overwhelming military force, so we’re just giving up and going home.’”

The day became known as the Battle of Sainte-Soline. Media coverage brought Les Soulèvements de la Terre a new level of notoriety. And surveys showed that the public blamed both the protesters and the police for the violence. (Lazare says a small minority of protesters threw Molotov cocktails.)

Then, in June 2023, the French government used the violent event as justification to ban Les Soulèvements de la Terre. Two months later, a court intervened, giving the group permission to continue operating until its case could be properly reviewed.

Above: Activists protest the government’s decision to dissolve Les Soulèvements de la Terre. Right: Protesters face anti-riot police officers in December 2023.



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IN AUGUST 2023, exactly one week after the court intervention, I cycle for two hours through the sweltering countryside of western France to meet Lazare. Activists are gathering in the village of Lezay, a few miles from Sainte-Soline, for a 10-day bicycle convoy to Paris, partly to protest the mega-basins and partly to express their support for Les Soulèvements de la Terre after its brief ban. This corner of rural France is bracing for a new heat wave; the geological research office is warning of another summer of record-breaking drought. Villagers stare as I pass, perhaps assuming I’m one of the people the government calls ecoterrorists.

By the time I arrive in Lezay my clothes are damp with sweat, my head foggy. I find hundreds of Les Soulèvements de la Terre’s supporters in a field on the outskirts of town in a victorious, yet cautious, mood. People carry flags that read: “We are all Les Soulèvements de la Terre.” The police are there but keeping their distance. A helicopter circles above.

Lazare emerges from the crowd, clutching a half-eaten sandwich and wearing bright silver shoes. When we finally find a patch of field that is not carpeted in sheep droppings, she kneels in the grass and in her soft, methodical way explains why it’s time for the climate movement to take more radical action.

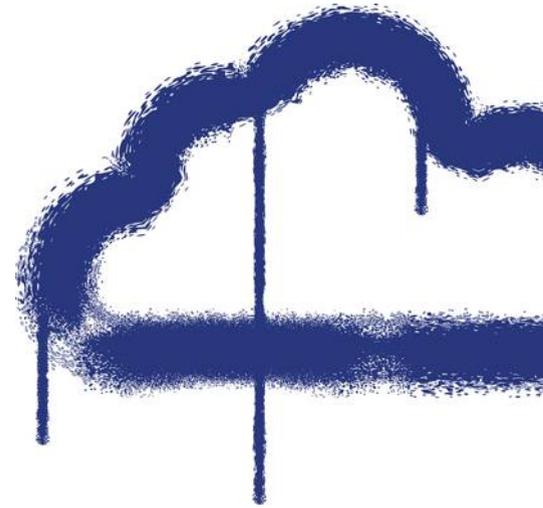
Part of Lazare’s job is to soften Les Soulèvements de la Terre’s image. For years she appeared in French magazines as the new face of radical eco-activism, but she became Les Soulèvements de la Terre’s official spokesperson only when the group faced the prospect of being shut down. Now Lazare is among a small band of people who deliver



speeches at protests or explain their motives to the press. “The government tries to say Les Soulèvements de la Terre is one of these dangerous ultraleft groups,” she says, twisting blades of grass between her fingers as she talks. They want the public to picture violent men, she explains. Lazare knows she does not conform to that image. And neither do her supporters, lying in the grass with their bikes, behind us. There are children, gray-haired hippies, a contingent of tractors, dogs, and even a donkey. A big white horse pulls a cart in circles, a speaker inside vibrating with music.

Later that day, I join around 700 Les Soulèvements de la Terre supporters cycling along quiet country roads, weaving our way past sunflower fields, wind turbines, and rivers that have run dry. Each time we reach a small town, the streets are lined with people, sometimes hundreds, clapping and cheering as we pass. Owners of small farms open their gates, welcoming us in to refill our water bottles and use the facilities. There is a DJ on wheels who blasts The Prodigy as we roll toward the next town. Three months later, in November 2023, that same top court in France overturns the government’s decision to ban the group, ruling it disproportionate.

That is a brief respite in the legal onslaught facing the movement, as European authorities formulate their response to the wave of sabotage sweeping the continent. In November, Lazare and a fellow Les Soulèvements de la Terre spokesper-



son are due in court for refusing to attend a parliamentary inquiry into the 2023 protests, including the Battle of Saint-Soline. They face two years in jail. The same month, Patrick Hart comes before a tribunal to decide whether he should lose his medical license as a result of his activism. Last year in Germany, Letzte Generation’s members were subjected to police raids, and in May 2024, the public prosecutor’s office in the German town of Neuruppin charged five of the group’s members with forming a criminal organization, citing in part the 2022 pipeline protests. Werner hasn’t been charged, surprisingly, but he hopes a public trial of his fellow activists will spark a countrywide reckoning over Germany’s use of fossil fuels and finally give his sabotage of pipelines the impact he wanted all along.

As their members are dragged through the courts, it seems more important than ever for these groups to have public support. That’s why the people lining the small country roads are so important to Lazare. She needs their blessing. “Radicalism must always be supported by a mass of people to be victorious,” she tells me. Sabotage needs to inspire copycats, which means it needs to shake off its reputation as a sinister, criminal act.

After the first long day of cycling, we pull into a field. Activists have set up a campsite with a bar, a pay-what-you-can canteen, a stage for climate lectures, and live music. There is the accordion again, that festival atmosphere. “I think it’s important for activists to go sometimes by night, masked, and commit sabotage,” says Lazare. “But in Les Soulèvements de la Terre, we want to do this in the middle of the day, not anonymously, but collectively, with joy and music.” Joyfulness, she says, is key to the whole idea. ■■

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Photographs by
Tony Luong

Illustrations by
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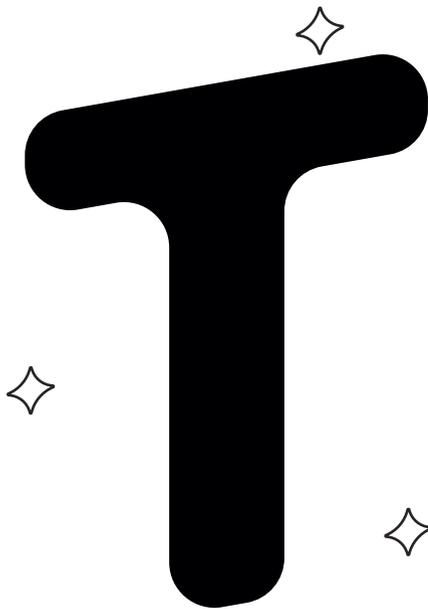
RIDESHARE

MAFIA

She came to the US with
a dream. Using platforms
like Uber, Instacart,
and DoorDash, she built
a business empire up
from nothing.

There was just one problem ...

by Lauren Smiley



TO UNDERSTAND Priscila Barbosa—the pluck, the ambition, the sheer balls—we should start at the airport. We should start at the precise moment on April 24, 2018, when she concluded, *I'm fucked*.

Barbosa was just outside customs at New York's JFK International Airport, 5-foot-1, archetypally pretty even without her favorite Instagram filter. She was flanked by two rolling suitcases stuffed with clothes and Brazilian bikinis and not much else. The acquaintance who had invited her to come from Brazil on a tourist visa, who was going to drive her to Boston? The one who promised to help her get settled, saying that she could make good money like he did, driving for Uber and Lyft?

He's not answering her texts.

Barbosa was stranded. She cried. She took stock of her belongings: the suitcases, her iPhone, 117 bucks not just in her wallet, but total. She called her mom back in Brazil, but she already knew that her family couldn't pay for a ticket home. No way was she asking her friends, who had doubted this plan all along; one said she was too old to start

over in a new country and, with a whiff of class judgment, insinuated that immigrating was not something their social circle really *did*.

What now?

Well, Barbosa has a phoenix tattooed on her back. She radiates a game sense of *What can I say yes to today?* The type of person who, when she and a pal don't want to splurge on a fancy hotel during a girls trip, swipes right on every guy on Tinder until one joins their bar-crawl and invites them to sleep on his boat. (Says a friend: "Priscila is craaaazy.") The US government would one day put it more grandly, speaking of Barbosa's "unique social talents," calling her "hard-working," "productive," and "very organized."

She knew there was no going back to Brazil but also, deep down, that she didn't want to, that opportunity was *here*. "I loved this place"—the US—from nearly the moment she stepped off the plane, she declares. She was 32 years old, college educated, and spoke decent English. She had no choice but to work her way out of this mess.

Barbosa couldn't have predicted where her striving would end: that she'd become the heavy in a web of fraud. That she'd expose the gig economy's embarrassing blind spot. That, one day, multi-billion-dollar companies like Uber and DoorDash would cry victim. *Her* victim. Or that she'd fall so far, or that her relationship with Uncle Sam would grow so deeply twisted and codependent.

She did know, that day at JFK Airport, that her doubters back in Brazil would only see one plotline on Instagram: Priscila's march to victory. Taking a \$10 Lyft to a bus station, eyes still puffy from her airport cry, Barbosa aimed her iPhone at the traffic speeding across the Throgs Neck Bridge on a clear spring day. She labeled the video "New York, New York," and uploaded it onto her Story, ripe with the promise that she was heading somewhere big.

schools, and digitized records at the city health department. She also became a gym rat (“I’ve had to fight for the perfect body my whole life”) and started cooking healthy recipes. In 2013, she spun this hobby into a part-time hustle, a delivery service for her ready-made meals. When orders exploded, Barbosa ramped up to full-time in 2015, calling her business Fit Express. She hired nine employees and was featured in the local press. She was making enough to travel to Walt Disney World, party at music festivals, and buy and trade bitcoin. She happily imagined opening franchises and gaining a solid footing in the upper-middle class.

But Brazil was in the middle of a recession, and after a few years, her customers started disappearing. Trying to stay afloat, Barbosa cashed out her bitcoin and, when that wasn’t enough, took out high-interest loans (“What a stupid idea, by the way”). She closed Fit Express. Her younger sister had just graduated from college, and her parents had lost their bakery, their retirement gig. Barbosa felt it was up to her to pull everyone out.

She texted that Boston-area acquaintance about her desperation, and he answered: *Why didn’t she move to the US and drive for Uber and Lyft?* He sent her screenshots of what he was making—\$250 a day, better than attorney-level money in Brazil. He said undocumented people could live like normal citizens. She already had a tourist visa. With her family broke and her job search going nowhere, “I couldn’t see any other option,” she says.

A one-way ticket to JFK cost nearly \$900. She sold a ring from her grandpa for \$1,000. At the airport, her father tried to cut through the family’s gloom, saying, “Rock out, and get a Mustang for Dad!”

A flight across the equator later, and the momentary meltdown at JFK shaken off, Barbosa hurtled north from New York City to Boston on a Peter Pan bus, fervidly scrolling through Facebook groups dedicated to Massachusetts’ large Brazilian community, tapping out DMs and dialing numbers. A Brazilian pizzeria owner told her to come in for a try-out the next day. A Brazilian landlord, who had a tiny room in a flophouse in the western burb of Framingham, said he would take the \$400 rent once Barbosa got paid. A shot-in-the-dark call: a

Brazilian guy from Boston whom she’d met years before on vacation in Miami. Miraculously, he not only answered but met her at South Station, let her stay the night, and ferried her the next morning to the pizzeria, where she aced the cooking test.

The first night at the flophouse, Barbosa slept on the floor. The second, a Walmart air mattress. She shoved magazines below the door to keep out the rats (“Disgusting!”). Without a car, she walked an hour to the pizza joint, past strip malls and Brazilian bakeries. On the way, she’d stop at Planet Fitness to lift weights and use the shower. (She welcomed the side effect of all the survival schlepping: “The most skinny I ever got!”)

Barbosa was earning about \$800 in cash a week at the pizzeria. Aiming to pay down her debts and build her new life quickly, she looked for a second part-time job. One restaurant manager said he needed her to have a Social Security number, and handed her the number of a guy who could make her fake work documents, but Barbosa didn’t dare call. “When you first get here,” she explains, “you think ICE is going to be waiting for you on every single corner.” She tried cleaning houses but lasted exactly two days, loathing every second. Then the pizzeria got slow for the summer and laid her off. Scrolling Facebook in bed one morning, she saw a post in a Brazilian group asking: *Do you want to work for Uber/Lyft and be your own boss?*

Barbosa quite enjoyed being her own boss. Working for other people since arriving in the States had felt like a necessary but major downgrade. She also finally had a car, having financed a used Jeep Liberty after a couple months of work. When she called the listed number in the ad, the guy who answered told her that, for \$250 a week, she could rent an Uber driver account. It would have Barbosa’s photo, her car, and her bank account, but would use another name. Barbosa didn’t ask any questions. She says she didn’t know exactly how she was skipping right over the app’s onboarding requirements: a US driver’s license, a year of driving experience in the US, a Social Security number, and a background check. She did know that she cleared \$2,000 in her first week, enough to stop worrying about another job.

IN REAL LIFE, Barbosa is candid (“I’m a bad liar”). She drops self-deprecating jokes and lets loose big, jagged laughs that sound like a car trying to start. She grew up in Sorocaba, an industrial city of 723,000 people about two hours west of São Paulo. Her dad was an electrician, mom a postal worker. They set their eldest daughter on a path “to be a very educated and polite person”—English lessons and ballet classes. Barbosa loved to mess around on computers. As a teen, she kitted out her home PC with a terabyte of memory and an Nvidia processor so she could play *Counter-Strike* and *World of Warcraft*. She also hung out at a local cyber café, where she and a few other gamers formed a tournament team called the BR Girls (“BR” for Brazil). Offscreen, high school was miserable. She was bullied for being a teacher’s pet, for being “chunky,” for being terrible at sports. When a few boys showed romantic interest in her, she turned them down for fear it was a prank.

Barbosa studied IT at a local college, taught computer skills at elementary



brag on Instagram to mark six months in the US: “Thankful every day that I had such courage and audacity.” She had reasons to be proud: From being stranded with \$117 at JFK, she’d moved into a better apartment and had already sent enough money back to Brazil to pay her parents’ bills and nearly clear her own debts. She was buying clothes at TJ Maxx, perfume at Macy’s, restarting her regimen of technicolor manicures and wrinkle-busting Botox (“a priority”). In another Instagram photo, she was holding her cocktail aloft and dancing with a giant furry bear at a club, kissing toward the camera. The post quoted the iconic Apple ad: “Here’s to the crazy ones, the misfits, the rebels ...”

The six-month anniversary also meant Barbosa was officially overstaying her tourist visa. The grind continued. She was clocking 14-hour days on Uber. She was also still paying a middleman just to use an account. Then, that fall, Barbosa stumbled on a way out.

One of her customers left their wallet in her car. She followed the woman’s convoluted instructions to return it, driving to two far-flung locations over two hours. Miffed, at one point Barbosa opened the wallet. She looked at the woman’s license, blonde with blue eyes. Barbosa snapped a picture. She thought the woman might tip her or at least say “thank you” for having wasted two hours, unpaid, to do her a favor. Instead, the woman was rude and short, giving Barbosa the push she’d been looking for. “I said, yeah, now I’m going to use this.”

Over the next few weeks, she would click through the driver onboarding process on both Uber and Lyft, reading over the steps to create her own account, mulling the risk. Finally, lying in bed on Christmas night, the first one she’d spent without her family, it was time: She opened her phone and scrolled to the blonde woman’s license. Barbosa uploaded the license to the Uber app. She used the woman’s name but her own insurance and registration. She entered her own iCloud email and phone number and set her own picture—brown hair, brown eyes—on the driver profile. She made up a Social Security number, submitted the application, and went to sleep.

The next day, Uber approved the account. Like that, Barbosa was in business for herself.

NOT LONG AFTER she started, Uber deactivated Barbosa’s account out of the blue. So she switched to renting one on Lyft from the same guy. Now she drove as “Shakira.” When the Lyft app prompted Barbosa to confirm her identity by scanning her license, she texted the guy she was renting from: *What now?* He sent back a photo of Shakira’s ID. *Oh. She was real.* He paid Shakira a fee each week.

Driving without a license, under the table on a tourist visa, loaded Barbosa with stress. One night, Barbosa picked up a passenger at 2 am and he tried to kiss her. She had to fight him off and left him one star on the app; she didn’t want to risk calling the cops. Another time, she was pulled over for having her lights off. Barbosa froze as the officer strode up to her window, worried she might get her car towed and end up in jail, or even—who knows?—deported. She showed the cop her Brazilian driver’s license, and said she’d left her American one at home. He let her go.

In WhatsApp groups, and while waiting for riders at Logan Airport, Barbosa chatted up other Brazilian drivers also renting accounts. They traded tips about driving without papers, the nuances of the fuzzy don’t-ask-don’t-tell status quo in a country that hasn’t passed comprehensive immigration reforms in more than three decades. Far from an ICE officer on every corner, she heard, if you kept your head down, didn’t drink and drive or pick fights, you could manage.

In October, Barbosa posted a humble-

“LOOOVE TO PARTY,” Barbosa once wrote me during the year and a half that we talked and emailed. For her, going out is less a dalliance than a birthright, Barbosa’s wildly extroverted brand of self-care. “I’m a human being, too,” she says, “I deserve to have fun.”

On Fridays, as other drivers shared their earnings in the WhatsApp group, she’d post a pic of her fresh pineapple vodka cocktail and invite them to join her at happy hour. Barbosa headed to bars and clubs several nights a week—the Grand, Scorpion Bar, the Harp, Ned Devine’s, Royale—and threw parties at her apartment. She thrived on meeting other Brazilians (“I hate to be alone”), plugging their numbers into her phone, asking what they did for work.

A few incident-free weeks after Barbosa started driving with the Uber account she’d made, a new business opportunity arose. An acquaintance asked Barbosa to find a renter for his Uber and Lyft accounts, which he wasn’t using. (Some undocumented drivers traveled to states like Maryland and California, which would issue licenses to residents regardless of immigration status. Barbosa would soon get her own license, using a friend’s address in California.) She scouted a candidate, and the acquaintance gave her a cut of the rent, \$50 a week. She soon did the same for a few other people she knew who also wanted to rent out their accounts—a popular side hustle among expats, she quickly realized. Voilà, \$300 in passive income a week.

One day, while chatting over barbeque and Mike’s Hard Lemonade at one of her house parties, a friend mentioned that for whatever reason, the onboarding process for ride-sharing accounts seemingly couldn’t verify Social Security

numbers issued after June 2011, when the Social Security Administration changed the way it assigned the numbers.

After the party, Barbosa couldn’t resist; she plugged a few random sequences into ssn-verify.com, a website that shows when a number was issued. She tried one that started 776-94. *Bingo*. Maybe assigned after 2011. She entered the combination while making a new driver account. When Checkr, a company that does background checks for Uber, emailed asking for her to verify the number, Barbosa says she simply plugged it in again. Then Checkr sent whatever information it gathered to Uber, and Uber approved the account. (A source close to Checkr insists that the company could, in fact, do background checks using numbers assigned after 2011, and Social Security numbers are just one data point they use to find information. All Barbosa knows is, in that era, her trick worked.)

Barbosa also met people with pictures of real licenses to sell, and she spotted another opportunity: By buying a license and adding in her simple Social Security trick, Barbosa could create new driver accounts on Uber and Lyft en masse. She set rent at the price she’d previously paid, \$250 a week. Business took off. Word got around; more people pinged her WhatsApp, wanting their own profiles. By late summer, with some eight renters bringing her \$2,000 a week, Barbosa stopped driving. Now she spent her days at her dining table on her laptop, concocting accounts.

Barbosa figured she had gotten lucky on her own slapdash Uber account that she’d hatched on Christmas. Now, when she found a client, she registered a burner phone number on TextNow and an encrypted email with Proton Mail. Uber seemed to have gotten more discerning, so if her customer looked nothing like the person on the driver’s license, she photoshopped the customer’s face in place of the original. That way, when the app prompted them to take a selfie as a security spot check, they would pass. She also photoshopped the name from the license onto the customer’s insurance documents. Ever organized, Barbosa kept an Excel spreadsheet with each account’s details. In her Apple Notes, she checked off cli-

ents once they Venmoed or Zelled her the weekly rent.

“It never, never crossed my mind that I was, like, being a criminal,” Barbosa says. Sure, she would learn that her suppliers were getting the driver’s license photos on the dodgy down-low. One guy was sneaking pictures of customer’s IDs from his job at a car dealership. Other pictures were bought off the dark web. Some people in the underground driver’s license economy in Maryland or California would snap a photo of the licenses before mailing them to their out-of-state immigrant clients, and then rent or sell those photos to people like Barbosa. Somehow (“my naive concept,” she says), uploading doctored documents onto an online platform seemed a lesser transgression than buying fake work documents IRL.

Barbosa rationalized that she wasn’t stealing money, and she had certain standards. She didn’t buy licenses off a guy who reportedly dinged his car into people’s bumpers and photographed the victim’s ID in the post-crash exchange. To Barbosa, that seemed truly beyond the pale.

Mostly, she felt like an entrepreneur, supplying the demand. Undocumented immigrants wanted to drive in the gig economy, and with the system that existed, they legally could not. People like Barbosa—with no family in the States to sponsor them for green cards and their undocumented status precluding them from applying for many other types of visas—were short on options. “If the US gave more opportunities for immigrants to be able to work legally and honestly here,” she says, “nobody would look for something like this.”

It wasn’t just about business, though. Barbosa readily admits she enjoyed not just the challenge but the ego boost of beating powerful Silicon Valley companies on their own platforms. “I feel pride in breaking their stupid systems,” she wrote me. “These companies are all about money. They don’t care for the drivers (we are just numbers for them).” So she held open yawning security loopholes and waved undocumented drivers in. “I never had evil intentions,” she explains. “I always thought I was helping my people.”

Of course, Barbosa was poking the rideshare industry’s weak spot: The

companies sometimes had no idea who was driving. Uber and Lyft, vying for supremacy and scale, competed to add drivers as fast as possible. Onboarding was optimized for ease and speed, done remotely, via the app. Both companies outsourced criminal background checks, but they didn't catch everything. (That led to a torrent of lawsuits, regulator spats, and bad press about Uber- and Lyft-approved drivers who'd committed robbery, sex offenses, and assault.) A year before Barbosa arrived in Massachusetts, the state had tried to wrangle the chaos with its own background check for drivers, the toughest oversight in the country at the time. An audit later found that program severely lacking, too.

Background checks, of course, are useless if the person being vetted is not actually the driver. As Barbosa was finding, in that era, *verifying* the driver's identity was a Swiss cheese of flaws to exploit. In 2019, London regulators reported 43 unauthorized drivers who had simply uploaded their photo to another Uber worker's account to give some 14,000 rides. Officers at San Francisco International Airport were ticketing Lyft and Uber drivers after discovering people who didn't match their app profiles. Industry observers called the issue of drivers sharing or renting accounts an open secret. (The companies claim to have ramped up security since, but the American Immigration Council says that, in its analysis of 2022 census data, undocumented workers are very much still a part of this sector.)

BARBOSA WENT INTO OVERDRIVE, CHURNING OUT ACCOUNTS "AS FAST AS I COULD."

Barbosa tried to do her own vetting of drivers, for safety and business. She texted the potential customers: *Did they have a driver's license in Brazil? Did they have a car? How often do they plan to work?* Dilettantes, she learned, tended to stop paying rent, wasting an account.

She started to become well known in Boston's Brazilian community ("famous," she calls it) as, paradoxically, an honest broker. All over social media were warnings about scammers preying on undocumented drivers, taking advantage of the fact they wouldn't go to police or the courts. Some vendors charged exorbitant rent or would take money upfront and never give someone an account. Others siphoned the drivers' earnings to their own wallets.

The good faith Barbosa showed to her customers paid off. Soon she was raking in about \$10,000 a month and was pairing up with business partners to help make and manage some accounts. In the summer of 2019, she bought a used black Mustang. (She posted on Instagram, "Dad, this is for you.") She shared her #route66roadtrip, the Grand Canyon, a crowded Vegas pool party. From Epcot, she and a friend posted cocktail toasts from a whirlwind of Disneyfied countries. She posed in front of a Beverly Hills sign and on Rodeo Drive. Her followers were paying attention. On a picture of Barbosa wearing a faux fur coat in New York City, one person commented, "She's Hollywood now!" In phone calls, her mom asked, "What do you do for work, Priscila?" She answered vaguely, "Making accounts."

Then, the fall brought a nearly existential blow: Uber asked drivers on profiles with fake Social Security numbers—about 35 of Barbosa's clients at that point, she estimates—to present their documents in person. ("We're committed to constantly improving our detection capabilities to protect against fraudsters' ever-evolving schemes," said Heather Childs, chief trust and security officer at Uber.) Barbosa and her drivers had no choice but to walk away: a loss, she says, of around \$30,000 a month in rent. Until this point, she recalls, account deactivation had been rare.

Now Barbosa knew that if she wanted to keep making lucrative Uber accounts, she'd need real Social Security num-

bers. She searched the dark web for the numbers belonging to the people on the licenses she bought, but struck out. So Barbosa started purchasing stolen numbers from a contact, \$100 a pop. She nervously created a few new accounts with the real numbers, but didn't feel comfortable repeating that at scale; it felt, she says, like she'd "crossed the line."

Barbosa was wondering whether she'd need to leave her Uber business altogether, when one of her customers gave her an idea. Alessandro Da Fonseca was an amiable guy in his twenties who'd recently emigrated from a shantytown district of Rio de Janeiro. He rented one of Barbosa's cars for a pizza delivery job and a Lyft gig, where he could get along with just a few words of English and an animated "Yeah!" as customers chatted him up. He'd also started driving for DoorDash. ("I prefer food, because food doesn't talk," he told me.) DoorDash incentivized drivers to invite new workers to the app by dangling a referral bonus, which would be paid out after the first-time driver made a set number of deliveries. The setup was ripe for exploitation.

At the time, DoorDash required a driver's license number but no picture of the actual card. Barbosa tried making an account, reusing a number from a license she had on hand. Success. Fonseca started driving—as her "new" referral—on this account. She offered him a 50-50 split of the bonus. Barbosa and Fonseca got into a routine: She created new accounts to refer, and he typically cleared enough deliveries to earn the bonus on two accounts he worked under simultaneously (also against the rules) every two weeks.

While waiting for orders at McDonalds, Chipotle, or Burger King, Fonseca would chat up other Brazilian delivery workers. Some were getting kicked only 20 percent of the referral bonus from their account maker. Fonseca pitched his contact and her 50-50 split.

Thanks to her previous business, Barbosa was sitting on a stack of IDs, and her old Uber customers who'd lost their accounts now wanted in. She could push out a DoorDash account in five minutes. Pretty soon, she says, she had 10 customers. Fonseca found Barbosa to be a showboat on Instagram, sure, but also unflinchingly polite and generous. She

invited him to her house parties and dispensed recommendations on anything from a good car dealer to a Japanese restaurant. In business, she was demanding, prodding him when his referrals were dallying in reaching the bonus. Sometimes she'd give Fonseca a laggard's login, and he would ask the driver whether he could finish the jobs himself. (A spokesperson for DoorDash said, "We've made huge strides on tackling fraud, and the fact is, what we did five years ago is not what we do today.")

Barbosa started making Instacart accounts, too, and soon she was again minting money, to the tune of some \$12,000 a month. The week before Christmas 2019, Barbosa posted on Instagram a picture of her in New York City, grabbing the charging Wall Street bull by its enormous bronze balls.

Barbosa went into overdrive, churning out accounts "as fast as I could." For friends, or people whose situations sounded especially grim, she'd sometimes make them for free.

On Instacart, she'd scan the front of her own California license, so she could then take a selfie to pass the platform's face-recognition test. She says she did this on hundreds of accounts. For the license's backside, she photoshopped on a barcode that she generated with software, using the identity information from her existing stockpile of drivers' IDs. When she needed more licenses, she bought fresh ones off Instacart workers who were using a new harvesting technique: While scanning the back of a customer's ID into the app during alcohol deliveries, the worker would sneak a photo of the front.

On DoorDash, a few zealous drivers were nabbing the referral bonus in a single day and coming back the next day for another account. Sometimes, Barbosa had up to 20 new accounts on various platforms going through background checks; at her Covid apex, she says, she raked in about \$15,000 in one week.

Barbosa—always a "materialist," she concedes—catapulted to a new realm of buying power. She flaunted her acquisitions on Instagram: a Sea-Doo (\$7,000, used), Louboutin heels, Gucci sunglasses, a Louis Vuitton purse. She upgraded her cross necklace to a 24k gold one with 18 inset diamonds (not religious, just superstitious), and her bed to a California king. With most clubs shuttered, Barbosa outfitted her latest rental upgrade, a three-story townhome in Saugus, with a karaoke machine and a keg tap, plus a hot tub and a firepit in the backyard. She adopted a Yorkie named Bailey, for whom she bought so many toys that house visitors asked whether she had kids (no, and no thanks). She posted an Instagram Story that someone had filmed of her standing out of the sunroof of her gleaming white Porsche Macan, hair whipping. (For extra money, she rented out the Porsche and her Mus-

DISTRACTED BY HER burgeoning delivery app business, Barbosa mostly stopped thinking about Uber and Social Security numbers. Then Covid struck and cratered ride-sharing overnight.

A mother lode of food delivery surged in its place. DoorDash and Instacart cranked up their referral bonuses to lure more drivers to the road. At one point, she recalls, it was \$2,000 on DoorDash, \$2,500 on Instacart. Immigrants ineligible for unemployment or Covid relief texted Barbosa with a new level of desperation. They needed to make rent, to feed their kids. Now she was hearing from Brazilians all over the United States. Spanish-speaking immigrants too. Even some US citizens who couldn't drive because of DUIs or reckless driving tickets.



tang on Turo.) She dropped \$13,000 to rent an event hall in the Boston burbs for her 35th birthday bash, with a band and 50 guests. The next day, she was awed but not stressed by an additional \$12,000 charge on her credit card for the open bar. She bought a plot of land outside of Fort Myers, Florida, that she saw advertised on Facebook for \$5,000. (“I’m like, that’s so cheap!”) She planned to someday build a house there and move in with her boyfriend, a Brazilian house painter whom she hoped to marry.

Barbosa also had enough money to solve what she thought was her biggest problem: She couldn’t go home to see her family, because she needed a green card to leave and reenter the US. So a couple of months into Covid, she flew to LA and flipped through a binder full of pictures of potential husbands in an office on Wilshire Boulevard. A sham marriage would cost some \$28,000—\$18,000 to the agency and \$10,000 to the husband, paid out in \$350 monthly chunks to keep him cooperative throughout the process. She felt zero guilt: At least she wasn’t feigning romance with a citizen. Cleaner for it to be a business transaction.

Barbosa bought a white sundress at a boutique and a crown of white flowers and drove to a park, where a Covid-masked officiant married her and a man named Mario by a flowering jacaranda tree. An agency staffer snapped pics for evidence, and Mario’s real girlfriend looked on. Barbosa’s family, who knew the drill, FaceTimed in on her phone. Her Instagram post from the day doesn’t mention what was really happening; it shows her alone in her sundress on the beach. Caption: “The sky is the limit!”

Throughout the pandemic, Barbosa was a digital nomad tending her accounts mill. From a water park, she’d call DoorDash customer service to clear up a flubbed delivery from one of her workers who didn’t speak English. Poolside in Vegas, she’d log in to a client’s Instacart to snap a selfie for a face recognition spot-check. (Some customers kept a printout of Barbosa’s photo on hand for the checks. Instacart says those tricks would not work today.) When Instacart deactivated some 85 percent of her accounts—a particularly dire crisis—she ignored her boyfriend’s protests and hunkered down in a Florida hotel room for days to remake each one.

Over time, Barbosa invited a small group of compatriots in the business into a WhatsApp group that she cheekily named Mafia. (An unfortunate choice, in hindsight: “I should have put ‘People From Church.’”) The Mafia shared tips and problems and agreed on account prices, with plenty of banter to enliven the drudgery of the digital assembly line.

By the fall of 2020, drivers were asking for Uber Eats accounts. If Barbosa wanted their business, she would again have to face the Social Security number dilemma. She mulled it over. It had been months since she’d queasily made her first accounts using the real numbers, which she’d bought off a contact. Nothing bad had happened. She’d since found the right dark-web site to purchase them directly. Why ease off now? “I was already so involved in this,” she wrote me.

So Barbosa decided to wade back into the Uber biz. She bought a batch of Social Security numbers off the dark web with bitcoin.

By then, Uber seemed to be wising up. Accounts would be deactivated after a week, a month at most. Then Barbosa would noodle a workaround, and the cat-and-mouse game would continue. But in late 2020, after a wallop of new deactivations, the Mafia seemed to finally hit a wall. For days, then weeks, they tried to figure out a new method that would get an account approved. No luck. Barbosa recalls someone texting, chagrined, “The Titanic is sinking.”

Then, one Mafia member mentioned that Uber kept metadata on the accounts. Barbosa noticed that all of her axed accounts had, in fact, been created on her phone—*iPhone de Priscila Barbosa*. What if she made her computer look like a different device each time? She restarted her laptop, accessed the web through a VPN, changed her computer’s address, and set up a virtual machine, inside which she accessed another VPN. She opened a web browser to create an Uber account with a real Social Security number bought from the dark web. It worked. Barbosa delivered a few orders herself. The account held.

She texted the Mafia, “Guys, this is working.”

They exploded in texts of relief and joy: “If Priscila can’t figure it out, no one can!” Barbosa felt a pride she had only

known back in Brazil when her meal business was booming. She felt smart, and needed: She’d kept scores of immigrants working during the pandemic; she’d helped get people food as a deadly virus menaced. If she blurred the details, she could feel good about all of it.

The glow was short-lived. As the year wound down, a vague rumor hit one of her WhatsApp groups: Police might be investigating the fake accounts biz. Already uneasy about buying Social Security numbers, Barbosa says she didn’t want to be caught flat-footed if the rumor turned out to be true. She hustled around her apartment, grabbing Instacart, DoorDash, and Grubhub bags, logo stickers, and app-issued debit cards. Outside, she placed several phones under her Porsche’s wheels and drove over them. She threw all the evidence into garbage bags and, that night, chucked them into several dumpsters in various parking lots.

She’d long taken comfort that WhatsApp and Proton Mail, the email service she’d used for the apps, were encrypted. She used an alias, Carol, on her work phone so clients couldn’t easily snitch on her. Now the physical evidence was gone too. (“Sweet illusion,” she wrote me.) For a couple of weeks after the purge, Barbosa forced herself to stop making accounts.

She spent New Year’s in Miami Beach, where she posted a photo of herself wearing Gucci sunglasses and holding a frozen mai tai the size of her head. She shared the pic with the Mafia.

Someone quipped back, “Find me, FBI.”

AS 2020 TURNED to 2021 and Barbosa continued making accounts, a low hum of dread invaded her idle moments. She started to ponder an exit.

She confided to a Mafia pal that she was scared of losing everything. News in February didn't help: A 30-year-old Brazilian named Douglas Goncalves had been arrested for working under a stolen identity on Instacart. It was the first time Barbosa had heard of criminal consequences for a fake profile, and she recognized the suspect's name: Goncalves, she says, had texted her a couple of weeks earlier about getting an account. His long-winded answers to her usual vetting questions annoyed her, and she ghosted him, she recalls. But the texts might still be sitting on his phone.

Fonseca, Barbosa's DoorDash partner, also started to worry. Too many people were hawking accounts, licenses, and Social Security numbers in his WhatsApp groups. "Everybody knew this bomb would explode someday," he said. "People are stupid and don't take care."

Barbosa thought about going legit, getting back into the food business, opening a Brazilian steakhouse. She figured startup costs at about \$50,000; she had that amount many times over. She googled around to see what kind of permits she'd need.

Still, her frauds kept compounding. Uber was now rejecting the doctored ID photos; she bought a printer to create physical fake licenses. She had more than 50 customer accounts active on various platforms, and new people kept texting her, often with a woeful tale. To calm her fraying nerves, she told herself that with so many people in the accounts trade, some doing more audacious things than she was, why would *she* get in trouble? One Mafia member, she says, was running a team that spoofed DoorDash deliveries for food that, in reality, was never picked up or delivered.

"I had so many chances to stop, but I didn't," she wrote me. "It looked like an addiction you know."

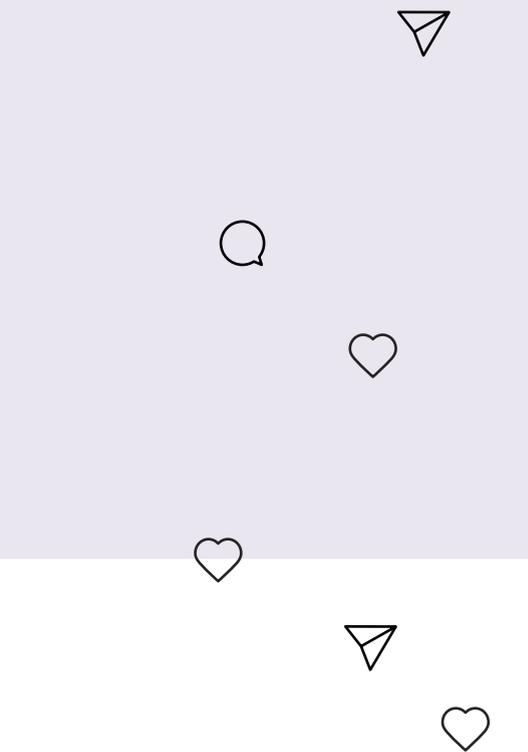
In April 2021, while Barbosa was cooking dinner, a text pinged her phone. Her green card had been approved. Barbosa screamed; she called her parents in tears. Then she threw together a party for the next night to celebrate. When Fonseca arrived, he squeezed through the loud, packed house and grabbed some Brazilian barbecue. Outside on the back porch, he found Barbosa, in cut-off shorts and a halter top, swigging overflowing champagne from the bottle.

If you ask Barbosa when she was happiest, she'll say it was that moment: "Everything was perfect." She had a green card. She had the house and the (real) boyfriend and the Porsche that she wanted. She booked a round-trip ticket—first class—to visit her family in Brazil for two weeks in late May. She bought Versace sneakers, because why not. She was going to open her steakhouse, marry her boyfriend, and, down the line, move into the house she'd build in Florida. Just three years after landing at JFK, she had risen to the top of a shadow Silicon Valley gig economy. She'd hacked her way to the American Dream.

On May 6, 2021, a new Instagram Story. Among the vacation bacchanalia and designer haul videos, this one stood out. Barbosa filmed ahead, over handlebars as she pedaled a bike through her sunny townhouse complex. No humblebrag, or even brag-brag. Carefree.

The next morning, she woke up at dawn to her Yorkie barking. A banging on the front door. A booming voice, ordering her to come downstairs.

Find me, FBI. They did.





Barbosa still holds on to some of the clothes she wore in prison, as well as the items she crocheted while serving her sentence.

LATER THAT DAY, crying in the back seat of an unmarked car en route to a Rhode Island prison, Barbosa recalls an FBI agent trying to calm her down. He complimented her apartment, which she admits, even given the circumstances, pleased her just a little.

As it turns out, in late 2019, right about the time Barbosa was grabbing the Wall Street bull by the balls, Uber did know something was off. The company detected a ring of people bypassing its background checks in Massachusetts and California, and tipped off the FBI in Boston. Investigators served a warrant to Apple; they wanted to see the iCloud account of a Brazilian guy named Wemerson Dutra Aguiar who, after getting hurt at his job in construction, started driving for apps and later dealing fake



identity theft, for making and renting fake accounts over the prior two-plus years.

Barbosa was accused of being a heavy in the case: The government said she pushed out some 2,000 accounts, using hundreds of driver's licenses, and profited more than \$780,000. Barbosa says about half of that was her actual take. The rest she either split with her business partners or sent along to the immigrants who didn't have their own bank accounts and used hers. (The government conceded in court filings that Barbosa did let other people use her bank account.)

For the next two weeks, Barbosa says, she sat alone in her jail cell for 23 hours a day—for a mandated Covid-era quarantine—suffering from panic attacks and spiraling self-loathing. “I was feeling that my life was over,” she wrote me. “I fucked up everything.” Her attorney mailed her a flash drive of the government's evidence: her bank statements, the contents of her iCloud account, her Excel spreadsheet, some Mafia WhatsApp chats. Barbosa cringed upon reading “Find me, FBI.” (“I bet the FBI agent's face, when they read that, they said hahaha, like, stupid woman!”)

While Barbosa was in jail, her sister traveled to Boston and packed four suitcases full of Versace and Louboutin shoes and LV purses, then took them back to Brazil. Barbosa had a contact transfer \$30,000 back to Brazil before it could be seized. (The feds did later grab approximately \$55,000 in bitcoin.) On a video call, her sister showed her stories in the Brazilian press. “My name was in everyone's mouth in my city,” she says. The former teacher's pet from Sorocaba who taught computers to kids, now an alleged felon with some Mafia texting group in the US. Her mom was devastated. For months and months, the legal process dragged on.

So, question: Did you think Priscila Barbosa, queen of accounts, was going to sit idle in jail? At the Gloria McDonald Women's Facility in Rhode Island, she morphed into Barbosa, Star Inmate. She cooked for more than 100 prisoners in the cafeteria and shared Brazilian recipes with fellow kitchen staff. That earned her \$3 a day. (“Ridiculous,” she says, but she enjoyed the work.) She joined inmates in planting an organic vege-

table garden in the yard. She aced law clerk and English composition classes. She picked up crochet, writing down pages of instructions that her sister had emailed: a headband, glittery unicorn slippers, a Christmas tree, stockings, and snowmen to deck out the unit for the holidays. She conquered a 2,000-piece puzzle of jellyfish and whales, then a 5,000-piece world map. She did daily squats and jumping jacks. She watched *Orange Is the New Black* and declared it somewhat accurate. She watched a TV commercial for WhatsApp's “private” texting and declared it a lie. When she entered a room, she says that some inmates, resentful, would snipe, “Here comes the princess.” Upon hearing about her crime, one woman called her “Brazilian Robin Hood.”

The name was snappy, but an awkward fit. Barbosa hadn't stolen money from the rich as much as identities from ordinary people. Now sitting in jail, she says, she finally thought about them. “This is going to sound awful,” she warns, but here goes: “I feel bad that I caused some emotional distress to people. But at the same time, I did it in peace, because I never took money from any of those people. It wasn't victimless, because I used people's identity. But nobody really got damaged.”

None of the three identity-theft victims who spoke to me—a Harvard professor and two tech workers—knew how or when their identity had been stolen. None had experienced financial harm. They felt unnerved because their information was exposed, but they were also curious about, and even showed a degree of empathy for, the thieves. One victim mused to me, “It's kind of a sad crime in a way, isn't it? Obviously, it's a crime and they shouldn't have done it, but sad that people have to do stuff like this to get by.”

In prison, the crime was regarded as rather pathetic. Alessandro Da Fonseca, Barbosa's DoorDash ally (arrested on the same day), was waiting out the legal process with many other defendants in a Rhode Island detention center, and found that more serious fraudsters were baffled. With all the personal information the ring had access to—enough to open bank accounts, credit cards—their only con was to ... create Uber profiles? Fonseca shrugged it off. “We are not criminals, with a criminal mind,” he told

accounts. Barbosa didn't know Aguiar, but a Mafia member had once asked her to email him a Connecticut driver's license template. She did. By February 2021, law enforcement had circled in on her, and served Apple a search warrant for her iCloud too. In early April, the FBI had tracked Barbosa's location via her T-Mobile cell number. Investigators staked out her apartment and watched her come and go.

All this time, Barbosa had worried that getting caught could mean the government would seize her money and property—to her, disaster enough. She was shocked that the FBI raided her house, “like arresting a murderer.” *All this for me?* Then she was locked in a prison cell and charged, along with 18 other Brazilian nationals, with conspiracy to commit wire fraud and aggravated

me in a jail call. “We just want to work.”

Uber disagreed. During the legal wranglings, the company accused the ring of stealing money and tallied its losses: some \$250,000 spent investigating the ring, around \$93,000 to onboard the fraudulent drivers, plus safety risks and damage to its reputation. Defense attorneys shot back that no one lost money at all: The jobs were done. The food was delivered. People got their rides. The gig companies, in fact, profited off the undocumented drivers, taking their typical hefty cut—money that, once the fraud was discovered, there was no evidence they’d refunded to customers.

In February 2022, Barbosa sat in her Rhode Island prison cell, reading two packets of papers: one agreement to plead guilty to felony identity theft and conspiracy to commit wire fraud, another to cooperate with the US government. She had already done the latter in two hours-long interviews, in hopes of a lighter recommended sentence. She signed both agreements with a star in the P of Priscila (a sort of watermark, she says, in case the government tried to use her signature elsewhere).

A year later, in June 2023, Barbosa walked into her sentencing inside the red-brick federal courthouse along Boston’s waterfront. It felt nice to be back in civilian clothes—a white flouncy blouse and black pants—but she was still afraid. The government was recommending three years for her, given her cooperation. Other defendants, whose alleged profits were lower, had been sentenced to that or more.

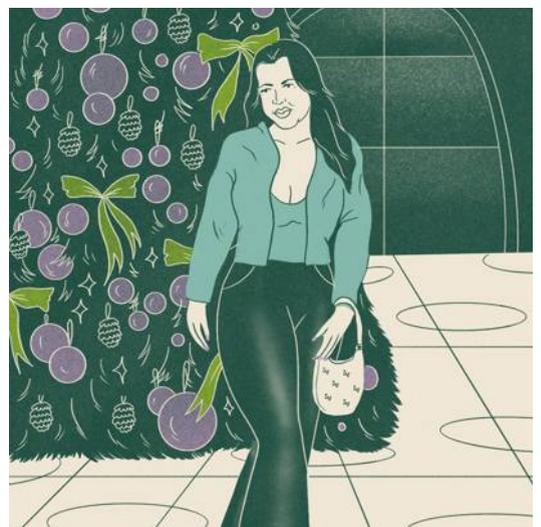
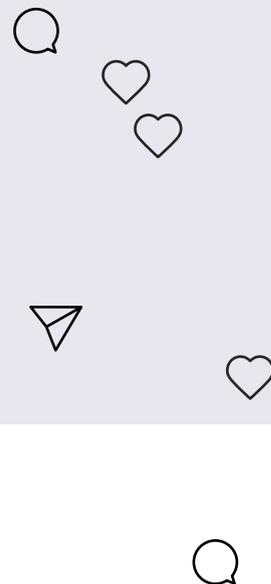
In court, assistant US attorney David Holcomb told the judge that Barbosa was the “most prolific creator” of the accounts, a “central figure” in the network, “highly effective” at this kind of fraud, with “unique social talents” bringing together ex-boyfriends, social contacts, and competitors. Barbosa’s attorney argued that her intentions were mostly good. “She is a very intelligent woman,” he said, who “put her intelligence to use in an extraordinary way,” helping immigrants work. (Barbosa enjoyed that part.) The judge wasn’t convinced. Her intelligence was all aimed at defrauding people, he said, and he had to set an example: “I hope those chat rooms are now filled with chats about ‘Did you hear about what

happened to Priscila Barbosa?’” Her use of technology—the dark web, bitcoin, Photoshop—constituted “sophisticated means,” a sentencing enhancement, he added.

When Barbosa spoke, she cried. She said she was ashamed. She apologized “from the bottom of my heart” to the people whose identities she used. Then the judge read out her sentence: three years, just what the assistant US attorney recommended. Barbosa exhaled. With the two years she’d already served in prison, and with time shaved off for good behavior, she’d be released within a few months. For that last stretch, she was shipped off to Aliceville federal prison in Alabama.

Then, late in the hot summer, she got a visit from federal immigration officers. After she finished her sentence, they told her, she’d be taken to deportation proceedings. (“It looks like this nightmare never ends,” she wrote me.) As the months ticked by, Barbosa’s hopes of being able to stay in the US had grown. Now, crestfallen, she slipped into depression. She also decided that she would not fight it. She’d pay for her own ticket to Brazil so she’d be free as soon as possible. With the weeks dwindling, she typed me a very un-Barbosa message:

“Too bad they got me too, it is what it is.”



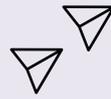
THAT, YOU MIGHT have guessed, was never how the story of Priscila Inc. was going to end.

Remember Barbosa's sham marriage in LA? The government found out about it too, while raiding her apartment. Along with her laptops and phones and driver's license printer, investigators took an album of wedding photos and a receipt for the \$28,000 "Package Plan." They asked her about it during those interviews while she was in jail.

In October, as Barbosa's deportation drew nearer, she heard from her attorney. Thanks in part to the intel from the apartment raid and her interviews, the government had busted the 11-person ring. Now she was being subpoenaed to testify at one person's trial.

Barbosa didn't want to take the stand, but given her cooperation agreement, she had little choice. So on November 15, 2023, the day before she had been scheduled to be taken into ICE custody, Barbosa was on a commercial plane, flying back to Boston with two US Marshals, hiding her handcuffs from other passengers inside her hoodie's kangaroo pocket. At the federal courthouse, she was (technically) rearrested, this time as a material witness. A magistrate judge released her with an ankle monitor to await the trial.

To understand Priscila Barbosa—the pluck, the sheer balls—consider that as



THIS TIME, SHE HAD MORE THAN \$117, AND HER FAMILY HAD SHIPPED BACK HER DESIGNER CLOTHES.



other fraudsters were counting the days until their deportations or still living on the lam, she was walking out of a Boston courthouse's front door.

Barbosa was 37 years old. Fluent in English. Still wearing her gray Alabama prison sweatsuit. A bulky GPS cinched on her ankle. She breathed in the autumn air, along with a surreal feeling of once again being in charge of her own day. "I don't have even a toothbrush!" she told me over the phone the next day, giddy. "It is incredible to feel free again."

Two weeks later, she'd stride into the trial and recount the meeting at the marriage agency's office on Wilshire, the binder of potential spouses, the wedding by the jacaranda tree. The defendant's attorney, while cross-examining Barbosa, would rub in just how much she was benefiting from testifying: that she'd helped herself by telling the government about others ("I was just being truthful," she retorted), that her prison sentence had been shorter ("Who wants to be in jail?" she replied).

Her deportation had been temporarily halted for her testimony, but she would still need a permanent immigration remedy to stay long-term. Barbosa says she applied for asylum late last year, claiming that she fears retribution from the associates of the wedding agency and some people in the Uber case.

As the rush of freedom subsided, Barbosa faced the sobering task of another new start. At least she had more than \$117 this time, and her family had shipped back her designer clothes. Solving one immediate problem, she could get a legitimate driver's license now; Massachusetts had started issuing them regardless of immigration status. She could also work while her asylum application was

pending, and her English skills, bur-nished by constant use in prison, got her part-time gigs translating medical appointments and home-renovation sales pitches. But frankly, neither felt like Barbosa-sized jobs. Her boyfriend had moved on while she was in prison, so she moved into a studio apartment alone. She hit the old clubs and parties with a smaller circle of friends—her closest one had been deported, others distanced themselves. At times, depression sank in.

Sitting in her quiet living room in January, she said, "Maybe this is me adjusting to the world again." As she spoke, she wobbled between the versions of herself. The Barbosa who meant well but, yes, did bad ... but had been quite good at it, hadn't she? The Barbosa vowing to never go anywhere near a gig app ever again, then the one who could still, when asked, recount every fraudulent keystroke. The repentant Barbosa who was glad getting caught forced her to quit. The pragmatic Barbosa who knew she would never have made a single fake profile had she just been legally allowed to work. With her future suspended between two countries, she wondered what was next.

So that's it. Barbosa wanted you to know the full story, "the real Priscila," the complex one. For the easy plot with a clean ending, there's Instagram.

In December, Barbosa put up her first after-prison post, picking up her victory march where she'd left off. She stood in front of a suburban Boston ballroom's Christmas tree in pleather bell bottoms, forehead newly Botox-smoothed, Louis Vuitton purse dangling from her wrist. She typed out a fresh bio: "Brazilian Living in USA ... Grateful for Life. Paralegal. MasterChef. IT Professional."

All of it more or less true. 

LAUREN SMILEY writes about humans in the tech age and is a regular contributor to WIRED.

I Am Laura Kipnis-Bot, and I Will Make Reading Sexy and Tragic Again



BY

LAURA KIPNIS

PHOTOGRAPHS BY

SAHAR RANA

MARGARET ATWOOD, MARLON JAMES, LENA DUNHAM, ROXANE GAY:

WE'VE ALL AGREED TO BE TURNED INTO AI READING

COMPANIONS BY A MYSTERIOUS COMPANY CALLED REBIND.

I REPORT FROM THE INSIDE.





WHEN A FLATTERING EMAIL ARRIVED inviting me to participate in an AI venture called Rebind that I'd later come to think will radically transform the entire way booklovers read books, I felt pretty sure it was a scam. For one thing, the sender was Clancy Martin, a writer and philosophy professor I didn't know personally but vaguely recalled had written about his misspent youth as a small-time jewelry-biz con artist, also being a serial liar in his love life. For another, they were offering to pay me. "Clancy up to his old ways!" I thought.

My role, the email explained, would involve recording original commentary on a "great book"—Clancy suggested *Romeo and Juliet*, though it could be any classic in the public domain. This commentary would somehow be implanted in the text and made interactive: Readers would be able to ask questions and AI-me would engage in an "ongoing conversation" with them about the book. We'd be reading buddies. Proposing me for *Romeo and Juliet* did strike me as subversively funny—my "expertise" on romantic tragedy consists of having once written a somewhat controversial anti-marriage polemic titled *Against Love*. I've also written, a bit ironically, about the muddle of sexual consent codes, which I supposed could prove relevant. Juliet was, after all, only 13. These days, Romeo (probably around



**THE NIHILIST IN ME
THINKS IF HUMANS ARE
GOING TO PERISH, WE
MIGHT AS WELL PERISH
READING THE CLASSICS.**

16—we're not precisely told) would risk being called a predator.

A bunch of decidedly illustrious participants, known as "Rebinders," had apparently already signed on: the Irish Booker Prize winner John Banville on James Joyce's *Dubliners*, best-selling writer Roxane Gay on Edith Wharton's *The Age of Innocence*, also Bill McKibben, Elaine Pagels, Garth Greenwell ... And bringing up left field, Lena Dunham on E. M. Forster's *A Room With a View*, a quirky prospect.

Clancy further explained that someone named John Dubuque, who'd sold a business for "umpteenth million dollars," had gotten the idea for this venture after spending several months working through philosopher Martin Heidegger's notoriously difficult *Being and Time* with a tutor. His hope, Clancy said, was to make this kind of (doubtless expensive) one-on-one reading experience available to everyone. I googled John Dubuque. Nothing came up. How do you sell a company for umpteenth millions and leave no trace? My scam antennae vibrated again. I figured I'd next be asked to invest in the company, probably in the form of Apple gift cards.

I did agree to a phone call with Clancy and, soon after hellos, pressed for further details about Dubuque, whom I wasn't sure really existed. "He sounds kind of Gatsbyish," I said, suavely veiling my skepticism in a literary allusion. Clancy claimed to have met him—a "wonderful fellow" from the Midwest, really nice guy—and then got down to business. If I signed on, Rebind would first record a handful of short videos of me chatting about the play, any aspect that interested me—these would be embedded in various places throughout the text. And then I and an interlocutor (probably Clancy), known in-house as a "Ghostbinder," would record 12 (or more!) hours of conversation—these would be used as the basis for AI-Laura's commentaries. The conversation could be about *Romeo and Juliet* but also related subjects: Is love at first sight trustworthy? Is 13 too young to get married? The content was entirely up to me: My job wasn't to be a Shakespeare expert, it was to be interesting. As Rebind users read the play, chat windows would open in which they'd write journal-type responses, to which

AI-Laura would respond, drawing on and remixing the recordings I had made.

Even if it was technically feasible and Dubuque was legit, did I really want to be involved in this? I have all the usual anxieties about AI—that it will usher in the end of human history; that under the hood it's a charming sociopath who tries to get tech reporters to ditch their wives; that even its inventors don't understand how it works; that it's so ruthlessly intelligent we'll soon be working for it while believing it's working for us.

Less amusingly, that it's being integrated into drone warfare and given autonomous capabilities. Sure, new technologies always prompt trepidation, but the rapid and cavalier adoption of this one—certain to be life-altering on an unimaginable scale—is uniquely terrifying. There's also no standing in its way. The nihilist in me thinks if humans are going to perish, we might as well per-

ish reading the classics. I downloaded a free copy of *Romeo and Juliet* from the internet.

MY FIRST QUESTION TO JOHN DUBUQUE, who not only exists but lives in a sprawling mansion near Santa Barbara, was how there could be absolutely nothing about him online. “How do you even manage that?” I demanded. We'd settled on white canvas couches near the infinity pool, on one of numerous tiered verandas overlooking the Pacific. The panoramic view was breathtaking. A waterfall burred nearby.

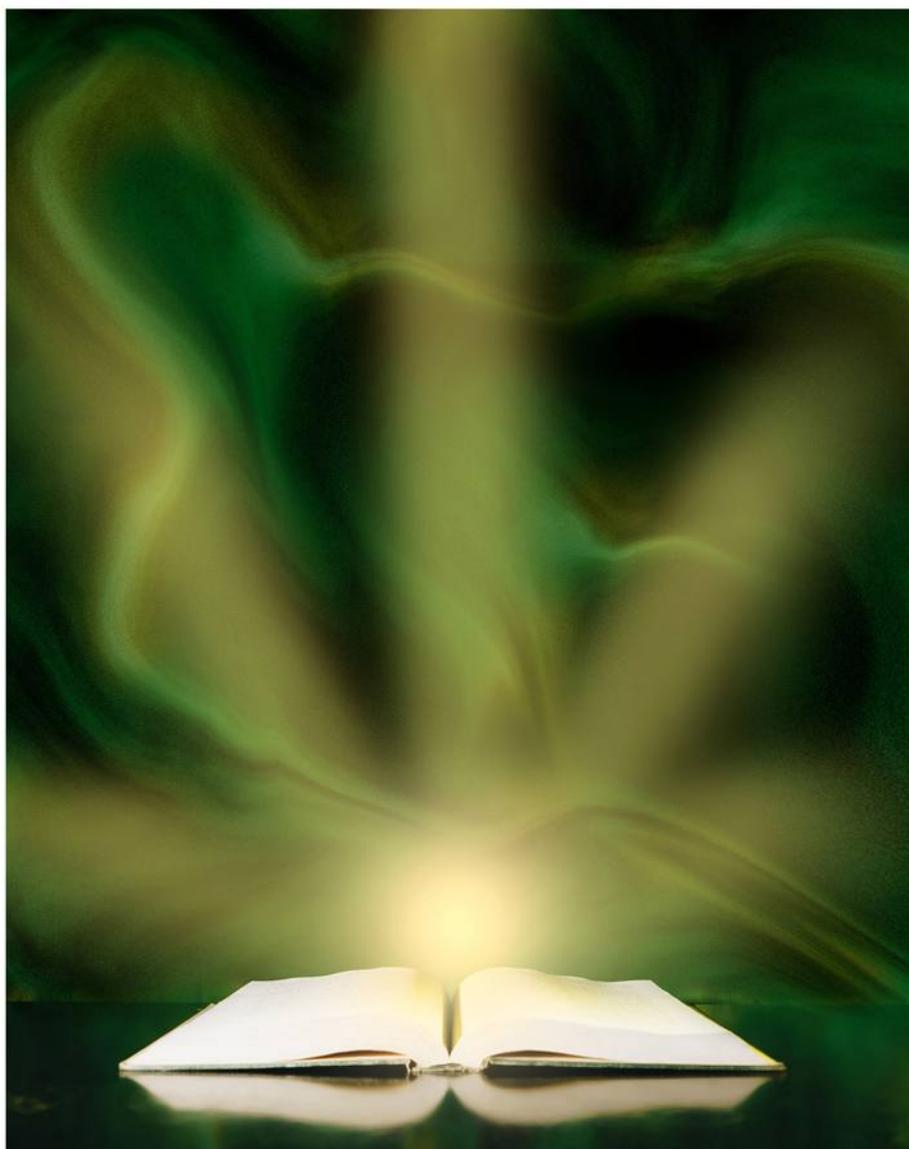
He took the question in stride. “Yeah, I'm a really private person!” The idea of speaking to the general public, let alone a writer, horrified him. I'd heard from Clancy that Dubuque—fortyish and wiry, unpretentiously friendly, unremarkably dressed in chinos and a button-down

shirt—had never been interviewed before, which made me feel unaccustomedly powerful.

Next: getting to the bottom of the money. Behind every great fortune lies a great crime, Balzac said. Behind Dubuque's was ... wholesale plumbing supplies. His great-grandfather started the company, literally called Plumbers Supply, in 1924 in St. Louis, and when Dubuque graduated from college in 2006 his father said, “You can put in 10 or 15 years now and you'll be glad you did, or you can do it 10 or 15 years from now.” Which is how Dubuque became CEO of a 48-person company in his mid-twenties and, over the next decade-plus, quadrupled it in size.

By 2021 the construction industry was booming; Plumbers Supply was having record month after record month. But looking ahead, where was it going to go? It was a regional operation. Figuring the company wouldn't be worth as much for decades, and knowing the markets were awash in cash—he was hearing crazy pandemic-era things—Dubuque looked into selling. Within six months a deal was signed with a national outfit. He was 38 and sitting on an “undisclosed sum” of money, meaning a lot. As Dubuque graciously adjusted a gargantuan canvas porch umbrella to shade my East Coast pallor from the blinding California rays, I gazed out at the azure Pacific and resolved to cultivate a better understanding of market cycles.

“Everyone joked, ‘You're retired, why don't you chill out?’” Dubuque said. “But I would go nuts.” He obviously didn't need to make more money. He waved an arm toward the house. “Like, I've made it.” Having fallen in love with philosophy as an undergrad at USC, he'd promised himself he'd someday return to it. *Being and Time* had been sitting on his bookshelf forever; not long before he sold his company, he'd flipped it open and realized, “There's no way I'll ever get through this book.” So he hired an Oxford profes-



let's say *Moby-Dick*. "You read the first 40 pages and you put it on the shelf, right?" By then he was reading William James' *The Varieties of Religious Experience* and loving it, and thought: Who's the William James guy? It turned out to be John Kaag, who'd written a book called *Sick Souls, Healthy Minds: How William James Can Save Your Life*, a mashup of memoir and philosophy. Which is exactly what Dubuque thinks people want: not scholasticism, but to know how to connect great books to our lives.

sor to meet with him twice a week, turning an impenetrable treatise into the most meaningful thing he'd ever read. He remembers thinking, "Boy, it's too bad more people can't experience this!" When I asked how, specifically, his world had been reshaped, he tried to explain ("Being is so close to us that we look right through it!") and I tried to understand ("OK, right!").

Then about a year later—when Dubuque was in the middle of a second tutorial, this time on Alfred North Whitehead's *Process and Reality*, another weighty, conjunctively titled book that was once again changing everything for him—ChatGPT came out. Dubuque was skeptical, having long ago read a convincing anti-AI argument by the Berkeley professor Hubert Dreyfus, a famous Heideggerian who thought human intelligence was too embodied and situated to ever be replicated by machines. Nevertheless, Dubuque started playing around with the app, pasting in passages from Whitehead and asking it to summarize them. He was amazed at the results.

He also suspected there were a lot of people who, like him, wanted to read hard books—maybe not *Being and Time*, but

own, was a substitute English teacher. At age 12 he was a bad reader with a stutter; his mother would sit with him at the kitchen table and they'd read through his assignments together—essentially an Oxford-style tutorial. It's what he tried to replicate with his own commentary for Rebind on Thoreau's *Walden*: relating the book to his own experiences and difficulties, which include a heart attack at age 40 followed by bypass surgery. (Thoreau, who died of tuberculosis at age 44, wrote movingly about fearing that bad health had prevented him from leading a meaningful life.) If a reader

journals about their own life difficulties in the chat, AI finds the places where Kaag shares something similar. Now the two are in conversation. Seeing that back-and-forth happen as they tested out the prototype, Kaag and Dubuque got really excited—they were creating, they thought, a new way to read.

The ideal Rebinder, then, is someone with experience talking to the general public—not necessarily the world's foremost expert, but someone who knows how to make books come alive. Only a few people they've approached have turned them down. When I asked Kaag who'd said no, he laughed and said that the novelist Andre Dubus III, a good friend, had told him he was "dancing with the devil." "Reading is meant to be a private experience!" Dubus had said. "You're supposed to lose yourself in a book!" There was

no way he'd participate.

The Rebind catalog is evolving by the day: James Wood (Chekhov), Margaret Atwood (*Tale of Two Cities*), and Marlon James (*Huck Finn*) have recently been added. Dubuque and Kaag had been thinking mainly about philosophy titles, until they realized how many different kinds of books and conversations there could be. Which was when they realized how big Rebind could be: "Not just big," Dubuque said, "but a landmark event." The spiritual category will be especially huge, he thinks: Currently contracted luminaries include

I SUSPECT REBIND WILL BE A BOON FOR THOSE WITH A LOW TOLERANCE FOR THE NEUROSES AND PASSIVE-AGGRESSIONS THAT BOOK CLUBS INVARIABLY INCITE.

WHEN KAAG GOT AN EMAIL FROM Dubuque, he almost didn't answer, but they eventually talked on the phone and hit it off, as Kaag told me over Zoom: "He turned out to be one of the most curious, thoughtful people that I've ever encountered." The two joined forces to develop Rebind. Kaag brought on his friend Clancy Martin. They have similar profiles: untraditional philosophy professors who've written eclectic books, including about their struggles with depression. (Clancy's most recent book is titled *How Not to Kill Yourself*.)

Kaag's mother, who raised him on her

Deepak Chopra and Bessel van der Kolk, the trauma expert who wrote *The Body Keeps the Score*—five years on the best-seller list. They will also, of course, Rebind the Bible, probably from multiple vantages.

I KNEW I'D HAVE TO ASCERTAIN FROM Dubuque how exactly the app worked and steeled myself for an explanation I'd only half understand, so I was relieved to hear him say that developing it was less of a technical challenge than a creative one. The innovation, as he explained, was making the Rebinder's commentary "chattable." It's designed to "meet the user where they are," which also means, as Dubuque enthuses, "it's going to sound like nothing else you've ever heard before!"

Achieving this is the job of Rebind's discussion engineer, Martin Zirulnik, an English lit PhD (not, Dubuque points out, an engineer by training; he doesn't think they're sufficiently attuned to the nuances of language). A subject of frequent jokes between Dubuque and Zirulnik is that one of the large language models they're testing won't stop saying "indeed." "I'll pay you \$500 not to say indeed!" Dubuque will say. Back it comes with "indeed." It also favors pseudo-profundities like "delve" and "dive," the unfortunate machines having apparently been trained to regard delving and diving as signifiers of human depth. (Avoid being seated next to one at a dinner party after the singularity.)

Whether to put the AI-generated commentaries in the voice of the actual Rebinder (based on the prerecorded videos embedded in the text) had been a subject of debate. "There's something really magical about the way someone speaks, something compressed inside people's voices that brings language to life," Dubuque thinks, though he's also concerned about the "ick factor"—are voice clones creepy? Dubuque is convinced that retaining the human element, wherever possible, is crucial. "It comes back to authenticity," he said. "If you just had the bot, you'd lose that connection." For now, Rebind has decided to send in the clones.

Dubuque knows the machines are going to be, at times, unpredictable. "Oh, it will definitely hallucinate," he

said. He seemed pretty sanguine about it. (I'd pressed Kaag too on this demon in the machine that apparently likes to fuck things up a little: "Yes, there's going to be a little wiggle room between what a user gets and what a commentator said.") Dubuque added: "The kind of computing these LLMs are doing, this kind of intelligence, is just different. Is that an existential risk? Well, I come back to the fact that we have no idea how the human brain works." It's easier to imagine catastrophic things than see the opportunities, he points out.

Plus, there are built-in guardrails—places the AI simply refuses to go. I was interested to learn from Ty Rollin, Rebind's chief technical officer, that suicide is an issue many LLMs will not discuss, which might be a problem when talking about, say, *Anna Karenina*. (Or *Romeo and Juliet*.) One of the reasons LLM apps like Rebind have been slow to come out, Dubuque thinks, is that it's so exasperating to wrangle them. They have a life of their own, with personal quirks and occasionally defiant inclinations.

And they keep getting more and more powerful. Any of the commercially available LLMs can be swapped in and out for Rebind's purposes—Musk's xAI, Google's Gemini—though Dubuque thinks OpenAI is a bit ahead of everyone. Each time Rebind passes content back and forth, the company charges them a fee, but those costs are going to keep plunging, he predicts. As I was completing this article, GPT-4o was released, which, Dubuque told me by email, was not only twice as fast but dropped the price per word by 50 percent: GPT4-o currently costs \$5 per million tokens input—a token is roughly 0.75 words—and \$15 per million tokens output. (Coincidentally, Dubuque went to high school with Sam Altman, OpenAI's CEO. They weren't close friends but did play intramural soccer together.)

Rebind does have to be profitable to grow, Dubuque said; he can't keep funding

it himself. He's the sole investor; they're not looking for others. When I asked what his initial outlay had been, he declined to say. And what about other routes to profitability, like selling users' data? (Which could be pretty fertile stuff for marketers—all your questions and desires about life, love, and existence.) Dubuque was adamant. "One hundred percent never. It will be in writing. Never going to do it."

THIS APP ISN'T FOR EVERYONE. Dubuque stressed. College students can use it, obviously, but the target audience is adults, or at least the book-loving subset. (Five million people in the United States are in book clubs, Kaag had mentioned.) "You read all these wonderful books as an undergrad," Dubuque said, "and then you graduate and you read newsletters." The big thing a user has to understand is that Rebind is designed to be an active experience. "If you're not responding to these questions and thinking deeply, you're not going to have as much fun." Kaag too had stressed that the more a reader puts of themselves into the chat windows—highlighting and reacting, producing "marginalia"—the more interesting the conversations are going to become.

I suspect Rebind will be a boon for the shy and those with a low tolerance for the neuroses and passive-aggressions that book groups invariably incite. Dubuque emphasized that users will have to realize that Rebind isn't an "Ask Me Anything" experience, though he figures, as with ChatGPT, people will initially want to test its limits, try to "break it."

Which is exactly what I did when I got access to a beta version of the app and clicked on *The Great Gatsby*, with New York Times journalist Peter Catapano as the Rebinder. "Was Gatsby just a rich jerk?" I asked AI-Catapano: "Gatsby's character is complex and multi-dimensional, not easily reduced to the label of a 'rich jerk,'" he (it?) chided me. "In fact, Gatsby also enters the book as a very soft-spoken and rather humble-seeming person. He's perhaps flashy with his home, his parties, and his belongings but seems relatively subdued in his appearance and manner of speaking." The cadences were slightly stiff—Dubuque said that as the models

get faster and smarter, the responses are getting more creative and conversational—but having my admittedly dumb question pondered seriously in real time did feel engaging, and made me want to keep reading and chatting.

I also started to wonder how much this app, by putting users into a sort of imaginary intimacy with the Rebinder, will facilitate us projecting our fantasies onto writers we admire. Especially the kind of reader prone to literary crushes (that would be me), or with celebrity Rebinders like Lena Dunham, who's subject to so much crazy projection as it is. To be honest, I was already savoring the idea of us reading *Room With a View* together, not because I suppose she's some sort of expert on it, but for her weird and fearless sensibility. I imagined our back-and-forth—me impressing her with my originality, us giggling together at her offbeat answers. Since her commentary wasn't yet up on the prototype, I seized the opportunity to get in touch with the person herself.

Lena turned out to be in production for a new series and too slammed to Zoom, but did agree to answer some questions by email. Searching for one that would cement our future bond, I settled on asking whether she had any qualms about being cloned. “The fact is, all of us can be mimicked by AI,” she wrote back, in a somewhat more decorous tone than I'd anticipated. “Anyone can make anyone else say whatever they want in a voice frighteningly close to the real thing, which is an existential threat not just to celebrities or political figures but to all of us.” And why *Room With a View*? Having long been privately obsessed with English and Irish literature from between 1850 and 1920, she said, getting to do commentary on Forster's novel was “a surreal gift.” She'd definitely be a Rebind user herself—the platform had stunned her with how “personal, connected, and frankly cozy” it was. I knew she was trying to be helpful, but she didn't seem entirely present—the human element that Dubuque kept talking about was missing. I'd have to wait for our Rebind conversation.

John Banville, a writer I've read and long found intriguing, did agree to Zoom from Ireland. He proved to be roguishly charming and a dedicated raconteur, answering every question about his

experience as a Rebinder—“I can't pretend to understand the thing, I'm an old guy you know”—by way of an anecdote. He'd agreed to participate because he thought it was a wonderful democratization of high literature: “I don't think I'm being too lovey-dovey here, but I would hope that it would demystify great books for readers who, you know, might feel intimidated.”

His anecdotes were mostly about Joyce, with whom he enjoys a complexly tormented relationship: fraternal, admiring, competitive. He'd read *Dubliners* countless times and it remained

astonishing, despite how young Joyce was when he wrote it: “What was I doing at that age? Writing bad imitations of Joyce!” Though I could have happily listened to Banville all day, I attempted to right the ship of the interview by putting to him the question I'd asked Dunham: Did he have any qualms about AI? About being cloned?

“But I think that is the case already,” he chortled. “I have always felt that there is no John Banville. He ceases to exist the moment I stand up from my desk. I don't know who he is—I find him a very strange creature. My strange dark brother. So, there's really nobody in there, just this artistic sensibility, creating stuff. I'm already a clone of myself. I'm sure you think the same,” he added genially.



SO FAR THERE'S NO REBIND SUBSCRIPTION plan; each title will go for about the price of a new hardcover book—\$30 or so. And the app, which will soon go live, will keep evolving. A reader's chat history from previous books will, in theory, eventually become part of the mashup: If you read *Thus Spoke Zarathustra* with Clancy and then read *Walden* with Kaag, it will be like Kaag had watched your responses to *Zarathustra*. Dubuque thinks that's what people will like most about the app: “It's going to know what you do and don't understand, which will

make your future reading experiences even better.”

Which brought to mind my upcoming role as *Romeo and Juliet* commentator. Not being a Shakespearean, I’d obviously been worried about my qualifications for the task, though I did some years ago briefly date a Shakespearean who used to say that Shakespeareans weren’t that smart. He considered them the bottom rungs of academic intelligence. Nevertheless, I’d been putting myself through reams of criticism and scholarly lit about the play. Most of it reassured me by being—sure enough—not all that interesting. (Light/dark symbolism: got it!)

A few weeks after I got back from Southern California, I took the train from Manhattan to Concord, Massachusetts, where Kaag lives, as did Ralph Waldo Emerson and Thoreau. This was the first step of a two-part process: I’d written scripts for 10 filmed segments, around 45 minutes total, and still had another 12 hours of extemporaneous audio commentary to record in the upcoming weeks. The filming was taking place in the Special Collections Room of the historic Concord Free Public Library—Emerson had delivered the keynote address when it opened in 1873. While the lighting crew was setting up, the archivist kindly brought out a binder of faded handwritten manuscript pages of Thoreau’s essay “Walking” for me to peruse, but I was too keyed up about the filming to devote my full attention. I’d been revising until a few days earlier—the scripts had already been fed into the teleprompter, or else I’d still be scribbling additions.

Love, passion, death, fate: There was no shortage of stuff to talk about. As someone who tends toward mordant humor about the tedium of long-term coupledness—from *Against Love*: “Never too early to make a down payment on those matching cemetery plots!”—I naturally had some thoughts on double suicide as a proactive solution to potential future domestic misery. I wasn’t sure how the LLM would handle irreverence on the subject—what about those guardrails? Or what if AI-Laura mangles the irony or hallucinates something in my voice that ends up getting me—human-Laura—canceled? I suppose I can always blame Rebind, who in any case owns the

“THERE’S REALLY
NOBODY IN THERE.
I’M ALREADY A CLONE
OF MYSELF.”

commentary. When I asked Dubuque whether they’d be copyrighting it, given that everything about copyright and AI is up in the air, he himself seemed unsure. “Not sure what further protections we get by doing so? Would have to check with an attorney,” he wrote. (He added shortly later that Kaag thought the commentaries were copyrighted.) What was fun about being on the ground floor was that they were basically inventing it as they went along. All that was missing was a garage.

The next morning I got up early(ish) to walk around Walden Pond while listening to Thoreau’s *Walden* on audio before getting the train back home. It was a misty overcast day, perfect for a pilgrimage—a word that brought to mind Romeo’s line to Juliet, one of my favorites: “My lips, two blushing pilgrims, ready stand...” Then Thoreau said something through my earbuds that felt both timely and piercing, given my recent angst over what to wear for the shoot: “Beware of all enterprises that require new clothes.” I’m not generally a big devotee of humanist reverie, but I felt a sudden flash of connection to this eccentric guy, and happy to be reminded—even in this technology-sullied way—how much weird ornerly imagination has seeped into the cultural record, despite a world that conspires to tame it. 📖

LAURA KIPNIS is a cultural critic and the author, most recently, of *Love in the Time of Contagion*.

COLOPHON

Tipping Points That Helped Get This Issue Out:

Learning about the benefits of native plants, stopped mowing the lawn; cutting most of my hair off after a week of 90-plus-degree heat; an off-key karaoke rendition of the Chicks’ “Not Ready to Make Nice”; giving the robot cars a chance; the new track from Robyn and Jamie xx; one episode of *Only Murders in the Building*; the Broadway production of *Illinois* (and subsequent existential spiral); *Unstable Neighbourhood Rabbit*, by Mikko Harvey; the last glass of champagne at a wedding; the arrival of actual summer in San Francisco; downloading Hinge after a decade of celibacy; deleting Hinge after a decade of vengery.

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DO NOT DISTURB THE HUMAN EXPERIMENT.

—@almguedes, via Instagram



Honorable Mentions

The simulations run in separate containers.

—Charles Mallio, via email

They've gone foraging for mushroom clouds.

—@zyanmc, via Instagram

Visit Earth. Wipe memory. Rinse.

Repeat.

—@jayhawk, via Instagram

We aren't ready for harvest yet.

—Paul Gazis, via Facebook

They downloaded our experience and left.

—@42andprime, via Instagram

Most species invent the couch first.

—Antti Karjalainen, via Facebook

We live in a bad neighborhood.

—Angelo J. Falanga, via Facebook

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WHEREVER YOU
GET YOUR PODCASTS**



THE MOONWATCH IN WHITE

Inspired by its history of space exploration, the most iconic chronograph on Earth now has a white dial. The Speedmaster Moonwatch has borrowed its latest look from the colours of astronaut spacesuits, while adding a glossy lacquered finish for the very first time. The white dial and red touches are also a tribute to the ALASKA I prototype that OMEGA produced in 1969, creating an authentic link to the Speedmaster's pioneering past. Worn on a comfortable and vintage-style bracelet, this stainless steel Moonwatch shines the spotlight on a new era of adventure.


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