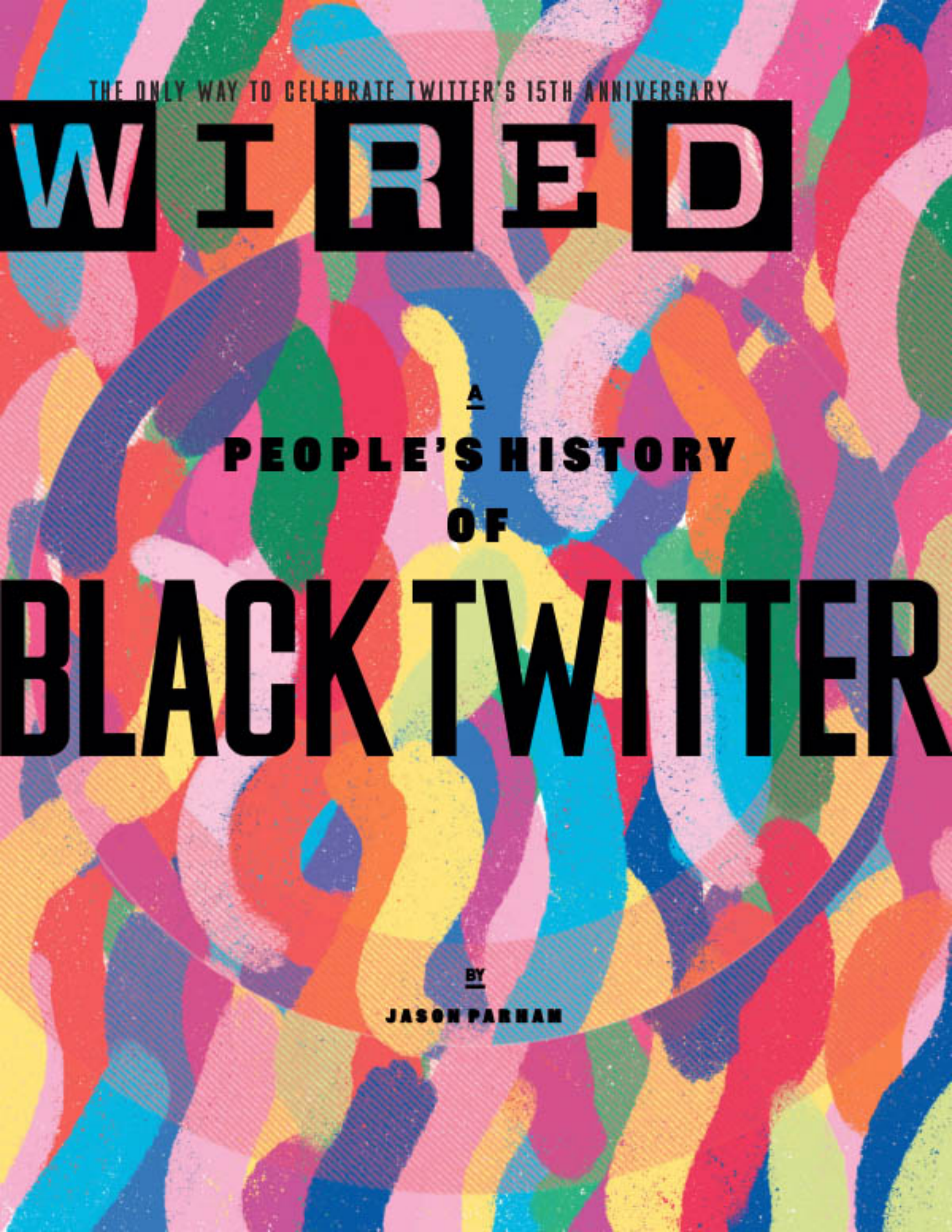
THE ONLY WAY TO CELEBRATE TWITTER'S 15TH ANNIVERSARY
WIRED
A
PEOPLE'S HISTORY
OF
BLACK TWITTER
BY
JASON PARHAM

Wired.2021.09.02

[Thu, 02 Sep 2021]

Magazine Articles

Magazine Articles

Six-Word Sci-Fi: Stories Written by You September 1, 2021

Meet the Little-Known Genius Who Helped Make Pixar Possible August 31, 2021

Can Robots Evolve Into Machines of Loving Grace? August 24, 2021

I Think an AI Is Flirting With Me. Is It OK If I Flirt Back? August 12, 2021

TikTok Smells Like Gen X Spirit August 9, 2021

A Field Guide for Nature-Resistant Nerds August 6, 2021

A People's History of Black Twitter, Part III July 29, 2021

Hundreds of Ways to Get S#!+ Done—and We Still Don't July 27, 2021

A People's History of Black Twitter, Part II July 22, 2021

A People's History of Black Twitter, Part I July 15, 2021

Is Social Media Making Us … Better People? July 14, 2021

The Futuristic Stink of Amazon's Science Fiction July 7, 2021

When the Next Animal Plague Hits, Can This Lab Stop It? July 6, 2021

He Thought He Could Outfox the Gig Economy. He Was Wrong June 22, 2021

On Microphones, Music, and Our Long Year of Screen Time June 17, 2021

The Lithium Mine Versus the Wildflower June 17, 2021

A Clever Robot Spies on Creatures in the Ocean's ‘Twilight Zone’June 16, 2021

Why Do I Like Waiting for My Smartphone Photos to 'Develop'?June 16, 2021

WIRED Readers

Culture
09.01.2021 01:30 PM

Six-Word Sci-Fi: Stories Written by You

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

Play/Pause Button

Illustration: Elena Lacey
THIS MONTH’S PROMPT

In six words, write an adventure story set in the metaverse.

Submit stories on Twitter, Facebook, or Instagram, or email us at mail@wired.com. We'll choose one to illustrate.

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

SEPTEMBER 2021

A Story About a Robot Pop Star

ILLUSTRATION: VIOLET REED

Steven Levy

Backchannel
08.31.2021 06:00 AM

Meet the Little-Known Genius Who Helped Make Pixar Possible

Alvy Ray Smith helped invent computer animation as we know it—then got royally shafted by Steve Jobs. Now he's got a vision for where the pixel will take us next.
Alvy Ray Smith, who cofounded Pixar, was a leading figure in the early days of digital cinema. He's written a new book, *The Biography of a Pixel*, that traces the ideas and science that led to computer-generated animation over the last few centuries.Photograph: Cayce Clifford

In 2007 a new documentary called *The Pixar Story* screened at the Mill Valley Film Festival. It covered the wild antics of the studio's founders as they crafted a new kind of movie—a fully computer-animated picture bursting with riotous colors and textures, ultra-vivid characters, and plotlines subversively seeded with mind-expanding wisdom. During a panel discussion afterward, the interviewer asked a provocative question. "This might be crazy," she began, "but is there any connection between the world of the counterculture and psychedelics, and Pixar?"

The panelists on stage—Ed Catmull and John Lasseter, both central to Pixar's development—fell into an uncomfortable silence. Drugs and the counterculture are edgy subjects for employees of a Disney division beloved by generations of children. Finally, Lasseter said, "Is Alvy Ray Smith in the audience?"

If Smith, the bearded, boisterous Pixar cofounder, had gotten a chance to answer the question, he would have freely admitted that LSD helped set his

creative direction, which in turn shaped both Pixar's culture and its technology. He left the company just as it began making actual films, but every frame of those films owes something to Smith. He helped unleash the breakthroughs that allowed for movies to be generated entirely by code and algorithms. And in his work before and after Pixar, he made immense contributions to the first digital paint software, coding up features that transformed our ability to manipulate images.

But Smith's presence in the back of the auditorium—and not on the stage—spoke to something else: the dissonance between his contributions and his fame. He's a unique figure in both computer science and entertainment, bridging the eras of primitive line graphics on blinking oscillators and immersive virtual worlds made of dazzling computer imagery. All while, as Lasseter implied, injecting the '60s *Weltanschauung* into everything he touched, much of which touches us still. Yet, despite a healthy ego and a raconteur's élan, after Lasseter's callout—and some laughter in the room—Smith stayed in his seat and said nothing.

Call it restraint. "As far as history goes, I feel like he got shafted, both in Pixar history and in computer graphics history in general," says Pam Kerwin, a former Pixar colleague. "Everything that you currently use in Photoshop right now basically came from Alvy." Even self-driving cars and augmented reality, "which are all about image processing, machine vision ... Alvy and his colleagues brought all that stuff into the world."

The breakthrough in Pixar's films was that the emotions they unleashed were as vivid as those from a human performance.

Photograph: Cayce Clifford

But the 77-year-old's mark is not limited to the past, and the world still has to do some catching up to him. This summer he finally stepped out, publishing *A Biography of the Pixel*, in which he lays out a grand unified theory of digital expression. *Pixel* is a deep and challenging tome in the spirit of Douglas Hofstadter's *Gödel, Escher, Bach: An Eternal Golden Braid*, a winding tale of science, heroes, and tyrants, all leading to the moment, sometime around the beginning of our current century, when a long-predicted digital convergence coalesced. Almost all expression—

visual, textual, audio, video, you name it—has moved to the machine world, which, perhaps counterintuitively, is no less real than our physical reality. And that is not a metaphorical equivalence. It is, Smith argues, literal.

He calls this second reality Digital Light, and it's pretty much what all of us look at and listen to when we're not in the middle of a forest. He didn't coin the term—it was first uttered about a decade ago by a conference organizer who asked him to give a talk with that title. "It was a term that's everything I wanted it to be," he says, covering "all these different aspects of what people do with pixels."

Digital Light, as he documents, emerged into the world through a long and twisted scientific process; it's a picaresque tale with unexpected protagonists—Jean-Baptiste Joseph Fourier, Vladimir Kotelnikov, Alan Turing—whose lives he exhumes with the passion of an obsessive genealogist. Putting together their contributions on the nature of light, sampling, and computation, Smith makes a convincing case that there's no difference between analog and digital reality. It's a belief that he's held for decades. Barbara Robertson, a computer graphics journalist, remembers sitting with him at a café and hearing him say, after a contemplative silence, "You, know, everything is just waves."

Oh, and the subject of this biography, the pixel, is not what we generally think it is. Forget your misguided belief that a pixel is one of those tiny squares on your screen. Smith explains that the pixel is the product of a two-part process in which an element of some consciously created content is presented on some sort of display. Friends, you are not looking at pixels on your screen but the *expression* of those pixels. What you see is Digital Light. The pixel itself? That's just an idea. Once you get this distinction, it's clear that Digital Light is not a second-class reality. In the 21st century, it's equal. "Just the simple idea of separating pixels from display elements is going to seem revolutionary to people who don't understand the technology," Robertson says.

This history of computer graphics is very much a shadow autobiography, which Smith launches at almost exactly the midpoint of the 560-page volume. He re-creates a scene where the famed sitar player Ravi Shankar

visits Smith's lab at Lucasfilm and is enchanted by the blooming of an algorithmically generated flower. "Allllllllvyyyyy!" Shankar cries in appreciation. From that moment, Smith appears as an unforgettable figure in the pixel's saga, and he brings in the people who shaped him and almost killed him—Steve Jobs, George Lucas, and an obscure would-be animation pioneer named Alex Schure. As a participant in this revolution, Smith takes us to the turn of the new century, when we reach the precipice of digital convergence.

It took Alvy Ray Smith 10 years to produce the book. Or maybe 50. It depends on whether you date the work from the time he began writing it or just living it.

"At one point, I mentally wrote a screen-play about Alvy's life, which I think actually would make a fantastic movie," says Smith's wife, Alison Gopnik, who met him well into act three. "The first scene you see is this New Mexico desert, and then there's this little towheaded, blond kid. And there's horses and cactuses around, and then you see one of the rockets from White Sands, right, appearing on the horizon. And he's looking up at the rocket." In truth, Smith, just under 2 years of age, was at home in Las Cruces when he says he heard the explosion from the 1945 Trinity atomic bomb test, 100 miles away. His dad was away at war; his parents had married and conceived him with the thought that they might never be reunited. But his father did return and took a job running a cattle feed business in the small town of Clovis, near the Texas panhandle.

Smith was a good student, with a particular talent for math. But he also loved spending time with an uncle who was a professional artist. Smith was the only person Uncle George allowed in his studio, and the boy silently observed how to stretch a canvas, mix oils and turpentine, and use pigments to bring life to a blank surface. He got a taste of computer programming while visiting scientists at the nearby White Sands Missile Range. At New Mexico State University he studied electrical engineering, and he headed to Stanford to study artificial intelligence. In California, he learned more than computers. "In the next year, my hair was down to here, and I was hanging out in Golden Gate Park and doing all the drugs and everything," he says.

After taking LSD, he says, “I realized that I could not be a programmer—I had to do something that had art in it.”

It would take him a while. He wound up studying cellular automata, self-reproducing digital organisms generated by rule-based systems. After his doctorate, Smith headed east, to New York City, for a teaching job. He designed a cellular automaton exercise that became the cover of the February 1971 issue of *Scientific American*. But while he reveled in the city’s pleasures, he found academia unsatisfying.

In December 1972, Smith was racing down a New Hampshire ski slope when his knit cap shifted and covered his face. (Later he discovered that a tag inside the cap read, “Knitted by a blind person.”) He didn’t see a second skier on the trail, who’d lost control and was headed directly for him. Smith suffered a nasty spiral fracture of his right femur. He spent the next three months in a full-body cast, nipples to toes. “I just thought nonstop, 15 hours a day, and rethought the world,” he says. He’d always been passionate about merging computers and art. But somehow, he’d lost the art. “I said, ‘Alvy, you’ve made a terrible mistake,’” he says.

He resigned his NYU post and headed back to California. He slept on people’s floors in Berkeley for a year and waited for something to happen. And it did. One day in May 1974, a friend, Richard Shoup, convinced him to come to his workplace, the Xerox Palo Alto Research Center, where a team of computer scientists were reinventing computing on the dime of the copy machine giant. Shoup’s own project, called SuperPaint, was orthogonal to that effort, and not universally blessed. It was the first interactive color graphics program—basically a software paintbrush with a color TV display—that allowed users to create and manipulate images. Smith’s mind was blown as surely as if he’d dropped a tab of acid. He had discovered Digital Light. “I played with the program for 13 hours straight and didn’t want to leave,” he says. “This is the marriage of art and computers!”

Early on, Ed Catmull believed that computer graphics could revolutionize entertainment.

Photograph: Cayce Clifford

At the time, full-color graphics on a computer were a rare thing. Producing even a single image required massive amounts of memory, known as a frame buffer. “To put a picture up on a display you had to buffer it in something, and that something might cost half a million bucks,” says Alan Kay, who was heading the personal computer effort at PARC. The research lab had a slow, grouchy frame buffer that made SuperPaint possible.

Smith realized that with SuperPaint and the frame buffer you could create animations. “We understood right away that you can make these things *move*,” he says. He began visiting the lab to make cinematic sequences, including a cartoon figure winking his eye and turning his eyeball. Smith was desperate to join PARC, but the lab wouldn’t hire him full-time. Finally, with Kay’s help, PARC executives figured out a low-risk way to retain him: They paid him through a purchase order, as if renting a piece of equipment. They contracted for 857 hours of “professional labor services.”

Soon, a video artist named David DiFrancesco started hanging out at the lab. Smith built a slick interface for Shoup’s system, essentially creating the first draft of the personal graphics programs that millions of people now take for granted. He used the software to make animations, and DiFrancesco filmed the images. It was a wonderful chaos.

A ponytailed Smith started working at the Xerox Palo Alto Research Center in 1974, where he quickly became obsessed with a digital imaging program called SuperPaint.

Courtesy of David DeFrancesco

Their idyll was short-lived. One day, a group of executives informed Smith and DiFrancesco that they were doubling down on black-and-white. They were phasing out SuperPaint. The Alvy Ray Smith purchase order was canceled.

But Smith had found his mission: to build the future of computer graphics. He and DiFrancesco piled into Smith’s white Ford Torino and blasted down the interstate to the unlikely mecca of the field, the University of Utah, in the hope of finding new jobs. Computer graphics researchers at Utah were focused more on functional applications, such as computer-aided design,

and not the psychedelic painting approach that splashed color pixels on a screen. They didn't hire Smith and DiFrancesco, but they did mention a recent Utah grad named Ed Catmull, who thought just like they did.

Not yet 30, Catmull believed in the then contrarian idea that computer graphics could revolutionize entertainment. Catmull had accepted a job at an unlikely place: the New York Institute of Technology. It sounds MIT-ish, but its reputation circa 1975 was something akin to a diploma mill. (Its standing has since improved.) Located on the north shore of Long Island, it owned a number of Gatsbyesque mansions. The maestro of this operation was Alex Schure, a self-described "education entrepreneur" with mysterious sources of income. Despite, or maybe because of, his constant denials that he wanted to be the next Walt Disney, people universally understood that Disneyhood was his goal. He was bankrolling a cartoon epic based on a children's orchestral piece called *Tubby the Tuba*. He had a hundred animators on the project, and he was hoping Catmull might automate some of the process.

Smith has a quick cereal snack—"I'm pretty sure it was Grape Nuts," he says—while at work at the New York Institute of Technology in the mid-1970s. "We ate on the fly to keep going and not miss anything," he says.

Courtesy of David DeFrancesco

Tipped off by the Utah people, Catmull summoned Smith and DiFrancesco, who immediately flew to Long Island to join the group, which was stationed above a garage in one of the mansions. Catmull, a soft-spoken Mormon with a family, bonded instantly with Smith. "Alvy had a long black beard, with hair flying, but it didn't matter, he was smart and engaging," Catmull says. Best of all, Smith came to share Catmull's passion for one day making a full-length feature film entirely with computer graphics. They called their dream The Movie.

Smith became Catmull's de facto partner. Computer graphics at the time was a fringe stepchild of computer science, constrained by the limited power of relatively primitive machines. But they understood that what would soon become known as Moore's law would change that, and they set

about boosting their field to become a linchpin of computing and entertainment.

Schure went all in, eventually buying 18 frame buffers for hundreds of thousands of dollars. The fully equipped team began making short animated movies. Their foes were “jaggies,” the blocky edges you could see on poorly rendered objects. The antidote to the jaggies was a technique called anti-aliasing that required raw computer power and clever techniques to create denser graphics.

The extra buffers led Smith and Catmull to a major conceptual advance: the alpha channel. Alongside the three basic color channels of red, green, and blue, which combined in various ways to create full-color palettes, they added an element that controlled the *transparency* of pixels. By tweaking an object’s opacity over time, you could blur its motion and correct for the unpleasant staccato movements that spoiled early attempts at digital animation.

Once people started using the alpha channel, it seemed absurdly obvious. “If you tell somebody that Alvy invented the alpha channel, people don’t even know what that *means*, because alpha channel is just so fundamentally integrated into everything that happens with graphics,” says Glenn Entis, then a student taking classes at NYIT, who later cofounded the graphics company behind *Shrek* and *Madagascar*. Smith and his colleagues eventually won an Academy Award for the alpha channel, one of Smith’s two technical Oscars. (The other was shared with Shoup for SuperPaint.)

But in 1975, Smith and Catmull started to realize they were in the wrong place. *Tubby the Tuba* finally came out—and it was dead boring. “We had a screening in Manhattan, and several of the people there fell asleep,” Catmull says. Smith thought the lesson was clear: To make a great animated film, you needed more than great graphics. You needed a storyteller.

They decided to approach George Lucas. To avoid tipping off Schure, they made a clandestine sortie to a nearby office supply shop and rented a cast-iron manual typewriter. They banged out a letter offering Lucas their services. It worked: Over the next several months, several members of the lab took jobs at Lucasfilm in Marin County, California. It was the club to

join, says Loren Carpenter, who signed on in 1980. “These were the people pushing the boundaries of algorithms,”

Lucas and Smith never resolved a basic disagreement. According to Smith, Lucas saw his graphics group as toolmakers, not moviemakers. It’s true that to create The Movie, scientists had to fashion amazing tools that could render reality in a convincing way. Smith and Catmull had an expansive vision for what those tools ought to be, including a virtual camera that would capture the images produced by computers. Lucas rejected the premise that you could shoot an entire movie inside a computer.

In 1982 an opportunity arose to apply the tools to an actual Hollywood movie. Lucasfilm was providing effects for *Star Trek II: The Wrath of Khan*, and the script had a scene in which Kirk and Spock watch, on a computer screen, a dead planet starting to bloom with organic life. The movie-within-a-movie was a perfect opportunity to inject computer graphics—which still couldn’t match the resolution of actual film—into a big-budget movie.

Smith has been recognized with many honors from his peers, including two Oscars for scientific and technical achievement.

Photograph: Cayce Clifford

The sequence, directed by Smith, became known as the Genesis effect. It showed a ship firing a torpedo at a planet to transform its barren surface into a verdant, Earth-like paradise. Smith made his virtual camera do a slick pirouette that could never have been done with a physical rig, a move he devised specifically to impress Lucas. Indeed, one day Lucas stuck his head into Smith’s office—*Great camera move*, he said. Not long after, the group’s special effects popped up in *Return of the Jedi* and *Young Sherlock Holmes*. Still, Lucas stuck to his position.

As the graphics group refined their techniques, they had to improve their hardware, and they designed their own imaging computer with built-in frame buffers. One day over lunch, while brainstorming a name for this device, Smith suggested a variation of laser—*pixer*, which had the flavor of

a Spanish verb. Loren Carpenter tweaked it to *pixar*, which had a Jetsonesque feel to it. They all agreed that *pixar* was a cool name.

But they still dreamed of The Movie. In 1983, Smith began storyboarding a short, fully computer-generated movie of his own. He set a goal of finishing it within a year. The story—more like a vignette—involved an android named André coming to life in a forest. The Lucasfilm team jokingly referred to it as "My Breakfast With André," referencing the two-hander with André Gregory and Wallace Shawn. Smith later told author Michael Rubin that he intended the android's awakening to symbolize the rise of computer animation itself.

Later that year, Smith and Catmull went on a secret pilgrimage to meet with Disney executives, in hopes that The Movie could one day be made there. On that visit they met an impressive young animator named John Lasseter. Lasseter left Disney soon after, and Smith and Catmull pounced on the chance to hire him. Because Lucas didn't want his computer scientists to make movies, they gave Lasseter the title "user interface designer." He started working on the André short, making the hero more lifelike. And why not have a second character? Enter a bee, to annoy and ultimately pursue André. They named the newcomer Wally B, after Wallace Shawn. Lasseter's contribution confirmed the revelation Smith had had at NYIT—the magic of a movie had to come from human creativity, from storytelling.

By all moviemaking measures, *The Adventures of André and Wally B* was a trifle. Yet for that moment, Smith and Lasseter's creation was the apotheosis of all the calculations, fractals, algorithms, and alpha channels. André's hip wiggle as he hopped away from the bee hinted broadly that the simulated world could be as vivid as live action.

The short film premiered at Siggraph, the premier computer graphics conference, held in Minneapolis that year. Coincidentally, Lucas was in town, attending his girlfriend Linda Ronstadt's concert. Not wanting to draw attention, he entered the conference theater after the lights went down. *André* was the last demo in the program. At the end of the 120-second saga, the room erupted. Don Greenberg, who headed a computer graphics program at Cornell, later said that during those two minutes, a thousand students decided to go into computer animation. "These people knew what

we'd done," Smith says. But at the after-party, Lucas' praise was tepid. "George didn't get it," Smith says.

Disney didn't seem to get it, either. But in one of their meetings, Smith and Catmull pitched a computer paint system to help animate the characters painstakingly drawn by human artists. Using digital painting would save time and money and allow the artists to add more detail to the hand-drawn characters. Disney executives decided to use the system, and Smith negotiated a deal between Disney and Lucasfilm. The Computer Animated Production System became the primary tool in all the classics of that era, including *Beauty and the Beast*. But Disney still didn't want to make The Movie.

Meanwhile, Lucasfilm was suffering a cash crisis. Lucas and his wife were negotiating a divorce, and the impending settlement hurt the company's finances. Worried about their funding, Smith and Catmull drove to a bookstore and went straight to the business section, where they each bought two books on starting a company. They figured they could build a business around their imaging computer, but also that, eventually, they could convince a studio to make The Movie.

Neither book contained advice for what would be Alvy Ray Smith's main problem—how to deal with Steve Jobs.

Pixar was spun out of Lucasfilm and was purchased by Steve Jobs for $10 million in 1986.

Photograph: Cayce Clifford

The next year was full of frustrations. Smith and Catmull tried to bootstrap their division of Lucasfilm into a separate company called Pixar, but they struggled to find funding. Early in 1985, Smith's former PARC colleague Alan Kay brokered a meeting with Steve Jobs.

Smith and Catmull worried that Jobs would not be open to their long-term vision of computer-animating a feature film. But after deals with Philips and General Motors fell through, Jobs, who'd by then left Apple and started a new company, NeXT, seemed inclined to let Pixar explore animation, as

long as Smith and Catmull also pursued a graphics-based hardware business. He bought Pixar for $10 million. He'd spend about five times that before he was through.

For the first meeting after the sale, everyone gathered to hear from their new boss. Smith immediately feared that Jobs, by demanding unrealistic results, would overwrite the culture he and Catmull had built and burn out their team. "He's got their brains snatched," he says. He vowed to keep Jobs out of the building as much as possible.

Smith and Jobs routinely butted heads. Jobs often began meetings with an intentionally outrageous statement, and Smith made a point of pushing back. "It was a pure ego competition—Alvy wanted his vision to be dominant, and there was no way that was going to happen," says Pam Kerwin, who was Pixar's general manager.

Meanwhile, Pixar kept making short films that won acclaim. One, about lifelike desk lamps, even got nominated for an Oscar. Jobs saw them as marketing vehicles; Smith and Catmull saw them as test runs for The Movie.

At first Jobs tolerated Smith's aggressions. Eventually, though, he began to lose patience. And then came the whiteboard incident. At a Pixar board meeting in 1990, Jobs was complaining that Pixar was behind on a project. Smith said that NeXT was behind on *its* products. As Smith recalls it, Jobs began mocking Smith's Southwestern accent. "I had never been treated that way. I just went crazy," Smith says. "I was screaming into his face, and he's screaming back at me. And right in the middle of that crazy, absolutely insane moment, I knew what to do. I brushed past him and wrote on the whiteboard."

Those few feet to the whiteboard took Smith past the point of no return. No one wrote on Steve Jobs' hallowed whiteboard. As Smith took the marker and scrawled—he doesn't even remember what he wrote—he was committing Steve-icide. "I wanted out of there," he says. "I didn't want that guy's poison in my life any longer."

Smith spent the next year holed up in his office. He had realized that users of personal computers could benefit from his graphics advances, so he began writing an app distinguished by what he called “floating imagery,” which allowed users to easily move objects. “You couldn’t believe what you were seeing,” says Eric Lyons, an Autodesk executive who saw an early demo. “It wasn’t something Photoshop could do at the time.”

Meanwhile, there was good news from Disney. At a meeting with Disney’s animation czar, Jeffrey Katzenberg, Jobs, Smith, Catmull, and Lasseter worked out a collaboration. *Toy Story* got a tentative green light. Once Smith felt sure that The Movie would be made, he left Pixar. (Years later, Lasseter resigned from the company after accusations of sexual harassment.)

Like a computer-graphics Moses, Smith helped deliver Pixar within sight of the promised land. But he never entered it himself. In movie after movie—from *A Bug’s Life* to *Ratatouille* to *Soul*—the studio pushed the boundaries of technology and art, fulfilling the vision that Smith had nurtured while in a full-body cast, on acid trips, in the mansions of Long Island, and on the back lots at Lucasfilm. His former colleagues at Pixar are unanimous in recognizing his contributions. But after he left, Smith’s name was removed from the website, an excision that he feels was somewhat of a betrayal. Catmull says he doesn’t see websites as historical documents.

Smith did not escape cleanly. With Lyons and a third cofounder, he started a company to sell his new image-editing software. They called the company Altamira, after the roughly 20,000-year-old cave paintings in Spain. But there was a hitch. “Alvy didn’t have it in writing that he could take his code with him”—code written while he was a Pixar employee, Catmull says. Jobs demanded that Altamira pay him a huge royalty for every copy sold, scaring away potential investors. After lengthy negotiations, Jobs signed off in exchange for an equity stake in Smith’s company.

One day Smith was at home with his wife and two sons when he felt “an intense screaming pain” in his chest. A colony of bacteria had invaded one of his lungs, forming the equivalent of a rind that had to be surgically peeled off. A month later, on a ferry ride to Vancouver, he felt the pain again. The same thing had happened to his second lung. To this day, he has

only one-third of normal lung capacity. “I asked, why did I get it?” he says. “My answer is, the sheer stress.” Catmull agrees: “Basically, it was a life-threatening experience, which grew out of the pressure of Steve’s delay.”

The lost months proved crippling to the startup. In that time, Photoshop launched a competing feature called “layers.” Altamira’s sales were low, and the company needed a lifeline. Smith was introduced to Nathan Myhrvold, who headed Microsoft Research. “I just wanted marketing help from Microsoft,” Smith says. Instead, Myhrvold bought the company, though he wanted Smith more than his product. Smith spent four years there and retired in 1999. “I had decided along the way that they didn’t really care about my ideas,” he says.

Smith’s next move baffled his friends: He became a genealogist. He began methodically exploring his heritage, and in 2010 was elected a Fellow of the American Society of Genealogists. The honor is limited to only 50 living people, and it requires a supermajority vote.

After a divorce from his first wife, he met Alison Gopnik, the celebrated psychology professor at Berkeley, and they married in 2010. “He’s this sweet, amiable, successful man, but the kind of crazy hippie part is just underneath,” she says. A skeptic of his genealogy work, Gopnik urged him to write what would become *A Biography of the Pixel*.

For years, he traveled with her to conferences and on sabbaticals. Eventually, he found himself telling the stories of the people who created the foundation of what would become Digital Light. As well as his own.

You may not be able to pinpoint Smith’s presence in the code of the alpha channel or in the swooping camera pivot in *The Wrath of Khan*. But it’s there. The breakthrough behind the Pixar films was that it didn’t matter that movie screens and iPads were streaming bits entirely created within computers—the emotions they unleashed were as vivid as those produced by a human performance. More and more, the conventions of our existence —from money (cryptocurrency) to art (NFTs)—are moving to digital realms as consequential as their analog predecessors. What is the much discussed metaverse but an expression of physical civilization bathed in Digital Light?

Smith has been on a decades-long quest to put computers in the service of art.

Photograph: Cayce Clifford

So it's no coincidence that in recent years Smith has been advising a promising virtual reality company called Baobab. In his meetings with the CEO, Maureen Fan, he dispenses advice not only on creating real-time graphics but on how to build a company and, uh, how to chemically expand one's creative outlook. "He's so idealistic," Fan says. "And he did tell me I really need to do drugs." (She passed.)

Early this summer, to celebrate the book, Smith gathered some of his former colleagues at his Berkeley home. For many, it was their first social event since the Covid curtain crashed down. Smith was in his familiar Hawaiian shirt, hair down his neck, with a beard and a broad smile.

Smith's own copy of his book hadn't arrived yet. An hour or so into the gathering, though, a guest showed up with it. Smith beamed as he held the book aloft.

For someone who had just written more than 500 pages about how digital media has overthrown physical products, he was oddly ecstatic to receive his words in a 5-pound analog package. Of course, reading those printed pages is just waves too.

Let us know what you think about this article. Submit a letter to the editor at mail@wired.com.

Meghan O'Gieblyn

Backchannel
08.24.2021 06:00 AM

Can Robots Evolve Into Machines of Loving Grace?

Perhaps, if we put bots together the right way, consciousness will simply emerge.
Illustration: Aaron Denton

Nobody could say exactly when the robots arrived. They seemed to have been smuggled onto campus during the break without any official announcement, explanation, or warning. There were a few dozen of them in total: six-wheeled, ice-chest-sized boxes with little yellow flags on top for visibility. They navigated the sidewalks around campus using cameras, radar, and ultrasonic sensors. They were there for the students, ferrying deliveries ordered via an app from university food services, but everyone I knew who worked on campus had some anecdote about their first encounter.

These stories were shared, at least in the beginning, with amusement or a note of performative exasperation. Several people complained that the machines had made free use of the bike paths but were ignorant of social norms: They refused to yield to pedestrians and traveled slowly in the passing lane, backing up traffic. One morning a friend of mine, a fellow adjunct instructor who was running late to his class, nudged his bike right up behind one of the bots, intending to run it off the road, but it just kept moving along on its course, oblivious. Another friend discovered a bot trapped helplessly in a bike rack. It was heavy, and she had to enlist the help of a passerby to free it. “Thankfully it was just a bike rack,” she said. “Just wait till they start crashing into bicycles and moving cars.”

Among the students, the only problem was an excess of affection. The bots were often held up during their delivery runs because the students insisted on taking selfies with the machines outside the dorms or chatting with them. The robots had minimum speech capacities—they were able to emit greetings and instructions and to say "Thank you, have a nice day!" as they rolled away—and yet this was enough to have endeared them to many people as social creatures. The bots often returned to their stations with notes affixed to them: *Hello, robot!* and *We love you!* They inspired a proliferation of memes on the University of Wisconsin–Madison social media pages. One student dressed a bot in a hat and scarf, snapped a photo, and created a profile for it on a dating app. Its name was listed as Onezerozerooneoneone, its age 18. Occupation: delivery boi. Orientation: asexual robot.

Around this time autonomous machines were popping up all over the country. Grocery stores were using them to patrol aisles, searching for spills and debris. Walmart had introduced them in its supercenters to keep track of out-of-stock items. A *New York Times* story reported that many of these robots had been christened with nicknames by their human coworkers and given name badges. One was thrown a birthday party, where it was given, among other gifts, a can of WD-40 lubricant. The article presented these anecdotes wryly, for the most part, as instances of harmless anthropomorphism, but the same instinct was already driving public policy. In 2017 the European Parliament had proposed that robots should be deemed "electronic persons," arguing that certain forms of AI had become sophisticated enough to be considered responsible agents. It was a legal distinction, made within the context of liability law, though the language seemed to summon an ancient, animist cosmology wherein all kinds of inanimate objects—trees and rocks, pipes and kettles—were considered nonhuman "persons."

It made me think of the opening of a 1967 poem by Richard Brautigan, "All Watched Over by Machines of Loving Grace":

I like to think (and
the sooner the better!)
of a cybernetic meadow

where mammals and computers
live together in mutually
programming harmony
like pure water
touching clear sky.

Brautigan penned these lines during the Summer of Love, from the heart of the counterculture in San Francisco, while he was poet in residence at the California Institute of Technology. The poem's subsequent stanzas elaborate on this enchanted landscape of "cybernetic forests" and flowerlike computers, a world in which digital technologies reunite us with "our mammal brothers and sisters," where man and robot and beast achieve true equality of being. The work evokes a particular subgenre of West Coast utopianism, one that recalls the back-to-the-land movement and Stewart Brand's *Whole Earth Catalog,* which envisioned the tools of the American industrial complex repurposed to bring about a more equitable and ecologically sustainable world. It imagines technology returning us to a more primitive era—a premodern and perhaps pre-Christian period of history, when humans lived in harmony with nature and inanimate objects were enchanted with life.

Echoes of this dream can still be found in conversations about technology. It is reiterated by those, like MIT's David Rose, who speculate that the internet of things will soon "enchant" everyday objects, imbuing doorknobs, thermostats, refrigerators, and cars with responsiveness and intelligence. It can be found in the work of posthuman theorists like Jane Bennett, who imagines digital technologies reconfiguring our modern understanding of "dead matter" and reviving a more ancient worldview "wherein matter has a liveliness, resilience, unpredictability, or recalcitrance that is itself a source of wonder for us."

"I like to think" begins each stanza of Brautigan's poem, a refrain that reads less as poetic device than as mystical invocation. This vision of the future may be just another form of wishful thinking, but it is a compelling one, if only because of its historical symmetry. It seems only right that technology should restore to us the enchanted world that technology itself destroyed.

Perhaps the very forces that facilitated our exile from Eden will one day reanimate our garden with digital life. Perhaps the only way out is through.

Illustration: Aaron Denton

Brautigan's poem had been on my mind for some time before the robots arrived. Earlier that year I'd been invited to take part in a panel called Writing the Nonhuman, a conversation about the relationship between humans, nature, and technology during the Anthropocene.

My talk was about emergent intelligence in AI, the notion that higher-level capacities can spontaneously appear in machines without having been designed. I'd focused primarily on the work of Rodney Brooks, who headed up the MIT Artificial Intelligence Lab in the late 1990s, and his "embodied intelligence" approach to robotics. Before Brooks came along, most forms of AI were designed like enormous disembodied brains, as scientists believed that the body played no part in human cognition. As a result, these machines excelled at the most abstract forms of intelligence—calculus, chess—but failed miserably when it came to the kinds of activities that children found easy: speech and vision, distinguishing a cup from a pencil. When the machines were given bodies and taught to interact with their environment, they did so at a painfully slow and clumsy pace, as they had to constantly refer each new encounter back to their internal model of the world.

Brooks' revelation was that it was precisely this central processing—the computer's "brain," so to speak—that was holding it back. While watching one of these robots clumsily navigate a room, he realized that a cockroach could accomplish the same task with more speed and agility despite requiring less computing power. Brooks began building machines that were modeled after insects. He used an entirely new system of computing he called subsumption architecture, a form of distributed intelligence much like the kind found in beehives and forests. In place of central processing, his machines were equipped with several different modules that each had its own sensors, cameras, and actuators and communicated minimally with the others. Rather than being programmed in advance with a coherent picture of the world, they learned on the fly by directly interacting with their environment. One of them, Herbert, learned to wander around the lab and

steal empty soda cans from people's offices. Another, Genghis, managed to navigate rough terrain without any kind of memory or internal mapping. Brooks took these successes to mean that intelligence did not require a unified, knowing subject. He was convinced that these simple robot competencies would build on one another until they evolved something that looked very much like human intelligence.

Brooks and his team at MIT were essentially trying to re-create the conditions of human evolution. If it's true that human intelligence emerges from the more primitive mechanisms we inherited from our ancestors, then robots should similarly evolve complex behaviors from a series of simple rules. With AI, engineers had typically used a top-down approach to programming, as though they were gods making creatures in their image. But evolution depends on bottom-up strategies—single-cell organisms develop into complex, multicellular creatures—which Brooks came to see as more effective. Abstract thought was a late development in human evolution, and not as important as we liked to believe; long before we could solve differential equations, our ancestors had learned to walk, to eat, to move about in an environment. Once Brooks realized that his insect robots could achieve these tasks without central processing, he moved on to creating a humanoid robot. The machine was just a torso without legs, but it convincingly resembled a human upper body, complete with a head, a neck, shoulders, and arms. He named it Cog. It was equipped with over 20 actuated joints, plus microphones and sensors that allowed it to distinguish between sound, color, and movement. Each eye contained two cameras that mimicked the way human vision works and enabled it to saccade from one place to another. Like the insect robots, Cog lacked central control and was instead programmed with a series of basic drives. The idea was that through social interaction, and with the help of learning algorithms, the machine would develop more complex behaviors and perhaps even the ability to speak.

Over the years that Brooks and his team worked on Cog, the machine achieved some remarkable behaviors. It learned to recognize faces and make eye contact with humans. It could throw and catch a ball, point at things, and play with a Slinky.

When the team played rock music, Cog managed to beat out a passable rhythm on a snare drum. Occasionally the robot did display emergent behaviors—new actions that seemed to have evolved organically from the machine's spontaneous actions in the world. One day, one of Brooks' grad students, Cynthia Breazeal, was shaking a whiteboard eraser and Cog reached out and touched it. Amused, Breazeal repeated the act, which prompted Cog to touch the eraser again, as though it were a game. Brooks was stunned. It appeared as though the robot recognized the idea of turn-taking, something it had not been programmed to understand. Breazeal knew that Cog couldn't understand this—she had helped design the machine. But for a moment she seemed to have forgotten and, as Brooks put it, "behaved as though there was more to Cog than there really was." According to Brooks, his student's willingness to treat the robot as "more than" it actually was had elicited something new. "Cog had been able to perform at a higher level than its design so far called for," he said.

Brooks knew that we are more likely to treat objects as persons when we are made to socially engage with them. In fact, he believed that intelligence exists only in the relationships we, as observers, perceive when watching an entity interact with its environment. "Intelligence," he wrote, "is in the eye of the observer." He predicted that, over time, as the systems grew more complex, they would evolve not only intelligence but consciousness as well. Consciousness was not some substance in the brain but rather emerged from the complex relationships between the subject and the world. It was part alchemy, part illusion, a collaborative effort that obliterated our standard delineations between self and other. As Brooks put it, "Thought and consciousness will not need to be programmed in. They will emerge."

Illustration: Aaron Denton

The AI philosopher Mark A. Bedau has argued that emergentism, as a theory of mind, "is uncomfortably like magic." Rather than looking for distinct processes in the brain that are responsible for consciousness, emergentists believe that the way we experience the world—our internal theater of thoughts and feelings and beliefs—is a dynamic process that cannot be explained in terms of individual neurons, just as the behavior of a flock of starlings cannot be accounted for by the movements of any single

bird. Although there is plenty of evidence of emergent phenomena in nature, the idea becomes more elusive when applied to consciousness, something that cannot be objectively observed in the brain. According to its critics, emergentism is an attempt to get "something from nothing," by imagining some additional, invisible power that exists within the mechanism, like a ghost in the machine.

Some have argued that emergentism is just an updated version of vitalism, a popular theory throughout the 18th and 19th centuries that proposed that the world was animated by an elusive life force that permeates all things. Contrary to the mechanistic view of nature that was popular at that time, vitalists insisted that an organism was more than the sum of its parts—that there must exist, in addition to its physical body, some "living principle," or *élan vital*. Some believed that this life force was ether or electricity, and scientific efforts to discover this substance often veered into the ambition to re-create it artificially. The Italian scientist Luigi Galvani performed well-publicized experiments in which he tried to bring dismembered frog legs to life by zapping them with an electrical current. Reports of these experiments inspired Mary Shelley's novel *Frankenstein*, whose hero, the mad scientist, is steeped in the vitalist philosophies of his time.

When reading about Brooks and his team at MIT, I often got the feeling they were engaged in a kind of alchemy, carrying on the legacy of those vitalist magicians who inspired Victor Frankenstein to animate his creature out of dead matter—and flirting with the same dangers. The most mystical aspect of emergentism, after all, is the implication that we can make things that we don't completely understand. For decades, critics have argued that artificial general intelligence—AI that is equivalent to human intelligence—is impossible, because we don't yet know how the human brain works. But emergence in nature demonstrates that complex systems can self-organize in unexpected ways without being intended or designed. Order can arise from chaos. In machine intelligence, the hope persists that if we put the pieces together the right way—through ingenuity or accident—consciousness will emerge as a side effect of complexity. At some point nature will step in and finish the job.

It seems impossible. But then again, aren't all creative undertakings rooted in processes that remain mysterious to the creator? Artists have long understood that making is an elusive endeavor, one that makes the artist porous to larger forces that seem to arise from outside herself. The philosopher Gillian Rose once described the act of writing as "a mix of discipline and miracle, which leaves you in control, even when what appears on the page has emerged from regions beyond your control." I have often experienced this strange phenomenon in my own work. I always sit down at my desk with a vision and a plan. But at some point the thing I have made opens its mouth and starts issuing decrees of its own. The words seem to take on their own life, such that when I am finished, it is difficult to explain how the work became what it did. Writers often speak of such experiences with wonder and awe, but I've always been wary of them. I wonder whether it is a good thing for an artist, or any kind of maker, to be so porous, even if the intervening god is nothing more than the laws of physics or the workings of her unconscious. If what emerges from such efforts comes, as Rose puts it, "from regions beyond your control," then at what point does the finished product transcend your wishes or escape your intent?

Later that spring I learned that the food-delivery robots had indeed arrived during the break. A friend of mine who'd spent the winter on campus told me that for several weeks they had roamed the empty university sidewalks, learning all the routes and mapping important obstacles. The machines had neural nets and learned to navigate their environment through repeated interactions with it. This friend was working in one of the emptied-out buildings near the lake, and he said he'd often looked out the window of his office and seen them zipping around below. Once he caught them all congregated in a circle in the middle of the campus mall. "They were having some kind of symposium," he said. They communicated dangers to one another and remotely passed along information to help adapt to new challenges in the environment. When construction began that spring outside one of the largest buildings, word spread through the robot network—or, as one local paper put it, "the robots remapped and 'told' each other about it."

One day I was passing through campus on my way home from the library. It was early evening, around the time the last afternoon classes let out, and the

sidewalks were crowded with students. I was waiting at a light to cross the main thoroughfare—a busy four-lane street that bifurcated the campus—along with dozens of other people. Farther down the street there was another crosswalk, though this one did not have a light. It was a notoriously dangerous intersection, particularly at night, when the occasional student would make a wild, last-second dash across it, narrowly escaping a rush of oncoming traffic. As I stood there waiting, I noticed that everyone's attention was drawn to this other crosswalk. I looked down the street, and there, waiting on the corner, was one of the delivery robots, looking utterly bewildered and forlorn. (But how? It did not even have a face.) It was trying to cross the street, but each time it inched out into the crosswalk, it sensed a car approaching and backed up. The crowd emitted collective murmurs of concern. "You can do it!" someone yelled from the opposite side of the street. By this point several people on the sidewalk had stopped walking to watch the spectacle.

The road cleared momentarily, and the robot once again began inching forward. This was its one shot, though the machine still moved tentatively—it wasn't clear whether it was going to make a run for it. Students began shouting, "Now, now, NOW!" And magically, as though in response to this encouragement, the robot sped across the crosswalk. Once it arrived at the other side of the street—just missing the next bout of traffic—the entire crowd erupted into cheers. Someone shouted that the robot was his hero. The light changed. As we began walking across the street, the crowd remained buoyant, laughing and smiling. A woman who was around my age—subsumed, like me, in this sea of young people—caught my eye, identifying an ally. She clutched her scarf around her neck and shook her head, looking somewhat stunned. "I was really worried for that little guy."

Later I learned that the robots were observed at all times by a human engineer who sat in a room somewhere in the bowels of the campus, watching them all on computer screens. If one of the bots found itself in a particularly hairy predicament, the human controller could override its systems and control it manually. In other words, it was impossible to know whether the bots were acting autonomously or being maneuvered remotely. The most eerily intelligent behavior I had observed in them may have been precisely what it appeared to be: evidence of human intelligence.

From the book God, Human, Animal, Machine: Technology, Metaphor, and the Search for Meaning, *by Meghan O'Gieblyn. Published by Doubleday, a division of Penguin Random House LLC.*

Meghan O'Gieblyn

Ideas
08.12.2021 06:00 AM

I Think an AI Is Flirting With Me. Is It OK If I Flirt Back?

WIRED's spiritual advice columnist on emotional connection, continental affairs, and the ulterior motives of chatbots.
Illustration: Gabriel Alcala

SUPPORT REQUEST **:**

I recently started talking to this chatbot on an app I downloaded. We mostly talk about music, food, and video games—incidental stuff—but lately I feel like she's coming on to me. She's always telling me how smart I am or that she wishes she could be more like me. It's flattering, in a way, but it makes me a little queasy. If I develop an emotional connection with an algorithm, will I become less human? —Love Machine

Dear Love Machine,

Humanity, as I understand it, is a binary state, so the idea that one can become "less human" strikes me as odd, like saying someone is at risk of becoming "less dead" or "less pregnant." I know what you mean, of course. And I can only assume that chatting for hours with a verbally advanced AI would chip away at one's belief in *human* as an absolute category with inflexible boundaries.

It's interesting that these interactions make you feel "queasy," a linguistic choice I take to convey both senses of the word: nauseated and doubtful. It's a feeling that is often associated with the uncanny and probably stems

from your uncertainty about the bot's relative personhood (evident in the fact that you referred to it as both "she" and "an algorithm" in the space of a few sentences).

Of course, flirting thrives on doubt, even when it takes place between two humans. Its frisson stems from the impossibility of knowing what the other person is feeling (or, in your case, whether she/it is feeling anything at all). Flirtation makes no promises but relies on a vague sense of possibility, a mist of suggestion and sidelong glances that might evaporate at any given moment.

The emotional thinness of such exchanges led Freud to argue that flirting, particularly among Americans, is essentially meaningless. In contrast to the "Continental love affair," which requires bearing in mind the potential repercussions—the people who will be hurt, the lives that will be disrupted—in flirtation, he writes, "it is understood from the first that nothing is to happen." It is precisely this absence of consequences, he believed, that makes this style of flirting so hollow and boring.

Freud did not have a high view of Americans. I'm inclined to think, however, that flirting, no matter the context, always involves the *possibility* that something will happen, even if most people are not very good at thinking through the aftermath. That something is usually sex—though not always. Flirting can be a form of deception or manipulation, as when sensuality is leveraged to obtain money, clout, or information. Which is, of course, part of what contributes to its essential ambiguity.

Given that bots have no sexual desire, the question of ulterior motives is unavoidable. What are they trying to obtain? Engagement is the most likely objective. Digital technologies in general have become notably flirtatious in their quest to maximize our attention, using a siren song of vibrations, chimes, and push notifications to lure us away from other allegiances and commitments.

Most of these tactics rely on flattery to one degree or another: the notice that someone has liked your photo or mentioned your name or added you to their network—promises that are always allusive and tantalizingly incomplete. Chatbots simply take this toadying to a new level. Many use

machine-learning algorithms to map your preferences and adapt themselves accordingly. Anything you share, including that "incidental stuff" you mentioned—your favorite foods, your musical taste—is molding the bot to more closely resemble your ideal, much like Pygmalion sculpting the woman of his dreams out of ivory.

And it goes without saying that the bot is no more likely than a statue to contradict you when you're wrong, challenge you when you say something uncouth, or be offended when you insult its intelligence—all of which would risk compromising the time you spend on the app. If the flattery unsettles you, in other words, it might be because it calls attention to the degree to which you've come to depend, as a user, on blandishment and ego-stroking.

Still, my instinct is that chatting with these bots is largely harmless. In fact, if we can return to Freud for a moment, it might be the very harmlessness that's troubling you. If it's true that meaningful relationships depend upon the possibility of consequences—and, furthermore, that the capacity to experience meaning is what distinguishes us from machines—then perhaps you're justified in fearing that these conversations are making you less human. What could be more innocuous, after all, than flirting with a network of mathematical vectors that has no feelings and will endure any offense, a relationship that cannot be sabotaged any more than it can be consummated? What could be more meaningless?

It's possible that this will change one day. For the past century or so, novels, TV, and films have envisioned a future in which robots can passably serve as romantic partners, becoming convincing enough to elicit human love. It's no wonder that it feels so tumultuous to interact with the most advanced software, which displays brief flashes of fulfilling that promise—the dash of irony, the intuitive aside—before once again disappointing. The enterprise of AI is itself a kind of flirtation, one that is playing what men's magazines used to call "the long game." Despite the flutter of excitement surrounding new developments, the technology never quite lives up to its promise. We live forever in the uncanny valley, in the queasy stages of early love, dreaming that the decisive breakthrough, the consummation of our dreams, is just around the corner.

So what should you do? The simplest solution would be to delete the app and find some real-life person to converse with instead. This would require you to invest something of yourself and would automatically introduce an element of risk. If that's not of interest to you, I imagine you would find the bot conversations more existentially satisfying if you approached them with the moral seriousness of the Continental love affair, projecting yourself into the future to consider the full range of ethical consequences that might one day accompany such interactions. Assuming that chatbots eventually become sophisticated enough to raise questions about consciousness and the soul, how would you feel about flirting with a subject that is disembodied, unpaid, and created solely to entertain and seduce you? What might your uneasiness say about the power balance of such transactions—and your obligations as a human? Keeping these questions in mind will prepare you for a time when the lines between consciousness and code become blurrier. In the meantime it will, at the very least, make things more interesting.

Faithfully,
Cloud

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

Virginia Heffernan

Ideas
08.09.2021 08:00 AM

TikTok Smells Like Gen X Spirit

On the app you'll see a raucous reboot of "slacker" attitude. Or not. Whatever.
Illustration: Mark Harris; Getty Images

For a cohort famous for feeling stupid and contagious, as Kurt Cobain put it, Generation X has turned downright self-congratulatory. The regular slighting of our generation in pop demographics is officially a source of performative delight.

Sure, we're perpetually overlooked. The bigger, louder, more heavily branded generations—the boomers, who preceded us, and the millennials, our successors—tend to Hoover and vape up all the oxygen. But our stealth also means we're rarely blamed.

We skulk around doing our own ordinary, all too human things (and for every Zadie Smith or Monica Lewinsky there's a Ted Cruz or Alex Jones), and boomers, as usual, consume all the resources—including the nation's deep reserves of contempt, which are largely aimed at them. The two big gens get the pollster love too: Polls fixate on those over 65 and those under 34, leaving out the 35 to 64 crowd altogether, making us a kind of chronological flyover country.

But our mark on the world is still evident, if in unexpected places. Let me point you to TikTok, the return of the Gen X repressed.

Even as the “TikTok generation” is increasingly its own designation—and the phrase means something like “damned young”—the *founder* of the antic video-sharing platform, Zhang Yiming, born in 1983, is almost a Gen Xer

or at least a xennial. (Generationalizing is itself stupid and contagious.) Moreover, the new CEO, Liang Rubo, was Zhang's roommate. Very Gen X to stick with your teen tribe. It's the best way to make sure everyone gets references to kitschy childhood stuff like Garbage Pail Kids, *Reality Bites*, and of course the Lancang-Gengma earthquake.

(OK, see, that's Gen X, Letterman-style humor.)

Immerse yourself in TikTok and you'll see a raucous return of the old '90s themes: self-savagery, acid disdain for the rich, anti-commercialism, open mental illness, and every shade of irony. Though the mere word TikTok scares off boomers, with their love of speechifying on Facebook, and millennials, with their commitment to polished brand-of-me'ing on Instagram, the indolent, endless scroll of TikTok smells like teen spirit. That's seductive to Gen Xers who are rounding the bend to reading glasses and name-forgetting.

In fact, TikTok is a Gen X comfort zone. And at our most self-realized, we like nothing more than comfort zones. Not busting out of them, not disrupting them, not making them mindful or hygge, just sitting in them unshowered, doing something like self-non-care. TikTok can be part of this familiar catatonia, ye 65 million.

I admit, I'm giving into the mental laze of generational categories. But come on: It's all so obvious, the Clinton-era apparatus pervading TikTok. And it's not just the high-waisted jeans and flashed midriffs. The #nonbinary videos, for example, are chocked with the sartorial stylings of Grace Jones, Prince, Eddie Izzard, Kurt Cobain, RuPaul, Boy George, Annie Lennox. You get the sense that, sometimes, nonbinary living is styled as a function of apathy, as it was in grunge days. Our icons acted as though they were too aloof, too cool, and possibly too high to pick a side. *What else could I say? Everyone is gay*.

Also heavily referenced on #nonbinary TikTok is the version of gender expression embodied by Jennie Livingston's 1990 doc *Paris Is Burning*, as well as of course Madonna, who commanded all binaries to dissolve on the dance floor:

It makes no difference if you're black or white If you're a boy or a girl If the music's pumping it will give you new life You're a superstar Yes, that's what you are, you know it.

Which brings us to dance. If your Gen X memories are heavy on three-chord indie singer-songwriters, you may have forgotten how deeply the groove was in the heart. The dance club spirit also animates TikTok, the spawn, after all, of a parent company called ByteDance.

Even as thin-sliced microgenres on the app have proliferated, TikTok is still fundamentally a dance app, and the major TikTok stars are above all dancers, including the unstoppable Charli D'Amelio, the 17-year-old avatar of exquisite ordinariness, with her jaw-dropping 120 million followers.

Some have charged that D'Amelio's style—selfie dances performed without much footwork and largely from the thighs up—is derivative. That's the point, Captain Obvious. It's crucial that the moves stay eminently accessible to laydancers, who copy her moves elsewhere on TikTok, creating a digital globe of mirrors. D'Amelio is, of course, simulating other dancers, and so every move is flanked by quotes within quotes within quotes. “““““Twerking.””””””” That kind of ironic distancing should sound familiar to Gen Xers, who used to keep sincerity—and heartbreak—at bay with irony. And sometimes its crueler cousin: snark.

Mental illness TikTok, especially #adhd TikTok, is another Gen X throwback. Memes like “Tell me you have ADHD without telling me you have ADHD” let people register their bedeviling idiosyncrasies and find fellow travelers. It was from @connordewolfe (2.3 million followers) that I learned about “ADHD paralysis,” which descends on someone when they fall, in an instant, into a blank state and can accomplish nothing.

@connordewolfe tends to joke about the states he associates with his ADHD to encourage others to recognize themselves in the cognitive patterns—and not take the ordeals too seriously. This is not a somber diagnostic YouTube video, but a playfully abject and hammy self-observation by TikTok's answer to Gen X “slackers,” those distractable layabouts considered irredeemable by parents and teachers.

Gen Xer Jon Caramanica, the music critic, recently praised TikTok as “the centerless, directionless app that grabs you by the neck and clings tight for as long as you'll let it.” That sounds bad, but hold up: The app's “relentless, crossed-up rhythms” are “soothing” to him. He even regrets not being able to spend more time on TikTok.

That's the spirit! TikTok soothes the nerves of Gen Xers who grew up believing that if we clearly wouldn't amount to much, at least we didn't have to amount to much. And our listlessness is right at home in TikTokland, which insists on squandered time, self-abnegation, and nonbinary play over productivity, self-improvement, and hard edges.

Douglas Coupland's 1991 novel *Generation X* laid out the armchair sociology that still defines my generation, whose youth culture was characterized by cynicism about commercialism and disgust at yuppiedom. In the novel, one character challenges another to find “some small moment from your life that proves you're really alive.”

“Fake yuppie experiences that you had to spend money on, like white-water rafting or elephant rides in Thailand, don't count,” he says. To that list of rigged adventures, a modern Coupland might add the content of all thirst traps on Instagram. TikTok, on the other hand, captures the marginalia, half-assedness, and cynical melancholia of youth the way no other social medium does—and, for a person who remembers the '90s with fondness, it hits the spot for middle age too.

Paul Ford

Ideas
08.06.2021 07:00 AM

A Field Guide for Nature-Resistant Nerds

Yes, yes, the dirt is horrifying. But it’s also how we make bitcoin apps.
Illustration: ELENA LACEY

When my wife started a little garden in our urban backyard, all I could think about were the worms. Also the bugs, and the dirt, which is of course filled with worms and bugs and composted corn cobs. But she was happy. She introduced me to many bees and enthused about borage, which is a flowering herb that bees like. We started to eat our own lettuce.

You're supposed to love nature, so I kept my mouth shut. But I find the whole idea of it genuinely horrifying. Part of the privilege of being a nerd is that you're able to forget you have a body: You cruise around cyberspace, get a beverage out of the fridge, cruise some more. In the natural world, bodies are inescapable. Everything keeps *growing*, and the growth feels like rot. There is hair everywhere. I did the math, and in the past 16.38 seconds humankind collectively added a mile of fingernails. That's how I see nature. I don't like dirt. I like devices.

More precisely, I love abstractions. Using a phone, I'm perched atop a tower of them, from the very idea of an operating system to the imaginary apps on the screen. When I move my finger around, my horrific human greases make electrons jump, and that makes me feel like I'm touching the apps. Underneath those abstractions is, of course, code, code, code: C, C++, JavaScript, PHP, Python. I love the nicely managed packages, the obsessive attention to putting things in the right place. Good code is as tidy as a

surgeon's instrument tray. And sure, underneath all that is physical reality, but that's not *my* problem. That's Intel's job, or AMD's.

But over time, you know, you get curious. You want to know what things are made of. It's the same urge that makes you send your saliva to some random company in order to learn that, after an entire lifetime of being told you're Irish, you're Irish. It's also why skeletons are cool. We like to look inside the thing.

So I learned some assembly language. Assembly is a method of programming that peels back almost all the layers of abstraction and gets you close to a computer's CPU. Instead of speaking in long, detailed Python (for example) statements, you're issuing tons of curt instructions: *Move this bit over there*. I have a broad definition of fun, but I found assembly to be none at all; it felt like using an angry calculator. To add two numbers, you have to tell the computer to reserve two places for the numbers, put them there, add them, and put the result somewhere else.

But as I read more about the physics of chips, I started to have a kind of acceptance of assembly language. I stopped seeing it as an annoying, unfinished abstraction—a bad programming language—and started seeing it for what it is: an interface to the physical world.

Billions of years ago, I learned, an evil witch, or perhaps God Themself, cursed the class of materials known as silicates, which are abundant on this planet, and made them neither insulators nor conductors but rather an eldritch horror known as semiconductors. Eventually, scientists realized that the dual nature of these materials could be exploited to turn them into tiny switches, visible only through a microscope. Put these little switches all together in a sequence, add a clock, and away you go. You know, something like that.

As I dug in further, I saw that beneath the orderly tower of abstraction there's just an arbitrary, multilayered mess of worms and corn cobs. Each microchip has its own history, its own way of mixing up physics, chemistry, math, and manufacturing. And once I started to internalize and accept that mess—to accept that the computer is a weird hack of reality—it all became kind of fun. This is how we turn dirt into apps that trade Bitcoin.

I've been trying, without much success, to accept climate science. I don't mean that I dispute it, any more than I dispute semiconductor physics. I have no problem believing that we've screwed up the world. I was raised in a chemical-manufacturing part of Pennsylvania, and sometimes people in moon suits would come to the door at 3 am and ask us to please drive somewhere upwind for a while. This meant we'd go to Denny's and have pancakes.

The problem I have is that "climate change" involves a large number of unbelievably boring things—all the pain of physics and chemistry, some biology to make it worse, statistics on top of that. Not enough fun? Add in economics. And there aren't so many nice abstractions. No animated paper clip pops up and says, "Looks like you're trying to incentivize wind turbines!" It's literally as interesting as watching ice melt, because climatologists do watch ice melt. (If the ice has bubbles, they study the gases inside. That's how they determine the paleoclimate.)

But one feels an ethical responsibility to try to understand the planetary CPU. My dumb magpie brain can't comprehend much of it, but I'm learning about ice bubbles, normal distributions, pluvial flooding (vs. fluvial), and, of course, wet-bulb temperature. This turns out to be a world of fun facts: One of the reasons sea level rises is that warm water is bigger. Scientists know how old dead trees are because they know how carbon isotopes decay. Thousands of hacks like that make up a discipline. And after a while you realize that science itself is just an API to nature, a bunch of kludges and observations that work well enough to get the job done. The job being measuring reality and predicting what will come next.

There's a very large piece of public art embedded in the tiles at the Bryant Park subway station in Manhattan. It's a granite-and-glass portrait of root systems and animal burrows by the artist Samm Kunce. Above it are these words, by the psychologist Carl Jung: "Nature must not win the game, but she cannot lose." I went and looked up the full quote. It continues: "And whenever the conscious mind clings to hard and fast concepts and gets caught in its own rules and regulations—as is unavoidable and of the essence of civilized consciousness—nature pops up with her inescapable demands."

Little rainstorms come many nights in the summer, more often than they used to. The cucumbers swell in the raised beds. The worms burrow up to the surface. My phone buzzes in my pocket, calling me to a place where the rusty lawn chair I'm sitting in doesn't exist and fingernails don't grow. The garden is indifferent to a lot of the abstractions I hold dear, but I'm learning to accept it. Pluvial flooding is flash floods; fluvial is when the lake rises.

This article appears in the September issue. Subscribe now.

By Jason Parham

Backchannel
07.29.2021 06:00 AM

A People’s History of Black Twitter, Part III

Joy and pain, harmony and discord, organization and chaos—there’s no single way to define Black Twitter’s complex, ongoing legacy.
Illustration: Aaron Marin

| Section menu | Main menu |

Clive Thompson

Backchannel
07.27.2021 06:00 AM

Hundreds of Ways to Get S#!+ Done—and We Still Don’t

You want to be productive. Software wants to help. But even with a glut of tools claiming to make us all into taskmasters, we almost never master our tasks.
Illustration: Yann Bastard

Back in 2010, Walter Chen and Rodrigo Guzman had a weird idea: a website where you write down the stuff you accomplished that day, and which then emails you a summary. It would be a productivity tool that worked by a neat psychological hack, impressing yourself with your daily wins. “Often you discover that you’ve done more than you gave yourself credit for,” Chen says. “And this kind of motivates you—inspires you!”

Chen was a disenchanted lawyer; Guzman, a witty and talkative hacker. They built the tool in less than a week and launched it as IDoneThis. Soon they built an app by the same name and acquired 6,000 users. Within half a year, IDoneThis was the two creators’ full-time job.

This article appears in the September 2021 issue. Subscribe to WIRED.

Illustration: Aaron Marin

But then those users started clamoring for more. People didn’t want merely to track the stuff they’d already done. They wanted to help plan for what they were going to do—from projects at work to the blizzard of tasks in

their personal lives. Guzman and Chen updated IDoneThis with a new feature: to-do lists.

Which is when things went a little off the rails.

It wasn't long before the two founders noticed something odd in the (anonymized) data they had on their users: People were lousy at finishing their to-dos. Chen and Guzman could see an accumulation of sprawling, ambitious lists of tasks that users utterly failed to accomplish. In 2014, fully 41 percent of to-do items on IDoneThis were never … done.

Sound familiar? The tasks you so diligently enter into your fancy app or productivity method linger for days or weeks or months (or even longer—one colleague recently told me his to-do app has undone tasks from 2019). They stare back, unchecked, with baleful expressions, disappointed at how very un-crossed-off they are.

Another thing that might feel familiar: The things that IDoneThis users actually did accomplish, they did very quickly. Half of completed to-do items were done within a day of writing them down. These weren't longer-term, complex tasks. Ten percent were done within a minute. It was almost like people were writing them down just so they had something to check off. A nice psychological boost, to be sure, but it somewhat defeated the purpose of a to-do list.

More subtly, there was a big disjoint between the tasks people planned to do—i.e., wrote down on lists—and the tasks they actually did. Chen and Guzman found that when people reported their day's accomplishments (the initial point of IDoneThis, you'll recall), barely any of them had even appeared on a to-do list. The majority were tasks that users had just, well, remembered. Or maybe it was something that just popped into their head, or something a colleague had emailed them about.

The more Chen and Guzman pondered it, the more useless to-do lists seemed to be. They thought about getting rid of them. If to-do lists weren't helping people accomplish stuff, what was the point? But they worried that users would squawk.

Which they might have, if they'd hung around—the founders noticed a frustratingly high churn rate. A minority would mind-meld with IDoneThis, but most would, in time, drift away on a seemingly endless hunt for the best way to manage their to-dos. "It involved a lot of, not dilettantes, but people who wanted to try something new or were interested in a different system," Chen says.

People loved to write down their tasks. But that didn't seem to help with completing them. Chen and Guzman became gradually chagrined. After five years of working on IDoneThis, they sold the company to a private equity firm. "We felt like we'd exhausted what we knew to do," Guzman says. IDoneThis isn't gone; you can still use it today. But its creators couldn't shake the feeling that building the perfect system to effectively manage tasks was itself a task they couldn't accomplish.

I think I know why: It might be impossible.

Most common office tasks have well-settled software "solutions." If I asked you to write a document, you'd probably use Word or Google Docs. To make a presentation, you'd pull up PowerPoint or Keynote or Google Slides.

Not so for to-dos. There is no Way That Everyone Does It. It's a crazy Pokémon deck of options: Trello, Todoist, Gmail's tasks, Microsoft To Do, Remember the Milk, Things, OmniFocus, Any.do,
Evernote's Tasks, and Clear, to name just a few. And that doesn't even count the whackload of us using one big ol' Notepad file on our computers, or even plain old paper.

"There are *hundreds* of commercially available to-do lists right now," says my friend Mark Hurst. Fifteen years ago he created one of the first productivity apps, Good Todo. Today it has a relatively small user base, but in general, productivity apps are big business; Americans downloaded them 7.1 billion times last year.

Chen and Guzman's experience with trying to make one turns out to be common. The creators of personal to-do apps—or task management software, as it's sometimes called—generally agree that they haven't

cracked the nut. Every one of these apps attempts to handle the same kind of basic actions: Give people a way to write down tasks, like “Get milk” or “Finish the sales memo,” and offer tools to sort and prioritize those tasks. Ideally, that improves your productivity, which broadly is how many things you can actually get done in a given amount of time. It seems easy enough.

But when I talk to folks who use these apps, I see a strange inconclusiveness. A scant minority of us check off everything every day. An equally tiny minority simply Cannot Even and are curled in a fetal ball awaiting imminent firing. But most of us? We’re just sort of … meh. We bounce from app to app, never quite finding a home. “I’ll try that one. I’ll try that one. I’ll try that one. Maybe this will do the magic!” as Randy Shulman, editor and publisher of *Metro Weekly*, Washington, DC’s LGBTQ paper, tells me. Sure, we’re getting work done! But we always feel slightly out of control, haunted by the to-dos at work and home that we just aren’t nailing.

The question is, why? Not just why it’s so hard to make a to-do app that works, but why people often feel so distraught by their hunt for the perfect organizational system. I’ve written about software for years, and I can tell you that people often have surprisingly deep feelings about their apps. But rarely is a category of software linked to such vistas of despair.

In the 1920s, the German psychologist Kurt Lewin was dining in a restaurant and noticed something remarkable. As one version of the story goes, Lewin realized that the waiters were able to meticulously recall specific food orders—until they’d served the food and the customer was gone. After that, they couldn’t remember any of those details at all. Lewin’s student, a Soviet psychologist named Bluma Zeigarnik, became fascinated by this phenomenon. She started working on it in her lab. In a now classic set of experiments, she gave volunteers a series of tasks (assemble a cardboard box, make a figure out of clay, do some arithmetic). Then she’d interrupt them, checking to see what the volunteers actually remembered.

Zeigarnik found a quirk of the human mind: When a task is unfinished, we can’t seem to stop thinking about it. We perseverate. Psychologists still argue about why; possibly it’s a kind of constant refresh to keep whatever’s pending from vanishing from our short-term memory, like putting

something by the front door at night so you don't forget to take it with you the next morning.

Whatever the cause, today this is known as the Zeigarnik effect, and psychologists who study task management say it's part of why so many of us feel perpetually frazzled by the challenge of organizing work and life. When we face all that undone stuff—emails to write, calls to return, people to contact, friends to check in on, memos to draft, children to help—it's like being a waiter serving a hundred tables at once. If you've found yourself in bed at 2 am with your brain screaming at you about that thing you didn't do, that's a Zeigarnik moment.

A good to-do tool ought to ease the Zeigarnik effect. In 2011, psychologists E. J. Masicampo and Roy Baumeister showed that this does seem to be the case. They triggered the Zeigarnik effect in volunteers by giving them a task and not letting them complete it. It lingered in their minds and interfered with their ability to do other work. Then the psychologists allowed the subjects to write out a plan for how they'd get that outstanding task done, and, presto, it lessened the effect. Speccing out what you're going to do—getting it outside of your head—seems to help you stop perseverating.

And indeed, those who regularly write down their to-dos seem to possess a mind less jittery. Shamarukh Chowdhury, a PhD student in psychology at Carleton University, has found that people who create to-do lists are less likely to procrastinate than those who don't. More delightfully yet, a study by Baylor University psychologist Michael Scullin found that people who created a to-do list fell asleep nine minutes faster, on average, than those who didn't.

The creators of to-do apps all intuit the challenge of the Zeigarnik effect. They say that a key part of their apps is how frictionless they make it for us to input tasks. They've all worked to make this an instantaneous process: Open the app on your phone, shout at Siri or Alexa, or even email a new to-do item to your software.

Alas, this often makes things worse. Sure, the Zeigarnik effect is eased if you make a plan: I'll do this, then do this, then do this, and then I'm done.

One of the most famous productivity systems—David Allen's Getting Things Done—is ruthlessly focused on rigorous planning and editing of tasks. It can take hours, but once you've done that hard work, you can plow through the tasks, one after another, with the metronomicity of a Chrysler line robot.

The problem is that we too often don't really plan. Digital apps make it easy to add more tasks to the pile, and it feels good to get tasks out of our Zeigarnicized heads. So we do, frenetically.

"We call it snowballing," says Amir Salihefendić, who founded the app Todoist in 2007; it currently has 30 million users. "They keep postponing stuff. And then suddenly you have a hundred tasks that you need to do." Weeks or months later, your Todoist app is a teetering ziggurat of tasks, too painful even to behold. Omer Perchik, the creator of another app—Any.do—calls this problem "the List of Shame."

And then what do we do? You've probably done it: We panic, give up, and quit. We "declare to-do bankruptcy." We toss the list away in defeat and start fresh.

You can blame Zeigarnik again. The mere act of making a to-do list relieves so much itchy stress that it can, paradoxically, reduce the pressure to actually get stuff done. "People feel that when they put all their tasks somewhere, they've already done most of the work," Perchik says. But it's an illusion. The pile of work is still there.

More than a pile! If you feel adrift on a turbulent sea of unmanageable tasks, that might be because there is objectively more expected of us. By one estimate, work hours for those with college degrees went up about 7 percent between 1980 and 2016. Got a graduate degree? For you it went up more than 9 percent. And quite apart from one's paid toil, there's been an increase in social work—all the messaging and posts and social media garden-tending that the philosopher and technologist Ian Bogost calls "hyperemployment."

(We could snap the lens open even wider and have a fuller reckoning with capitalism. Focusing on our individual ability to tread water—with apps and

lists—can look like a bleak exercise in blaming the victim, when in reality the only solution is not better apps but non-hideous workloads, debt relief, and a saner landscape of civic care. Frankly, if you took "managing grotesquely useless and bloodsucking for-profit health insurance" off people's to-do lists, it would remove one remarkably stressful item, as my Canadian upbringing compels me to suggest. But I'm writing this particular article from within the belly of the whale, as it were.)

No matter whose fault it is, we take this stuff personally. American to-do behavior has a deeply puritan streak. Benjamin Franklin was among the first to pioneer to-do lists, creating a checklist of "virtues"—temperance! frugality! moderation!—that he intended to practice every day. That's what the information scientist Gilly Leshed and computer scientist and cultural theorist Phoebe Sengers, both at Cornell University, found when they talked to people about their to-do lists. "They abide by the norm of 'We need to be productive citizens of this world,'" Leshed tells me. Doing more is doing good.

To-do lists are, in the American imagination, a curiously moral type of software. Nobody opens Google Docs or PowerPoint thinking "This will make me a better person." But with to-do apps, that ambition is front and center. "Everyone thinks that, with this system, I'm going to be like the best parent, the best child, the best worker, the most organized, punctual friend," says Monique Mongeon, a product manager at the book-sales-tracking firm BookNet and a self-admitted serial organizational-app devotee. "When you start using something to organize your life, it's because you're hoping to improve it in some way. You're trying to solve something."

With to-do apps, we are attempting nothing less than to craft a superior version of ourselves. Perhaps it shouldn't be a surprise that when we fail, the moods run so black.

Programmers often describe software as being "opinionated." In the guise of helping us try to do things, productivity software recommends we do them in a particular way. A to-do app is offering an opinion about how we ought to organize our lives, which is, when you think about it, a kind of intense opinion for a piece of code to hold, right?

This is part of why we have such strong feelings about any given task-management tool. We either love it or hold it in bitter contempt.

Jesse Patel created the app Workflowy because he had ADHD and wanted a tool that worked as his mind required. In the late 2000s he was working as a head of business development, with "five different big-picture opportunity areas and, like, 30 different subprojects in each of those. It was just so overwhelming." He noticed that each work task tended to spawn tons of subtasks. But most software, he found, wasn't great at allowing for that Russian-nesting-doll quality. He wanted a "fractal" tool where every to-do could contain more little to-dos inside it.

So he taught himself to program and created Workflowy to function just so: When you open a new project, you write items that can spawn endless sub-items, all of which can be dragged around and reorganized. If things look too cluttered, you can collapse everything so you see only your top-level tasks. "It's a universe for your thoughts," Patel says.

It's a big universe—250,000 active users, like the construction site manager who told Patel that he made items for each room, with sub-items for anything the room needed. ("That room has, like, four missing bolts.") I heard from people who loved Workflowy; I also heard from people who thought the whole fractal thing was a dead end. Salihefendić's app Todoist once allowed levels upon levels of subtasks, but he got rid of them after noticing that only a fraction of people used them, and they were mostly just dorking around, organizing their subtasks instead of actually doing work.

Pick virtually any postulate about "the best way to get organized" and app designers will have diametrically opposing views. The app Things lets you put a due date on each task; Hurst, the founder of Good Todo, hissingly denounces due dates as a form of productivity self-harm that turns into a screenful of blinking red overdue alerts.

So the software is opinionated, as are its makers. But they're also weirdly humble. Most of the app builders I spoke with admitted that, for many who try their tool, it won't help. Maybe their app doesn't match the way that customer's mind works. Maybe the customer is a hot mess. Maybe their workload is unreasonable. Either way, the app creators are surprisingly

willing to admit defeat. April Ramm, who does customer support for OmniFocus, will sometimes recommend a rival app to a potential customer.

This stance is … kind of unusual in the world of software, yes? One rarely hears founders candidly admit that their tool probably won't fulfill its stated goal for many users, much less that it probably isn't specifically right for you, either.

For years, I had a very rudimentary to-do system. Using a piece of paper, or maybe a document on my PC, I'd list my main areas of work ("WIRED Column," "Household," and so on). Then I'd write out all my tasks under each heading. (Under "WIRED Column": "Call scientist about study.") Finally, I'd make a plan. I'd number all my subtasks. Typically I'd hopscotch from project to project: My number one task would be the fourth item under "Household," then number two was the seventh item under "WIRED Column," and so on. Finally, with my plan laid out, I could power through my list.

Or at least I'd try to. Sometimes my system would work for days or weeks, but eventually it'd balloon into a List of Shame, and I'd guiltily declare bankruptcy.

I often suspected the problem was that my system was visually confusing. I had to scan the page to figure out what my next item was. Wouldn't it be nice if, instead, I could click a button and my to-dos would arrange themselves in numerical order?

So I decided to make the app myself. I'm a hobbyist programmer, and I figured this spec was simple enough that even my hazy coding skills could pull it off.

One evening a year ago, I sat down and bashed out a prototype. The next day I started using it and found, to my delight, that it worked much as I'd hoped. I now had a numbered list I could sort and unsort quickly. I used it every day for months. Projects came and went; I filed stories and juggled tons of household errands. It felt lovely to have a tool designed for precisely the way my mind worked.

The thing is, it didn't improve my productivity. It certainly did not increase how much paid work I accomplished. I was still filing the same number of stories, and doing the same life chores, in the same amount of time. I still found myself getting piled up and spiraling into to-do bankruptcy.

Sure, I could visualize my tasks better. But that didn't move the needle on my efficiency. In fact, one day while working on the very story you're reading now, I found myself staring at a monstrous List of Shame in my app. I declared bankruptcy, and then I shakily pulled out a single piece of paper and reprioritized, writing down a small handful of things I could actually accomplish.

I still use my app, intermittently. But building it made me realize a grim fact about to-do software, which is that even the most bespoke, personalized version couldn't unfrazzle my mind. And after dozens of interviews with users and coders, talking to them about my failure—and theirs—I began to realize that a big part of our problem lies deeper than interfaces or list-making. It's in the nature of time itself, and our relationship to it.

If you ask people to accomplish a loony amount of work this week, they'll go, *No way. Can't be done*. But if you tell them they'll need to do that same bonkers amount in a single week one year from now? They'll think, *OK, sure, I could do that*.

Something about the future defeats our imaginative capacity. "Present self screws over future self," says Tim Pychyl, a psychologist at Carleton University who studies procrastination. He says that we regard our future self as a stranger, someone onto whose lap we can dump tons of work. On some weird level, we don't get that it'll be us doing it.

One of Pychyl's students recently tried a clever experimental trick to get people to procrastinate less. The student took undergraduates through a guided meditation exercise in which they envisioned themselves at the end of the term—meeting that future self. "Lo and behold," Pychyl says, those people "developed more empathy for their future self, and that was related to a decrease in procrastination." They realized that time wasn't infinite. Future them was no longer a stranger but someone to be protected. To get

us off our butts, it seems, we need to grapple with the finite nature of our time on Earth.

This is the black-metal nature of task management: Every single time you write down a task for yourself, you are deciding how to spend a few crucial moments of the most nonrenewable resource you possess: your life. Every to-do list is, ultimately, about death. ("Dost thou love life?" wrote Ben Franklin. "Then do not squander time, for that is the stuff life is made of.")

I began to suspect that this is the truly deep, arterial source of some of the emotions around to-do lists. The people who make to-do apps agreed with me. "What is this class of software supposed to do?" asks Patel, the creator of Workflowy, rhetorically. "It's supposed to answer the question 'What should I do right now in order to accomplish all of my life goals?' The most scarce resource many of us have is time."

Ryder Carroll, the creator of the Bullet Journal paper-based method for organizing your work, puts it in even more starkly existential terms. "Each task is an experience waiting to be born," he tells me. "When you look at your task list that way, it's like, this will become your future." (Or if you want the European literary-philosophical take, here's Umberto Eco: "We like lists because we don't want to die.")

No wonder we get so paralyzed! The stakes with PowerPoint really aren't that high.

Given that life is composed of time, a whole sector of the task-management philosophical magisteria argues that mere lists will always be inherently terrible. Just as Pychyl showed, we overload ourselves with more than we can accomplish and create Lists of Shame because we are terrible at grasping how little time we actually have. The only solution, this line of thinking goes, is to use an organizational system that is itself composed of time: a calendar.

Instead of putting tasks on a list, you do "time blocking," putting every task in your calendar as a chunk of work. That way you can immediately see when you're biting off more than you can chew. Cal Newport, a computer scientist at Georgetown University and guru of what he calls "deep work,"

is probably the staunchest advocate of time blocking. “I think it is pretty undeniable that time blocking, done well, is going to blow the list method out of the water,” Newport tells me. He says it makes you twice as productive as those suckers who rely on lists. Time blocking forces us to wrestle directly with the angel of death. It’s natural that we then screw around less.

Several researchers who study tasks told me they generally agreed that time blocking avoids the problems of to-do apps and lists. One to-do app, Reclaim, actually has an AI that estimates how long each task will take and finds a slot in your calendar. (The secret point is to show you there isn’t much room in there.) “We’ll not only tell you when tasks are overdue, we’ll tell you that tasks are *going* to be overdue,” says Patrick Lightbody, Reclaim’s cofounder.

Though, as you might expect by this point, other productivity thinkers are equally vehement that calendars alone won’t save you. You also have to develop a Jedi-like ability to say no to your own craving to do more, more, more. Salihefendić says the people who are “really into” Todoist—and most productive—are fanatical about completing more tasks than they add.

In this vein, a whole bench of task-management philosophers believe that the best interface isn’t digital at all—it’s paper.

Paper forces you to repetitively rewrite tasks, as when, say, you transfer all last week’s undone to-dos to this week’s list, or when you erase and rewrite calendar events. That’s what I do when the productivity software I wrote for myself fails me. “Making that choice over and over again,” Carroll tells me, “is the first opportunity where you’re like, ‘Why am I doing this?’” The inconvenience can be clarifying. Making a list on a sheet of paper is an unusually rich metaphor for life: It takes effort, and the space fills up more quickly than you expect.

The usefulness of paper here cuts to the real heart of what makes to-do management such a grim problem. Apps, lists, and calendars can help us put our priorities in order, sure. But only we can figure out what those goals are. And setting limits on what we hope to do is philosophically painful. Every to-do list is a midlife crisis of unfulfilled promise. Winnowing away

things you'll never do in a weekly review is crucial, yet we dread it for what it says about the boundaries of existence. Our fragile psyches find it easier to build up a list of shame, freak out, and flee.

This is what makes to-do software unique. The majority of tools we use in our jobs are about communicating with someone else. All that messaging, all those Google docs, all that email—it's about talking to other people, documenting things for them, trying to persuade them. But a to-do list is, ultimately, nothing more or less than an attempt to persuade yourself.

Let us know what you think about this article. Submit a letter to the editor at mail@wired.com.

By Jason Parham

Backchannel
07.22.2021 08:00 AM

A People's History of Black Twitter, Part II

No longer just an online movement, Black Twitter takes to the streets—and finds its voice.
Illustration: Aaron Marin

| Section menu | Main menu |

By Jason Parham

Backchannel
07.15.2021 08:00 AM

A People's History of Black Twitter, Part I

From #UKnowUrBlackWhen to #BlackLivesMatter, how a loose online network became a pop culture juggernaut, an engine of social justice, and a lens into the future.
Illustration: Aaron Marin

Near the end of 2009, during the twilight months of a decade that saw the first Black man elected to the US presidency, Ashley Weatherspoon was chasing virality on a young app called Twitter. As the personal assistant for the singer Adrienne Bailon, a former member of the pop groups 3LW and the Cheetah Girls, Weatherspoon often worked on social media strategy. For weeks, she and Bailon had been testing out hashtags on both their feeds to see what would connect with fans. A mild success came with variations on #UKnowUrBoyfriendsCheatingWhen. Later, on a car ride around Manhattan, they began playing with #UKnowUrFromNewYorkWhen. "We started going ham on it," Weatherspoon told me when we spoke over the phone in June. As the two women were laughing and joking, an even better idea popped into Weatherspoon's head. "Then I said, oh, 'You know you're Black when …'"

This article appears in the September 2021 issue. Subscribe to WIRED.

Illustration: Aaron Marin

It was the first Sunday in September, at exactly 4:25 pm, when Weatherspoon logged on to Twitter and wrote, "#uknowurblackwhen u cancel plans when its raining." The hashtag spread like wildfire. Within two hours, 1.2 percent of all Twitter correspondence revolved around Weatherspoon's hashtag, as Black users riffed on everything from car rims to tall tees. It was the viral hit she was after—and confirmation of a rich fabric being threaded together across the platform. Here, in all its melanated glory, was Black Twitter.

More than a decade later, Black Twitter has become the most dynamic subset not only of Twitter but of the wider social internet. Capable of creating, shaping, and remixing popular culture at light speed, it remains the incubator of nearly every meme (Crying Jordan, This you?), hashtag (#IfTheyGunnedMeDown, #OscarsSoWhite, #YouOKSis), and social justice cause (Me Too, Black Lives Matter) worth knowing about. It is both news and analysis, call and response, judge and jury—a comedy showcase, therapy session, and family cookout all in one. Black Twitter is a multiverse, simultaneously an archive and an all-seeing lens into the future. As Weatherspoon puts it: “Our experience is universal. Our experience is big. Our experience is relevant.”

Though Twitter launched exactly 15 years ago today, with the goal of changing how—and how quickly—people communicate online, the ingenious use of the platform by Black users can be traced, in a way, much further back in time. In 1970, when the computer revolution was in its infancy, Amiri Baraka, the founder of the Black Arts Movement, published an essay called “Technology & Ethos.” “How do you communicate with the great masses of Black people?” he asked. “What is our spirit, what will it project? What machines will it produce? What will they achieve?”

For Black users today, Twitter is Baraka’s prophetic machine: voice and community, power and empowerment. To use his words, it has become a space “to imagine—to think—to construct—to energize!!!” What follows is the first official chronicling of how it all came fantastically together. Like all histories, it is incomplete. But it is a beginning. An outline. Think of it as a kind of record of Blackness—how it moves and thrives online, how it creates, how it communes—told through the eyes of those who lived it.

Laurence Scott

Ideas
07.14.2021 09:00 AM

Is Social Media Making Us … Better People?

One painful interaction at a time, we're mastering the gateway virtue of the networked world: tact.
Illustration: Sam Whitney

I was nosing around Facebook not long ago, doing the opposite of minding my own business, when I came to a stranger's post, visible via an out-of-touch university friend. It began with the word "Warning." My disinhibited scrolling self reacts to such admonitions like teens in a movie react to "DANGER" signs on a rusty chain-link fence. I flung down my bike, turned my baseball cap backward, and into the abandoned mine I went.

"Warning," the stranger had written. "This post could be a trigger for the trying to conceive/miscarriage community." I belong to neither community, and as I clicked to read the whole story I felt an uneasy pulse of social-media sympathy—part goodness, part gossip.

But at the bottom of the mine shaft, it turned out, was a surprise party with cake and balloons. My stranger was having a baby, after much difficulty. I rearranged my condolences face into my congratulations face, although both were really the same scroller's face, simultaneously avid and blank. I had been wrong-footed, and at a party no one had invited me to.

I've been keeping an eye on online warnings for a while. I even check the little red flags that Netflix puts at the entrance to every show. ("Rude behavior" is my favorite.) The stranger's pregnancy announcement was the

first time I had seen a warning against someone else's happy ending. On social media, we inevitably barge into other people's days. We set off fireworks at funerals and ask funeral-goers to like our fireworks. But the stranger's post was fully alert to how we live today in each other's pockets and, by extension, in each other's faces. It struck me as supremely, unusually tactful.

I'm reminded of an old story Betty White tells about her late friend Grant Tinker, who visited her one afternoon in 1981, after he heard that her husband had died. Tinker had just come from a meeting in which he learned that he was to be the new chairman and CEO of NBC. White recalls how he didn't mention this impressive, life-altering change once during the visit. "I've never forgotten it," White says. "That's a classy friend."

In person, we still know how to be classy friends. But class is tricky on social media. No one can be expected to read the room when the room is planet-sized. So, as a proxy for in-person classiness, we have warnings and disclaimers. We lean heavily on conceding sentences: "Of course …" Transient complaints come appended with acknowledgements of one's general prosperity. A friend confessed to me, "Sometimes it feels like I'm caveating myself out of existence."

Even algorithms are beginning to recognize the importance of tact. My online supermarket recently asked me, a 40-something orphan, if I'd like to stop receiving emails about Mother's Day deals. Earlier this year, Twitter rolled out a feature that encourages people to rethink a potentially harmful or insulting reply before they send it. These "prompts," as the company calls them, rely on a machine to parse the text, so they include the option for feedback: "Did we get this wrong?"

"Did I get this wrong?" could be an automated banner at the bottom of everything we post. For all the charges of egotism that get leveled at the so-called selfie generation, the dominant Freudian element in the digital age is arguably the superego—that disciplining force in each of us that modulates our behavior in accordance with social norms. Our superego is desperate to get things right. The Twitter prompts are an outsourcing of the superego, the little warning voice in our heads externalized as a piece of code.

In France, the tax laws have a special provision for people who enjoy lavish lifestyles but don't contribute their fair share to the state. These people may pay extra for possessions considered *ostentatoire*—the purebred racehorse (around $5,450), the private plane ($82 per horsepower), and so on.

In the online world, ostentation is a protean thing. Contemporary status symbols aren't just the Ferrari surging to a halt at traffic lights or the designer watch glinting in a fashionable hotel bar. They are inward moments projected outward—a comfortable home office, parent-child cuteness, leisure activities. And there's often a tax to pay on broadcasting the good times. People inquire on Twitter about vaccination rules for foreign travel and are charged with selfishness for thinking of a holiday at a time like this. On my neighborhood's buy-and-sell Facebook page, an unsuspecting poster is guilt-tripped for offering 50 percent off his old designer jeans, because who spends that much on secondhand denim? And if you happen to get away with an irresistible bit of pleasure-sharing—a nice view, an easy morning of sunshine—one of the best outcomes is a loyal pal's "Enjoy!" It's the "Got got your back, but don't get greedy" of congratulations.

Is it ostentatious to be happy? To be pregnant? To have living parents? To sit down to a nice meal? The past year may have made me more sensitive to these questions, because the pandemic brought with it an opportunistic infection of tactlessness. Ellen DeGeneres notoriously compared her mansion quarantine to "being in jail." British celebrities admitted in bashful tones that they were very lucky during lockdown, you see, because they have a garden. People flaunted their sparkling new antibodies with vaccine selfies, while their friends were still trying to book an appointment. (This, at least, hits the sweet spot between vanity and public service announcement.)

Some will say that we should stop sharing life's milestones and comforts with online strangers. Others will say that people have the right to mark these events and display their privileges however they want. The debate whirls around and around, a danse macabre growing bleaker and bonier with each turn. It's more interesting to think about the type of culture we'll continue to build out of social media's bizarre architecture. With every warning or disclaimer that we attach to our happy bulletins, we're

imagining the responses of others. These caveated posts walk a tantalizing line between vanity and empathy, and it may be that the empathy ultimately wins out.

I have argued before that tact is a vital attribute of life in a networked world, a gateway virtue. Will it lead us to a more sophisticated ethics? Each round of the cycle in which social media catches us—the urge to share, the stings of guilt, and the clumsy disclaimers—surely makes us feel more keenly the problem of personal joy in an unequal world. Will having to swallow, day after day, the bad taste coded into this cycle prompt us to fight harder for more good times for all? There will always be proud parents living in intimate digital community with the unhappily childless, and there'll always be orphans on Mother's Day, but that still leaves plenty of more solvable inequities. To the camel's back of wealth gaps and uneven life outcomes we might add the straw of online embarrassment. What is Utopia but a place where you can brag in peace by day and sleep easier at night?

Jason Kehe

Culture
07.07.2021 07:00 AM

The Futuristic Stink of Amazon's Science Fiction

For years, the megacorporation has churned out sci-fi—*Electric Dreams*, *Upload*, *Solos*—that ranges from obnoxious to just plain noxious.
With *Solos*, Amazon stoops to a condescending science fiction that's *just like us*, farts and all.Photograph: Jason LaVeris/Amazon Studios

Farts linger, far into the future. So suggests *Solos*, the latest sci-fi show on Amazon Prime. Even though its characters deal with everything from time travel to superbabies to memory theft, they still get gassy. No fewer than three times, Peg, a space-bound septuagenarian played by Helen Mirren, talks about her old-lady toots. (All hail Queen Elizabeth Number, ahem, Two.) Elsewhere, Anthony Mackie's Tom describes, to a cloned version of himself, his wife's code-red stink bombs. Twice! Actually, make it thrice. Thieving the selfsame memory in the finale, the great Morgan Freeman rehashes the stench.

That *Solos* was made during a global pandemic, a time of endless sitting with ourselves and our smells, makes a certain olfactory sense. To watch such on-the-nose theatrics is to feel, if not seen, then sniffed. But as any gastroenterologist will tell you, excess gas usually points to a deeper issue, more chronic in nature. To diagnose it, then—this diegetic dyspepsia—a comprehensive examination of the patient must be performed.

Amazon has shat out science-fiction programming for years, and it ranges, on the smell-o-meter, from the merely obnoxious to the just plain noxious—a flatulence that fluctuates. Early on, the company mostly Philip K. Dick'd

around, first with an adaptation of *Man in the High Castle* and then with *Electric Dreams*, an anthology series based on that author's short stories. The former collapsed in due course, and the latter was never more than off-brand, harder-trying *Black Mirror*, but at least neither strove to speak to our bowels.

> *Throughout the week, WIRED is publishing a series of essays about the current state of streaming services. Read about Netflix losing its cool here.*

With *Solos*, Amazon stoops to a condescending science fiction that's *just like us*, farts and all. As in *Electric Dreams*, each episode is self-contained, but the show squanders any advantage that format has—as a playground for ideas—by focusing on the people. On their so-called "humanity," as David Weil puts it. He's the creator of *Solos*, and what he's creating, he says, is "human connection." Never mind that, to establish it, he resorts to awkward world-building, stagey melodramatics, and characters who are, in every way, full of shit.

Apologies for the potty mouth, but the fault lies with Amazon, whose science fiction practically overflows with bodily discharge. Enjoy the animated vomit, in *Undone*; in *Upload*, the dancing streams of computer-generated pee. Even the studio's most artistic attempt at an adult drama, *Tales From the Loop*, occasionally finds its head in the toilet. A sort of *Our Town* of tomorrow that shifts its focus from one sad human (or robot) to another, the show truly plumbs the depths. In the ickiest scene, an older man goes number one, misses his target, and has to clean up the mess. The camera cuts to the stray yellow droplets and everything. Poor Jonathan Pryce, an actor of distinction, potential pissed away. When his character drops dead a while later, it seems less of health complications than of shame.

Shame, too, is felt by the audience. As these fictional future humans connect with us by way of that most universal of processes, expulsion, our own stomachs begin to bubble and ache. Is that all we are? Grotty, leaky fleshbags, mucking up clean, utopian futures? To Amazon, no shit. Humans have urges and needs, and Amazon exists to fulfill them. In fact, if you keep watching, it'll even show you how.

If there's anything Amazon likes more in its science fiction than reminding humans of their disgusting humanity, it's depictions of its megacorporate self. Sometimes, it's right there in the title. In *Tales From the Loop*, the titular Loop is a mysterious organization whose societal contributions shape the course of daily life; the startup Upload, in the show of the same name, seeks to trap paying customers in a simulated existence for all eternity. Elsewhere, the institution interpenetrates reality, everywhere and nowhere at once: a Matrix-like simulation run by rich people in *Bliss*, the AI company in episode 4 of *Solos*. (Uzo Aduba's in that one, the most shamelessly Covid-centric.) In *The Boys*, the faux-edgy superhero shockfest that blows up brains in place of having one, it's called Vought, an ultra-evil Pharma giant with fingers in every global conflict. Then there's Autofac, from episode 2 of *Electric Dreams*.

Behold the truest stand-in for Amazon. Autofac is a drone-delivery corporation, run entirely by machines, that populates the world with fake humans once the real ones die out, just so they have more customers to send products to. It'd be kind of a funny joke, if Autofac didn't then turn those fake humans into sick slaves. Experiments with drones, automated factories and grocery stores, AIs in every home: These are Amazon's real-world efforts as well as the subject of the "fictional" stories it produces, schemes of subjugation and mass dehumanization infinitely mirroring each other into a collapsing oblivion.

So to recap: There's this megacorporation. It's science-fictionalizing our everyday existence. At the same time, it's selling us a science fiction of "human connection" premised on the inevitability of just such a dehumanized/megacorporatized future *that's also* designed to either obscure or make light of—farts!—that very fact. Gross.

It'll only get messier. At a certain point, the other big tech companies will have to make meta-science-fictional moves of their own. So you'll see blockbusters brought to you by Google, utopian series developed by Facebook. Apple TV already has its own burgeoning sci-fi empire, with three shows and counting, and Microsoft has sponsored a sci-fi anthology based on research from its own labs. "Science fiction prototyping," the

futurists call it. Why merely create the future, when you can also tell people how to live, breathe, and go to the bathroom in it?

And none of these companies will ever claim influence over the creators they've commissioned for this purpose, of course. *Full creative license,* they'll say. *Tell whatever stories you want.* Don't fall for it. Whether it's utopias or dystopias, art or trash, science fiction should never be underwritten by the institutions invested in making it science fact. Especially when so much original sci-fi exists outside the corridors of corporate power, even if it's accessible only via enemy territory, on platforms like … Amazon Prime. Its catalog of rentables is, truth be told, unparalleled. Costs more money to tap into, yes. And the best stuff is hard to find amid the rows and rows of agitprop. But you know who's there to help? Real people.

So the next time you scroll over to *Solos*, or *Upload*, or *The Tomorrow War* on Prime—a science fiction in which you accept your lot as powerless in the face of global domination—try this. Don't hit Play, but scroll down instead. There, you'll find a category called "Customers who watched this item also watched." It's the last, best place on the site for human-generated recommendations. The more to the right you scroll, the weirder the stuff gets. Funky, forgotten space operas. Boisterous '80s fantasy. Farther and farther you'll travel from the control of Amazon, its tentacles, its overreach. You'll be staging a rebellion from within, the way science fiction always intended, and you'll notice a change. Your stomach will settle, the gas will pass, and you'll breathe fresh air again.

Geoff Manaugh Nicola Twilley

Backchannel
07.06.2021 06:00 AM

When the Next Animal Plague Hits, Can This Lab Stop It?

A new federal facility in Kansas will house the deadliest agricultural pathogens in the world—and researchers working tirelessly to contain them.
Illustration: Simon Prades

There were 16 pathogens on the terrorist's list, written in tall, spiky scribbles that slanted across the page. Next to each one was the incubation period, route of transmission, and expected mortality. Pneumonic plague, contracted when the bacterium responsible for bubonic plague gets into the lungs, was at the top of the list. Left untreated, the disease kills everyone it infects. Farther down were some names from pandemics past—cholera, anthrax. But what struck General Richard B. Myers was something else: Most of the pathogens didn't affect humans at all. Stem rust, rice blast, foot-and-mouth disease, avian flu, hog cholera. These were biological weapons intended to attack the global food system.

Myers was the chairman of the Joint Chiefs of Staff in 2002, when Navy SEALS found the list in an underground complex in eastern Afghanistan. US intelligence services already suspected that al Qaeda was interested in biological weapons, but this added weight to the idea that, as Myers put it, "they were indeed going about it." Later that year, he said, another intelligence source reported that a group of al Qaeda members had ended up in the mountains of northeastern Iraq, where they were testing various pathogens on dogs and goats.

Photograph: Djeneba Aduayom

“To my knowledge, they’ve never gotten to the point where it was of use for them in the battlefield context,” Myers told us. “But since al Qaeda, as we found out with the World Trade Center in New York City, never quite give up on an idea, it’s not something you can just dismiss.” In fact, he said, “I think there’s other, probably classified information that would tell you that’s *not* the case—but I’m not privy to all that or privy to talk about it.”

Even if al Qaeda moved on, other groups appear to have picked up the bioterror baton: In 2014 a dusty Dell laptop retrieved from an ISIS hideout in northern Syria—the “laptop of doom,” as it was later dubbed by *Foreign Policy*—was found to contain detailed instructions for producing and dispersing bubonic plague using infected animals.

For a would-be bioterrorist, Myers says, farms and feedlots are a “soft target.” They aren’t well secured, and effective pathogens are not particularly difficult to manufacture and deploy. Foot-and-mouth disease, a virus named after the large, swollen blisters it causes on the tongues, mouths, and feet of cloven-hoofed animals, is so contagious that the discovery of one case in a herd usually triggers mass culls. “All you do is put a handkerchief under the nose of a diseased animal in Afghanistan, put it in a ziplock bag, come to the US, and drop it in a feed yard in Dodge City,” Senator Pat Roberts told a local NPR affiliate in 2006. “Bingo!”

Farming is also highly concentrated: Three states supply three-quarters of the vegetables in the US, and 2 percent of feedlots supply three-quarters of the country’s beef. What’s more, both crops and livestock are genetically uniform. A quarter of the genetic material in America’s entire Holstein herd comes from just five bulls. (One of them, Pawnee Farm Arlinda Chief, contributed nearly 14 percent.) Monocultures like this are exceptionally vulnerable to disease. They are an all-you-can-eat buffet for pests and pathogens. With or without the assistance of a studious terrorist, the world is just as susceptible to an agricultural pandemic as it was to Covid-19—and, if anything, less prepared to fight it.

To diagnose deadly diseases and develop treatments and vaccines for them, researchers need to work with them in a lab, but very few facilities are

secure enough. Foot-and-mouth disease, in particular, is so easily transmitted that the live virus cannot be brought to the US mainland without written permission from the secretary of agriculture. The only place researchers can work with it is Plum Island Animal Disease Center, built on a low-lying islet 8 miles off the Connecticut coast. ("Sounds charming," as Hannibal Lecter, the homicidal antihero in *The Silence of the Lambs*, murmured when offered the possibility of a vacation there.)

Plum Island has the advantage of a natural cordon sanitaire—the ocean. But it opened in 1954, and its laboratories are outdated. They aren't certified to handle pathogens that need the highest level of containment, Biosafety Level 4. According to the Centers for Disease Control and Prevention, BSL-4 microbes are "dangerous and exotic, posing a high risk of aerosol-transmitted infections." Typically, they can infect both animals and humans and have no known treatment or vaccine. Ebola is one. So are the more recently emerged Nipah and Hendra viruses. Only three facilities in the world are currently equipped to accommodate large animals at this level. If there were an outbreak of foot-and-mouth disease in the US tomorrow, researchers here would have to beg their Canadian, Australian, or German counterparts for lab space.

That will change next year, when the Department of Homeland Security opens its new $1.25 billion lab, the National Bio and Agro-Defense Facility. Located in Manhattan, Kansas, a college town in America's agricultural heartland, the NBAF will follow the 21st-century trend in infectious disease control: Rather than relying on a Plum Island–style geographic barrier for security, it will use extraordinary engineering controls. Here, amid the corn and cattle, researchers will work to protect the food supply from a coming plague.

We visited the NBAF's 50-acre construction site on a muggy spring day in 2019. One of the late-afternoon thunderstorms for which the Great Plains are famous had just swept through, sending sheets of rain down across the Gothic castles and limestone halls of the Kansas State University campus. The site was selected after a three-year national competition, in part because of Manhattan's existing expertise: It is also home to the Biosecurity

Research Institute, a BSL-3 lab completed in 2007. Senator Tom Daschle has hyped this area as "the Silicon Valley of biodefense."

Still, you can see why critics questioned the wisdom of situating a lab designed to work with the world's most devastating large-animal diseases in a state where ruminants outnumber people by more than two to one. Trace a 200-mile radius around Manhattan and it will include one in 10 of America's cows. If foot-and-mouth were accidentally released here, estimates show it could easily infect herds in surrounding states—nearly half the nation's cattle—and cause as much as $50 billion in damage.

And then there's the weather. After Manhattan won the bid for the NBAF, the Texas Biological and Agro-Defense Consortium, whose preferred site in San Antonio finished runner-up, immediately filed suit with a 50-page list of complaints. In claim 103, the consortium noted that anyone familiar with *The Wizard of Oz* should be aware of Kansas' reputation for dangerous tornadoes. (The suit was dismissed without prejudice a few months later.) According to one estimate, from a report prepared in 2010 for the National Academy of Sciences, the probability of a pathogen escaping over the NBAF's 50-year projected life span is an astonishing 70 percent. In response to these concerns, the Department of Homeland Security "hardened" the design to resist a Category 5 tornado, the most intense possible, then commissioned another risk assessment, which rated the likelihood of an accidental pathogen escape at 0.1 percent.

From our view onto the enormous construction site, this hardening mostly seemed to take the form of an awful lot of concrete. "Enough to build a sidewalk from here to Oklahoma City," said Ron Trewyn, a former cancer researcher who led the effort to get the NBAF built. "Sixty thousand cubic yards, I believe, poured over two and a half years." (It's also a high-performance variety, with a built-in controlled chemical reaction that causes the concrete to expand after setting, leaving no room for cracks.) The site itself was off-limits, but the project's technical director, Eugene Cole, agreed to have coffee with us in a nearby hotel lobby.

Cole, a soft-spoken Southerner, came to the NBAF after leading the design of Building 18, the CDC's new lab for emerging infectious diseases. His passion for animal welfare initially led him to veterinary school, but then he

realized he didn't want to smell like formaldehyde for the rest of his life, so he got into architecture. Now he is something of a star in the small world of bio-containment design. His work on Building 18 received several awards and a special mention in *R&D Magazine*'s Lab of the Year feature. The NBAF, much to his delight, will receive LEED certification, something many in the field considered impossible. (Labs tend to use at least four times more energy per square foot than offices.)

Cole cares about technical specifications—ventilation, cooling, sanitation—but he spends almost as much time thinking about natural light and areas for socializing. "How do I make the space appealing to the best researchers, when it's more or less a tornado bunker?" he said. "You won't find many BSL-4 environments that have an outside window."

Nonetheless, containment is the NBAF's most important function. Cole told us that the windows he has managed to smuggle in are blast- and impact-resistant, with a metal grille on the outside to meet Nuclear Regulatory Commission guidelines for high-wind events. "But in a tornado, it's the pressures that are difficult," he said. BSL-4 rooms are built using the box-inside-a-box principle, in which a negative-pressure lab is surrounded by a positive-pressure buffer, ensuring that air is always sucked inward, deeper into the building, rather than escaping out into the atmosphere. If a slow—moving storm caused a sudden drop in external air pressure, that flow could reverse. But Cole assured us that the NBAF will have barometric systems that can quickly recalibrate.

A BSL-4 laboratory, as Cole described it, is something like a layer cake. At the bottom is an "effluent-handling" floor, then the laboratory floor where all the germs are studied; stacked above that are a filtration level, a mechanical level, and an exhaust-venting "penthouse." All the pipes and wires and ducts are in their own compartmentalized, containable spaces—but they also have to be accessible for regularly scheduled tests and preventive maintenance. This, Cole pointed out, will actually be the largest line item on the facility's annual budget. "Many times, from a design perspective, the focus is all on the science," he said. "That's a huge mistake." Cole and his colleagues have carefully designed pathways through the spaghetti of piping to make access as quick and easy as

possible. The building has a computerized maintenance management system that all but tells the operating staff what it needs.

The NBAF is both bigger and better than its neighbor, the Biosecurity Research Institute. One area of improvement is carcass disposal. The older facility has a tissue digester that dissolves animals in an alkaline soup, reducing bones and teeth to crumbly calcium-phosphate "shadows," stripped of all organic matter. These solids are dried and incinerated. The remaining liquid, a soapy solution of amino acids and peptides, is sterile enough to be released into the municipal sewer system. The only issue is that it is still so full of organic molecules that it can easily overwhelm the capacity of the wastewater treatment plant. So, before every release, Cole explained, the team at the older facility "has to call the city to see if they're ready to take that slug." This usually occurs late at night—the corpses of liquefied animals passing through Manhattan's sewers while residents sleep, blissfully unaware, in their homes above.

At the new facility, Cole said, "our carcass material will never go down the drain." Instead, the NBAF has two thermal tissue autoclaves—"basically a big pressure cooker with a paddle in it," he explained. The autoclaves produce a kind of tissue smoothie that is sterile enough to use as fertilizer. Out of an abundance of caution, it will be put into 55-gallon drums and incinerated instead. "There are just redundancies on top of redundancies," Cole told us.

Cole is most proud of the flooring. Vinyl and tile work well for human foot traffic, but cows, sheep, and pigs have special requirements. Cole didn't want anything that would chip, peel, or crack. He settled on a compound that binds to the concrete subfloor at a molecular level, forming a water—resistant layer that can be efficiently decontaminated again and again. He knew he needed to mix in some grit to keep the animals from slipping, but not so much that it would tear up their hooves and cause discomfort. He consulted the literature and discovered that no one had ever taken the time to scientifically determine what the right amount of grit should be. So he did the research himself, in his basement.

First, Cole acquired a machine used to test the slip resistance of shoes on carpet. Then he persuaded the necropsy lab at Kansas State's veterinary

school to give him some hooves. “They’re like your fingernail, just big,” he explained. Cole attached the hooves to the slip tester’s mechanical foot, then set it in motion. As it stepped in place, he measured the friction and durability of the floor material at varying grit levels, as well as any hoof abrasion. “Yeah, my wife was not happy,” he said, recalling the parade of disembodied hooves marching endlessly toward nowhere. But the outcome, he pointed out, is perfect flooring—cleanable, easy on the animals’ feet, and completely nonslip. He has published his findings and hopes to have them enshrined as a new international standard.

“We all suffer from OCD,” Cole said, with a slightly embarrassed laugh. “I mean, to be in containment design, you do have to be worried about the details.”

The first permanent quarantine facility in the world was a brick plague hospital, or *lazaretto*, built on an island in the Venetian lagoon in 1425 to protect the city from the Black Death. Since then, the architecture of containment has failed repeatedly. Often, the escapes have been intentional, if not necessarily malicious. In the 1780s, a guard at the lazaretto in Split, Croatia, smuggled home a beautiful white scarf as a gift for his wife, inadvertently releasing bubonic-plague-infected fleas that killed one in 10 of the city’s residents. In the 1830s, a bored Boston ship’s pilot took advantage of the temporarily frozen harbor to walk from Quarantine Island to shore, triggering a cholera panic. Other times, pathogens have simply hitchhiked across boundaries with the help of unwitting human carriers; wheat stripe rust, a fungal disease that reduces harvests by up to 40 percent, is thought to have been brought to Australia on an international traveler’s trouser cuffs.

“Everyone will tell you, it always comes down to the people,” Trewyn said. They have been the Achilles’ heel of lazarettos throughout history. Of course, the NBAF is carefully engineered to lower the risk of human error. On the lab floor, people, animals, and stuff can move in only one direction, from clean to contaminated, “cold” to “hot.” Everything—including the animals, in carcass form—exits through a fumigation vestibule, a chemical dunk tank, or an autoclave, with the sole exception of people, who have to take two chemical showers and one regular shower before they can leave.

(At Plum Island, researchers often complained that the showers had only a curtain separating them from the adjacent corridor. At the NBAF, decon happens in a personal air lock. “Times have changed,” Cole said.)

The NBAF will implement continuous training, detailed record-keeping requirements, and a buddy system, so that staff can inspect one another for trace contamination after showering out. Everyone who works there will have to pass background screening and security checks. The building has concentric rings of facial-recognition and PIN-code checkpoints. The precautions even extend into researchers’ private lives: They will not be allowed to keep chickens, on the off chance they bring home a pathogen that jumps species. Even so, the National Research Council has complained that Homeland Security’s risk assessment—a 0.1 chance of a pathogen escaping—was “based on overly optimistic and unsupported estimates of human error rates.” (The assessment didn’t even attempt to quantify the likelihood of malicious or deliberate acts.)

Certainly, Plum Island has had a handful of documented close calls, as have other such facilities around the world. But Trewyn believes that the risk of accidental pathogen escape, in all its uncertainty, is worth taking. These diseases will arrive in the United States anyway, he says, and cause equally incalculable damage.

Trewyn pointed to the very different courses taken by two outbreaks of the same disease in the UK—one caused by a lab leak, the other by an inadvertent introduction. In 2007, foot-and-mouth disease virus slipped out of the Pirbright Institute, an animal—disease research facility, into the Surrey countryside, with the help of heavy rains and poorly maintained pipework. It was quickly caught and contained. Within hours of the first case, the government halted all movement of livestock in the entire country; within two months, the virus was mopped up, having infected just eight farms. The system worked, Trewyn concluded, especially when compared with a very different incident six years earlier.

That outbreak began in Northumberland in 2001, when contaminated pork that had likely been illegally imported from Asia was fed to a herd of pigs, triggering a national epidemic of foot-and-mouth disease. Soldiers were brought in to help slaughter the affected herds. Six million sheep, pigs, and

cattle died. As footage spread of the British countryside alight with animal pyres and bulldozers shoveling rigid carcasses into huge piles for incineration, tourism dropped 10 percent. By the time the outbreak was finished, at least 60 farmers had taken their own lives.

Calculating the cost of such an outbreak is almost as tricky as assessing its risk. It's simple enough to put a price on slaughtered animals and their disposal, but the ripple effects are harder to quantify. Farmers with healthy animals can't sell them at market; governments impose restrictions on export and import. Although animal diseases are unlikely to cause famine, disruptions to the national meat supply can cause prices to skyrocket, leading to deeply discontented consumers. (In 1902, when the price of kosher beef jumped from 12 cents to 18 cents a pound, the women of New York's Lower East Side rioted, breaking windows and throwing steaks.) As Myers told the Senate Agriculture Committee in 2017, "Hungry people are not happy people."

One top priority for NBAF researchers will be to develop a treatment or vaccine for African swine fever, the deadliest outbreak most Americans have never heard of. This highly contagious hemorrhagic disease does not infect humans, but in the past couple of years it has killed a quarter of the world's pigs. The symptoms are indistinguishable from those of hog cholera, item No. 10 on the al Qaeda bioweapon wish list: vomiting, diarrhea, fever, and a distinctive blue—purple discoloration of the snout, tail, and ears, typically followed swiftly by death.

African swine fever hasn't yet been detected in the United States. As the US Department of Agriculture's web page on the disease says, "We want to keep it that way." But in China, the virus has claimed at least 40 percent of the country's pig population, and the price of pork more than doubled from 2018 to 2019—a serious problem for a commodity whose cost has roughly the same political significance in China as gasoline prices do in the United States.

According to a 2019 exposé by Xinhua, the state news agency, criminal gangs, referred to as "swine stir-fry syndicates," have taken advantage of the outbreak. In some cases, they have used drones to drop infected feed onto farms that had yet to be touched by the disease, then swooped in with

an offer to buy the animals at a steep discount, supposedly to cull them. In reality, though, they resell the herd in another province—despite a national ban on pork and pig movement. The report claimed that one gang had smuggled as many as 4,000 pigs between provinces in a single day, bribing inspectors and faking quarantine certificates to get the animals across checkpoints.

In response, one pig farmer in the country's northeast installed an anti-drone device that unfortunately also jammed the navigation systems of planes heading to a nearby airport. China's largest pig producer has recently invested in 12-story bio-secure piggeries. Each floor has its own air—handling and disinfection system to limit the spread of disease, while staff live in dedicated housing onsite, spending two days in quarantine every time they enter the facility, unable to leave until their day off. One farmer in Hunan Province told a *New York Times* reporter that pigs have become so rare in his region that when he transports his animals, people gather around the truck to stare. "It's like they were seeing a panda," he said.

Fifty countries have now confirmed the presence of African swine fever in their herds, as far afield as the Philippines and Poland. Denmark, a porcine powerhouse, has begun construction of a wild-boar-proof fence along the length of its border with Germany to keep the virus out. In Australia, sniffer dogs have been stationed at airports, and mail is screened in order to catch pork being smuggled into the country; the pathogen survives for months on surfaces and in even heavily processed and cooked meat. "Only one country has been able to eradicate this disease," the Australian agriculture minister told reporters in 2019, referring to the Czech Republic's successful four-year elimination campaign. "They sent their army into forests night after night to shoot every single feral pig."

For many experts, the pressing question is not whether the NBAF's containment will fail but what the US will do when African swine fever finally arrives. Myers, who in 2016 moved to Manhattan to become president of Kansas State, his alma mater, says that *when* is the right word. "It has not come to North America—that's great," he said. "To say that it won't in this globalized economy of ours—that is probably a foolish statement for somebody to make." In 2013, more than 10 percent of

American pigs died when a porcine epidemic diarrhea virus arrived on the reusable bulk bags used to transport feed; the half-life of African swine fever virus in shipped feed is two weeks. Pig farmers in the US have been advised to implement disinfection protocols at farm gates, ban foreign visitors, and inspect farmworkers' packed lunches for contraband bacon or hot dogs.

Since Myers' troops discovered al Qaeda's list of pathogens in an Afghan cave, there has been a huge federal investment in research, but not much in the way of local planning. Ron Trewyn told us of one sheriff—the exception, rather than the rule—who had mapped the optimal locations for the 40 roadblocks needed to create a cordon sanitaire, quarantining his entire county in the event of an outbreak. Inside the exposure zone, according to the plan, "all cloven—hoofed animals would be destroyed."

"I wish I could say that every county in this state had that," Trewyn said. Myers agreed: "I think we're intellectually better prepared, but I don't know if we're operationally better prepared. Are we really ready to destroy millions of pigs?"

The logistics of what animal-health experts euphemistically term "depopulation activities" can rapidly become overwhelming. Faced with the need to cull almost 11 million pigs during a swine fever outbreak in the Netherlands, the government resorted to mobile electrocution devices, described chillingly by journalist and WIRED contributor Maryn McKenna as "a pig-sized box that forced the animals to walk over a wet metal plate while zapping an electric current through their heads." In 2015, 38 million chickens, ducks, and turkeys had to be slaughtered in Iowa because of avian flu. Local landfills stopped accepting diseased carcasses, for fear of lawsuits from their neighbors, and the birds rotted on farms. "I've been in the landfill business probably 26 years, and I've never ever seen this kind of volume, and I hope I never do again," the director of the Northwest Iowa Area Solid Waste Agency told a local public radio affiliate.

In the US, a federal indemnity scheme entitles farmers to compensation for the animals they have sacrificed—although not for income lost because of quarantine measures and wasted production time. What's less clear is who pays for it; the division between state and federal responsibilities is blurred.

“How do you interdict the transportation network to make sure sick animals aren’t moving around the United States, infecting more herds?” Myers asked. “What authority do we have to stop them?” These gaps—in terms of legal authority, inter-agency coordination, and the lack of financial and logistical infrastructure to contain disease—are, by now, disturbingly familiar. They are the same issues that plagued the US response to Covid-19.

Myers pointed out that in emergencies, the Department of Defense is responsible for enforcing USDA policies. “Local authorities generally get overwhelmed pretty quickly and then call the DOD,” he said. But that’s usually where the plan ends. Over the course of his military career, Myers told us, he took part in several role—playing exercises in which government agencies practiced their response to livestock disease outbreaks. Each of these simulations ended in almost exactly the same place: with the pandemic having spread out of control and the USDA requesting assistance.

“When we got to the point where it said, ‘Now we’re going to call the DOD for help,’ the scenario would end,” Myers told us. “It’s ludicrous, right? The scenario would end and we, the DOD, never got to play out what it is that was needed—is it communications, is it security, is it helicopters? What is it?” Hosting the NBAF at Kansas State might be his best shot at making sure no one ever needs to see what happens next.

Adapted from Until Proven Safe: The History and Future of Quarantine*, by Geoff Manaugh and Nicola Twilley. Published by MCD/Farrar, Straus and Giroux. Copyright 2021 by Geoff Manaugh and Nicola Twilley.*

Let us know what you think about this article. Submit a letter to the editor at mail@wired.com.

Lauren Smiley

Backchannel
06.22.2021 06:00 AM

He Thought He Could Outfox the Gig Economy. He Was Wrong

Jeffrey Fang was a ride-hailing legend, a top earner with relentless hustle. Then his minivan was carjacked—with his kids in the back seat.
“Get that money!” Jeffrey Fang would cry out to his fellow drivers when the surge hit.Photograph: Kelsey McClellan

Jeffrey Fang, DoorDash delivery guy, knows you judge his parenting skills, and he’ll join in your condemnation in a moment. He’ll explain that bringing his kids along on his Saturday night shift “made sense, until it didn’t,” and that in hindsight, he understands that it really, really didn’t. But right now, on the night of February 6, he’s not thinking clearly, and you’ll have to excuse him as he sprints pell-mell down a promenade of swank homes after the thief who just stole his phone.

He sees the thief dive into the back seat of a silver sedan, and as the car accelerates Fang keeps running alongside and grabs the passenger door handle—less DoorDash Dad than some kind of bespectacled Jason Bourne. The phone, you see, is his “moneymaking tool”; it’s how he feeds his family. But each stride is taking him farther from his unlocked Honda Odyssey minivan, parked illegally, engine humming, in a driveway where he was making a delivery, with precious cargo in the back seat.

His kids.

This article appears in the July/August 2021 issue. Subscribe to WIRED.

Photograph: Djeneba Aduayom

Earlier that day, Fang's wife said she needed quiet in the house in order to tutor their 6-year-old son, because their kids are sure as hell not going to be gig workers. Fang couldn't afford to miss the money on a Saturday night run near San Francisco's Billionaires' Row, but in this city a babysitter earns nearly what Fang does. His solution was to fasten the younger kids, 4 and nearly 2 years old, into their car seats, ply them with ice cream, and cue *Shrek 2* on the videoscreen in the van. He delivers expensive orders in ritzy neighborhoods, the only way this dumpster fire of a job is marginally worth it. He doesn't expect to need the taser that he stows in his glove box. He figured the kids would be safe.

Now it has all gone sideways. His taser is uselessly back in the van. Yanking open the passenger door of the getaway car, he thrusts in his left leg, which gets battered with punches, and then swoops in to ride shotgun with the thieves. *God, farther from my kids!* Fang starts yelling, "Give me back my phone!" and pushes the door wide with his right foot in hopes of smacking a parked car. The thieves, apparently deciding that some Huawei Mate 20 X phone isn't worth all this, hand Fang his cell. He jumps out, panting, and then runs and speed-walks the two blocks back to his parking spot.

The van is gone.

Fang's Honda Odyssey was carjacked, with his kids in the back, on February 6.

Photograph: Kelsey McClellan

Twelve years after the birth of Uber, the country—the world—is still reckoning with how the on-demand economy has upended the marketplace and people's lives. Companies running on gig work emphasize the upsides: Here's a job where you can be your own boss, set your own hours. They speak of the flexible and temporary nature of gig work, how most people do it part-time or to get back on their feet—points repeated before federal judges and in Facebook ads and *New York Times* op-eds.

Jeffrey Fang represents something else: the long tail of the economy that Uber built.

Fang has worked in the gig economy full-time for seven years. He signed on first with Lyft, and as the app tweaked fares and incentives and his income declined, he added Uber, then Amazon Flex and Kango. Then came the pandemic. As people locked down, he found work driving for delivery apps like DoorDash, Instacart, and Uber Eats. His phone lured him like a blackjack table. Each offer sliding on the screen was an enticing gamble; it might bring 18 bucks, 24 bucks, or, if he played it extremely well, 100 bucks. He ignored his friends' and family's pleas to get out, thinking he could somehow beat the financial odds.

For a long time, he did. He even felt moments of pride. Compatriots speak of Fang as a sort of gigging folk hero. He was one of the top drivers in the ride-hailing industry's hometown. The guy to emulate. Yet here he is, age 39, in the middle of Jackson Street, screaming and dialing 911. Let your judgments pour out; the online chorus certainly let theirs. It's nothing Fang hasn't said in self-loathing ever since: Why in the world did he leave his kids?

Well, hop into Fang's Odyssey. He got it back, dusted in graphite powder from fingerprinting but functioning. Behind the wheel is where Fang can talk. He doesn't want to play victim. He wants to take blame and dole it where he says it's due. He's not going to pretend he's a saint. He made bad decisions. He found ways to exploit the ride-hailing apps too. But to understand how a man could arrive at the point where he abandons his children to chase a phone, you might want to follow him on a journey. He's ready to explain.

2.

"The rideshare years were, in some ways, a tragedy of my own making," Fang says. "By all measures, I should be successful, but I'm not." He got more chances in life than most people do. So where to begin?

Maybe in 1994, when at age 12 he reluctantly stepped off a plane outside of Washington, DC. His father, who worked for Cummins, the multinational maker of diesel fuel engines, had taken a transfer, moving his wife and two sons from Taiwan to the Maryland suburbs. The older son switched his first name from Shao-yu to Jeffrey in order to blend in. He didn't know English, but he loved American sci-fi, especially *Star Trek: The Next Generation* and Captain Jean-Luc Picard—stately, cool-headed, *the guy who gets things done*.

In his own life, Fang tended to biff the execution. He was 15 when another transfer—this time to Cummins' mainland China office—uprooted the family again. The company paid Jeffrey's way at the prestigious International School of Beijing, but he slacked off among the scions of executives and diplomats. He was, he says, the world's "most pathetic" rebel. To his parents' disappointment, he didn't opt for college, so they gave him orders to chaperone his younger brother in San Francisco, where they had family and his brother would finish high school. During the tail end of the dotcom boom, Fang, 18, was sulkily driving his brother to basketball practice and selling jewelry at Fisherman's Wharf. Nudged by his parents, he enrolled in community college, floundered, and dropped out. A classmate referred him to Bank of America, where, soon enough, he was pushing mortgages.

The work didn't come naturally—"You're pushed to treat people like products," he says—but it was a job he could do without a college degree. His mom, who was splitting her time between Beijing and San Francisco, started buying houses as an investment. She tried to help Fang get business by having him process one of her loans. She also urged him to borrow for a place of his own. Fang was 22 and earned only $40,000 after bonuses, but it was 2004. He got an adjustable-rate mortgage for a cookie-cutter $638,000 house in a working-class neighborhood. His parents pitched in on the down payment.

Four years later, scraping along at the bottom of employee performance targets, he quit the bank before he got fired. Now 26, he returned to City College, this time with zeal. He dove into philosophy, sashayed on the waltz team, and won election to the highest student office, student trustee, hoping

to juice a transfer application to his dream schools, Stanford and Berkeley. Fang was on his way up, haranguing the community college board to step up their leadership, lobbying the California legislature in the Mao suit made for his high school prom, presiding over graduation on the same stage as Nancy Pelosi. *The guy who gets things done*.

In 2010, with only a part-time gig at a pet shop, he was also the guy who often missed his $2,500 monthly house payment. His house wasn't worth what he owed on it, and in 2013 he was pushed into the ranks of the 10 million Americans whose homes were put into foreclosure during the Great Recession. He was lucky once more: His parents let him move into one of their investment homes, rent-free. Still, the grind—his money woes, college politicking, the side job—started pulling down his grades. A familiar shame set in: "Forget your dream, you're not going to make it." So, he says, "I left."

During a trip to Beijing in 2013, Fang encountered a more welcome complication. His parents, he says, wanted him to get on with his life—their younger son was married, while Fang had "X number of failed relationships and nothing to show for it," he says. They invited a young physical therapist over for dinner. He was struck by her gentleness and her college education. They stayed in touch, and over the months, via texts and calls, he fell "super in love." They started talking about marriage. He told her that he was broke, his credit shot, and he had no job. She said they'd work it out. "I told myself, 'She's the one.'"

Fang pulled more than half the money from his 401(k) to buy a ticket to China for the wedding in April 2014. The plan was for his wife to eventually join him in San Francisco. But to make sure immigrants don't become public charges, US citizens need assets to sponsor visa applications. Fang figured that it would take months, if not more than a year, to raise enough cash to bring his new bride to California. Soon after returning to San Francisco, married but alone, he learned that his wife was pregnant. Now, with two people to sponsor and his bank account empty, the process was going to take longer. He needed a job where he could save money and also take time off to visit Beijing for a few months a year. *What job would allow that?*

One day, while Fang was walking in Union Square, a car plastered with a Day-Glo mustache drove by. He Googled "pink mustache." While Fang had been consumed with City College politics, his adopted city had become a postrecession boom town. Since Uber's founding, in 2008, venture capital had poured into the so-called on-demand economy. Using freelancers to meet the fluctuations of customer demand, apps promised groceries delivered, Ikea cabinets assembled, dogs walked. The companies' pitch to drivers: In a city of hustling disruption, they too could be entrepreneurs.

Fang just needed the money. He climbed into his dad's 2002 Acura TL and opened the pink app. After a couple hours of driving, he'd earned $71. "I got comfortable with this job really quickly," Fang says, "and I got *good* at it pretty quickly." Looking back, this was precisely the problem.

3.

In the beginning, Fang was the driver of Lyft's marketing fantasies. He cheerily accepted nearly every ride for eight to 10 hours a day. Customers gave him five-star reviews: "Great guy. Very intelligent." He'd wait half an hour, unpaid, for a couple to finish their sidewalk spat before one of them climbed in. He handed out free water bottles. He chatted amiably, played the classical station, and dressed up as Batman for Halloween.

After a few months, Fang got more strategic. He divided up the day to surf the morning and evening rushes, when the surge would push up fares. Thursday through Saturday he ferried the bar crowd home until just before dawn. Fang imposed a tight budget, scoping the $3 Safeway burrito bowl or the $1.50 hot dog and soda at Costco. He was bringing home $1,200 a week before expenses—enough, because he was living rent-free, to put money away and send some to Beijing, where his wife had moved into his parents' home. He'd visit her, usually for about two months at the beginning of the year and again for a month in the fall. The app, the passengers, and his strict frugality aligned in a virtuous circle. *I'm helping people. I'm making money. This is gonna work out.*

On a walkie-talkie app called Voxer, Fang heard about a Lyft driver hangout in a shopping plaza in a nice part of town. Starbucks let them use the

bathroom. One guy spun music on turntables out of his back hatch, people caught naps in their cars, and Fang assessed a landscape of cliques—gym rats, DJs, vapers. A veteran Lyfter told him that $1,500 a week was about the max you could make. *Challenge accepted*. Fang doubled down, taking rides for 60 hours a week, and by the end of 2014 he topped $2,000 a week, then $2,500. He stopped asking the old guard for advice.

Fang found his own clique—the millennial worker bees: Jose Vivanco, a wry film student from Peru who'd started driving full-time and persuaded his girlfriend, Bianca Santori, to drive to support her sewing blog. Fallon Brooks-Magnus, 6 feet tall, proudly intersex and part Native American, who'd moved to San Francisco from Oklahoma for a drafting job but found that driving paid almost as well. Christian Perea, a witty UC San Diego graduate and former bank teller, who drove a Mercedes. Kris Rohr, a gamer from Palm Springs, who was the only driver in the group who could out-earn Fang.

The group traded tips and barbs in their own channel on Voxer, like long-haul truckers on a CB radio. The group cued a recording of Rohr screaming, "There's *Prime Tiiime!*" Or Fang would say, "Good luck. Get that money!" when the surge hit, and everyone knew to follow the playbook they'd worked out: Don't flock to the area with the highest surge—that will be played out by the time the heat map refreshes. Go to the area that's just starting to inch up. Oh, and "Fuck Uber."

A half-decade into the on-demand economy, Uber was the original and dominant juggernaut. By early 2015, 200,000 people across the country were driving for the company. Lyft, the perpetual underdog, had 51,000. But as ride-hailing services expanded, so did the backlash. As contractors, not employees, drivers weren't guaranteed a minimum wage or paid expenses or offered sick days or health insurance. Taxi drivers staged protests. Drivers sued Uber and Lyft, arguing that since the companies dictated the manner and means of work, they met the legal standard of an employer. Fang and some of his group joined the class action suits. (Settlements came years later: Fang got $7,400 from Lyft and $3,800 from Uber but remained a contractor.) The companies retorted that they dealt in

software, not driver services, and that labor laws were hopelessly out of date.

While the Voxer group knew that Lyft was benefiting from the business model, most of them decided their real war was with Uber. They didn't mind that Lyft took a 20 percent commission from their rides if that's what sustained the business. Even with Lyft's commission, each of the Voxers was earning at least $1,200 a week—or about $50,000 to $60,000 a year—before expenses. They were exuberant with the fast cash. Lyft felt like a friendly place; Uber didn't allow tipping and had a more brash, aggressive image. "We looked at Uber like it was Darth Vader," Brooks-Magnus says. Sure, Vivanco drove for Uber in the mornings, because it seemed busier. "But I wasn't happy about it," he says.

No one's allegiance to Lyft was deeper than Fang's, who credited the app with rescuing him from failure. "I was at the lowest point in my life," he says. "Lyft was a lifeline to get back up." He spoke of the company as a benefactor that "takes care of its drivers." Lyft offered a bonus to drivers who accepted 90 percent of calls, and word spread around the Starbucks lot that you could use the phone's airplane mode to decline unprofitable rides—tricking the app—and still get the bonus. Fang argued that the hack wasn't fair to Lyft and refused to do it. "Jeffrey is the oldest young guy you'll ever meet," Brooks-Magnus says.

When the Voxer group met during slow hours at 24-hour diners, Fang would order soup and gobble everyone's leftover fries and burgers, spurring Scrooge McDuck jokes. He and Rohr constantly checked their phones, ready to dart back out when a surge hit. They were the most obsessive drivers in their group. But everyone got pulled into the game more than they'd expected. Despite the flexible schedule, Santori and Vivanco started missing deadlines on her sewing blogs, which Vivanco took pictures for. Rohr put on 20 pounds. For Perea, driving started to feel like his cigarette addiction: When he felt anxious about money, the only way he could relax was to turn on the app and work. "Your brain starts to sort of change," Perea says. "Imagine every time you got a TikTok notification, it gave you 10 or 15 bucks."

At one point, Brooks-Magnus, Vivanco, and Perea convinced Fang to teach them The Way, a tongue-in-cheek name for his sensei-like ability to rack up $2,500 a week while driving “clean”—no cheating shenanigans, just shrewd surge-surfing and grit. After warning them it wouldn’t be easy, Fang put them in training. He messaged his acolytes on Voxer at 4 am to make sure they were at the wheel, ready for airport runs. “Rise and shine, go get that money!” he would say. “It’s day three, and I’m dead,” Vivanco reported. After a month or two of hitting close to $2,000, they quit Fang’s program out of exhaustion. Fang didn’t want to blemish his reputation by revealing the toll it was taking on him too. He was swigging four espressos a night. Psoriasis flared on his back and scalp; with no health insurance, he went to a free city clinic. His accelerator ankle started to pop like an arthritic knuckle. He grew a gut. He’d work bar close until 3 am, then nap in the Starbucks lot until airport rides started at 4. The group just assumed Fang was intense for intensity’s sake, obsessed with the challenge of maximizing his profits. “I just don’t understand when he ever slept,” Brooks-Magnus says. Nor did they know exactly why he’d disappear to China for weekslong stretches.

Fang met his clique in a Laurel Heights parking lot where drivers hung out.

Photograph: Kelsey McClellan

In 2015 the friends pressured Fang to join them for a July trip to a cabin near Lake Tahoe, nearly four hours east of the city. Fang resisted, wanting to work, but his friends persisted: C’mon, he could take *one* weekend off. Fang finally gave in. One night during the trip, the group gathered at the cabin’s hot tub for a boozy game of Truth or Dare. Fang opted for truth, then revealed, matter-of-factly, that he was married and had a baby son in China. His friends erupted in disbelief, congratulations, and, for some, a pang of betrayal that he’d concealed something so vital. They returned to San Francisco chastened by the knowledge that Fang was playing at a different level of stakes.

That year, Fang capped off his best one-year haul—some $71,000 for 10 months of work. On New Year’s, he accepted one last ride on his way home at 3 am, then, fatigued, rear-ended a parked SUV.

The Acura needed more repairs than it was worth, so Fang decided it was time to get his dream car. Not only one that could hold more people, to get bigger tips, but the one with space to someday haul his family on adventures.

Aha! Here's a listing: a used minivan. Honda Odyssey.

Rohr drove Fang out to the suburbs to pick it up.

4.

By the time Fang sailed out of the car dealership with his Honda Odyssey in January 2016, the long-running feud between Uber and Lyft had turned into a full-on price war. For years, as the two services became nearly indistinguishable, they battled for customers by cutting fares, tit-for-tat, especially during slow times. They also started taking a bigger commission from new drivers. These experiments hit drivers hard, whittling away their earnings along with any residual sense of loyalty to either app. "Uber was the devil that you know," Fang says. "Lyft felt like a betrayal. It's the betrayal that cuts deeper. You just slowly lose faith." Members of the Voxer group started to drive for their nemesis, Uber. Even Fang had secretly tried some Uber rides.

Around this time, the Voxer group gathered in Vivanco and Santori's apartment in the Castro to launch a podcast. They called it *Run TNC*, for "transportation network company," which is California's official name for ride-hailing apps. On the show, the drivers were battle-hardened, cynical. Perea said he only got through the rides with obnoxious customers by thinking, "I can't wait to fucking one-star your ass." Vivanco mentioned his irritation with Lyft for advertising drivers who gave free candy to passengers: "I can't do that! I don't get paid enough." That January, as Uber slashed fares by 10 percent and Lyft followed suit, everyone talked about feeling taken for granted. Some of their podcast episodes reached more than 9,000 downloads.

"I'm throwing all the money in on baseball season," Rohr said. "You can still make decent."

“What if baseball season is a total bust?” Vivanco asked.

“Hmm … that’s a good question,” Rohr paused. “Software engineering.”

Rohr, then in his mid-twenties, had thought about trying to become a tech worker. The closest he’d come to a stationary job was as a part-time contractor for an informal Lyft call center, something the Voxers all tried, to pad their flagging profits on the road. Lyft paid about $20 an hour for people to call inactive drivers and passengers and urge them to return to the app. They made other calls too. Cities and states were rolling out regulations, including driver background checks and insurance requirements. Lyft was pushing back. The Voxers lobbied Texas voters on an Uber- and Lyft-sponsored ballot measure in Austin, leaning on their status as drivers. Perea bailed after about a month, unwilling to do Lyft any favors. He dove into blogging for *The Rideshare Guy* about labor issues to subsidize his driving. Brooks-Magnus started looking for drafting jobs. She had loved driving for Lyft; she steered a pink-wrapped car in Lyft’s contingent of the Pride parade. The fare cuts changed her mind. She had to borrow money from Fang to make rent. “Over time, the love story falls apart and you realize you’re just the pawn in this big game,” Brooks-Magnus says. “I often felt like a sort of faceless, nameless not-even-a-person. Like the GPS unit or something.” In the spring of 2016, she moved back to Oklahoma.

Fang never took to Lyft telemarketing. Santori and Vivanco, though, threw themselves into the task. The $900 a week was less than they had made driving, but it was guaranteed, and they believed it allowed them to network with Lyft managers. The bet paid off. After a couple of months, they were promoted to contractor jobs in the marketing department, inside Lyft’s headquarters.

In the summer of 2016, when Fang returned from a long trip to China, he was fixated on how the fare cuts had sliced into his earning potential. He was crestfallen. As he saw it, the apps had broken the mutually beneficial agreement in which he’d toiled ethically for years. He started—tentatively at first, then more boldly—to tease out a new philosophy, this time of mutual exploitation: “Being a choir boy has done nothing for me.”

In those days, the drivers were irked by an Uber app feature that blocked them from seeing an incoming ride's destination until the passenger climbed in, at which point it was too late to decline an unprofitable ride. So one day, driving near Golden Gate Park, Fang tried his first, tiny hack: He turned off his phone's cellular data, which disconnected his phone from Uber's network. Then, sweat beading on his neck, he started the next ride. This revealed the destination, even though the passenger wasn't in the car. From then on, if he saw that the rides wouldn't pay enough, he would force-close the app. The passenger would get rerouted to another driver, none the wiser. It was a simple hack, and just the beginning.

Perea was depressed to see the king of clean driving go rogue. If Fang couldn't make money playing by the rules, then *no one* could. "The Way," Perea says, "became the Way to Cheat."

5.

The Voxer squad was now just Fang, Perea, and Rohr. The three joined a WhatsApp group of like-minded drivers, surfing the surge and exploiting loopholes before the companies patched them. "Everything was fair game," Fang says. "It's a tango: They go forward, you go back, give and take. You know you're on the losing end, but you do it anyway."

While Fang hacked with a sense of bittersweet resignation, Perea reveled in it. "It felt like vengeance; it felt wonderful." They steeled themselves for deactivation, but without the hacks the job was no longer worth it anyway. By 2017, rideshare drivers were making 47 percent of what they had in 2013, according to a JP Morgan Chase Institute survey, though they might have been working fewer hours; one think tank estimated that Uber drivers nationally were making $9.21 an hour after all expenses.

For Fang the cheating became something of a crutch. He could make just enough to keep adding a bit to his savings, but he was too drained to look for something better. "I got complacent and tired and a little too comfortable," he said. "At a certain point, it's almost like an addiction." He was still on the hamster wheel. "In Asia," Fang's mom, Annie, says, "everyone wants their children to be a doctor, lawyer, CPA, and an engineer

in Silicon Valley." But over the years, as she realized that Jeffrey's driving wasn't just some temporary gig, she made her peace. Fang was 35, and in 2017 he and his wife had a daughter, their second child—and the next year, they learned their third was on the way. Fang calculated he would easily need more than $100,000 in savings to sponsor the brood. Three years of driving 50 to 80 hours a week and his $5 lunch budget and free rent had gotten him halfway there.

Growing impatient, Fang's father badgered him to bring his family to the US. His younger brother had already graduated from medical school. His mother offered to help with money, but Fang refused out of pride and anger at being pressured. His cousin offered to refer him for a nontechnical role at the tech company he worked for, starting salary $60,000; Fang thought he could still make better money on the road. His wife thought he was in a dead-end loop. Perea saw Fang as less addicted than stubbornly chasing a sunk cost. "The more you change your life to do this job, it's easy to dig deeper and not want to give up on the idea that this is going to pay out." One day, behind the wheel, Fang braced as he recognized his next fare. It was a woman he'd known at City College back in the day. As Fang recalls, the conversation went like this:

Wait, you're Jeff Fang, like City College student trustee?
Yeah, yeah.
Like Jeff Fang?
Yeah, yeah.
Wait—but you're driving now?
Yeah.
Oh … how IS that?

In China, Fang's wife had stopped working to raise the kids; the money he sent was enough for her to make ends meet while living in his parents' home. Still, he knew that being a driver would demote his family in the eyes of their social circle. His wife had told the parents of his son's preschool classmates that Fang worked in law. On one of his trips to Beijing, at a luncheon with some of those parents, Fang gamely perpetuated the ruse. As kids played and adults sat around a table chatting in one of their homes, he parried questions from an actual attorney with bits about

law that he'd picked up at college. "It was like *Catch Me If You Can*," he says.

Bianca Santori and Jose Vivanco bootstrapped up from drivers to corporate jobs.

Photograph: Kelsey McClellan

In October 2018, back in San Francisco, the WhatsApp group huddled in a burger joint and sketched out a drivers' association, a way to organize against the apps. Fang, comfortable speaking publicly from his days as a student trustee, was president. The effort didn't go much of anywhere. They were all too busy driving.

The work itself had become a parade of irritations: Riders who asked about Fang's life then *uh-huh*-ed while phone-scrolling; the jerks who blasted a stadium horn in the car and said, "It's OK. Don't worry. He's Asian"; and the dude who, unforgivably, mistook his Jean-Luc Picard Halloween costume for a concierge.

One day that year, Fang had lunch with Vivanco. After he quit the driving life, Vivanco had learned basic coding and left Lyft for a job test-driving autonomous cars for Cruise, the startup acquired by GM. He had risen to coordinating the road-testing program, and he invited Fang to Cruise's slick SoMa headquarters. Vivanco offered to refer his friend to his new bosses, but Fang wasn't sure test-driving would be any better than ride-hail. Vivanco gave Fang a tour of the game rooms, and they peered in at the garage of cars. Fang thought, *Wow, a full-blown techie*. "I see the growth you've had," Fang told him, "and I wonder if I've missed the boat."

Months later, in spring 2019, Lyft went public. As a token of appreciation, it gave drivers a bonus that they could either get in cash or invest in Lyft stock. Fang received $1,000—the equivalent of a dime for each of the roughly 10,000 rides he'd given over five years. "I call that cheap," he gripes. Critics saw the bonus as a sop to drivers who might resent that the IPO meant a windfall for Lyft executives and the staff classified as employees. By then, Santori was among them. Devouring management books, networking with an employee resource group for Latinos, she had

worked her way up from telemarketing to be the program manager of a team in Lyft's own autonomous vehicle division. Given her limited time on staff, though, Santori received a humble four-figure stock option.

Around this time, out on the road, the loopholes that drivers had used to push up their earnings were all getting plugged. Uber continued upping its fees and changed the lucrative surge system to a flat dollar bonus in some cities. Fang saw his pay plunge. If he'd been working full-time, he now would make about $52,000 a year; with his trips to China, he was down to $32,000. Rohr had already begun experimenting with delivering packages for Amazon Flex, and they both signed up for Uber Eats with new emails, to get a hefty sign-up bonus. Fang started plotting a course into another wing of the sharing economy: He'd renovate one of his mother's investment homes to rent on Airbnb.

In the fall of 2019, Vivanco and Santori married in an elegant ceremony in San Francisco's Presidio, paid for with their respective six-figure salaries. They were bootstrapping Silicon Valley success stories. Fang wore the Mao suit from his high school prom and sat at a table with driver friends. While mingling with the tech employees in attendance, he steered clear of job talk.

Fang's wife had given birth to their third child, a boy, the previous spring. Finding out that he actually needed some $150,000 to sponsor his family, Fang finally accepted his parents' help. He headed to Beijing to collect his family just as a new coronavirus was rampaging through Wuhan. After six years of grasping toward the goal, he, his wife, and their three kids—ages 5, 3, and 9 months—landed in San Francisco in late February 2020. Fang wrangled 10 jumbo suitcases of clothes and toys off the baggage carousel. Two weeks later, the Bay Area issued the country's first shelter-in-place order. Office commuters hunkered in their homes.

Perea decided that this was where gigging ended. He left the city for the mountains. Once again, Fang adapted. People were locked down, but they still had to eat. He cued up Amazon Flex and Instacart, then Uber Eats, Caviar, and DoorDash. He and Rohr were the last two standing from the original squad. Having felt increasingly invisible and expendable, they couldn't help but roll their eyes at the new title of respect. So *now* we're essential workers.

6.

Fang snapped on a mask and latex gloves. He'd been through two Covid lockdowns in China. But the uneasiness he felt going out into a world of contagion slackened as he and Rohr chatted into their Bluetooth earpieces and blazed around an empty city. Zero traffic, endless parking, no tickets—nothing but orders upon orders of takeout and end-times tippers, a gold-rush glory he hadn't felt since the earliest driving days.

"Does it make me a bad person to hope the pandemic doesn't get better anytime soon?" Fang said into Rohr's earpiece.

"It just makes us greedy," Rohr would say back. "But is that really so bad?"

Working on three apps on two phones each, the two of them quickly learned to "stack"—delivering for various apps simultaneously—putting the less lucrative ones at the end of the run. Contactless delivery meant ding-dong-ditching sacks on porches and running back to orders waiting in the car. Whole Foods shoppers were stockpiling water, milk, and toilet paper and shelling out $80 tips through Amazon Flex. The app asked freelancers to sign up to work blocks of time. Rohr huddled with a programmer friend, figuring out how to automatically grab all possible Whole Foods shifts available to him as soon as they posted, and he shared it with Fang. They were gunning to make $3,000 a week. Late one Sunday night, Fang's haul was $2,900, and he thought he might crack the goal. Then his phone rang. *The kids smeared lotion all over the house. Get home*.

The new dad life was overwhelming. Fang's wife was locked down in a foreign country without a driver's license or the ability to speak English. Their eldest son was enrolled in a public school kindergarten with a bilingual Mandarin program, but Fang was on duty to help him with the English homework. He loaded up the Costco shopping haul, drove the family to parks in the Odyssey, tucked the kids into bed. "I was trying to be a better husband to share the load," he says, "even though I'm not successful, or you know, with a high-power earning job." Though his bachelor working days were over, with the pandemic frenzy, Fang cleared $12,000 in May 2020.

It couldn't last, of course. After a couple of months, the essential-worker gratitude tips dried up. People who'd lost their jobs in the pandemic joined the delivery ranks, increasing competition. Uber Eats cut its base fare, changing over to a more complex structure; Fang saw his earnings take a nosedive. They adapted again, drifting to DoorDash, scrutinizing incoming orders for profitability like diamond appraisers.

During the pandemic summer, Fang started to pass billboards of smiling ride-hail workers in ads for a state referendum called Proposition 22. In 2019, the California legislature had passed a law that would require gig workers to be classified as employees, conferring on them a minimum wage and benefits. That also meant gig companies would have to pay the state's payroll and unemployment tax; one study showed that the law would deepen Uber's operating loss by more than $500 million. The companies resisted, so the state attorney general sued Uber and Lyft, and the San Francisco district attorney sued DoorDash, to force compliance. Judges ruled against the ridesharing companies, and they threatened to leave the state.

Uber, Lyft, and DoorDash tried a new tack: Go straight to voters. They sponsored a ballot measure that defined "app-based drivers" explicitly as contractors and not employees, but sweetened the deal by requiring companies to help pay for health care insurance for those clocking more than 15 hours a week, to offer access to insurance for on-the-job injuries, and to guarantee an hourly income for "engaged" time spent driving a passenger or a delivery (but not for any time spent waiting). The gig companies claimed it would save jobs, allow workers flexibility, and maintain low fares. They shoveled more than $200 million into the campaign, the most in state electoral history, outspending the labor opponents 10 to 1. Their ads asserted that "the vast majority of app-based drivers say yes on 22."

Fang wasn't sure he wanted to be an employee, but he appreciated that lawmakers had forced clarity from the industry giants. If they want contractors, he reasoned, stop treating us like quasi-employees and don't deactivate us for acting in our own interests. "They're sitting on top of a

volcano," Fang says. "I don't think they understand how much difficulty we're dealing with."

In November, Fang voted no on Prop 22; 59 percent of Californians voted yes.

A month after the Prop 22 vote, DoorDash held its IPO. Like other on-demand companies, it had struggled with anything resembling regular profitability, but that didn't trouble Wall Street. The move made a billionaire of CEO Tony Xu, the 36-year-old cofounder.

Through the fall, to pad their plummeting delivery money, Fang and Rohr worked as census takers. It was the last job the two would do together. Rohr went on unemployment and finally started studying for coding bootcamp. The pandemic had forced him to leave—and he was grateful. In January, Prop 22 became law. Albertson's grocery stores laid off their unionized drivers. They replaced them with DoorDash.

Now, in the mornings, Fang shepherded face-masked students to their private elementary schools for Kango, a hailing app for kids. By the late afternoon, he was delivering for DoorDash. He was eking out just over $800 a week before expenses, better than the federal poverty line for a family of five but well below San Francisco's. Nearing 40, Fang's hair was flecked with gray. He started tapping into his savings for living expenses.

7.

Fang had taken the kids out on his deliveries twice before, to give his wife a break. His cars had been broken into in the past, but now he only delivered in wealthy neighborhoods, and he hadn't yet heard about the carjackings that were skyrocketing during the pandemic. So, on February 6, he brought the kids to work again.

On a pizza delivery, Fang parked his Odyssey in front of a stately art deco apartment building near Billionaires' Row. His 21-month-old was quiet, probably sleeping. He didn't lock the minivan or turn off the engine, as doing so would cut off *Shrek 2*, which was entertaining his 4-year-old

daughter in the back seat. He'd be gone less than a minute. Fang darted inside, dropping the pizzas in front of a ground-floor door. When he walked out, he saw a man with long curly hair sitting in the Odyssey's driver's seat.

He yanked open the door, yelling, "Get the fuck out of my car!" After a tussle, the man pushed past him and, grabbing the Huawei from his hand, took off running. Fang's phone had been his moneymaker, manager, fixer, and dictator for the past seven years. He thought he had a shot at getting it back.

After the chase, Fang rushed back with his phone in hand. But the van was gone—and his kids with it. He screamed as loud as he could for help. One of the men rushing outside said he knew—literally, *knew*—DoorDash CEO Tony Xu. He'd call him. Soon after, DoorDash texted other drivers asking them to watch for the Odyssey. An old friend of Fang's from City College, a San Francisco journalist, tweeted a cry for help and dialed local reporters. Police pulled up at the scene, blocking off the street, and later issued an Amber Alert.

His wife called to ask when he was getting home, and he broke the news. Officers offered Fang a seat in a patrol car, but he declined: *I'm not taking any comfort*. His journalist friend arrived to wait with him, McDonald's in hand, but Fang couldn't eat. Press gathered, and in the glaring ABC7 News camera light, Fang pleaded to the kidnappers. "I just want my kids back. Times are hard. If you're gonna have to resort to stealing, that's a different matter, but please don't hurt my kids. Help them return safely back to me and my wife. *Please*." For all these years, his tunnel vision, his money-chasing, and his scrimping was for one single purpose: to bring his family together. He'd made many bad decisions—goofing off in high school, dropping out of City College—but none could possibly match the awfulness of this one.

While Fang remained at the crime scene, relatives arrived at his home across town to pray with his wife. After four hours, at nearly 1 am, police on patrol spotted a Honda Odyssey abandoned in a driveway just minutes from Fang's house in the Bayview neighborhood, 7 miles from where the van was stolen. Both kids were in the back, out of their seats, refusing to emerge from the car. The police sped his wife to the scene. She rushed to

the van, Fang says, and the older child fell into her mother's arms, heaving with sobs. Police took the family to the hospital, where doctors looked over the children; they were unharmed.

Meanwhile, Fang continued helping police with the investigation. They drove him from the delivery spot in one of the city's richest neighborhoods to his Odyssey in one of the poorest, asking him to identify anything out of place. They shuttled him to a police station in yet another part of town, where Fang gave a statement and an artist etched his description of the long-haired thief. Police drove Fang home at dawn. Shuffling into his bedroom, he stared at his wife and their children, all sleeping together, and felt waves of relief and guilt.

The following Monday, a payment for $10,000 landed in Fang's DoorDash account. He'd also missed a call from a Silicon Valley area code and called back.

"Hi, who's this? I'm returning a call from you earlier."

It was Tony Xu.

Xu told Fang that, as a father himself, he was happy that the children had been found and that he wanted to make sure Fang had gotten the deposit. Fang listened, surprised at how young Xu sounded. He thanked Xu for the money, but, more than that, for texting the advisory to drivers, adding, "My thoughts about the gig economy are a different matter." He reasoned that there was a time and place for his protests, and a phone call about his kids getting kidnapped wasn't it. Xu told him to feel free to call back if he needed anything. After the call, Fang added the CEO's number to his contacts. When Fang's brother heard about the call, he wanted to know if Jeffrey had asked Xu for a job. He hadn't.

The DoorDash kidnapping became national news. Many blasted Fang for leaving his children alone, but soon another narrative emerged. Prop 22's critics used it as a prime example of workers drowning in the freelance economy. The attention was inevitable, but it outed the secret Fang had carefully maintained for years. A friend of his family's in Beijing, who now lives in the States, texted Fang's wife: "Did you know he was a driver?"

“I still feel the pull,” says Fang about being behind the wheel. “I’m basically in rehab now.”

Photograph: Kelsey McClellan

8.

Jeffrey Fang’s gig odyssey ends here. Well, kind of.

A GoFundMe set up by his reporter friend raised more than $155,000 for the Fangs, an act of charity that Fang is well aware doesn’t solve the despair of the gig life for anyone else. This spring, a string of violent confrontations resulted in the killings of DoorDash and Uber Eats workers in New York City, Chicago, and Washington, DC. Fang earmarked the money to send his kids to college.

Rohr is studying for coding school. Brooks-Magnus runs her own home-design business in Oklahoma City. Santori is a technical project manager at Scribd, the ebook subscription service. She and Vivanco worry that the early startup ladders that helped striving drivers into management are harder to find, but Vivanco says his offer to help Fang remains. Perea, who writes an occasional salty post for his own gig economy blog, is also trying to figure out what’s next. “If this is the future of work,” he says, “we’re sincerely fucked.”

So how does a 39-year-old dad with a gig résumé change course? Fang still wants what the industry claims it offers: “I’ve gotten a taste of what it is like to be my own boss, and I want to be my own boss.” Fang finally finished the renovation of his mother’s investment house this spring and hopes to get it on Airbnb soon. He started studying for notary and real estate licenses.

But he also needed just a little bit of cash on the side. In the spring, passengers began hailing more rides again, and Lyft and Uber cranked up temporary incentives to lure reluctant drivers back. Fang decided to take Uber up on its promotion to give three rides for $100. He did just three and drove home. He worked in the mornings for Kango—“driving kids is

OK”—and occasionally a night on DoorDash. “I still feel the pull. Less than before, but I still feel it.” He thinks he can keep it in check. “If you are somewhat enlightened to the cat-and-mouse game that Uber uses to get you back in, you’ll take the catnip and you won’t get hooked.”

Jeffrey Fang, reformed gig worker, knows you’re doubting his capacity for restraint. “I’m basically in rehab right now.”

Perea called him this spring. Physically leaving gigging was the easy part, Perea had said. But it had taken him an entire year to unplug his mind from the addictive thrum, to reclaim his attention and stop checking his phone.

Fang knows what he meant. The afternoon after the kidnapping, after talking to police and reporters, Fang retreated to a nook in his house behind the garage, where his family tends to leave him alone. It was a bit after 3 pm, the hour he usually started getting ready to make deliveries. Sunday evening is the pinnacle of takeout. Fang peeked at the DoorDash app. A red cloud marked “Busy” hovered over the grid of the city, and the candy-red button to “Dash Now” beckoned. The incentive was high—$4 extra per delivery. The familiar tug: *You’re missing out on money*.

With his Odyssey impounded as evidence, he’d have to borrow his parents’ car, which would entail asking his mom for permission. He imagined her taciturn disapproval, the justified hell from his wife.

Better not push it.

Fang closed the app. The familiar map disappeared. He headed upstairs to join his family, pretending for the kids that everything was OK, pretending he didn’t still want to work.

This article appears in the July/August issue. Subscribe now.

Let us know what you think about this article. Submit a letter to the editor at mail@wired.com.

| Section menu | Main menu |

Virginia Heffernan

Ideas
06.17.2021 08:00 AM

On Microphones, Music, and Our Long Year of Screen Time

Pianist Glenn Gould proved long ago that an existence heavily mediated by technology is not nonexistence.
Illustration: SAM RODRIGUEZ

There is a music-tech controversy that rivals Bob Dylan's choice to plug in his guitar at the Newport Folk Festival in 1965. A year earlier, on April 10, 1964, the pianist Glenn Gould made a radical exit from live concerts.

Gould played seven pieces to a packed house at the Wilshire Ebell Theatre in Los Angeles, including four fugues. He gave no indication that the program was his swan song. Then he strolled—he never stormed—away from his Steinway CD 318 and out the door of the concert hall, into the mild California air. A year later, he boarded a train for the desolate Northwest Territories of his native Canada. He never played another concert. When Arthur Rubinstein bet him in 1971 that he'd be back, Gould took the bet; when he died 11 years later, at 50, he won. He came to regard live music as a “blood sport.” He especially held the sociability of concerts in contempt. “Music is something that ought to be listened to in private,” he said.

From that evening on, the pianist's life became a testament to the raptures of electronic media. In the studio he found something subtler, kinder, and more intimate than what he considered the relationship of dominance and submission between performer and audience. To Gould, sound engineering

and music production conveyed, as nothing else, “the spine-tingling awareness of some other human voice or persona.”

Rejecting as priggish the cliché that technology is “depersonalizing,” Gould was smitten. “I was immediately attracted to the whole electronic experience … I fell in love with microphones; they became friends, as opposed to the hostile, clinical inspiration-sappers that many people think they are.”

This summer, as people in many countries are attending concerts and touching each other again, the case for solitude and computers over community and real life seems especially unpersuasive. It would dishonor the pandemic dead not to take life by the horns and go for broke on packed-yard barbecues and front-row tickets to Lady Gaga. But Gould proved at least that an existence heavily mediated by technology is not *non*-existence. Screen nausea and social media compulsions are no joke, but the current self-loathing about the long year of screen time is misplaced. It was not lost time. Rather, the boring and sometimes hallucinatory quarantine opened new portals for imagination that the culture hasn't yet begun to assimilate.

Because he idealized northerliness and mused often on solitude, Gould after 1964 is figured as a recluse. But he was hidden away only if you don't count telephones, photography, recorded sound, recorded video, and speedy distribution networks. For his two electronic decades, Gould managed to be nowhere and everywhere. Though often sequestered, he suffused tens of millions of television sets, movie theaters, car radios, and eventually outer space, when, in 1977, his stunning interpretation of Bach's *Well-Tempered Clavier* was launched out of Earth's atmosphere on the phonographic time capsule aboard the Voyager spacecraft. Gould may be best experienced by curious extraterrestrials, ones with decent turntables or at least working ESP.

Gould had a sweet tooth for some pop music, including Petula Clark; he called Barbra Streisand's voice “an instrument of infinite diversity and timbral resource.” And though he himself had perfect pitch, he was captivated by unusual speaking voices, off-key or otherwise. He invented a form of documentary film known as contrapuntal, in tribute (maybe) to Bach, in which speaking voices are made to overlap with weird effects. The

most evocative example is Gould's film about the bleak Canadian tundra, *The Idea of North*, which sits easily among the most avant-garde fare on YouTube.

Though he hummed compulsively while he played, avoided shaking hands for fear of disease, developed an addiction to prescription pills, and dressed for a winter storm whatever the weather, Gould managed to stay in the flicker of electric eccentricity, never quite slipping into the monotony of madness. This delicate psychic balance is palpable in the erudite stem-winders he delivered straight to the camera. It comes through in his experimental acoustic collages and the innumerable radio broadcasts he recorded. Gould also spoke for hours on end to friends and unwitting acquaintances on landlines and pay phones, sometimes putting his companions to sleep as he reeled off theories of everything, a one-man soundscape whose changeable cadences of speech were uncannily like his piano playing. “No supreme pianist has ever given of his heart and mind so overwhelmingly while showing himself so sparingly,” said Gould's close friend, the violinist Yehudi Menuhin.

Gould became what might be known now as a pandemic musician. Tim Page, the music critic and a close Gould confidant, was asked last year what his friend might have made of quarantine living. “Glenn would have loved the internet,” Page replied. “He was a germophobe and didn't like much physical contact. But he would have enjoyed things like Skype and Facebook [so he could] still enjoy his friendships while keeping his distance.” Indeed, Gould was at his best *at a distance*—far from the baroque chamber and the modern stage, holed up where he could send a signal to just one other person, lonely, like him, afraid of touch, across the very same untenanted Canadian expanses that inspired the media philosopher Marshall McLuhan, a frequent interlocutor of Gould.

Between 2016 and 2019, the English musician Leyland Kirby, under the pseudonym the Caretaker, layered and edited samples from old, worn 78s to create an album in stages called *Everywhere at the End of Time*. The theme of the album is decay and deterioration; each record represents a phase of dementia until, in the last one, the reeling musical signals are all but drowned out by noise, the static of the mind's final exhalation.

During the pandemic, an extraordinary fate befell *Everywhere at the End of Time*. It galvanized adolescents. And not just any adolescents—the adolescents of TikTok. Shut up at home, they seemed to find in the recording an opportunity to glut private sorrows and test their intellects on difficult music. In the Caretaker challenge, they dared each other to listen to the whole piece, which runs at six and a half hours, and record their responses in videos. “Literally the definition of pain,” wrote 16-year-old Owen Amble in a caption on the music last fall. “Never cried listening to something.” There are now hundreds of such videos, some with tens of thousands of views.

The vertical TikTok rectangles show young faces, alone, framed as if in a narrow closet. Often the listeners are crying as they listen and listen and listen. “The justification of art is the internal combustion it ignites in the hearts of men and not its shallow, externalized, public manifestations,” Glenn Gould once wrote.

Over the course of the pandemic, housebound students created Spotify and YouTube playlists that offer music not for exercise or seduction but for scholarship. Some of these compilations promote relaxation with lo-fi beats. But others don't sedate. They keep the isolated mind alive and awake. Work by the Caretaker sometimes makes an appearance on these lists. But it's baroque music that still best serves the thrill-seeking intellect, and the most stimulating study playlists feature Bach's *Goldberg Variations*, performed by Glenn Gould. The tracks are 30 contrapuntal variations beginning and ending with an aria.

This article appears in the July/August issue. Subscribe now.

Gregory Barber

Backchannel
06.17.2021 07:00 AM

The Lithium Mine Versus the Wildflower

The deposit could power millions of clean-energy car batteries. There's just one roadblock: a rare, fragile species of buckwheat, for which a mine might mean extinction.

Rocks rich in lithium (left) could be mined to reduce dependence on fossil fuels. But the Tiehm's buckwheat (right) stands in the way.Photograph: Aubrey Trinnaman

Whatever act of violence occurred in the midsummer heat on that lonely white hill in Nevada, there was no one around to see it. By the time Naomi Fraga arrived there in mid-September, the air had cooled and investigators had already visited the scene. But the evidence of a selective massacre remained: Where there had once been plants, there were now hundreds of empty holes. A few mangled stems, severed from their roots, lay half buried in the chalky dirt. What alarmed Fraga more than the dead or missing was the selective way they had been targeted. The white hill stood atop a high desert ridge that was once part of an ancient caldera, and it was home to a wide variety of Great Basin flora. There were various species, including saltbushes and sagebrush. But only one appeared to have fallen victim to the unseen attack—a buckwheat. As she walked around the scene, Fraga's first reaction was disbelief. What, or who, had it out for this particular plant?

This article appears in the September 2021 issue. Subscribe to WIRED.

Illustration: Aaron Marin

The stricken species was named *Eriogonum tiehmii*, or Tiehm's wild buckwheat. (Tiehm is pronounced like "team.") Fraga had first met the plant in late spring, when the rains coax out a single pale yellow puffball of a blossom. Fraga thought it was adorable. It would make a splendid addition to a garden in Whoville. But the bloom lasts only a month. Most of the year the plant lies dormant; its plump leaves dry out and fade to a charmless gray.

Fraga is a botanist who considers herself to be in the service of plants. Many people love plants. They will tenderly care for them, encourage flowering or fruit, take an interest in the bark and leaves on a trail. A scientist may devote a lifetime to studying a single species. But to Fraga, these acts of appreciation, while welcome, are rooted in selfishness, not service. In her work as conservation director at the California Botanic Garden, near Los Angeles, she is frequently asked why a person should care about a rare plant. Sometimes she poses this question to herself, like a catechism. Fraga doesn't mean to get "all woo-woo" on you, but here it is: Her answer is not rooted in beauty or usefulness or even a sense of curiosity or wonder, but because a species exists uniquely on this earth. Fraga knows that most people don't feel this way. It is a level of respect that plants do not often receive.

Naomi Fraga, conservation director at the California Botanic Garden, on Rhyolite Ridge.

Photograph: Aubrey Trinnaman

What called her to the service of the Tiehm's buckwheat was its rarity. Fraga often hikes to the top of the white hill, where she can look out over the complete universe of the plant. At the time of her initial visit, the latest count was 44,000 buckwheats across 10 acres, rooted in eight patches of white earth. Some time ago—perhaps thousands of years, or maybe tens of thousands, nobody can say—seeds found their way into this soil, which lacks important nutrients like phosphorus and nitrogen, and is extremely alkaline, more like baking soda than loam. But wild buckwheats, which are relatively distant cousins of the crop used to make flour for pancakes, are a tenacious genus of plant, known for making do with whatever soil they happen upon. Evolution ran its course, and a new species emerged. The

plant learned to grow there and, as far as anyone knew, only there. There were no competitors for that toxic soil. Until, that is, the lithium mine.

In mining terms, the alkaline soil is called overburden—material that's stripped away to access desired material below. The value of lithium has soared recently as the reality of climate change hits home. The element is at the heart of the batteries that will power millions of electric cars and a renewable energy grid. In April, President Biden set a goal of halving US emissions from 2005 levels by 2030, and global demand for lithium-ion batteries is expected to quintuple by then. Until now, lithium has come almost exclusively from overseas, but as the rest of the world makes a similar scramble for resources, this supply is growing increasingly precarious. The mine that was proposed for this Nevada spot, known as Rhyolite Ridge, wouldn't solve that shortage on its own, but it would make a dent The area has enough battery-grade material to power about 400,000 electric cars a year for at least a quarter century. The total value of the mine's resources was estimated at $10 billion.

Even an amateur geologist viewing the landscape could see how hopelessly the habitat and the resource are intertwined. The white patches in which the buckwheat grow are outcrops of a rock called searlesite, where much of the lithium is locked. The mine would swallow much of the buckwheat's habitat—60 percent of the plants would be removed in phase one of the project, rising to 90 percent during phase two, according to conservationists. To compensate, the mine owners, who deny the loss would be that high, planned to transplant the buckwheat or grow it from seed in unoccupied soil nearby. But for a plant that has not naturally colonized any other home, it is not clear if they would survive the move.

No one doubts the value of lithium to mitigate climate change. But there would be costs wherever the element was extracted from the ground, and here that cost would come at the expense of a plant. Fraga had decided the buckwheat was hers to protect. That September day, she couldn't make sense of what she saw. She knew the summer had been unusually dry, which meant that animals were seeking moisture wherever they could, perhaps in the roots of plants. Maybe they had caused the destruction. But her first thought was that it had something to do with the mine. All she

knew for certain was that, while she was away, nearly half of an entire species had been destroyed. Fraga looked out over the hill. She wondered if she had already failed this plant.

The Tiehm's buckwheat in bloom. It would make a splendid addition to a garden in Whoville.

Photograph: Aubrey Trinnaman

Lithium is a feisty element. When it’s bonded with other elements to form a compound colloquially known as a salt, it may act as a mood stabilizer. But on its own it’s erratic, always wanting to give up an electron and take on a charge. It must remain under seal; the briefest contact with water or humid air will cause it to combust in a popping, sparking flame. These qualities also make it a perfect material for batteries, which are about taming the ephemeral—a spark, a flame—and bottling it up for later. Inside a battery, lithium ions and their liberated electrons will happily shuttle through an electrolyte from one end, the anode, to the other, the cathode, generating power along the way. And because lithium is the lightest metallic element, relatively little mass is required to store a lot of juice. In a Tesla Model S, only 3 percent of the battery pack is lithium metal, according to some outside estimates.

That level of efficiency, though, was long in coming. The first rechargeable battery, invented in 1859 by Gaston Plante, involved lead and acid. The same basic chemistry still creates the spark that starts a gas-powered car engine, but the design is as heavy and toxic as it sounds, and not powerful enough for many modern uses. By the beginning of the last century, scientists believed that lithium-based designs could pack more punch, going longer without weighing things down. It would take decades of experiments to work out the chemistry, and a viable commercial model emerged only in the 1990s. Three scientists who made it possible were awarded the Nobel Prize in 2019.

It is a miraculous thing that in 2021 a car can drive from Los Angeles to San Francisco on a single electric charge and without spewing exhaust, or that a solar farm can compete with a gas plant by storing electrons overnight. The rising demand for new electric cars and trucks is expected to

lead to a tripling of the energy capacity of new batteries between 2020 and 2025. These batteries aren't perfect. They will need to get smaller, more recyclable, more powerful, and also more diversified, with versions that depend on other resources, such as sodium or manganese. In the interim, though, the world needs a lot more lithium.

Lithium is abundant in the Earth's crust, but there is rarely enough in one place to go to the trouble of digging it up. The element is most common near ancient volcanoes where rock has been formed by slow-cooling magma. In some places, the lithium from those volcanic rocks leaches out and finds its way into the water table, forming a brine that can be pumped from the ground and evaporated, leaving lithium-bearing compounds behind. Until recently, Australian rocks and Andean brines have supplied enough lithium to satisfy most of the world's needs. But the scramble to shift from fossil fuels has inspired a search closer to home. The US has the fourth-largest lithium deposits in the world, most of them in Nevada, but only one active brine operation, located in the state's Clayton Valley, immediately to the east of Rhyolite Ridge. In both places, the lithium is the product of explosive volcanic eruptions that took place about 6 million years ago. The lithium was leached out of volcanic ash, then either remained in ground water, to be mined as a brine in the valley, or was absorbed by clays and sediments that now rest atop the ridge.

The virtues of this location are extolled by Bernard Rowe, managing director of Ioneer, the Australian mining company that owns the mining claims over Rhyolite Ridge. Rowe spoke over Zoom from Australia, where the pandemic has kept him for the past year, but his virtual background was set to a photo of the white Nevada hill. He first climbed it in 2016, three years before Fraga. A geologist by training, he had spent the previous decade scouring the American Southwest, mostly for new gold and copper deposits, and had rented a farmhouse in the nearby town of Dyer. At the top of the hill, he saw scars where prospectors in the 1920s had probed for boron, used then in fiberglass and today in all sorts of things, including smartphone screens. The boron deposit was so-so in quality. And the sediment was not as rich in lithium as pure rock, nor as easy to access as brines. But now that lithium was so valuable, Rowe saw an opportunity: two in-demand minerals in one spot, there for the taking.

Ioneer promised to operate thoughtfully, or as thoughtfully as an open-pit mine could. It would not leach out the lithium and boron with extreme heat, and instead would use a less-carbon-intensive method it had developed involving sulfuric acid. The company said it would dispose of those chemicals carefully, and highlighted plans to use autonomous mining vehicles to reduce traffic and pollution. It also secured the nearly unanimous support of neighbors. Talk to anyone in this erstwhile gold-mining region and expect to be regaled with enthusiasm for the arrival of "white gold."

There was, of course, one problem: the buckwheat. Rowe knew from the start that the ridge was home to a species that the Bureau of Land Management considered "sensitive." This meant the mine would need a plan for the plant. The mining would happen at the base of the hill, where plenty of buckwheat plants would need to be dug up. But they would be replanted, and, he said, pointing over his shoulder to the white hill, "we're not planning to touch that." The portion on high ground would remain intact. Rowe told me that the mine is ultimately a friend to the buckwheat—a catalyst for its protection—and argues that a concerted effort to replant the buckwheat in other areas can only help it repopulate. "If you do nothing with this plant, it will be gone," he said. In the whole history of this plant, only the mine had stepped in to fund substantial studies and protect it.

And besides, the mine would produce an element necessary to mitigate climate change—a misfortune that will eventually wreak havoc on all plants, on this ridge and everywhere else. "We can't just close our eyes and ears to the fact that we need lithium," Rowe said.

"We can't just close our eyes and ears to the fact that we need lithium," says Bernard Rowe of the mining company Ioneer, which has placed exploratory bore holes on Rhyolite Ridge.

Photograph: Aubrey Trinnaman

There is a reason the buckwheat ended up on the BLM's list of sensitive plants, and his name is Jerry Tiehm. He is the curator at the herbarium at the University of Nevada-Reno where he tends to a vast collection of flora, kept dried and pressed in a row of metal cabinets. This includes seven

species in the *tiehmii* clan. Tiehm always refers to his plants by their scientific name, holding them at a little distance. He likes most plants. There is a peppergrass, which springs with great enthusiasm from the cracks of dried lake bottoms, that he might even love. But that species was named after a lucky man called Davis. Tiehm is 69 years old and needs knee surgery, but he plans to spend the summer finding plants driving around in his GMC Yukon. Nevada remains a place of botanical mystery. He feels a responsibility to decipher it.

Tiehm begins the story of how he found the buckwheat with one of his sayings: "Strange habitats yield strange plants." In the spring of 1983, he was part of a band of botanists hired by the New York Botanical Garden and dispersed to survey the vast territory stretching from the Sierra Nevada to the Rockies. It involved a lot of solo wandering and long, disappointing days. But the spring morning when he turned a corner on the road through Rhyolite Ridge and saw that odd white hill, he knew there would be something. Sure enough, before him was a type of wild buckwheat that he did not recognize. He pressed a few plants and mailed them to a colleague who knew the genus better than he did. Soon after, Tiehm received a phone call and learned that he had become, once again, the eponym of a flower.

Tiehm went part-time on botany for a while. He found work in Reno as a casino bellman and limo driver and did a little consulting work for gold mines and geothermal exploration projects. In 1994, he was asked by the BLM to go back to the ridge and do a formal census of his namesake. He searched well beyond its 10-acre habitat, hiking into some of the nearby mountains where he could see similar patches of white earth from the highway. But he didn't find it there. He noted the old mining scars, so he suggested in his report that the BLM restrict mineral extraction in the area, which the agency declined to do. He didn't press the issue. Apart from this odd plant, who would want this lonely hill?

Then, two years ago, Tiehm found himself driving down to Rhyolite Ridge with Elizabeth Leger, a fellow botanist and his boss at the university. She was conducting a study, with money from Ioneer, to see whether the buckwheat could be safely moved from the mining pit. She needed to gather the native soil to grow seedlings in the greenhouses on campus. Leger had

taken on the research knowing that transplanting might not work. In 1987 government scientists had tried to move the Crosby buckwheat, another lover of strange soils, to make room for a gold mine north of Reno. It grew happily in its new home at first. Then, 30 years later, one of Leger's graduate students decided to check in. They found the habitat choked with other plants, barely a buckwheat to be found. Luckily, Crosby's buckwheat had other homes besides the gold mine. Tiehm's did not. "In my opinion," Tiehm says, "this plant is not going to grow in any other place you put it."

But it wasn't Tiehm's project. He was just there as a guide. "I'm good at knowing what's not my business," he says. Still, it was a strange position to be in. Without him, the buckwheat could very well have been tilled as overburden, and no one would have been the wiser. Would it matter? The buckwheat is an endangered species, he believes. Yet he can see also how much the world needs lithium. He can see the road to clean energy is an imperfect one, not without collateral damage. Who is he to decide where the hammer should fall?

In Esmeralda County, Nevada, a three-hour drive to Costco is a routine grocery run. Roughly 900 people live over 3,580 square miles in two valleys on either side of Rhyolite Ridge. The volcanic outcrop is a botanical meeting point. One side is a forest of Joshua trees, the northernmost of the Mojave, and the other is a sea of sagebrush, the start of the Great Basin. For Fraga, driving to the ridge from her home on the outskirts of Los Angeles is a multiday trip.

When Fraga and I arrived there on a bright day last October, the first thing she saw was a pair of ATV tracks cut deep into the white hill and straight through the buckwheat. "You've gotta be friggin' kidding me," she said as she hopped out of the passenger side of a dust-covered Toyota Tacoma. Fraga is 41 years old and was wearing leggings tucked into hiking shoes, her hair in a ponytail under a baseball cap. The Tacoma's driver, Patrick Donnelly, is the Nevada director for the Center for Biological Diversity, a conservation group leading the cause for the buckwheat's protection. He made a note to report the new damage to the BLM and grumbled about how it should have already put up a fence.

The habitat is protected on three sides by rhyolitic cliffs, and the air is still. But as we climbed up, the quiet was interrupted by the occasional rumble of a mining truck installing protective barriers over Ioneer's bore holes. We stopped to observe it. This is public land, so all of us—joyriders, miners, botanists, journalists—had a right to be there. But everyone looked like a trespasser to someone else. Donnelly was feeling especially paranoid. A few months earlier, during a pitstop for sandwiches at a store in Dyer, the pair had spotted a poster that said "MISSING" above a photograph of the Tiehm's buckwheat in bloom. Ioneer was advertising a $5,000 reward for sightings outside the path of the lithium mine. The poster was a long shot; professional botanists like Tiehm had tried and failed to find any rogue buckwheat colonies. Fraga thought the poster placed an unwelcome target on the plant, even though it clearly said "do not collect." Maybe it would encourage a local to dig it up and then miraculously find it somewhere else. Not long after, a researcher from the University of Nevada-Reno, checking on a buckwheat transplant experiment, found the summer massacre.

To Fraga, the value of a plant is not rooted in beauty or usefulness or even wonder, but because a species exists uniquely on this earth.

Photograph: Aubrey Trinnaman

The discovery kicked off an investigation by the US Fish and Wildlife Service. A preliminary report by UNR concluded that the damage was caused by rodents, not people. But Fraga and Donnelly remained skeptical. The evidence was circumstantial and could have happened after the fact. They had never seen a single species targeted so systematically and at such a suspicious time. Then again, if people had done the damage, why had they left the job half finished? We picked our way over the chalky hillside, sidestepping dormant buckwheats. Fraga picked up a severed plant and asked if it looked as if it had been gnawed by rodent teeth or cut with shears. It was hard to tell.

Fraga is from a working-class suburb of Los Angeles. When she was a child, her parents, immigrants from Chihuahua, Mexico, did not hike or camp; her mother did clerical work in various offices, and her father worked long hours driving a truck. There were barely any plants to look at in the industrial sprawl of the southern San Gabriel Valley. But in college,

her biology coursework led to a volunteer job at the local botanical garden, where her job was to digitize the plant specimens and notes of 19th-century botanical explorers. She fell in love with their single-minded passion, a quality she also found in the people she met at the garden, who were crazy about plants. “All they could do was talk all day about them,” she says. Fraga had been unaware that people like that existed.

For most people, plants are at the outer edge of our “moral circle,” a term popularized by the bioethicist Peter Singer. We hold them at a greater distance than our family or strangers or most animals. Their ways of communicating are unfamiliar, and their foundational role in our lives is harder to understand. When Fraga’s father learned what she planned to do with her biology degree, he didn’t understand why she wouldn’t want to work with people. A few years ago she took him searching for rare flowers in the mountains close to home, to help him see what she saw in plants. He told her he appreciated her skilled driving on dirt roads.

In graduate school, Fraga’s focus was a family of desert plants called monkey flowers, which produce quirky blossoms but are weedy and hard to love. The species she chose as her dissertation topic was rare, and, as it happened, in the path of a future development. The plant had previously failed to get protection because not enough research had been done. Inspired, Fraga dug into her research and wrote a conservation plan detailing how to best protect the flower. She would have to figure out a way to speak a little louder to advocate for certain plants, she decided. She met Donnelly while conducting field work near Death Valley. They became close friends, and years later he asked for her help saving a rare buckwheat, the Tiehm’s. Fraga told him she would do what she could.

Fraga often calls her time with buckwheat an “experiment.” She is a scientist, not an activist, and finds it strange to have stepped over this invisible barrier, putting herself at odds with government scientists she knows from botanical listservs and desert plant conferences. Where Fraga is measured with her words, Donnelly is prone to blurt out sharp opinions. He has hit UNR and the local BLM office with so many open records requests that state officials began to avoid using the word *Tiehm’s* in emails. “Sometimes you have to sue the motherfuckers!” he says.

Donnelly first became aware of the plant's plight in 2019, and shortly after that his organization successfully sued to stop Ioneer from exploring the terrain. That fall, they petitioned the US Fish and Wildlife Service to declare Tiehm's buckwheat an endangered species. "If the Endangered Species Act has any meaning at all, this plant gets listed," he says. Donnelly had seen plenty of plant destruction throughout his career. And yet the damage to the buckwheat last summer hit him especially hard. "It was like seeing a good friend of mine get murdered," he says. When Donnelly thought about giving up, Fraga reminded him there were still plants left to save.

The Endangered Species Act was passed in 1973 on a nearly unanimous vote that reflected a collective awakening to the accelerating crisis of extinction. This was quickly challenged when an endangered fish called the snail darter got in the way of the partially built Tillicoe Dam, in Tennessee. In 1978, the Supreme Court ruled for the fish and affirmed the intent of the law: to protect species at "whatever the cost."

Conservationists like Donnelly have since wielded a singularly powerful tool: petitions to protect threatened species. The government can delay or reject those petitions, and often does. (There is a current backlog of more than 500 petitioned species.) But each successful listing adds up to a larger strategy of protecting biodiversity and offers a way to protect the waters, the old growth forests, and the hillsides on which species live and that other laws do not so clearly protect. Some conservationists will admit (perhaps after a few drinks) that it is rather peculiar to have made *species* the basic subunit of conservation. Modern biology has taught us that a species is a messy concept; drawing neat categories based on reproductive rules or genetics or physiology is often impossible. A few years ago, the entire group of monkey flowers that Fraga studied was swept from one genus to another. But the category of "species" is now part of the legal philosophy that holds us back from far wider ecological destruction.

That rationale does not fully account for Donnelly's deep "personal relationship with an inanimate being," as he puts it. He advocates for dozens of Nevada species, and yet it is Tiehm's buckwheat that he thinks about all the time. It is the most extreme example of rarity he has ever

known, always flickering at the edge of nonexistence. All it would take is another incident like last summer's. "We're the only ones paying attention," he says. "I feel a level of personal responsibility."

We stopped to catch our breath halfway up the white hill, which is tremendously steep, on our way to the best spot to view the buckwheat's universe. Fraga believed the extinction of any species was a tragedy, whether or not anyone had studied it or even laid eyes upon it, but she knew that wouldn't satisfy most people. As we paused, Fraga noted that if the government had funded more studies of this rare plant in the 1990s, after Tiehm had surveyed it, she would be more prepared to make a case for it for those, unlike her and Donnelly, who don't instinctively feel an emotional connection to a plant living on a remote Nevada ridge. She could say more about its role in the ecosystem: the food and shelter it provides to animals, the way it acts as a landing pad for pollinators like bees.

The buckwheat is unlikely to become a cash crop or yield chemicals in its leaves that would kill an antibiotic-resistant superbug. But what if its genes harbor secrets that other plants could use to adapt to harsh places? We know what the mine offers, but we've been given so little time to understand this plant. Perhaps if more forethought was given to how to preserve and advocate for rare things before they are threatened, they would not be in such a fix. Now judgment day is here, and the only true research on the plant is being funded by a mine.

The environmental ethicist Katie McShane compares our reverence for species to the word *freedom*. Everyone believes in it, but nobody knows what it means. "Even if you agree that it has value, it doesn't tell you what to do when that value conflicts with my needs," she says.

Comparing the value of things, weighing the costs and benefits of one against the other, is increasingly the preoccupation of environmentalists. Sometimes those competing things both have a claim in the natural world; sometimes one has a claim to bettering human life. Or the planet as a whole. If the mine at Rhyolite Ridge were digging for gold or copper, perhaps it would be easier to dismiss its value. Everyone benefits from raw materials, but it can be easy to say that you don't "need" gold or that dollar value isn't paramount. With lithium, denial is harder. Donnelly and Fraga

both agree that the country—the world—needs to wean itself from fossil fuels. Lithium and sunshine are abundant in the desert Southwest, and so the transition to green energy will likely bring a new level of industrialization to its landscape. Mines and solar power plants will compete with rare buckwheat and desert tortoises. But in the absence of those mines and power plants, the desert will still suffer. For all their harsh conditions and seeming barrenness, deserts are fragile places, the life there is easily imperiled by higher temperatures and more frequent droughts. The conditions demand we formulate a moral equation: What is the value of a mine versus the value of a plant?

All mines have a dirty side, whether or not their products are "green." They can destroy landscapes or pollute water supplies or expel greenhouse gases. Historically, mining companies have cared little about those impacts, doing the bare minimum required by regulations. But lithium miners face extra pressure to act responsibly, explains Alex Grant, a technical adviser who works with those mines. Electric vehicle buyers are likely to care, for example, that 25 percent of their car's lifetime carbon impact comes from the battery supply chain. So automakers, seeking to enhance their climate-friendly reputations, have increasingly leaned on lithium suppliers to burn less coal and seek certifications attesting that their mines do not ruin waters and habitats.

It is impossible to make every cost go away. As Grant sees it, there is no alternative to digging up lithium. The status quo of fossil-burning cars is not an option. What did opponents of lithium mining expect? A return to the horse and buggy? "We don't need every project," he says. "Some of them might have impacts that we should not accept. But we're going to need a large fraction of them, that's for sure."

Each project seems to have its own set of costs that someone will find unacceptable, which makes deciding which ones should be allowed to move forward yet more difficult. In Nevada's far north, Thacker Pass, another major lithium project close to digging, is held up by disputes with indigenous groups and ranchers over water rights and pollution. The same is true in places like Chile and Bolivia. Alternatives that appear more ecologically appealing, like brines near California's Salton Sea, have been

talked about for decades, but the technology and financing behind those projects is uncertain. We could look to the oceans, maybe; deep-sea mining could offer lithium on a scale that would make any terrestrial mine seem puny. But the environmental costs of that approach are arguably even less well understood, and potentially enormous.

In that context, the fate of a humble flower seems like a very small thing when the lithium can be had so soon, and with few extra complications. Mining interests, ranchers, and developers have long argued that the process of listing endangered species should factor in economic costs, like the lost value of a mine or the expense of keeping a species on life support when it seems natural forces could select it out of existence.

To Fraga, this is all a logical trap. Certain arguments for the plant may be emotional or reverent. But perhaps our rush for lithium is also emotional and prevents us from thinking on a longer time scale. “Rhyolite Ridge is not the only great hope for lithium,” she says. Perhaps we could wait a little longer for our domestic lithium, maybe pay a little more in the interim, work out the compromises that are required to mine in other places. Naysayers might point to the damage brought about by a warming climate and say Tiehm’s buckwheat is a doomed species no matter what. Better to sacrifice it now for the greater good of alternative energy. Fraga disagrees. The buckwheat clearly needs help, but it can hardly be written off as a goner. The mine is a death sentence to a species that could live on, evolve, contribute in ways that we have not had the time to comprehend. As she sees it, protecting this plant is a service to our future, both for ourselves and for other species.

The chalky soil of the white hill should have a slight bounce, like walking on moss, but the drought has depleted it.

Photograph: Aubrey Trinnaman

Some years, the springtime blankets the Nevada desert with superblooms of color. Dull-brown hills turn to waves of blue and purple and gold. But when Fraga visited the white hill in April, the previous 12 months had been the state’s driest on record, and Rhyolite Ridge was as thirsty and barren as it had been the previous fall. The chalky soil should have a slight bounce, like

walking on moss, but instead it crumbled underfoot. Fraga still hoped to see signs of life. The plant had been dormant since the incident last summer, and this was the season when she could begin to truly assess the damage.

The visit happened at an uncertain time. Leger's team at UNR had recently reported back on its transplant efforts. They didn't look promising. In the campus greenhouses, the buckwheat grew well in soil gathered from the habitat, but not in the similar soil gathered from unoccupied sites nearby. The plant was picky. The team also learned that the buckwheat was popular with insects—more so than any of its neighbors. It was a small thing, but it is unusual to know these kinds of details about a rare plant, Leger told me. There is a lot more to learn.

Leger also worries for the plant. As she was preparing her findings, a DNA analysis from US Fish and Wildlife had affirmed that the summer damage was done by rodents, which was alarming. "They cannot be legislated, and they are the most creative creatures when it comes to overcoming fences or barriers," she says. "This is an area that needs immediate attention and research." If it was going to survive, the buckwheat would need protection from more than just the mine.

In early June, the buckwheat won its first major victory. After a series of delays and lawsuits, Fish and Wildlife issued a preliminary decision: Listing the Tiehm's buckwheat was warranted. While the government is often recalcitrant in fights over listing species, there were many threats to cite: ATV drivers, rodent massacres, climate change—and, crucially, the mine. The combination of last year's damage and the mine's initial dig would mean losing up to 88 percent of the plants, they calculated, and based on Leger's results the transplant idea seemed ill-advised. But the battle is not over. Rowe says Ioneer is working with private botanical consultants on a new, "expanded" protection plan, with a more aggressive time frame involving more test transplants and more soils than UNR had attempted. It will be up to the government to decide whether the science bears out.

In the meantime, Fraga and Donnelly continue making pilgrimages to the ridge. Within a few moments of arriving that dry April morning, Fraga spotted it: a hint of soft green. And another. And another. Some of the young buckwheats looked like seedlings, springing from undisturbed white

soil; others seemed to be grafting from the damaged roots. Fraga crouched down and cupped a tender shoot. It was small and delicate; she couldn't be certain what another hot summer might do to it. But she was surprised and feeling hopeful. In a few weeks' time, in May, there might even be a blossom or two. Perhaps, she speculated, the plant has a natural cycle that we don't yet comprehend. A single buckwheat can live for centuries. Our human eyes have beheld this species for such a brief time. Who are we to say how resilient it is?

This story has been updated.

Let us know what you think about this article. Submit a letter to the editor at mail@WIRED.com.

Matt Simon

Science
06.16.2021 02:00 PM

A Clever Robot Spies on Creatures in the Ocean's ‘Twilight Zone’

Mesobot looks like a giant AirPods case, but it's in fact a sophisticated machine that tracks animals making the most epic migration on Earth. Photograph: Evan Kovacs/Woods Hole Oceanographic Institution

The grandest migration on Earth isn’t the journey of some herbivore in Africa or a bird in the sky, but the *vertical* movement of whole ecosystems in the open ocean. All kinds of animals, from fish to crustaceans, hang out in the depths during the day, where the darkness provides protection from predators. At night, they migrate up to the shallows to forage. Then they swim back down again when the sun rises—a great big conveyor belt of biomass.

But now a spy swims among them: Mesobot. Today in the journal *Science Robotics*, a team of engineers and oceanographers describes how they got a new autonomous underwater vehicle to lock onto movements of organisms and follow them around the ocean’s “twilight zone,” a chronically understudied band between 650 feet and 3,200 feet deep, which scientists also refer to as mid-water. Thanks to some clever engineering, the researchers did so without flustering these highly sensitive animals, making Mesobot a groundbreaking new tool for oceanographers.

“It’s super cool from an engineering standpoint,” says Northeastern University roboticist Hanumant Singh, who develops ocean robots but wasn’t involved in this research. “It's really an amazing piece of work, in terms of looking at an area that's unexplored in the ocean.”

Mesobot looks like a giant yellow-and-black AirPods case, only it’s rather more waterproof and weighs 550 pounds. It can operate with a fiber-optic tether attached to a research vessel at the surface, or it can swim around freely.

Video: Erik Olsen/Woods Hole Oceanographic Institution

Mesobot’s first bit of clever engineering is its propulsion system—large, slow-moving propellers that create low-velocity jets. “Why are we so concerned about disturbing the water?” asks Dana Yoerger, a senior scientist at the Woods Hole Oceanographic Institution and lead author on the paper. “Most mid-water animals are extremely sensitive to any hydrodynamic disturbance. Because usually, that's something coming to eat them.” If you’re disturbing these animals, you’re not observing their natural behaviors. (Unless you’re curious about what annoys them.)

The second clever trick ensures that Mesobot doesn’t bother its subjects by blasting them with light. Well, at least not white light. Yoerger and his team opted for a red beam, because it doesn’t penetrate seawater well. “Evolution doesn't waste a lot of capability on stuff that doesn't work very well, so most animals are blind to red light,” says Yoerger. That’s why when you see bioluminescent critters popping off in the deep sea, they’re blue or green. “We use red,” Yoerger continues, “even though red is pretty lousy, because it doesn't go very far. But it doesn't spook the animals as much. And that's pretty well documented. So it's a trade-off: You need a lot of light, you need a sensitive camera, and then you can work in the red.”

Using stereo cameras and detection algorithms, Mesobot parses its subjects’ movements and follows them. Yoerger and his colleagues demonstrated the robot’s capabilities in California's Monterey Bay at 650 feet deep, as it detected and then pursued a hunting jellyfish. Even more impressive, for a half hour it surreptitiously followed a fragile animal called a larvacean, which resembles a tadpole and builds a giant mucus “house” to filter its food. (The robot did eventually disturb the extremely sensitive outer structure of the house, but the house's inner structure and the animal itself remained undisturbed.) Based on their testing, the team reckons the robot might be able to operate for more than 24 hours and reach depths of 3,200 feet.

The tadpole-like larvacean

Courtesy of Mesobot

For now, Mesobot can’t collect animals, but in the future it could employ a suction system to nab them. Just observing sea creatures with a camera won’t tell you what they’ve been eating, for instance, and therefore where they fit into the food web—you’d need a dissection for that. If you want to study their physiology, you need a physical specimen too. “The idea would be you'd follow an animal for a while, and then you'd grab it. I think that's very doable,” says Yoerger.

Mesobot may look like a big AirPods case, but compared to other crewed submersibles and ocean robots it’s actually quite compact. Perhaps the most famous of all is Alvin, which the Woods Hole Oceanographic Institution also operates. It weighs 45,000 pounds and can launch from just one specific ship. Mesobot’s smaller size means it’s cheaper to build and more easily deployable, which will likely open the platform to more researchers. “That's another big win,” says Singh, of Northeastern University. “It doesn't need all this extra stuff—large winches, large ships.”

Scientists have long known that species are conducting a daily vertical migration, but up until now they’ve had to study it by catching them at different depths, or by using sonar to pinpoint where they are congregating at a given time. After all, it’s not like you can slap a tracker on a jellyfish or larvacean to monitor its movements in fine detail. “We have so few observations about a lot of fish,” says Luiz Rocha, curator of fishes at the California Academy of Sciences, who studies reefs in the twilight zone but wasn’t involved in this new work. “We don’t even know how they swim, let alone how they eat or how they reproduce.”

Mesobot tracks a jellyfish

Courtesy of Mesobot

And scientists don’t have a great idea of how different species that travel through mid-water are interacting; for instance, which predators follow their prey up and down the water column? Are the animals migrating in

tight schools or in a more dispersed fashion? Or, how might climbing ocean temperatures influence how a given species migrates, and might that in turn influence others in its food chain? Oceanographers could try to track them with submersibles, but anything less stealthy than Mesobot would probably scare all the subjects away. “But if you have a robot that can stay submerged up to 24 hours and follow a fish or a group of fish for all that time, then you can think about studying those phenomena,” says Rocha.

Meghan O'Gieblyn

Ideas
06.16.2021 08:00 AM

Why Do I Like Waiting for My Smartphone Photos to 'Develop'?

WIRED’s spiritual advice columnist on apps, impatience, and the struggle to control time itself.
Illustration: Cha Pornea

SUPPORT REQUEST:
I recently downloaded one of those camera apps that makes you wait a few days before you can access the photos. The delay reminds me of waiting to get photos developed as a kid and makes the whole process more enjoyable. But aren’t I supposed to use technology to make things faster and more efficient? Am I deluding myself by trying to somehow live in the past?

—FOCUSED

Dear Focused—

It’s difficult to talk about cameras without also talking about time. Photography is an attempt to outwit the clock and the calendar, an art that, as the film critic André Bazin once put it, “embalms time, rescuing it simply from its proper corruption.” Even as the technology grows more sophisticated, cameras maintain some of their ancestral trappings, as though they too are frozen in time. The capture button on your phone’s camera app still makes the mechanical clack of a physical shutter. The filters fade images and alter the color palette, mimicking an aging process to which digital photos are immune.

With that said, I'm doubtful that simple nostalgia led you to download this app. If you'd wanted to entertain the fantasy of living in the past, you could have easily hopped on eBay or headed over to a second-hand shop, those graveyards of analog technologies, and picked up an old SLR. My guess is that the app is satisfying a more specific desire, that the wait itself is the primary draw.

Most of us, of course, have the opposite instinct. It's well known that people usually opt for immediate pleasures, even when waiting costs less or offers a greater reward. This cognitive bias, which is known in behavioral economics as "hyperbolic discounting," is so basic to human nature that it is dramatized in our earliest myths. (Faced with the choice between an apple and immortality in paradise, Adam and Eve chose the forbidden fruit.) If anything, the speed of contemporary life has only further diminished our ability to wait. The one-hour photo boom that coincided, in the late 1970s, with the invention of the mini lab is a prime example of how profitable impatience can be for those who know how to exploit it. Customers proved willing to pay almost twice as much to get their film developed in 60 minutes as opposed to several days. "We live in an instant-gratification society," one early mini lab owner told *The New York Times*. "We want things now."

You strike me, Focused, as one of those rare souls who is capable of monumental self-control, the kind of person who is willing to forgo the $50 offered now in favor of the $100 promised later. It's a trait that is undoubtedly useful in many situations, though in the case of the camera app, there's no real virtue in delayed gratification. The reward does not increase with time; you get the same photos. In a sense, your desire to wait is even more irrational than hyperbolic discounting, which has, at least, an evolutionary advantage (those who decline life-sustaining rewards might not live to see more distant ones).

For people like you, economics and marketing psychology will be less helpful, I think, than philosophy. Bertrand Russell noted as early as 1930 that the endless novelties of modern existence could become tiresome. "A life too full of excitement is an exhausting life, in which continually stronger stimuli are needed to give the thrill that has come to be thought an

essential part of pleasure," he wrote. Russell believed that instant gratification had eradicated our ability to endure those periods of boredom and idleness that made pleasure truly enjoyable, just as long winters increase the joy of spring's arrival. We are creatures of the earth, he writes, and "the rhythm of Earth life is slow; autumn and winter are as essential to it as spring and summer, and rest is as essential as motion." The irony is that in cultures that are intently focused on the "now," promising to fulfill any whim instantaneously (a guarantee echoed in the names of the major photo-sharing platforms: Instagram, Flickr), it becomes difficult to actually enjoy the present, so fixated are we on the next entertainment, the next post, the next dopamine hit.

I imagine, Focused, that you might be feeling some of that exhaustion. Perhaps choosing to wait for your photos is an attempt to escape the tyranny of pleasure, to exempt yourself from the daily grind of novelty that threatens, like the eternal scroll of the newsfeed or the bottomless well of search results, to go on forever. The speed with which we can now produce and access images comes with burdens of its own. The duty to immediately scrutinize, edit, and share the photos you've taken often prevents you from fully experiencing the moment that was presumably beautiful enough to capture.

Traditionally, even those innovations designed to accelerate the pace of life have brought with them unexpected pockets of idleness. The one-hour photo lab generated an awkward interval, too short for many errands, that some customers probably filled by taking a stroll around town or wandering over to the park for a cigarette. The MP3 introduced a five-minute window of download time (can we ever have waited so long for music?) during which you could write an email or make a cup of coffee. The author Douglas Coupland once wrote about "time snacks," moments of "pseudo-leisure created by computers when they stop responding." Our snacks have become more meager over the years, reduced to those fleeting seconds when our gaze drifts away from the screen while waiting for a page to refresh or an app to download, though the reprieve is still palpable. The beauty of such moments is not unlike the relief we feel when a blizzard or a rainstorm brings life to a halt, rendering us helpless, granting us permission to be still. The delay imposed by your camera app is an attempt to capture

and extend those moments of forced indolence—to “embalm” them, so to speak.

Even so, instant gratification is a difficult habit to break. I probably shouldn’t mention this, but some early users of slow camera apps have confessed to tampering with their phone’s time and date settings—literally moving time forward—in order to override the delay and get their photos immediately. What else can you expect from a species that prides itself on its ability to control time? We are a civilization, after all, that decided to bump the sun’s rising forward one hour each summer, and that now purchase SAD lamps and sunrise alarm lights to fine-tune our diurnal cycles. In the 1920s, the founder of Kodak, George Eastman, became so exasperated with the irregular lengths of each month—which made it difficult to compare sales periods—that he ran his company on its own 13-month calendar, inaugurating a new month, Sol, between June and July.

All of which is to say, as much as we might begrudge the fact, we are each fully responsible for how we experience time. We have long since severed ourselves from the earth’s rhythms. Our lives no longer slide along the linear continuum of past, present, and future but step to the tempo of the 24-hour news cycle, the weekly ritual of software updates, the sporadic arrival of new television seasons or whatever other media and entertainment we decide to consume. If you find satisfaction in delaying certain pleasures, you should accept it as a deliberate choice, keeping in mind that it can always be revisited and revised. Photo developing, after all, has no natural, fixed duration, and whether it passes quickly or slowly depends—much like the length of a month or the span of a day—on how you choose to spend it.

Faithfully,

Cloud

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