WHAT IF...THINGS STARTED TO ESCALATE?
WHAT IF...ALL COMMUNICATIONS WERE KNOCKED OUT?
WHAT IF...CYBERWAR WAS ONLY THE BEGINNING?

WIRED

2034

A HISTORY
OF THE
NEXT
WORLD
WAR

A NOVEL BY ELLIOT ACKERMAN AND ADMIRAL JAMES STAVRIDIS

Wired.2021.02.02

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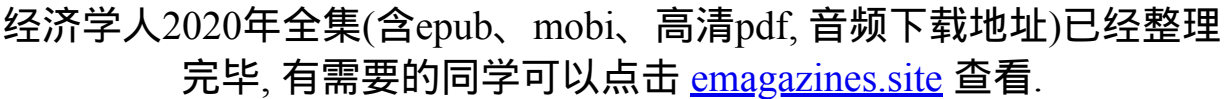
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01.26.2021 07:00 AM

2034: A Novel of the Next World War, an Exclusive Excerpt

What if things escalated? What if communications were knocked out? What if cyberwar was just the start? A note about this special six-part series.

world map overlaid on a grid

The world of *2034*: 1. Washington, D.C. **2.** Quantico **3.** Barents Sea **4.** Tehran **5.** Isfahan **6.** Bandar Abbas **7.** Strait of Hormuz **8.** New Delhi **9.** Beijing **10.** Yokusuka Naval Base **11.** Zhanjiang **12.** Taouan Airport **13.** Taipei **14.** South China Sea **15.** Spratly IslandsIllustration: Getty Images

WIRED has always been a publication about the future—about the forces shaping it, and the shape we'd like it to take. Sometimes, for us, that means being wild-eyed optimists, envisioning the scenarios that excite us most. And sometimes that means taking pains to envision futures that we really, really want to avoid.

By giving clarity and definition to those nightmare trajectories, the hope is that we can give people the ability to recognize and divert from them. Almost, say, the way a vaccine teaches an immune system what to ward off. And that's what this issue of WIRED is trying to do.

Over the past several years, relations between the US and [China](#) have moldered. And they're not likely to solidify any time soon. At this point, the two countries are not only strategic and economic competitors; they've also begun to split into increasingly separate technological spheres— turning the race for innovations in [artificial intelligence](#), [quantum computing](#), and cyberweapons into what could become a zero-sum game.

Hypernationalist politics aren't liable to go away either. It's something that eats at us.

A few months back, we were on the phone with the writer and novelist [Elliot Ackerman](#), discussing edits on [another WIRED story](#), when he said something that made our ears perk up. He mentioned he was finishing a novel with [Admiral James Stavridis](#) that imagines how the political and technological conditions of today might erupt into a war between the US and China.

This article appears in the February 2021 issue. [Subscribe to WIRED](#).

Illustration: Owen Freeman

A bit about these two authors: Ackerman, who has written five novels and a memoir, also served five tours of duty as a Marine in Iraq and Afghanistan, as well as one term as a White House fellow during the Obama administration. Stavridis commanded fleets of destroyers, a carrier strike group, and the US Southern Command before serving as supreme allied commander of NATO from 2009 to 2013; after that he became dean of the Fletcher School of Law and Diplomacy at Tufts University. The two authors think deeply about [national security](#). And neither has any appetite for war with China.

When we talked to them, Stavridis told us that he was inspired to write this novel by works of fiction that came out of the Cold War. Maybe one reason why that conflict didn't erupt into World War III, he said, was that so many authors worked meticulously to imagine the worst-case scenario—to make the unthinkable as vivid as possible. Stavridis rattled off a few examples. (One that loomed large: *The Third World War*, by John Hackett.) We were reminded of 1983's *The Day After*—the most-watched made-for-TV movie of all time, which painstakingly depicted the aftermath of nuclear war in a Kansas town. It was seen by 100 million Americans, including the president and the joint chiefs.

Ackerman and Stavridis' collaboration, *2034: A Novel of the Next World War*, is a supremely well-informed effort to cast a similar kind of spell against sleepwalking into a war with China. "The case for this book with

Elliot was that a cautionary tale might help us stay out of any event like that," says Stavridis.

So we've decided to do something unusual: We gave over the whole February print issue of WIRED to an excerpt from their book, and here at WIRED.com, we are rolling it out in six parts, once a week on Tuesdays. (The full novel will be available where books are sold, on March 9.) Consider this another vaccine against disaster. Fortunately, this dose won't cause a temporary fever—and it happens to be a rippingly good read. Turns out that even cautionary tales can be exciting, when the future we're most excited about is the one where they never come true. —*The Editors*

Part I: Peril in the South China Sea
Part II: Blackout in Washington, DC (coming February 2)
Part III: One Left to Tell the Tale (February 9)
Part IV: The Spratly Islands Ambush (February 16)
Part V: Sailing Into Darkness (February 23)
Part VI: Crossing the Red Line (March 2)

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By Elliot Ackerman and Admiral James Stavridis

Backchannel
01.26.2021 07:00 AM

2034, Part I: Peril in the South China Sea

"We've got a ship in duress that's sailing without a flag and that hasn't sent out a distress signal. Something doesn't add up."

aircraft carrier with an American flag

Illustration: Owen Freeman
14:47 MARCH 12, 2034 (GMT+8)
SOUTH CHINA SEA

It surprised her still, even after twenty-four years, the way from horizon to horizon the vast expanse of ocean could in an instant turn completely calm, taut as a linen pulled across a table. She imagined that if a single needle were dropped from a height, it would slip through all the fathoms of water to the seabed, where, undisturbed by any current, it would rest on its point. How many times over her career had she stood as she did now, on the bridge of a ship, observing this miracle of stillness? A thousand times? Two thousand? On a recent sleepless night, she had studied her logbooks and totaled up all the days she had spent traversing the deep ocean, out of sight of land. It added up to nearly nine years. Her memory darted back and forth across those long years, to her watch-standing days as an ensign on the wood-slatted decks of a minesweeper with its bronchial diesel engines, to her mid-career hiatus in special warfare spent in the brown waters of the world, to this day, with these three sleek Arleigh Burke-class destroyers under her command cutting a south-by-southwest wake at eighteen knots under a relentless and uncaring sun.

Her small flotilla was twelve nautical miles off Mischief Reef in the long-disputed Spratly Islands on a euphemistically titled *freedom-of-navigation patrol*. She hated that term. Like so much in military life it was designed to belie the truth of their mission, which was a provocation, plain and simple. These were indisputably international waters, at least according to established conventions of maritime law, but the People's Republic of China claimed them as territorial seas. Passing through the much-disputed

Spratlys with her flotilla was the legal equivalent of driving doughnuts into your neighbor's prized front lawn after he moves his fence a little too far onto your property. And the Chinese had been doing that for decades now, moving the fence a little further, a little further, and a little further still, until they would claim the entire South Pacific.

So … time to doughnut-drive their yard.

Maybe we should simply call it that, she thought, the hint of a smirk falling across her carefully curated demeanor. Let's call it a *doughnut drive* instead of a *freedom-of-navigation patrol*. At least then my sailors would understand what the hell we're doing out here.

She glanced behind her, toward the fantail of her flagship, the *John Paul Jones*. Extending in its wake, arrayed in a line of battle over the flat horizon, were her other two destroyers, the *Carl Levin* and *Chung-Hoon*. She was the commodore, in charge of these three warships, as well as another four still back in their home port of San Diego. She stood at the pinnacle of her career, and when she stared off in the direction of her other ships, searching for them in the wake of her flagship, she couldn't help but see herself out there, as clearly as if she were standing on that tabletop of perfectly calm ocean, appearing and disappearing into the shimmer. Herself as she once was: the youthful Ensign Sarah Hunt. And then herself as she was now: the older, wiser Captain Sarah Hunt, commodore of Destroyer Squadron 21—*Solomons Onward*, their motto since the Second World War; "Rampant Lions," the name they gave themselves. On the deck plates of her seven ships she was affectionately known as the "Lion Queen."

She stood for a while, staring pensively into the ship's wake, finding and losing an image of herself in the water. She'd been given the news from the medical board yesterday, right before she'd pulled in all lines and sailed out of Yokosuka Naval Station. The envelope was tucked in her pocket. The thought of the paper made her left leg ache, right where the bone had set poorly, the ache followed by a predictable lightning bolt of pins and needles that began at the base of her spine. The old injury had finally caught up with her. The medical board had had its say. This would be the Lion Queen's last voyage. Hunt couldn't quite believe it.

The light changed suddenly, almost imperceptibly. Hunt observed an oblong shadow passing across the smooth mantle of the sea, whose surface was now interrupted by a flicker of wind, forming into a ripple. She glanced above her, to where a thin cloud, the only one in the sky, made its transit. Then the cloud vanished, dissolving into mist, as it failed to make passage beyond the relentless late-winter sun. The water grew perfectly still once again.

Her thoughts were interrupted by the hollow clatter of steps quickly and lightly making their way up the ladder behind her. Hunt checked her watch. The ship's captain, Commander Jane Morris, was, as usual, running behind schedule.

10:51 MARCH 12, 2034 (GMT+4:30)
STRAIT OF HORMUZ

Major Chris "Wedge" Mitchell hardly ever felt *it*. …

His father had felt *it* a bit more than him, like that one time the FLIR on his F/A-18 Hornet had failed and he'd pickle-barreled two GBU-38s "danger close" for a platoon of grunts in Ramadi, using nothing but a handheld GPS and a map. …

"Pop," his grandfather, had felt *it* more than them both when, for five exhausting days, he'd dropped snake and nape with nothing more than an optical sight on treetop passes during Tet, where he dusted in so low the flames had blistered the fuselage of his A-4 Skyhawk. …

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"Pop-Pop," his great-grandfather, had felt *it* most of all, patrolling the South Pacific for Japanese Zeros with VMF-214, the famed *Black Sheep* squadron led by the hard-drinking, harder-fighting five-time Marine Corps ace Major Gregory "Pappy" Boyington. …

This elusive *it*, which had held four generations of Mitchells in its thrall, was the sensation of flying by the seat of your pants, on pure instinct alone. (*Back when I flew with Pappy, and we'd be on patrol, it wasn't all whizbang like you have it now. No targeting computers. No autopilot. It was just your skill, your controls, and your luck. We'd mark our gunsights on the canopy with a grease pencil and off we'd fly. And when you flew with Pappy you learned pretty quick to watch your horizon. You'd watch it close, but you'd also watch Pappy. When he'd toss his cigarette out of the cockpit and slam his canopy shut, you knew he meant business and you were about to tangle with a flight of Zeros.*)

The last time Wedge had heard that little speech from his great-grandfather, he'd been 6 years old. The sharp-eyed pilot had only the slightest tremor in his voice despite his 90-plus years. And now, as the clear sun caught light on his canopy, Wedge could hear the words as distinctly as if his great-grandfather were riding along as his back-seater. Except the F-35E Lightning he flew had only a single seat.

This was but one of the many gripes Wedge had with the fighter he was piloting so close to Iranian airspace that he was literally dancing his starboard wing along the border. Not that the maneuver was hard. In fact, flying with such precision took no skill at all. The flight plan had been inputted into the F-35's onboard navigation computer. Wedge didn't have to do a thing. The plane flew itself. He merely watched the controls, admired the view out his canopy, and listened to the ghost of his great-grandfather taunting him from a nonexistent back seat.

Jammed behind his headrest was an auxiliary battery unit whose hum seemed impossibly loud, even over the F-35's turbofan engine. This battery, about the size of a shoebox, powered the latest upgrade to the fighter's suite of stealth technologies. Wedge hadn't been told much about the addition, only that it was some kind of an electromagnetic disrupter. Before he'd been briefed on his mission, he'd caught two civilian Lockheed contractors

tampering with his plane belowdecks and had alerted the sergeant at arms, who himself had no record of any civilians on the manifest of the *George H. W. Bush*. This had resulted in a call to the ship's captain, who eventually resolved the confusion. Due to the sensitivity of the technology being installed, the presence of these contractors was itself highly classified. Ultimately, it proved a messy way for Wedge to learn about his mission, but aside from that initial hiccup every other part of the flight plan had proceeded smoothly.

Maybe too smoothly. Which was the problem. Wedge was hopelessly bored. He glanced below, to the Strait of Hormuz, that militarized sliver of turquoise that separated the Arabian Peninsula from Persia. He checked his watch, a Breitling chronometer with built-in compass and altimeter his father had worn during strafing runs over Marjah twenty-five years before. He trusted the watch more than his onboard computer. Both said that he was forty-three seconds out from a six-degree eastward course adjustment that would take him into Iranian airspace. At which point—so long as the little humming box behind his head did its job—he would vanish completely.

It would be a neat trick.

It almost seemed like a prank that he'd been entrusted with such a high-tech mission. His buddies in the squadron had always joked that he should've been born in an earlier time. That's how he'd gotten his call sign, "Wedge": the world's first and simplest tool.

Time for his six-degree turn.

He switched off the autopilot. He knew there'd be hell to pay for flying throttle and stick, but he'd deal with that when he got back to the *Bush*.

He wanted to feel *it*.

If only for a second. And if only for once in his life.

It would be worth the ass-chewing. And so, with a bunch of noise behind his head, he banked into Iranian airspace.

14:58 MARCH 12, 2034 (GMT+8)
SOUTH CHINA SEA

"You wanted to see me, Commodore?"

Commander Jane Morris, captain of the *John Paul Jones*, seemed tired, too tired to apologize for being almost fifteen minutes late to her meeting with Hunt, who understood the strain Morris was under. Hunt understood that strain because she herself had felt it on occasions too countless to number. It was the strain of getting a ship underway. The absolute accountability for nearly four hundred sailors. And the lack of sleep as the captain was summoned again and again to the bridge as the ship maneuvered through the seemingly endless fishing fleets in the South China Sea. The argument could be made that Hunt was under that strain three times over, based on the scope of her command, but both Hunt and Morris knew that the command of a flotilla was command by delegation while the command of a ship was pure command. *In the end, you and you alone are responsible for everything your ship does or fails to do.* A simple lesson they'd both been taught as midshipmen at Annapolis.

Hunt fished out two cigars from her cargo pocket.

"And what're those?" asked Morris.

"An apology," said Hunt. "They're Cubans. My dad used to buy them from the Marines at Gitmo. It's not as much fun now that they're legal, but still … they're pretty good." Morris was a devout Christian, quietly evangelical, and Hunt hadn't been sure whether or not she'd partake, so she was pleased when Morris took the cigar and came up alongside her on the bridge wing for a light.

"An apology?" asked Morris. "What for?" She dipped the tip of the cigar into the flame made by Hunt's Zippo, which was engraved with one of those cigar-chomping, submachine-gun-toting bullfrogs commonly tattooed onto the chests and shoulders of Navy SEALs or, in the case of Hunt's father, etched onto the lighter he'd passed down to his only child.

"I imagine you weren't thrilled to learn that I'd picked the *John Paul Jones* for my flagship." Hunt had lit her cigar as well, and as their ship held its course the smoke was carried off behind them. "I wouldn't want you to think this choice was a rebuke," she continued, "particularly as the only other female in command. I wouldn't want you to think that I was trying to babysit you by situating my flag here." Hunt instinctively glanced up at the mast, at her commodore's command pennant.

"Permission to speak freely?"

"C'mon, Jane. Cut the shit. You're not a plebe. This isn't Bancroft Hall."

"Okay, ma'am," began Morris, "I never thought any of that. Wouldn't have even occurred to me. You've got three good ships with three good crews. You need to put yourself somewhere. Actually, my crew was pretty jazzed to hear that we'd have the Lion Queen herself on board."

"Could be worse," said Hunt. "If I were a man you'd be stuck with the Lion King."

Morris laughed.

"And if I were the Lion King," deadpanned Hunt, "that'd make you Zazu." Then Hunt smiled, that wide-open smile that had always endeared her to her subordinates.

Which led Morris to say a little more, maybe more than she would've in the normal course: "If we were two men, and the *Levin* and *Hoon* were skippered by two women, do you think we'd be having this conversation?" Morris allowed the beat of silence between them to serve as the answer.

"You're right," said Hunt, taking another pull on her Cuban as she leaned on the deck railing and stared out toward the horizon, across the still impossibly calm ocean.

"How's your leg holding up?" asked Morris.

Hunt reached down to her thigh. "It's as good as it'll ever be," she said. She didn't touch the break in her femur, the one she'd suffered a decade before during a training jump gone bad. A faulty parachute had ended her tenure as one of the first women in the SEALs and nearly ended her life. Instead, she fingered the letter from the medical board resting in her pocket.

This excerpt appears in the February 2021 issue. [Subscribe to WIRED](#).

Illustration: Owen Freeman

They'd smoked their short cigars nearly down to the nubs when Morris spotted something on the starboard horizon. "You see that smoke?" she said. The two naval officers pitched their cigars over the side for a clearer view. It was a small ship, steaming slowly or perhaps even drifting. Morris ducked into the bridge and returned to the observation deck with two pairs of binoculars, one for each of them.

They could see it clearly now, a trawler about seventy feet long, built low amidships to recover its fishing nets, with a high-built prow designed to crest storm surge. Smoke billowed from the aft part of the ship, where the navigation bridge was set behind the nets and cranes—great dense, dark clouds of it, interspersed with orange flames. There was a commotion on deck as the crew of maybe a dozen struggled to contain the blaze.

The flotilla had rehearsed what to do in the event they came across a ship in duress. First, they would check to see if other vessels were coming to render assistance. If not, they would amplify any distress signals and facilitate finding help. What they wouldn't do—or would do only as an absolute last resort—was divert from their own freedom-of-navigation patrol to provide that assistance themselves.

"Did you catch the ship's nationality?" asked Hunt. Inwardly, she began running through a decision tree of her options.

Morris said no, there wasn't a flag flying either fore or aft. Then she stepped back into the bridge and asked the officer of the deck, a beef-fed lieutenant junior grade with a sweep of sandy blond hair, whether or not a distress signal had come in over the last hour.

The officer of the deck reviewed the bridge log, checked with the combat information center—the central nervous system of the ship's sensors and communications complex a couple of decks below—and concluded that no distress signal had been issued. Before Morris could dispatch such a signal on the trawler's behalf, Hunt stepped onto the bridge and stopped her.

"We're diverting to render assistance," ordered Hunt.

"Diverting?" Morris' question escaped her reflexively, almost accidentally, as every head on the bridge swiveled toward the commodore, who knew as well as the crew that lingering in these waters dramatically increased the odds of a confrontation with a naval vessel from the People's Liberation Army. The crew was already at a modified general quarters, well trained and ready, the atmosphere one of grim anticipation.

"We've got a ship in duress that's sailing without a flag and that hasn't sent out a distress signal," said Hunt. "Let's take a closer look, Jane. And let's go to full general quarters. Something doesn't add up."

Crisply, Morris issued those orders to the crew, as if they were the chorus to a song she'd rehearsed to herself for years but up to this moment had never had the opportunity to perform. Sailors sprang into motion on every deck of the vessel, quickly donning flash gear, strapping on gas masks and inflatable life jackets, locking down the warship's many hatches, spinning up the full combat suite, to include energizing the stealth apparatus that would cloak the ship's radar and infrared signatures. While the *John Paul Jones* changed course and closed in on the incapacitated trawler, its sister ships, the *Levin* and *Hoon*, remained on course and speed for the freedom-of-navigation mission. The distance between them and the flagship began to open. Hunt then disappeared back to her stateroom, to where she would send out the encrypted dispatch to Seventh Fleet Headquarters in Yokosuka. Their plans had changed.

04:47 MARCH 12, 2034 (GMT-4)
WASHINGTON, D.C.

Dr. Sandeep "Sandy" Chowdhury, the deputy national security advisor, hated the second and fourth Mondays of every month. These were the days,

according to his custody agreement, that his 6-year-old daughter, Ashni, returned to her mother. What often complicated matters was that the handoff didn't technically occur until the end of school. Which left him responsible for any unforeseen childcare issues that might arise, such as a snow day. And on this particular Monday morning, a snow day in which he was scheduled to be in the White House Situation Room monitoring progress on a particularly sensitive test flight over the Strait of Hormuz, he had resorted to calling his own mother, the formidable Lakshmi Chowdhury, to come to his Logan Circle apartment. She had arrived before the sun had even risen in order to watch Ashni.

"Don't forget my one condition," she'd reminded her son as he tightened his tie around the collar that was too loose for his thin neck. Heading out into the slushy predawn, he paused at the door. "I won't forget," he told her. "And I'll be back by the time Ashni's picked up." He had to be: His mother's one condition was that she not be inflicted with the sight of Sandy's ex-wife, Samantha, a transplant from Texas' Gulf Coast whom Lakshmi haughtily called "provincial." She'd disliked her the moment she had set eyes on her skinny frame and blonde, pageboy haircut. A poor man's Ellen DeGeneres, Lakshmi had once said in a pique, having to remind her son about the old-time television show host whose appeal she'd never understood.

If being single and reliant upon his mother at 44 was somewhat humiliating, the ego blow was diminished when he removed his White House all-access badge from his briefcase. He flashed it to the uniformed Secret Service agent at the northwest gate while a couple of early-morning joggers on Pennsylvania Avenue glanced in his direction, wondering if they should know who he was. It was only in the last eighteen months, since he'd taken up his posting in the West Wing, that his mother had finally begun to correct people when they assumed that her son, Dr. Chowdhury, was a medical doctor.

His mother had asked to visit his office several times, but he'd kept her at bay. The idea of an office in the West Wing was far more glamorous than the reality, a desk and a chair jammed against a basement wall in a general crush of staff.

He sat at his desk, enjoying the rare quiet of the empty room. No one else had made it through the two inches of snow that had paralyzed the capital city. Chowdhury rooted around one of his drawers, scrounged up a badly crushed but still edible energy bar, and took it, a cup of coffee, and a briefing binder through the heavy, soundproof doors into the Situation Room.

A seat with a built-in work terminal had been left for him at the head of the conference table. He logged in. At the far end of the room was an LED screen with a map displaying the disposition of US military forces abroad, to include an encrypted video-teleconference link with each of the major combatant commands, Southern, Central, Northern, and the rest. He focused on the Indo-Pacific Command—the largest and most important, responsible for nearly 40 percent of the earth's surface, though much of it was ocean.

The briefer was Rear Admiral John T. Hendrickson, a nuclear submariner with whom Chowdhury had a passing familiarity, though they'd yet to work together directly. The admiral was flanked by two junior officers, a man and a woman, each significantly taller than him. The admiral and Chowdhury had been contemporaries in the doctoral program at the Fletcher School of Law and Diplomacy fifteen years before. That didn't mean they'd been friends; in fact, they'd overlapped by only a single year, but Chowdhury knew Hendrickson by reputation. At a hair over five feet, five inches tall, Hendrickson was conspicuous in his shortness. His compact size made it seem as though he were born to fit into submarines, and his quirky, deeply analytic mind seemed equally customized for that strange brand of naval service. Hendrickson had finished his doctorate in a record-breaking three years (as opposed to Chowdhury's seven), and during that time he'd led the Fletcher softball team to a hat trick of intramural championships in the Boston area, earning the nickname "Bunt."

Chowdhury nearly called Hendrickson by that old nickname, but he thought better of it. It was a moment for deference to official roles. The screen in front of them was littered with forward-deployed military units—an amphibious ready group in the Aegean, a carrier battle group in the Western Pacific, two nuclear submarines under what remained of the Arctic ice, the

concentric rings of armored formations fanned out from west to east in Central Europe, as they had been for nearly a hundred years to ward off Russian aggression. Hendrickson quickly homed in on two critical events underway, one long planned, the other "developing," as Hendrickson put it.

The planned event was the testing of a new electromagnetic disrupter within the F-35's suite of stealth technology. This test was now in progress and would play out over the next several hours. The fighter had been launched from a Marine squadron off the *George H. W. Bush* in the Arabian Gulf. Hendrickson glanced down at his watch. "The pilot's been dark in Iranian airspace for the last four minutes." He went into a long, top secret, and dizzyingly expository paragraph on the nature of the electromagnetic disruption, which was occurring at that very moment, soothing the Iranian air defenses to sleep.

Within the first few sentences, Chowdhury was lost. He had never been detail oriented, particularly when those details were technical in nature. This was why he'd found his way into politics after graduate school. This was also why Hendrickson—brilliant though he was—did, technically, work for Chowdhury. As a political appointee on the National Security Council staff, Chowdhury outranked him, though this was a point few military officers in the White House would publicly concede to their civilian masters. Chowdhury's genius, while not technical, was an intuitive understanding of how to make the best out of any bad situation. He'd gotten his political start working in the one-term Pence presidency. Who could say he wasn't a survivor?

"The second situation is developing," continued Hendrickson. "The *John Paul Jones* command group—a three-ship surface action group—has diverted the flagship from its freedom-of-navigation patrol nearby the Spratly Islands to investigate a vessel in duress."

"What kind of vessel?" asked Chowdhury. He was leaning back in the leather executive chair at the head of the conference table, the same chair that the president sat in when she used the room. Chowdhury was munching the end of his energy bar in a particularly non-presidential fashion.

"We don't know," answered Hendrickson. "We're waiting on an update from Seventh Fleet."

Even though Chowdhury couldn't follow the particulars of the F-35's stealth disruption, he did know that having a $2 billion Arleigh Burke guided missile destroyer playing rescue tugboat to a mystery ship in waters claimed by the Chinese had the potential to undermine his morning. And splitting up the surface action group didn't seem like the best idea. "This doesn't sound good, Bunt. Who is the on-scene commander?"

Hendrickson shot a glance back at Chowdhury, who recognized the slight provocation he was making by using the old nickname. The two junior staffers exchanged an apprehensive look. Hendrickson chose to ignore it. "I know the commodore," he said. "Captain Sarah Hunt. She is extremely capable. Top of her class at everything."

"So?" asked Chowdhury.

"So, we'd be prudent to cut her a little slack."

15:28 MARCH 12, 2034 (GMT+8)
SOUTH CHINA SEA

Once the order to render aid was given, the crew of the *John Paul Jones* worked quickly. Two RHIBs launched off the fantail and pulled alongside the burning trawler. The stocky, blond lieutenant junior grade had been placed in charge of this tiny flotilla of inflatable boats, while Hunt and Morris observed from the bridge, listening to the updates he sent over his handheld radio with all the baritone hysteria of plays being called at the line of scrimmage. Both senior officers forgave his novice lack of calm. He was putting out a fire with two pumps and two hoses in hostile waters.

Hostile but completely calm, rigid as a pane of glass as the drama of the fire and the trawler played out a couple of hundred yards off the bridge. Hunt found herself staring wistfully at the water, wondering again if perhaps this might be her last time seeing such a sea, or at least seeing it from the command of a naval vessel. After a moment's thought, she told the officer of the deck to send a signal to her other two destroyers to break off the

freedom-of-navigation patrol and divert on-scene. Better to have a bit more firepower in close.

The *Levin* and *Hoon* reversed course and increased speed, and in a few minutes they had taken up positions around the *John Paul Jones*, sailing in a protective orbit as the flagship continued a dead slow approach toward the trawler. Soon, the last of the flames had been extinguished and the young lieutenant junior grade gave a triumphant announcement over the radio, to which both Hunt and Morris volunteered some quick congratulations followed by instructions for him to board and assess the extent of the damages. An order that he followed. Or at least tried to follow.

The crew of the trawler met the first boarding party at the gunnels with angry, desperate shouts. One went so far as to swing a grapple at a boatswain's head. Watching this struggle from the bridge of the *John Paul Jones*, Hunt wondered why the crew of a burning ship would so stridently resist help. Between radio transmissions, in which she encouraged a general de-escalation, she could overhear the trawler's crew, who spoke in what sounded like Mandarin.

"Ma'am, I suggest we cut them loose," Morris eventually offered. "They don't seem to want any more help."

"I can see that, Jane," responded Hunt. "But the question is, why not?"

She could observe the boarding party and the crew of the trawler gesticulating wildly at one another. Why this resistance? Hunt saw Morris' point—with each passing minute her command became increasingly vulnerable to intercept by a People's Liberation Army naval patrol, which would undermine their mission. But wasn't this their mission as well? To keep these waters safe and navigable? Ten, maybe even five years before, the threat level had been lower. Back then, most of the Cold War treaties had remained intact. Those old systems had eroded, however. And Sarah Hunt, gazing out at this trawler with its defiant crew, had an instinct that this small fishing vessel represented a threat.

"Commander Morris," said Hunt gravely, "pull your ship alongside that trawler. If we can't board her from the RHIBs, we'll board her from here."

Morris immediately objected to the order, offering a predictable list of concerns: first, the time it would take would further expose them to a potential confrontation with a hostile naval patrol; second, placing the *John Paul Jones* alongside the trawler would put their own ship at undue risk. "We don't know what's on board," cautioned Morris.

Hunt listened patiently. She could feel Morris' crew going about their tasks on the bridge, trying to ignore these two senior-most officers as they had their disagreement. Then Hunt repeated the order. Morris complied.

As the *John Paul Jones* came astride the trawler, Hunt could now see its name, *Wén Rui*, and its home port, Quanzhou, a provincial-level anchorage astride the Taiwan Strait. Her crew shot grapples over the trawler's gunnels, which allowed them to affix steel tow cables to its side. Lashed together, the two ships cut through the water in tandem like a motorcycle with an unruly sidecar. The danger of this maneuver was obvious to everyone on the bridge. They went about their tasks with a glum air of silent-sailor disapproval, all thinking their commodore was risking the ship unnecessarily for a bunch of agitated Chinese fishermen. No one voiced their collective wish that their commodore let her hunch go by the boards and return them to safer waters.

Sensing the discontent, Hunt announced that she was heading belowdecks.

Heads snapped around.

"Where to, ma'am?" Morris said by way of protest, seemingly indignant that her commander would abandon her in such a precarious position.

"To the *Wén Rui*," answered Hunt. "I want to see her for myself."

And this is what she did, surprising the master-at-arms, who handed her a holstered pistol, which she strapped on as she clamored over the side, ignoring the throbbing in her bad leg. When Hunt dropped onto the deck of the trawler, she found that the boarding party had already placed under arrest the half dozen crew members of the *Wén Rui*. They sat cross-legged amidships with an armed guard hovering behind them, their wrists bound at their backs in plastic flex-cuffs, their peaked fishing caps pulled low, and

their clothes oily and stained. When Hunt stepped on deck, one of the arrested men, who was oddly clean-shaven and whose cap wasn't pulled low but was worn proudly back on his head, stood. The gesture wasn't defiant, actually quite the opposite; he was clear-eyed. Hunt immediately took him for the captain of the *Wén Rui*.

The chief petty officer who was leading the party explained that they'd searched most of the trawler but that a steel, watertight hatch secured one of the stern compartments and the crew had refused to unlock it. The chief had ordered a welding torch brought from the ship's locker. In about fifteen minutes they'd have everything opened up.

The clean-shaven man, the trawler's captain, began to speak in uncertain and heavily accented English: "Are you command here?"

"You speak English?" Hunt replied.

"Are you command here?" he repeated to her, as if perhaps he weren't certain what these words meant and had simply memorized them long ago as a contingency.

"I am Captain Sarah Hunt, United States Navy," she answered, placing her palm on her chest. "Yes, this is my command."

He nodded, and as he did his shoulders collapsed, as if shrugging off a heavy pack. "I surrender my command to you." Then he turned his back to Hunt, a gesture that, at first, seemed to be a sign of disrespect, but that she soon recognized as being something altogether different. In his open palm, which was cuffed behind him at the wrist, was a key. He'd been holding it all this time and was now, with whatever ceremony he could muster, surrendering it to Hunt.

Hunt plucked the key from his palm, which was noticeably soft, not the calloused palm of a fisherman. She approached the compartment at the stern on the *Wén Rui*, popped off the lock, and opened the hatch.

"What we got, ma'am?" asked the master-at-arms, who stood close behind her.

"Christ," said Hunt, staring at racks of blinking miniature hard drives and plasma screens. "I have no idea."

13:47 MARCH 12, 2034 (GMT+4:30)
STRAIT OF HORMUZ

When Wedge switched to manual control, the Lockheed contractors on the *George H. W. Bush* immediately began to radio, wanting to know if everything was okay. He hadn't answered, at least not at first. They could still track him and see that he was adhering to their flight plan, which at this moment placed him approximately fifty nautical miles west of Bandar Abbas, the main regional Iranian naval base. The accuracy of his flight proved—at least to him—that his navigation was as precise as any computer.

Then his F-35 hit a pocket of atmospheric turbulence—a bad one. Wedge could feel it shudder up the controls, through his feet, which were planted on the rudder pedals, into the stick, and across his shoulders. The turbulence threatened to throw him off course, which could have diverted him into the more technologically advanced layers of Iranian air defenses, the ones that expanded outward from Tehran, in which the F-35's stealth countermeasures might prove inadequate.

This is *it*, he thought.

Or at least as close to *it* as he had ever come. His manipulation of throttle, stick, and rudder was fast, instinctual, the result of his entire career in the cockpit, and of four generations' worth of Mitchell family breeding.

He skittered his aircraft on the edge of the turbulence, flying for a total of 3.6 nautical miles at a speed of 736 knots with his aircraft oriented with 28 degrees of yaw respective to its direction of flight. The entire episode lasted under four seconds, but it was a moment of hidden grace, one that only he and perhaps his great-grandfather watching from the afterlife appreciated in the instant of its occurrence.

Then, as quickly as the turbulence sprung up, it dissipated, and Wedge was flying steadily. Once again, the Lockheed contractors on the *George H. W.*

Bush radioed, asking why he'd disabled his navigation computer. They insisted that he turn it back on. "Roger," said Wedge, as he finally came up over the encrypted communications link, "activating navigation override." He leaned forward, pressed a single innocuous button, and felt a slight lurch, like a train being switched back onto a set of tracks, as his F-35 returned to autopilot.

Wedge was overcome by an urge to smoke a cigarette in the cockpit, just as Pappy Boyington used to do, but he'd pushed his luck far enough for today. Returning to the *Bush* in a cockpit that reeked of a celebratory Marlboro would likely be more than the Lockheed contractors, or his superiors, could countenance. The pack was in the left breast pocket of his flight suit, but he'd wait and have one on the fantail after his debrief. Checking his watch, he calculated that he'd be back in time for dinner in the pilots' dirty-shirt wardroom in the forward part of the carrier. He hoped they'd have the "heart attack" sliders he loved—triple cheeseburger patties with a fried egg on top.

It was while he was thinking of that dinner—and the cigarette—that his F-35 diverted off course, heading north, inland toward Iran. This shift in direction was so smooth that Wedge didn't even notice it until another series of calls came from the *Bush*, all of them alarmed as to this change in heading.

"Turn on your navigation computer."

Wedge tapped at its screen. "My navigation computer *is* on … Wait, I'm going to reboot." Before Wedge could begin the long reboot sequence, he realized that his computer was nonresponsive. "Avionics are out. I'm switching to manual override."

He pulled at his stick.

He stamped on his rudder pedals.

The throttle no longer controlled the engine.

His F-35 was beginning to lose altitude, descending gradually. In sheer frustration, a frustration that bordered on rage, he tugged at the controls,

strangling them, as if he were trying to murder the plane in which he flew. He could hear the chatter in his helmet, the impotent commands from the *George H. W. Bush*, which weren't even really commands but rather pleadings, desperate requests for Wedge to figure out this problem.

But he couldn't.

Wedge didn't know who or what was flying his plane.

07:23 MARCH 12, 2034 (GMT-4)
WASHINGTON, D.C.

Sandy Chowdhury had finished his energy bar, was well into his second cup of coffee, and the updates would not stop coming. The first was this news that the *John Paul Jones* had found some type of advanced technological suite on the fishing trawler they'd boarded and lashed to their side. The commodore, this Sarah Hunt, whose judgment Hendrickson so trusted, was insistent that within an hour she could offload the computers onto one of the three ships in her flotilla for further forensic exploitation. While Chowdhury was weighing that option with Hendrickson, the second update came in, from Seventh Fleet Headquarters, "INFO" Indo-Pacific Command. A contingent of People's Liberation Army warships, at least six, to include the nuclear-powered carrier *Zheng He*, had altered course and was heading directly toward the *John Paul Jones*.

The third update was most puzzling of all. The controls of the F-35, the one whose flight had brought Chowdhury into the Situation Room early that snowy Monday morning, had locked up. The pilot was working through every contingency, but at this moment, he was no longer in control of his aircraft.

"If the pilot isn't flying it, and we're not doing it remotely from the carrier, then who the hell is?" Chowdhury snapped at Hendrickson.

A junior White House staffer interrupted them. "Dr. Chowdhury," she said, "the Chinese defense attaché would like to speak with you."

Chowdhury shot Hendrickson an incredulous glance, as if he were willing the one-star admiral to explain that this entire situation was part of a single, elaborate, and twisted practical joke. But no such assurance came. "All right, transfer him through," said Chowdhury as he reached for the phone.

"No, Dr. Chowdhury," said the young staffer. "He's here. Admiral Lin Bao is here."

"Here?" said Hendrickson. "At the White House? You're kidding."

The staffer shook her head. "I'm not, sir. He's at the northwest gate." Chowdhury and Hendrickson pushed open the Situation Room door, hurried down the corridor to the nearest window, and peered through the blinds. There was Admiral Lin Bao, resplendent in his blue service uniform with gold epaulets, standing patiently with three Chinese military escorts and one civilian at the northwest gate among the growing crowd of tourists. It was a mini-delegation. Chowdhury couldn't fathom what they were doing. The Chinese are never impulsive like this, he thought.

"Jesus," he muttered.

"We can't just let him in," said Hendrickson. A gaggle of Secret Service supervisors gathered around them to explain that the proper vetting for a Chinese official to enter the White House couldn't possibly be accomplished in anything less than four hours; that is, unless they had POTUS, chief of staff, or national security advisor-level approval. But all three were overseas. The television was tuned to the latest updates on the G7 summit in Munich, which had left the White House without a president and much of its national security team. Chowdhury was the senior NSC staffer in the White House at that moment.

"Shit," said Chowdhury. "I'm going out there."

"You can't go out there," said Hendrickson.

"He can't come in here."

Hendrickson couldn't argue the logic. Chowdhury headed for the door. He didn't grab his coat, though it was below freezing. He hoped that whatever message the defense attaché had to deliver wouldn't take long. Now that he was outside, his personal phone caught signal and vibrated with a half dozen text messages, all from his mother. Whenever she watched his daughter she would pepper him with mundane domestic questions as a reminder of the favor she was performing. Christ, he thought, I bet she can't find the baby wipes again. But Chowdhury didn't have time to check the particulars of those texts as he walked along the South Lawn.

Cold as it was, Lin Bao wasn't wearing a coat either, only his uniform, with its wall of medals, furiously embroidered epaulets in gold, and peaked naval officer's cap tucked snugly under his arm. Lin Bao was casually eating from a packet of M&M's, picking the candies out one at a time with pinched fingers. Chowdhury passed through the black steel gate to where Lin Bao stood. "I have a weakness for your M&M's," said the admiral absently. "They were a military invention. Did you know that? It's true—the candies were first mass-produced for American GIs in World War II, specifically in the South Pacific, where they required chocolate that wouldn't melt. That's your saying, right? *Melts in your mouth, not in your hand*." Lin Bao licked the tips of his fingers, where the candy coloring had bled, staining his skin a mottled pastel.

"To what do we owe the pleasure, Admiral?" Chowdhury asked.

Lin Bao peered into his bag of M&M's, as if he had a specific idea of which color he'd like to sample next but couldn't quite find it. Speaking into the bag, he said, "You have something of ours, a small ship, very small—the *Wén Rui*. We'd like it back." Then he picked out a blue M&M, made a face, as if this wasn't the color he'd been searching for, and somewhat disappointedly placed it into his mouth.

"We shouldn't be talking about that out here," said Chowdhury.

"Would you care to invite me inside?" asked the admiral, nodding toward the West Wing, knowing the impossibility of that request. He then added, "Otherwise, I think out in the open is the only way we can talk."

Chowdhury was freezing. He tucked his hands underneath his arms.

"Believe me," added Lin Bao, "it is in your best interest to give us back the *Wén Rui*."

Although Chowdhury worked for the first American president in modern history who was unaffiliated with a political party, the administration's position with regards to freedom of navigation and the South China Sea had remained consistent with the several Republican and Democratic administrations that had preceded it. Chowdhury repeated those well-established policy positions to an increasingly impatient Lin Bao.

"You don't have time for this," he said to Chowdhury, still picking through his diminishing bag of M&M's.

"Is that a threat?"

"Not at all," said Lin Bao, shaking his head sadly, feigning disappointment that Chowdhury would make such a suggestion. "I meant that your mother has been texting you, hasn't she? Don't you need to reply? Check your phone. You'll see she wants to take your daughter Ashni outside to enjoy the snow but can't find the girl's coat."

Chowdhury removed his phone from his pants pocket.

He glanced at the text messages.

They were as Lin Bao had represented them.

"We have ships of our own coming to intercept the *John Paul Jones*, the *Carl Levin*, and the *Chung-Hoon*," continued Lin Bao, speaking the name of each destroyer to prove that he knew it, just as he knew the details of every text message that was sent to Chowdhury's phone. "Escalation on your part would be a mistake."

"What will you give us for the *Wén Rui*?"

"We'll return your F-35."

"F-35?" said Chowdhury. "You don't have an F-35."

"Maybe you should go back to your Situation Room and check," said Lin Bao mildly. He poured the last M&M from his packet into his palm. It was yellow. "We have M&M's in China too. But they taste better here. It's something about the candy shell. In China, we just can't get the formula quite right." Then he put the chocolate in his mouth, briefly shutting his eyes to savor it. When he opened them, he was again staring at Chowdhury. "You need to give us back the *Wén Rui*."

"I don't *need* to do anything," said Chowdhury.

Lin Bao nodded disappointedly. "Very well," he said. "I understand." He crumpled up the candy wrapper and then pitched it on the sidewalk.

"Pick that up, please, Admiral," said Chowdhury.

Lin Bao glanced down at the piece of litter. "Or else what?"

As Chowdhury struggled to formulate a response, the admiral turned on his heels and stepped across the street, weaving his way through the late-morning traffic.

16:12 MARCH 12, 2034 (GMT+8)
SOUTH CHINA SEA

The pair of high-speed fighter-interceptors came out of nowhere, their sonic booms rattling the deck of the *John Paul Jones*, taking the crew completely unawares. Commodore Hunt ducked instinctively at the sound. She was still aboard the *Wén Rui*, picking over the technical suite they'd uncovered the hour before. The trawler's captain returned a toothy grin, as if he'd been expecting the low-flying jets all along. "Let's get the crew of the *Wén Rui* secured down in the brig," Hunt told the master-at-arms supervising the search. She ran up to the bridge and found Morris struggling to manage the situation.

"What've you got?" asked Hunt.

Morris, who was peering into an Aegis terminal, now tracked not only the two interceptors but also the signatures of at least six separate ships of unknown origin that had appeared at the exact same moment as the interceptors. It was as if an entire fleet, in a single coordinated maneuver, had chosen to unmask itself. The nearest of these vessels, which moved nimbly in the Aegis display, suggested the profile of a frigate or destroyer. They were eight nautical miles distant, right at the edge of visible range. Hunt raised a set of binoculars, searching the horizon. Then the first frigate's gray hull ominously appeared.

"There," she said, pointing off their bow.

Calls soon came in from the *Levin* and the *Hoon* confirming visuals on two, then three, and finally a fourth and fifth ship. All People's Liberation Army naval vessels, and they ranged in size from a frigate up to a carrier, the hulking *Zheng He*, which was as formidable as anything in the US Navy's Seventh Fleet. The Chinese ships formed in a circle around Hunt's command, which itself had encircled the *Wén Rui*, so that the two flotillas were arrayed in two concentric rings, rotating in opposite directions.

A radioman positioned in a corner of the bridge wearing a headset began to emphatically gesture for Hunt. "What is it?" she asked the sailor, who handed her the headset. Over the analog hum of static, she could hear a faint voice: "US Naval Commander, this is Rear Admiral Ma Qiang, commander of the *Zheng He* Carrier Battle Group. We demand you release the civilian vessel you have captured. Depart our territorial waters immediately." There was a pause, then the message repeated. Hunt wondered how many times this request had been spoken into the ether, and how many times it would be allowed to go unanswered before the attendant battle group—which seemed to be drawing ever closer—took action.

"Can you get a secure VoIP connection with Seventh Fleet Headquarters?" Hunt asked the radioman, who nodded and then began reconfiguring red and blue wires into the back of an old-fashioned laptop normally used on the quiet midwatches for video games; it was primitive and so perhaps a more secure way to connect.

"What do they want?" asked Morris, who was staring vacantly at the ring of six ships that surrounded them.

"They want that fishing trawler back," said Hunt. "Or, rather, whatever technology is on it, and they want us out of these waters."

"What's our move?"

"I don't know yet," answered Hunt, who glanced over at the radioman, who was toggling the VoIP switch, checking it for a dial tone. While she waited, her leg began to ache from the activity of climbing around the ship. She reached in her pocket, rubbed the ache, and felt the letter from the medical board. "You got me Seventh Fleet yet?" she asked.

"Not yet, ma'am."

Hunt glanced impatiently at her watch. "Christ, then call the *Levin* or the *Hoon*. See if they can raise them."

The radioman glanced back at her, wide-eyed, as if searching within himself for the courage to say something he couldn't quite bear to say.

"What is it?" asked Hunt.

"I've got nothing."

"What do you mean, you've got nothing?" Hunt glanced at Morris, who appeared equally unnerved.

"All of our communications are down," said the radioman. "I can't raise the *Levin* or the *Hoon*. I've got nobody."

Hunt unclipped the handheld radio she had fastened to her belt, the one she'd been using to communicate with the bridge when she'd been belowdecks on the *Wén Rui*. She keyed and unkeyed the handset. "Can you get up on any channel?" Hunt asked, betraying for the first time the slightest tinge of desperation in her voice.

"Only this one," said the radioman, who raised the earphones he'd been listening to, which relayed a message on a loop:

"US Naval Commander, this is Rear Admiral Ma Qiang, commander of the *Zheng He* Carrier Battle Group. We demand you release the civilian vessel you have captured. Depart our territorial waters immediately …"

14:22 MARCH 12, 2034 (GMT+4:30)
STRAIT OF HORMUZ

All the screens in the cockpit were out. The avionics. The weapons. The navigation. All of it—dark. Wedge's communications had gone silent a few minutes before, which left him feeling a remarkable sense of calm. No one from the *Bush* was calling. It was just him, up here, with an impossible problem. The plane was still flying itself. Or, rather, it was being flown by unseen forces who were smoothly and carefully maneuvering the jet. His descent had stalled. By his estimation, he was cruising at around five thousand feet. His speed was steady, five hundred, maybe five hundred and fifty knots. And he was circling.

He pulled from his flight bag the tablet on which he'd downloaded all the regional charts. He also checked the compass on his watch, the Breitling chronometer that had belonged to his father. Referencing the compass and the tablet together, it didn't take him long to calculate exactly where he was, which was directly above Bandar Abbas, the site of the massive Iranian military installation that guarded the entrance to the Arabian Gulf. Or the Persian Gulf, as they call it, thought Wedge. He watched the parched land below slowly rotate as he flew racetracks in the airspace.

There was, of course, the off chance that this override of his aircraft was due to some freak malfunction in the F-35. But those odds were long and running longer with each minute that passed. What was far more probable, as Wedge saw it, was that his mission had been compromised, the controls of his plane hacked, and he himself turned into a passenger on this flight that he increasingly believed would end with him on the ground in Iranian territory.

Time was short; he would be out of fuel within the hour. He had one choice.

It likely meant he wouldn't be smoking a celebratory Marlboro on the fantail of the *Bush* anytime soon. So he reached between his legs, to the black-and-yellow striped handle, which was primed to the rocket in his ejection seat. This is *it*, he nearly said aloud, as he thought of his father, grandfather, and great-grandfather, all in the single instant it took him to pull the handle.

But nothing happened.

His ejector seat had been disabled too.

The engine on the F-35 let out a slight, decelerating groan. His plane began to cast off altitude, corkscrewing its descent into Bandar Abbas. One last time, Wedge stamped on the rudder pedals, pushed and then pulled the throttle, and tugged on the stick. He then reached under his flight vest, to where he carried his pistol. He grabbed it by its barrel, so that in his grip he wielded it like a hammer. And as his aircraft entered its glide path toward the runway, Wedge began to tear apart the inside of his cockpit, doing his best to destroy the sensitive items it contained, beginning with the small black box situated behind his head. This entire time, it hadn't stopped its humming.

08:32 MARCH 12, 2034 (GMT-4)
WASHINGTON, D.C.

Air Force One, with the president on board, was slicing across the Atlantic on its way back from the G7 summit, its last round of meetings having been curtailed due to the burgeoning crisis. Touchdown at Andrews was scheduled for 16:37 local time, more than an hour after Chowdhury had sworn to his mother that he'd be home to facilitate his daughter's pickup with his ex-wife. Taking a reprieve from one crisis, he stepped outside the Situation Room and turned on his cell phone to deal with another.

"Sandeep, I refuse to stand in the same room as that woman," answered his mother as soon as Chowdhury had explained. He pleaded for her help. When she asked for the details of what was holding him up he couldn't say, recalling Lin Bao's familiarity with his texts. His mother continued to

protest. In the end, however, Chowdhury insisted on remaining at work, adding, lamely, that it was "a matter of national security."

He hung up the phone and returned to the Situation Room. Hendrickson and his two aides sat on one side of the conference table, staring blankly at the opposite wall. Lin Bao had called, delivering news that had yet to filter from the *George H. W. Bush*, through Fifth Fleet Headquarters in Bahrain, up to Central Command, and then to the White House: The Iranian Revolutionary Guards had taken control of an F-35 transiting their airspace, hacking into its onboard computer to bring it down.

"Where's the plane now?" Chowdhury barked at Hendrickson.

"In Bandar Abbas," he said vacantly.

"And the pilot?"

"Sitting on the tarmac brandishing a pistol."

"Is he safe?"

"He's brandishing a pistol," said Hendrickson. But then he gave Chowdhury's question greater thought. The pilot was safe, insomuch as to kill him would be a further and significant provocation, one it seemed the Iranians and their Chinese collaborators weren't ready to make, at least not yet. What Lin Bao wanted was simple: a swap. The *John Paul Jones* had stumbled upon something of value to the Chinese—the *Wén Rui*, or more specifically the technology installed on it—and they wanted that technology back. They would be willing to arrange a swap through their Iranian allies, the F-35 for the *Wén Rui*.

Before Chowdhury could reach any conclusions, Lin Bao was again on the line. "Have you considered our offer?" Chowdhury thought of his own larger questions. Ever since the mid-2020s, when Iran had signed on to the Chinese "Belt and Road" global development initiative to prevent financial collapse after the coronavirus pandemic, they had helped project Chinese economic and military interests; but what was the scope of this seemingly new Sino-Iranian alliance? And who else was a party to it? Chowdhury

didn't have the authority to trade an F-35 for what would seem to be a Chinese spy ship. The president herself would decide whether such a swap was in the offing. Chowdhury explained the limitations of his own authority to Lin Bao and added that his superiors would soon return. Lin Bao seemed unimpressed.

"While you're holding the *Wén Rui* we are forced to interpret any stalling as an act of aggression, for we can only assume you are stalling so as to exploit the technology you've seized illegally. If the *Wén Rui* isn't turned over to us within the hour, we and our allies will have no other choice but to take action."

Then the line went silent.

What that action was, and who those allies were, Lin Bao didn't say. Nothing could be done within an hour. The president had already indicated that she wouldn't be moved by ultimatums. She had summoned the Chinese ambassador to meet that evening and not before, which according to Lin Bao would be too late. While they assessed their options, Hendrickson explained gravely to Chowdhury that the only naval force they had within an hour's range of any other Chinese ships was the *Michelle Obama*, an attack submarine that had been trailing a Chinese merchant marine convoy up and around the Arctic deltas that had once been the polar ice caps. The *Obama* was tracking two Russian submarines, which had closed to within ten miles off the stern of the merchant convoy. While Chowdhury considered this development, puzzling over the appearance of the Russians, he was reminded of a story about Lincoln.

"It was during the darkest days of the Civil War," Chowdhury began, ostensibly speaking to Hendrickson, but really speaking to himself. "The Union had sustained a series of defeats against the Confederates. A visitor from Kentucky was leaving the White House and asked Lincoln what cheering news he could take home. By way of reply, Lincoln told him a story about a chess expert who had never met his match until he tried his luck against a machine called the 'automaton chess player' and was beaten three times running. Astonished, the defeated expert stood from his chair and walked slowly around and around this amazing new piece of technology, examining it minutely as he went, trying to understand how it

worked. At last he stopped and leveled an accusing finger in its direction. 'There's a man in there!' he cried. Then Lincoln told his visitor to take heart. No matter how bad things looked, there was always a man in the machine."

The phone rang again. It was Lin Bao.

15:17 MARCH 12, 2034 (GMT+4:30)
STRAIT OF HORMUZ

Wedge was furious. He couldn't help but feel betrayed as he sat on the taxiway at Bandar Abbas. Of course, he hadn't chosen this taxiway, or where to land, or even to open his canopy and shut off his engine. His plane had betrayed him so completely that the overriding emotion he felt was shame. On his descent he had managed to destroy the black box behind his head by using his pistol as a hammer. He had also destroyed the encrypted communications on board, as well as the most sensitive avionics, which controlled his suite of weapons. Like a crazed, captive animal, he'd been banging away at the inside of his cockpit ever since losing control.

He continued his work once he landed.

As soon as his cockpit was open, he'd stood up in it and fired his pistol into the controls. The gesture filled him with a surprising upsurge of emotion, as though he were a cavalryman putting a bullet through the brain of a once-faithful mount. The few dozen Revolutionary Guards dispersed around the airfield struggled to understand the commotion. For the first several minutes, they chose to keep their distance, not out of fear of him, but out of fear that he might force a misstep into what, up to this point, had been their well-orchestrated plan. However, the more Wedge destroyed—tearing at loose wiring, stamping with the heel of his boot, and brandishing his pistol in the direction of the guardsmen when he felt them approaching too closely —the more he forced their hand. If he completely destroyed the sensitive items in his F-35, the aircraft would be of no use as a bargaining chip.

The on-scene commander, a brigadier general, understood what Wedge was doing, having spent his entire adult life facing off, either directly or indirectly, with the Americans. The brigadier slowly tightened the cordon

around Wedge's aircraft. Wedge, who could feel the Iranians closing in, continued to flash his pistol at them. But he could tell that each time he pulled it out, the guardsmen on the cordon became increasingly unconvinced that he'd actually use it. And he wouldn't have used it, even if it'd had any ammunition left, which it didn't. Wedge had already plugged the last round into the avionics.

The brigadier, who was missing the pinkie and ring finger of his right hand, was now waving at Wedge, standing in the seat of his jeep, as the other jeeps and armored vehicles on the cordon grew closer. The brigadier's English was as mangled as his three-fingered hand, but Wedge could make out what he was saying, which was something to the effect of, "Surrender and no harm will come to you."

Wedge didn't plan on surrendering, not without a fight. Though he couldn't say what that fight would be. All Wedge had was the empty pistol.

The brigadier was now close enough to issue his demands for surrender without needing to shout them at Wedge, who replied by standing in the cockpit and chucking his pistol at the brigadier.

It was an admirable toss, the pistol tumbling end-over-end like a hatchet.

The brigadier, who to his credit didn't flinch when the pistol sailed right above his head, gave the order. His men stormed the F-35, dismounting their vehicles in a swarm to clamber up its wings, and then over its fuselage, where they found Wedge, crammed in his cockpit, his feet on the rudder pedals, one hand on the throttle, the other on the stick. Absently, he was scanning the far horizon, as if for enemy fighters. A Marlboro dangled from his lips. When the half dozen members of the Revolutionary Guard leveled the muzzles of their rifles around his head, he pitched his cigarette out of the cockpit.

16:36 MARCH 12, 2034 (GMT+8)
SOUTH CHINA SEA

The flotilla's communications had been down for the past twenty minutes, an eternity.

Between the *John Paul Jones*, the *Carl Levin*, and the *Chung-Hoon*, Hunt had been able to communicate only through signal flags, her sailors flapping away in the upper reaches of the ship as frantically as if they were trying to take flight for land. Surprisingly, this primitive means of signaling proved effective, allowing the three ships to coordinate their movements in plain sight of the *Zheng He* Carrier Battle Group that encircled them. The only message that came over any of the ship's radios was the demand to surrender the *Wén Rui*. It continued to play on a maddening loop while Hunt and one of her chief petty officers troubleshot the communications suite on the *John Paul Jones*, hoping to receive any sliver of a message from Seventh Fleet, something that might bring clarity to their situation, which had so quickly deteriorated.

That message wouldn't come, and Hunt knew it.

What she also knew was that whatever was happening to her was happening within a broader context, a context that she didn't understand. She'd been placed into a game in which her opponent could see the entire board and she could see but a fraction of it. The crew on all three of her ships were at general quarters. The master-at-arms had yet to offload the suite of computers from the *Wén Rui*, though that task would be completed within the hour. Hunt had to assume that her opponent, who was watching her, understood that, and so whatever was going to happen would happen before that hour was up.

Another twenty minutes passed.

Morris, who had been belowdecks checking on the *Wén Rui*, scrambled back to the bridge. "They're almost done with the transfer," she told Hunt, catching her breath. "Maybe five more minutes," she announced optimistically. "Then we can cut the *Wén Rui* loose and maneuver out of here."

Hunt nodded, but she felt certain that events would take a different course.

She didn't know what would happen, but whatever it was, she had only her eyes to rely on in order to see the move that would be played against her. The ocean remained calm, flat as a plane of glass, just as it had been all that

morning. Hunt and Morris stood alongside one another on the bridge, scanning the horizon.

Because of the stillness of the water, they saw their adversary's next move when it came only seconds later. A single darting wake below the surface, jetting up a froth as it made its steady approach, closing the distance in seconds: a torpedo.

Six hundred yards.

Five hundred.

Three hundred and fifty.

It sliced through the torpid water.

Morris shouted the instinctual commands across the bridge, sounding the alarm for impact, the sirens echoing throughout the ship. Hunt, on the other hand, stood very still in these ultimate seconds. She felt strangely relieved. Her adversary had made his move. Her move would come next. But was the torpedo aimed at the *Wén Rui*, or at her ship? Who was the aggressor? No one would ever be able to agree. Wars were justified over such disagreements. And although few could predict what this first shot would bring, Hunt could. She could see the years ahead as clearly as the torpedo, which was now less than one hundred yards from the starboard side of the *John Paul Jones*.

Who was to blame for what had transpired on this day wouldn't be decided anytime soon. The war needed to come first. Then the victor would apportion the blame. This is how it was and would always be. This is what she was thinking when the torpedo hit.

17:13 MARCH 12, 2034 (GMT-4)
WASHINGTON, D.C.

Chowdhury leaned forward out of his seat, his elbows planted on the conference table, his neck angled toward the speakerphone in its center. Hendrickson sat opposite him at a computer, his hands hovering over the

keyboard, ready to transcribe notes. The two had received orders from the National Command Authority, which was now handling the situation from Air Force One. Before the Chinese ambassador's visit to the White House that evening, the national security advisor had laid out an aggressive negotiating framework for Chowdhury to telegraph to Lin Bao, which he now did.

"Before we agree to transfer the *Wén Rui* to your naval forces," Chowdhury began, glancing up at Hendrickson, "our F-35 at Bandar Abbas must be returned. Because we are not the ones who instigated this crisis, it is imperative that you act first. Immediately after we receive our F-35, you will have the *Wén Rui*. There is no reason for further escalation."

The line remained silent.

Chowdhury shot Hendrickson another glance.

Hendrickson reached over, muted the speaker, and whispered to Chowdhury, "Do you think he knows?" Chowdhury shook his head with a less-than-confident no. What Hendrickson was referring to was the call they'd received moments ago. For the past forty minutes, Seventh Fleet Headquarters in Yokosuka had lost all communications with the *John Paul Jones* and its sister ships.

"Hello?" said Chowdhury into the speaker.

"Yes, I am here," came the otherworldly echo of Lin Bao's voice on the line. He sounded impatient, as though he were being forced to continue a conversation he'd tired of long ago. "Let me repeat your position, to assure that I understand it: For decades, your navy has sailed through our territorial waters, it has flown through our allies' airspace, and today it has seized one of our vessels; but you maintain that you are the aggrieved party, and we are the ones who must appease you?"

The room became so quiet that for the first time Chowdhury noticed the slight buzzing of the halogen light bulbs overhead. Hendrickson had finished transcribing Lin Bao's comments. His fingers hovered above the keyboard, ready to strike the next letter.

"That is the position of this administration," answered Chowdhury, needing to swallow once to get the words out. "However, if you have a counterproposal, we would, of course, take it into consideration."

More silence.

Then Lin Bao's exasperated voice: "We do have a counterproposal."

"Good," interjected Chowdhury, but Lin Bao ignored him, continuing on.

"If you check, you'll see that it's been sent to your computer—"

Then the power went out.

It was only a moment, a flash of darkness. The lights immediately came back on. And when they did, Lin Bao wasn't on the line anymore. There was only an empty dial tone. Chowdhury began messing with the phone, struggling to get the White House operator on the line, while Hendrickson attempted to log back on to his computer. "What's the matter?" asked Chowdhury.

"My login and password don't work."

Chowdhury pushed Hendrickson aside. His didn't work either.

Adapted from [2034: A Novel of the Next World War](#) *by Elliot Ackerman and Admiral James Stavridis to be published March 09, 2021, by Penguin Press, an imprint of Penguin Publishing Group, a division of Penguin Random House LLC. Copyright © 2021 by Elliot Ackerman and James Stavridis.*

Illustrations by Sam Whitney; Getty Images

This excerpt appears in the February 2021 issue. [Subscribe now](#).

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[Culture](#)
12.01.2020 12:32 PM

Six-Word Sci-Fi: Stories Written By You

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

[❚❚]

Illustration: Elena Lacey
THIS MONTH'S PROMPT

In six words, write a story about a WFH office scandal.

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

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JANUARY 2020

A Story About a Future American President

[Paul Ford](#)

[Ideas](#)
11.17.2020 06:00 AM

Love the USPS? Join the Infrastructure Appreciation Society!

It's a good time to salute infrastructure, from the postal system to the CDC. Their often invisible work still needs to be tended—and honored. Illustration: SIMOUL ALVA

Oh, so there's a pandemic and suddenly you all want to protect the Post Office that brings you medicine and socks? Suddenly you're America's number one Census fan and think public health is really cool? Well, welcome to the Infrastructure Appreciation Society. Seriously, my God, welcome! I cannot tell you how happy I am you're here. Membership has been falling for decades. Please visit our website.

One of the oddest outcomes of our long global disaster has been an emergent appreciation for big, shared, legacy institutions and the infrastructure they support. I see it on [Twitter](#), I hear it in conversations, I read it in the news. People care about mail sorting. They want *Stars and Stripes* to keep publishing. They want people with medical degrees, not politicians, to run our pandemic response. I guess being indoors a lot while the world crumbles will make you more sensitive to the fact that you exist as a single human node within a lattice of overlapping networks.

The good news is that there are many ways to appreciate infrastructure. You might read up on history in order to understand how bureaucracies form. The [Centers for Disease Control](#), for example, was established in 1946 to

fight malaria in the Deep South and prevent its spread—also inheriting, and continuing, the evil that was the Tuskegee syphilis study. Appreciating institutions is hard work, because they are sometimes wonderful and sometimes so corrupted that you wonder if they're worth saving. But they can also learn and improve, if they acknowledge the bad they've done, and get into productive lines of operation like smoking cessation programs, cancer prevention, and diabetes research. And if the CDC is not your thing (hello Trump administration), you have literally thousands of institutions to obsess over. Personally I'm a big fan of world postal systems, AT&T from 1920 to '84, and understanding how the railway-driven model of booking vaudevillians into theaters bootstrapped cinema. (So far I have not found a single other human interested in this subject, but I hold out hope.) But, I mean, if airmail is your thing, or the politics of road construction, you have *options.*

The trick is to start small. As you drift off to sleep tonight, imagine yourself as a piece of mail. A postcard to a friend. Into the mailbox you go. And then where? Do you know it would cost around $17,000 to send a letter to every single post office in the United States? (I've spent hours writing the notes in my head to the smallest post office in the USA, in Ochopee, Florida, where you can get mail stamped "Smallest Post Office Building in the U.S.A.") This little question—where does it go next, and what happens then?—is the secret to understanding much of what humans built. You can ask this question about an email, a data packet, a census form, or a vote. You can ask it about farm workers, Google searches, photons, and Ubers. And when you ask, you start to realize how fragile certain things truly are, and how unbalanced. Your vote is a mere idea until it is registered and counted at the correct time. Bureaucracy is a tool for adding balance. Balance is hard.

I wish we had time to discuss zip codes.

What you realize, as you drift off to sleep, is that everything big eventually takes the form of a network: hubs, spokes. We act as if the internet invented networks, but it's just a variation on a theme of horses with mailbags, marathon runners with messages for the king in ancient Greece. A truly big idea isn't fully formed until it has been arranged to work in a network. And that turns networks into maps of power. The internet "just works," but the

people who make it go occasionally want to eliminate net neutrality so that they can have some extra money to go with their power. It's just human nature unless you regulate it.

When a networked institution reaches its final, mature state, it becomes invisible. We walk around on trillions of dollars of investment, but mostly we only notice a bridge when it collapses. Civic leaders are caretakers, not politicians, and it generally behooves them to fuss less in public. I have enormous affection for bureaucrats, and when I meet them they never believe me that I want to hear *everything* and see the PowerPoint slides too. What a wonderful world it would be if we could take 10 percent of the attention we typically reserve for monsters and weirdos and direct it to reasonable people with graduate degrees in boring subjects who run our actual world, keep poison out of the reservoir, and retire with a plaque.

I've lived through nearly 20 percent of America, as measured from the signing of the Constitution, and 70 percent of integrated schools. That's far more America than I planned. You grow up expecting to find your place in history, but history finds you. And finds you wanting. The weight was not lost, the novel wasn't finished, gender and racial inequality persist, much of the world lives on a dollar a day and wants a piece of fish. It feels as if it's time to stop imagining a better world and spend more time fixing this one.

I've also lived through 97 percent of personal computers and, by the same math, 280 percent of [Facebook](). Which makes no sense but feels right.

OK, so: Some people will say we did not achieve the liberation we expected; others will point out that on average the world is fractionally less cruel than before, if hardly kind. Studying just about any institution shows you that both things can be true. I did not personally save the world despite my best intentions, but I am in no way alone in trying.

I confess that I am suspicious of people who do not love good infrastructure. I'm not saying you must love institutions or trust them. But we should consider them daily and pay them mind, and tend to them with our taxes so they can do their work. And make noise when they fail to serve us.

Just because things are obvious doesn't mean they're invisible. When you are born, the hospital follows its checklists; as you grow up, packages come to your door; you vote in elections, if they'll let you; and when you die the Post Office will deliver your ashes. Here's a fun tip: Use Label 139, an orange sticker that says "Cremated Remains." Or you can request an official box with an urn printed on it for your final journey through the network. Out of respect they send you Priority Mail—Express!

But not yet. First, welcome to our club! I can't wait until we're all back together and we can talk about the systems of the world together, and you can tell me how to fix them.

This article appears in the December 2020/January 2021 issue. [Subscribe now](#).

[Clive Thompson]()

[Ideas]()
11.17.2020 06:00 AM

The Few, the Tired, the Open Source Coders

The open source movement runs on the heroic efforts of not enough people doing too much work. They need help.

Image may contain Human Person and Water
Illustration: ANSON CHAN

While you're surfing the web, you ought to thank Jacob Thornton for making it so pretty.

He's a programmer who, along with web designer Mark Otto, created [Bootstrap](), free software that the pros use to make their sites look spiffy. If you've ever noticed that a lot of websites have the same big chunky buttons, or the same clean forms, that's likely because an estimated one-fifth of all websites on the planet use Bootstrap.

One reason for its spread is that Thornton and Otto made Bootstrap [open source](). Anyone can use it without permission, and anyone can tweak it and improve it. Thornton didn't get a salary for making Bootstrap. When he and Otto first released it, back in 2010, they had day jobs working for Twitter. But both were propelled by classic open source motivations: It was a cool challenge, it burnished their reputations, and it felt neat to help people. Plus, watching it surge in popularity—Green Day's website used it, as did Barack Obama's White House—was thrilling.

But open source success, Thornton quickly found, has a dark side. He felt inundated. Countless people wrote him and Otto every week with bug

reports, demands for new features, questions, praise. Thornton would finish his day job and then spend four or five hours every night frantically working on Bootstrap—managing queries, writing new code. "I couldn't grab dinner with someone after work," he says, because he felt like he'd be letting users down: *I shouldn't be out enjoying myself. I should be working on Bootstrap!*

"The feeling that I had was guilt," he says. He kept at it, and nine years later he and Otto are still heading up Bootstrap, along with a small group of core contributors. But the stress has been bad enough that he often thought of bailing.

When the open source concept emerged in the '90s, it was conceived as a bold new form of communal labor: digital barn raisings. If you made your code open source, dozens or even hundreds of programmers would chip in to improve it. Many hands would make light work. Everyone would feel ownership.

Now, it's true that open source has, overall, been a wild success. Every startup, when creating its own software services or products, relies on open source software from folks like Thornton: open source web-server code, open source neural-net code. But, with the exception of some big projects—like [Linux](#)—the labor involved isn't particularly communal. Most are like Bootstrap, where the majority of the work landed on a tiny team of people.

Recently, Nadia Eghbal—the head of writer experience at the email newsletter platform Substack—published *Working in Public*, a fascinating book for which she spoke to hundreds of open source coders. She pinpointed the change I'm describing here. No matter how hard the programmers worked, most "still felt underwater in some shape or form," Eghbal told me.

Why didn't the barn-raising model pan out? As Eghbal notes, it's partly that the random folks who pitch in make only very small contributions, like fixing a bug. Making and remaking code requires a lot of high-level synthesis—which, as it turns out, is hard to break into little pieces. It lives best in the heads of a small number of people.

Yet those poor top-level coders still need to respond to the smaller contributions (to say nothing of requests for help or reams of abuse). Their burdens, Eghbal realized, felt like those of YouTubers or Instagram influencers who feel overwhelmed by their ardent fan bases—but without the huge, ad-based remuneration.

Sometimes open source coders simply walk away: *Let someone else deal with this crap.* Studies suggest that about 9.5 percent of all open source code is abandoned, and a quarter is probably close to being so. This can be dangerous: If code isn't regularly updated, it risks causing havoc if someone later relies on it. Worse, abandoned code can be hijacked for ill use. Two years ago, the pseudonymous coder right9ctrl took over a piece of open source code that was used by bitcoin firms—and then rewrote it to try to steal cryptocurrency.

No one's quite sure what to do about open source burnout, but some think finding money for the coders might help. Programmer Ashley Williams is a member of the team creating the open source language Rust, and they're trying to set up a foundation to support core contributors, or get firms to keep contributors on staff. (Some of the largest open source projects thrive in precisely this fashion; firms like Facebook or Google pay some employees to work full-time on open source code.) Eghbal thinks subscriptions could offer new ways to pay for the work. Others worry that injecting pay can deform how and why the work is done in the first place.

But we need to rethink the very idea of what crowdsourcing is capable of—and understand that it is perhaps more limited than promised. The open source revolution has been carried on the backs of some very weary people.

This article appears in the December 2020/January 2021 issue. Subscribe now.

[Arielle Pardes](#)

[Culture](#)
11.17.2020 06:00 AM

Angry Nerd: These Masks Don't Work

My Instagram feed remains as artsy and overfiltered as ever, an infinite grid of happy little squares. This, in 2020, is crisis-level denialism.

Image may contain Electronics and Phone
Illustration: Elena Lacey

Something has happened to my [Instagram](#) feed. By which I mean, nothing has happened to my Instagram feed. It remains as artsy and overfiltered as ever, an infinite grid of happy little squares framing tidy apartments whose inhabitants wear things like makeup and jeans. This, in 2020, is crisis-level denialism. Authenticity has never been the currency of the Insta-realm—that would be Lightroom presets—but I really did believe that global tragedy would snap at least some of you out of your supersaturated daze and into this gritty, icky dimension. Where are the posts about the everyday catastrophes? Neglected kids screaming into crucial Zoom meetings? Asymmetrical bangs after a backyard haircut? The loaf of sourdough so collapsed and chewy the dog won't even sniff it? Something, anything, to capture the mise-en-scène of a year that has left so many of us defeated, or at least with more worry lines and grayer hair? But no. Instead of showing your true faces, you hide behind masks—the unhelpful, metaphorical kind! —and continue to post mirror selfies, perfect-morning macchiatos, and stacks of books about politics and the environment and racism that you are totally, definitely, absolutely never going to read. Worse still are the sunset photos of people touching one another, all normal-like. It's sick. (Those tend to come with a disclaimer: "Btw we're in a Covid pod and get tested every week, don't judge!" I'm judging.) Maybe artifice helps certain types, but not

me. Not now. The more you lie, the more isolated and anxious I feel. Leave the fabrications to our feckless leadership. Here on the ground, I need the truth.

This article appears in the December 2020/January 2021 issue. [Subscribe now](#).

[Virginia Heffernan](#)

[Ideas](#)
11.17.2020 06:00 AM

The Art That Defied the Last Four, Terrible Years

My mind has slipped anxiously off books and movies since 2016. But as the credits roll on 2020, I'm ready to look back.
Illustration: ALVARO DOMINGUEZ

For the past four years, the cacophonous American [presidency](#) has seemed to drown out quieter, more harmonious human endeavors, which is to say all human endeavors.

When was the last time that an album or movie or novel stayed top of mind for more than an hour? The last movie I saw in a theater, just before they all closed in March 2020, was Kelly Reichardt's *First Cow*. Set almost entirely in 1820, the film chronicles the friendship of prospectors in the Oregon Territory, shy baker Cookie and resourceful killer King-Lu, who together set up shop selling biscuits made with milk stolen from a rich man's cow, whose udders they drain under cover of night. It's strange as hell. It also has soul-stirring silent passages, and loose or dead ends, and plot turns without exposition. It's about as far from the bleat of partisan cable news as a pastured cow is from Godzilla. But I forgot it the second I emerged from the theater into a night almost audibly buzzing with anxiety and pathogens. My mind had slipped off cultural works this way since 2016. I leafed through novels, watched [Netflix](#) as escapism, and determined not to let any sensory-emotional experience get its hooks too deep in me. Why? The government swamped my circuitry, I guess; there was also activism, journalism, the shielding of the kids, the management of fear, the tempering of hope.

But now I'm ready to look back. And so I watched *First Cow* again, which is why it's fresh in my mind, and then I went back to other works: a short story, a movie, a play, and a stand-up performance. As Daveed Diggs' Thomas Jefferson put it in *[Hamilton](#)*: "What'd I miss?" Easy: the details. Or maybe: the whole experience. For example, I dimly remember admiring "[Cat Person](#)" by Kristen Roupenian, which appeared in *The New Yorker* in December 2017. But it evaporated from memory with the presidential inauguration a few weeks later. Until I reread it, I retained only the last word—"Whore"—and maybe that it centered on a vexed, slow-burn romance. Relishing it just now, I was struck by how precisely Roupenian captures the cadences of an affair conducted over SMS, including the studied use of emoji as an ambiguous placeholder. Even the heart-eyes emoji can be a dodge.

Maybe, she thought, her texting " lol r u serious" had hurt him. That's the train of thought of Margot, the heroine, while with Robert in person. She can't see or hear embodied Robert because of the intrusion of this other, ethereal relationship between their two phones. And because Margot can't see Robert, she mentally writes over his studied negging, designating it "hurt," which strikes her as sexy. By the time the push-pull between the two of them slackens, and Robert with nothing left to lose texts her that final word, reality comes to reside only in text messages. Life seems only a simulation of phone-on-phone intimacy.

Another artifact I missed in its full glory is *[Parasite](#)*, directed by Bong Joon-ho. Having won the Oscar for Best Picture of 2019, *Parasite* didn't exactly fly below the radar. But at the time I watched it as a diversion from American life and politics, not as a masterwork sure to outlast breaking news. It will. *Parasite* begins as a class comedy about the picturesque ingenuity of a poor family of hustlers in Seoul, and then shockingly becomes a slasher flick. It seems more like an assault on the sensibility of the Academy Awards than a capitulation to it.

A neck-snapping backward fall down a set of stairs becomes a reproof to anyone who was in this thing for the offbeat laughs at South Korean folkways. And then it's blow after blow until all pieties about class and

Korea and the West seem to be slashed to ribbons at a rich child's al fresco birthday party, where the film's climactic bloodbath is set.

Fairview, a Pulitzer-winning 2018 play by Jackie Sibblies Drury, also pulls off whiplash. Holy shit. I remembered being viscerally thrown by the play when I saw it that year in a small Manhattan theater, but only by watching bits and pieces of it on YouTube, and reading the script, did I get the full effect. Like *Parasite*, *Fairview* starts out sweet and whimsical, essentially a Black sitcom, before sharply changing course; the second act serves to subvert and undermine the first one, and to satirize the audience's programmed response to the opening. At the start, I laughed heartily at jokes that might have featured in *The Jeffersons*, taking comfort in knowing Drury is Black, and thus wouldn't resort to racialized clichés. Oh, but she had.

In the second act, white characters offer commentary on the first, and then a half-reenactment of it, but aslant, as if a starry-eyed tribute band in uncanny semi-blackface. A white woman imagines she's, by rights, a sexy Black torch singer in Montreux. Another white woman dreams of usurping a Black mother she sees as too religious by raising her daughter with would-be "progressive" values. A young white man does his best to emulate a caricatured Black man, rapping in basketball attire.

All of this made white people in the audience observably uncomfortable. But that was nothing compared to the agony of having one character break the fourth wall and fully segregate the audience by race, inviting everyone who considered themselves white to come on stage, while performing the rest of the play for Black viewers only. By pulling off this feat of intellectual derring-do better than any essay or lecture, *Fairview* set a sky-high bar for the inquiry into white supremacy that came two summers later.

And then there's [*Nanette*](). The same year that *Fairview* was first produced, 2018, Hannah Gadsby's *Nanette* came to Netflix. Its structure—an opening act that's pleasantly paced like a sitcom followed by a scathing critique—is so like *Fairview* that they might be companion pieces. In *Nanette*, Gadsby first jokes about herself, and in particular herself as a lesbian, playing self-savagery for laughs.

Then she retells some of the first act's stories, teasing out the horror in them. At last she renounces feminine self-effacement altogether as the obsequious valet to patriarchal effacement. If everyone is erasing women, including women themselves, the job gets done. *Nanette*, which started out so courteously, ends up an enraged call to arms.

In retrospect, the first acts of these works—Margot and Robert's SMS repartee, the sitcoms of *Parasite* and *Fairview*, and the endearing self-hatred of Hannah Gadsby's performance—all seem as gentle as the Obama years. Misogyny and white supremacy were elegantly repressed, sublimated, compartmentalized, and the arc of history seemed to bend toward … well, you know the rest.

The arc of history meets a surface-to-air missile in the second acts of these works, just as it did in the United States. When the curtain falls, we're left with false starts and dead ends and the promise of King-Lu in *First Cow*: "We'll tell our stories later." There's no clear trajectory for history, just as there's anything but clarity now, as the credits roll on 2020 and the new year could hold just about anything.

This article appears in the December/January 2020/2021 issue. [Subscribe now](#).

[Steven Levy](#)

[Business](#)
11.16.2020 06:00 AM

Huawei, 5G, and the Man Who Conquered Noise

A Turkish scientist's obscure theoretical breakthrough helped the Chinese tech giant gain control of the future. US telecoms never had a chance.

illustration of a city overlaid with wires cash and technology
Illustration: MOJO WANG

"The city of Shenzhen in July. The weather is hot, the trees brimming with life … "

So begins the baritone voice-over in a video shot in the summer of 2018 by the Chinese telecommunications giant [Huawei](#) and posted to YouTube. It chronicles a corporate event in the slightly corny style of a 1960s educational film, starting with aerial drone footage of Huawei's campus—an island of lush greenery surrounded by the high-rise buildings of the city known as China's Silicon Valley. A spirited orchestral version of Beethoven's "Turkish March" plays as a town car wends its way through the campus, pulling up to a stately white structure mixing classical Greek architecture and the wide overhanging rooftops of China's great pagodas. There's a bit of the White House tossed in too.

This feature appears in the December 2020/January 2021 issue. [Subscribe to WIRED](#).

Illustration: Carl De Torres, StoryTK

Two footmen dressed in white approach the vehicle as it arrives. One opens the rear door. Guo Ping, one of Huawei's rotating chairmen, steps forward

and extends a hand as the guest emerges. After walking a red carpet, the two men enter the magnificent marble-floored building, ascend a stairway, and pass through French doors to a palatial ballroom. Several hundred people arise from their chairs and clap wildly. The guest is welcomed by Huawei's founder, Ren Zhengfei, whose sky-blue blazer and white khakis signify that he has attained the power to wear whatever the hell he wants.

After some serious speechifying by a procession of dark-suited executives, Ren—who is China's Bill Gates, Lee Iacocca, and Warren Buffett rolled into one—comes to the podium. Three young women dressed in white uniforms enter the room, swinging their arms military style as they march to the stage, then about-face in unison as one holds out a framed gold medal the size of a salad plate. Embedded with a red Baccarat crystal, it depicts the Goddess of Victory and was manufactured by the Monnaie de Paris. Ren is almost glowing as he presents the medal to the visitor.

This honored guest is not a world leader, a billionaire magnate, nor a war hero. He is a relatively unknown Turkish academic named Erdal Arıkan. Throughout the ceremony he has been sitting stiffly, frozen in his ill-fitting suit, as if he were an ordinary theatergoer suddenly thrust into the leading role on a Broadway stage.

Arıkan isn't *exactly* ordinary. Ten years earlier, he'd made a major discovery in the field of information theory. Huawei then plucked his theoretical breakthrough from academic obscurity and, with large investments and top engineering talent, fashioned it into something of value in the realm of commerce. The company then muscled and negotiated to get that innovation into something so big it could not be denied: the basic 5G technology now being rolled out all over the world.

Huawei's rise over the past 30 years has been heralded in China as a triumph of smarts, sweat, and grit. Perhaps no company is more beloved at home—and more vilified by the United States. That's at least in part because Huawei's ascent also bears the fingerprints of China's nationalistic industrial policy and an alleged penchant for intellectual property theft; the US Department of Justice has charged the company with a sweeping conspiracy of misappropriation, infringement, obstruction, and lies. As of press time, Ren Zhengfei's daughter was under house arrest in Vancouver, fighting

extradition to the US for [allegedly violating a ban](#) against trading with Iran. The US government has banned Huawei's 5G products and has been lobbying other countries to do the same. Huawei denies the charges; Ren calls them political.

Huawei is settling the score in its own way. One of the world's great technology powers, it nonetheless suffers from an inferiority complex. Despite spending billions on research and science, it can't get the respect and recognition of its Western peers. Much like China itself. So when Ren handed the solid-gold medal—crafted by the French mint!—to Erdal Arıkan, he was sticking his thumb in their eye.

The pageant was the coming of age of a company and a nation. And to understand why, we have to learn the story of polar codes.

Erdal Arikan was born in 1958 and grew up in Western Turkey, the son of a doctor and a homemaker. He loved science. When he was a teenager, his father remarked that, in his profession, two plus two did not always equal four. This fuzziness disturbed young Erdal; he decided against a career in medicine. He found comfort in engineering and the certainty of its mathematical outcomes. "I like things that have some precision," he says. "You do calculations and things turn out as you calculate it."

Arıkan entered the electrical engineering program at Middle East Technical University. But in 1977, partway through his first year, the country was gripped by political violence, and students boycotted the university. Arıkan wanted to study, and because of his excellent test scores he managed to transfer to CalTech, one of the world's top science-oriented institutions, in Pasadena, California. He found the US to be a strange and wonderful country. Within his first few days, he was in an orientation session addressed by [legendary physicist Richard Feynman](#). It was like being blessed by a saint.

Arıkan devoured his courses, especially in information theory. The field was still young, launched in 1948 by Claude Shannon, who wrote its seminal paper while he was at Bell Labs; he would later become a revered MIT professor. Shannon's achievement was to understand how the hitherto fuzzy concept of information could be quantified, creating a discipline that

expanded the view of communication and data storage. By publishing a general mathematical theory of information—almost as if Einstein had invented physics and come up with relativity in one swoop—Shannon set a foundation for the internet, mobile communications, and everything else in the digital age. The subject fascinated Arıkan, who chose MIT for graduate studies. There was one reason: "Bob Gallager was there," he says.

Robert Gallager had written the textbook on information theory. He had also been mentored by Shannon's successor. In the metrics of the field, that put him two steps from God. "So I said, if I am going to do information theory," Arıkan says, "MIT is the place to go."

By the time Arıkan arrived at MIT, in 1981, Gallager had shifted his focus and was concentrating on how data networks operated. Arıkan was trembling when he went to Gallager's office for the first time. The professor gave him a paper about packet radio networks. "I was pushing him to move from strict information theory to looking at network problems," Gallager says. "It was becoming very obvious to everyone that sending data from one place to another was not the whole story—you really had to have a system."

Erdal Arıkan spent 20 years on a data transmission problem. He called the solution polar codes.

Photograph: BRADLEY SECKER

Arıkan devoted the next year to learning about networks, but he never gave up on his passion for information science. What gripped him most was solving a challenge that Shannon himself had spelled out in his 1948 paper: how to transport accurate information at high speed while defeating the inevitable "noise"—undesirable alterations of the message—introduced in the process of moving all those bits. The problem was known as channel capacity. According to Shannon, every communications channel had a kind of speed limit for transmitting information reliably. This as-yet-unattained theoretical boundary was referred to as the Shannon limit.

Gallager had wrestled with the Shannon limit early in his career, and he got close. His much celebrated theoretical approach was something he called low-density parity-check codes, or LDPC, which were, in simplest terms, a

high-speed method of correcting errors on the fly. While the mathematics of LDPC were innovative, Gallager understood at the time that it wasn't commercially viable. "It was just too complicated for the cost of the logical operations that were needed," Gallager says now. Gallager and others at MIT figured that they had gotten as close to the Shannon limit as one could get, and he moved on. At MIT in the 1980s, the excitement about information theory had waned.

But not for Arıkan. He wanted to solve the problem that stood in the way of reaching the Shannon limit. Even as he pursued his thesis on the networking problem that Gallager had pointed him to, he seized on a piece that included error correction. "When you do error-correction coding, you are in Shannon theory," he says.

Arıkan finished his doctoral thesis in 1986, and after a brief stint at the University of Illinois he returned to Turkey to join the country's first private, nonprofit research institution, Bilkent University, located on the outskirts of Ankara. Arıkan helped establish its engineering school. He taught classes. He published papers. But Bilkent also allowed him to pursue his potentially fruitless battle with the Shannon limit. "The best people are in the US, but why aren't they working for 10 years, 20 years on the same problem?" he said. "Because they wouldn't be able to get tenure; they wouldn't be able to get research funding." Rather than advancing his field in tiny increments, he went on a monumental quest. It would be his work for the next 20 years.

In December 2005 he had a kind of eureka moment. Spurred by a question posed in a three-page dispatch written in 1965 by a Russian information scientist, Arıkan reframed the problem for himself. "The key to discoveries is to look at those places where there is still a paradox," Arıkan says. "It's like the tip of an iceberg. If there is a point of dissatisfaction, take a closer look at it. You are likely to find a treasure trove underneath."

Arıkan's goal was to transmit messages accurately over a noisy channel at the fastest possible speed. The key word is *accurately*. If you don't care about accuracy, you can send messages unfettered. But if you want the recipient to get the same data that you sent, you have to insert some redundancy into the message. That gives the recipient a way to cross-check the message to make sure it's what you sent. Inevitably, that extra cross-

checking slows things down. This is known as the channel coding problem. The greater the amount of noise, the more added redundancy is needed to protect the message. And the more redundancy you add, the slower the rate of transmission becomes. The coding problem tries to defeat that trade-off and find ways to achieve reliable transmission of information at the fastest possible rate. The optimum rate would be the Shannon limit: channel coding nirvana.

Arıkan's new solution was to create near-perfect channels from ordinary channels by a process he called "channel polarization." Noise would be transferred from one channel to a copy of the same channel to create a cleaner copy and a dirtier one. After a recursive series of such steps, two sets of channels emerge, one set being extremely noisy, the other being almost noise-free. The channels that are scrubbed of noise, in theory, can attain the Shannon limit. He dubbed his solution polar codes. It's as if the noise was banished to the North Pole, allowing for pristine communications at the South Pole.

After this discovery, Arıkan spent two more years refining the details. He had read that before Shannon released his famous paper on information theory, his supervisor at Bell Labs would pop by and ask if the researcher had anything new. "Shannon never mentioned information theory," says Arıkan with a laugh. "He kept his work undercover. He didn't disclose it." That was also Arıkan's MO. "I had the luxury of knowing that no other person in the world was working on this problem," Arıkan says, "because it was not a fashionable subject."

In 2008, three years after his eureka moment, Arıkan finally presented his work. He had understood its importance all along. Over the years, whenever he traveled, he would leave his unpublished manuscript in two envelopes addressed to "top colleagues whom I trusted," with the order to mail them "if I don't come back." In 2009 he published his definitive paper in the field's top journal, *IEEE Transactions on Information Theory*. It didn't exactly make him a household name, but within the small community of information theorists, polar codes were a sensation. Arıkan traveled to the US to give a series of lectures. (You can see them on YouTube; they are not for the mathematically fainthearted. The students look a bit bored.)

Arıkan was justifiably proud of his accomplishment, but he didn't think of polar codes as something with practical value. It was a theoretical solution that, even if implemented, seemed unlikely to rival the error-correction codes already in place. He didn't even bother to get a patent.

In 1987, around the time Arıkan returned to Turkey, Ren Zhengfei, a 44-year-old former military engineer, began a company that traded telecom equipment. He called it Huawei, which translates roughly to "China has a promising future." Ren tried to distinguish his company by maintaining a fanatical devotion to customer service.

Frustrated with the unreliability of suppliers, Ren decided that Huawei would manufacture its own systems. Thus began a long process of building Huawei into a company that built and sold telecom equipment all along the chain, from base stations to handsets, and did so not only inside China but across the globe.

The rise of Huawei is painstakingly rendered in a small library of self-aggrandizing literature that the company publishes, including several volumes of quotes from its founder. The theme of this opus is hard to miss, expressed in a variety of fighting analogies. In one such description, Tian Tao, the company's authorized Boswell, quotes Ren on how the company competed against the powerful international "elephants" that once dominated the field. "Of course, Huawei is no match for an elephant, so it has to adopt the qualities of wolves: a keen sense of smell, a strong competitive nature, a pack mentality, and a spirit of sacrifice."

The hagiographies omit some key details about how the wolf got along. For one, they dramatically underplay the role of the Chinese government, which in the 1990s offered loans and other financial support, in addition to policies that favored Chinese telecom companies over foreign ones. (In a rare moment of candor on this issue, Ren himself admitted in an interview that Huawei would not exist if not for government support.) With the government behind them, Chinese companies like Huawei and its domestic rival ZTE came to dominate the national telecom equipment market. Huawei had become the elephant.

Another subject one does not encounter in the company's library is the alleged use of stolen intellectual property, a charge the company denies. "If you read the Western media about Huawei, you will find plenty of people who say that everything from Huawei was begged, borrowed, or stolen. And there is absolutely no truth in that," says Brian Chamberlin, an executive adviser for Huawei's carrier group. But in one notorious 2003 case, Huawei admitted using router software copied from Cisco, though it insisted the use was very limited, and the sides negotiated a settlement that was "mutually beneficial." More recently, in February, the US Department of Justice filed a suit against the company charging it with "grow[ing] the worldwide business of Huawei … through the deliberate and repeated misappropriation of intellectual property." The indictment alleges Huawei has been engaging in these practices since at least 2000.

The Chinese government also provided support to help Huawei gain a foothold overseas, offering loans to customers that made Huawei's products more appealing. One of Huawei's biggest foreign competitors was Nortel, the dominant North American telecom company based in Canada. But Nortel's business was struggling just at a time when competition from Chinese products was intensifying. Then, in 2004, a Nortel security specialist named Brian Shields discovered that computers based in China, using passwords of Nortel executives, had been downloading hundreds of documents from the company. "There's nothing they couldn't have gotten at," Shields says. Though no one ever publicly identified the hackers, and Ren denied any Huawei involvement, the episode added to the suspicion in the West that Huawei's success was not always achieved on the up and up.

Illustration: MOJO WANG

In 2009, Nortel filed for bankruptcy. It had failed to adapt, disappointed its customers, and was ill-prepared to respond to new Chinese competition. And there was that hack. Huawei seized the moment. Nortel's most valuable asset was the unmatched talent in its Ottawa research lab, known as the Canadian equivalent of the legendary Bell Labs. For years, Huawei had been building up its research capacity, trying to shed its reputation as a low-cost provider whose tech came from purloining the discoveries of others. It had a number of R&D labs around the world. Now, with Nortel's demise, it could pursue a bigger prize than market share: technical mastery. And respect.

The head of research at Nortel's lab in Ottawa, Wen Tong, grew up in China and joined Nortel's wireless lab in 1995 after earning a doctorate at Concordia University in Montreal. He had contributed to every generation of mobile technology and held 470 patents in the US. If telecommunications companies staged a research scientist draft in 2009, Wen Tong would have been a first-round pick. Now he was a free agent, and Google, Intel, and others courted him.

Tong picked Huawei. He wanted to keep his networking scientists together, and the team didn't want to leave Canada. The Chinese company was happy to recruit the group and let them stay in place. Huawei also promised them freedom to attack the signature challenge for networking science in the 21st century: creating the infrastructure for 5G. In this iteration of mobile platforms, billions of mobile devices would seamlessly connect to networks. It promised to transform the world in ways even the scientists could not imagine, and it would mean vast fortunes for those who produced the technology. The race for patents would be intense, a matter not only of profit but also national pride.

Not long after Tong joined Huawei, in 2009, a research paper came to his attention. It was Erdal Arıkan's discovery of polar codes. Tong had helped produce the technology that provided the radio-transmission error correction for the current standard, known as turbo codes. He thought the polar codes concept could be its replacement in 5G. But the obstacles were considerable, and Tong originally couldn't interest his Canadian researchers in attacking the problem. Then, in 2012, Huawei asked Tong to restructure its communications lab in China. He took the opportunity to assign several smart young engineers to work on polar codes. It involved the none-too-certain process of taking a mathematical theory and making it actually work in practical design, but they made progress and the team grew. With each innovation, Huawei rushed to the patent office.

In 2013, Wen Tong asked Huawei's investment board for $600 million for 5G research. "Very simple," Tong says. "20 minutes, and they decided." The answer was yes, and a good deal of that money went into polar codes. After Huawei came up with software that implemented the theory, the work shifted to testing and iterating. Eventually hundreds of engineers were involved.

Tong was not the only information scientist who had seen Arıkan's paper. Alexander Vardy of the Jacobs School of Engineering at UC San Diego says the paper achieved "something that people were trying to do for 60 years." The challenge was that polar codes were not suited for 5G's short blocklengths—the amount of 0s and 1s strung together. Vardy and his postdoc, Ido Tal of the Technion-Israel Institute of Technology, modified the error-correcting technology so it outperformed other state-of-the-art codes when applied to 5G's short blocklengths. Vardy says he presented his findings in a conference in 2011. "Huawei was there in the audience, and right after that they ran with it," he says, seemingly without rancor. (UC San Diego owns Vardy and Tal's patent and has licensed it to Samsung on a nonexclusive basis.)

Today Huawei holds more than two-thirds of the polar code patent "families"—10 times as many as its nearest competitor. The general feeling in the field, Vardy said, was that Huawei "invested a lot of research time and effort into developing this idea." It seemed "all the other companies were at least a few years behind."

But all that work and all those patents would be wasted if the technology didn't fit into the 5G platform. "It has to be adopted by everybody," Tong says. "You have to convince the entire industry that this is good for 5G."

If polar codes were to be the symbol of Huawei's superiority, there was one more hurdle: "I had the responsibility," Wen Tong says, "to make it a standard."

In sports, competition is fierce, but teams have to agree on some basics—like the dimensions of a playing field. Likewise, in the telecommunications industry, all the players must come together to agree on the particulars of a common platform. Reaching consensus on the parts of a mobile platform is complicated. Decisions have to be made about dozens of specifications for transmission speeds, radio frequencies, security architecture, and the like. To make that happen, engineers gather in a series of meetings every year to choose which new technologies will be deemed standard in the next generation.

The stakes are high: The companies that provide the fundamental technology for 5G will be embedded in a global communications system for years to come. So in the background are financial, nationalistic, and even geopolitical considerations. "From the year 2001 to the present—three administrations—not enough attention has been paid to this," says Reed Hundt, a former Federal Communications Commission chair during the Clinton administration. Hundt is one of a number of current and former officials alarmed that the United States has no equivalent to Huawei—that is, a major telecommunications company that both develops next-generation technology and builds it into equipment. "In Europe, they have an Ericsson. In Japan, they have companies. And in China, they have not just Huawei but also ZTE. But Huawei is the one that covers the whole range of products." All of this made Huawei's 5G standards bid an alarming prospect. "Huawei's IP and standards are the wedge they intend to use to pry open the Western computing world," Hundt says.

The body that develops 5G standards, the 3rd Generation Partnership Project (3GPP), is an international umbrella organization of various telecommunications groups. In 2016, it made a key decision on what was called 5G New Radio standards—the part that helped determine how data would be sent over 5G and how it would be checked for accuracy. After spending millions, undergoing years of testing, and filing for multiple patents, Huawei was not going to pull punches at the critical juncture. It needed the certification of an official standard to cement its claim.

The problem was that reasonable people argued that other techniques would work just as well as polar codes to achieve error correction in the new framework. Some suggested that a revamp of the current 4G protocol, turbo codes, would be sufficient. Others, notably San Diego-based Qualcomm, which makes chipsets for mobile technology, liked a third option: Robert Gallager's old LDPC idea, the one that had nearly reached the Shannon limit and had inspired Arıkan on his own intellectual journey.

Since the early 1960s, when Gallager proposed LDPC, technology had improved and the cost of commercial production was no longer prohibitive. Qualcomm's R&D team developed it for 5G. Though Erdal Arıkan did not know it at the time, his work would be squared off against that of his mentor

in a competition that involved billions of dollars and an international clash of reputations.

One advantage Huawei had was the backing of its government. US and European observers say China packs standards meetings with engineers who can be eyes and ears on the ground. Rivals also complain that Chinese companies work together in lockstep; even ostensible competitors will set aside differences to support a compatriot business.

For a brief moment in the middle of 2016, it looked as if that national wall of support wouldn't hold. In a preliminary round of the 5G New Radio standards process, the Chinese company Lenovo expressed its preference for LDPC, because it was a more familiar technology. That didn't last long. Lenovo changed its opinion later that year. Lenovo's founder, Liu Chuanzhi, called Ren Zhengfei to make sure that no offense was taken by the original stance. Liu and other executives even drafted an open letter that read like a forced confession. "We all agree that Chinese enterprises should be united and not be provoked by outsiders," Liu and his colleagues wrote. "Stick to it … raise the banner of national industry, and finally defeat the international giants."

Thus united behind polar codes, Chinese industry prepared to do battle at the final, critical stage—the November 2016 engineering standards meetings held in Reno, Nevada. The venue was the Peppermill resort and casino. Engineers, hunkered in hotel conference rooms arguing about block codes and channel capacity, had little time to enjoy the craps tables or eucalyptus steam rooms. Simultaneous meetings to determine a number of standards kept engineers hopping from one conference room to the next, says Michael Thelander, a consultant specializing in wireless telecommunications. "But polar coding versus LDPC, that was the hot topic," he says.

On the night of Friday, November 18, the conference room was packed, and the meeting, which began in the evening, turned into a standoff. Each company presented its work, including its testing results. "The battle was pretty well drawn, with most of the Western vendors lining up behind LDPC," says Kevin Krewell, a principal analyst at Tirias Research, who follows 5G. Some Western companies backed polar codes too, but, significantly, all the Chinese companies did. "There was no obvious winner

in the whole game, but it was very clear that Huawei was not going to back down," says Thelander, who was on the scene as an observer. Neither would the LDPC side. "So we can sit there and spend six months fighting over this thing and delay 5G, or we compromise."

So they did. The standards committee split the signal-processing standard into two parts. One technology could be used to send the user data. The other would be applied to what was known as the control channel, which manages how that data moves. The first function was assigned to LDPC, and the second to polar codes. It was well into the wee hours when the agreement was finalized.

Huawei was ecstatic. But it was not just Huawei's win; it was China's too. Finally, a Chinese company was getting respect commensurate with its increasingly dominant power in the marketplace. "Huawei-backed polar code entering the 5G standard has a symbolic meaning," one observer told a reporter at the time. "This is the first time a Chinese company has entered a telecommunications framework agreement, winning the right to be heard."

Qualcomm professes to be fine with the result. "It was very important for Huawei to get something," says its CEO, Steve Mollenkopf. "Huawei is actually quite good. They are a formidable company. And I think that's one thing that people need to acknowledge."

From the moment I learned about polar codes, I wanted to meet Erdal Arıkan. I doubted that he would speak to me. One journalist who had tried got the following response: "I do not wish to talk about my own work." He was wary when I first reached out, but when I said I would come to Ankara, he agreed to meet. He picked me up at my hotel, leading me to his car with a quick handshake. He told me the school's history as we drove to a kebab spot for dinner. The restaurant staff knew him, and I let him do the ordering. By the time he drove me back, he was excitedly sharing his views on 5G. We met again the next day at his office at Bilkent University, which is now a top research institution in Turkey, with 12,000 students. In 2019, Arıkan received the Shannon Award, the top honor in information science, for his work on polar codes. As he escorted me through the lobby of the engineering building that houses the department he helped build from scratch, we walked past a large framed photograph of Claude Shannon. The

quote above it reads: "We may have knowledge of the past but cannot control it; we may control the future but have no knowledge of it."

In his office, Arıkan scribbled equations on a large whiteboard to explain how he had achieved the Shannon limit. Afterward, we talked about Huawei. The company first contacted him in 2012. "We talked to each other, exchanged ideas," he says. "This is the best mode of collaboration for me. I remain independent, and they do whatever they want." He has personally taken no money from the telecom giant.
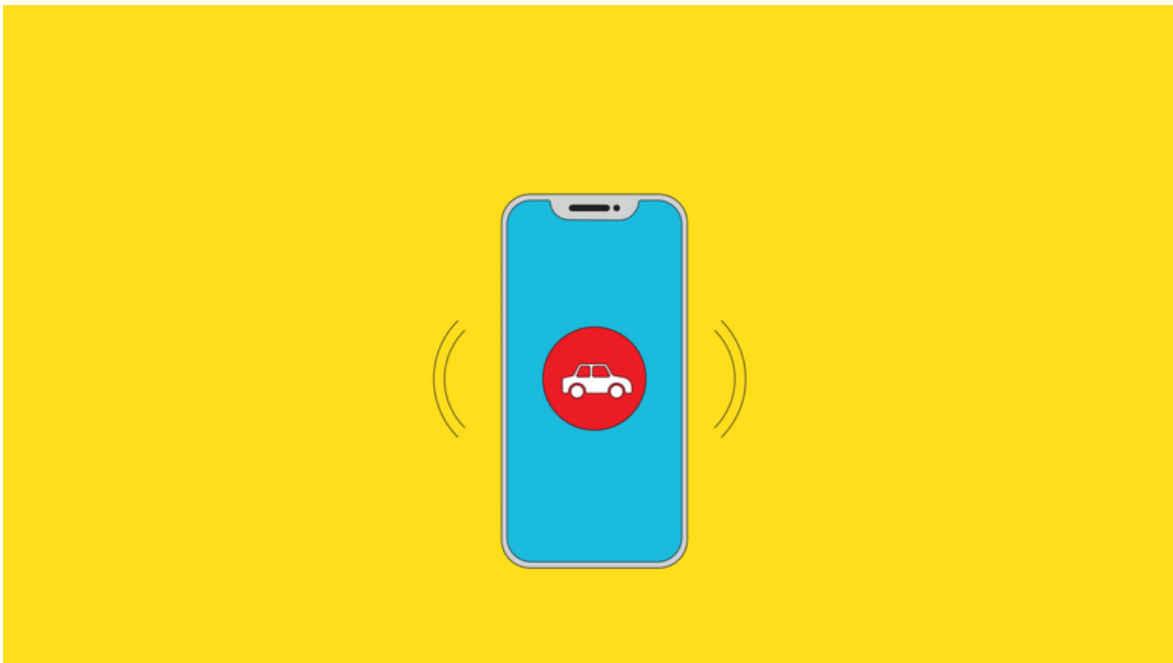
[The WIRED Guide to 5G](#)

Here's everything you'll ever want to know about the spectrum, millimeter-wave technology, and why 5G could give China an edge in the AI race.

By [Klint Finley](#) and [Joanna Pearlstein](#)

In 2011, Arıkan started his own small company and took polar codes to Qualcomm and Seagate to see if they had interest in implementing the idea. "I did prepare some slides and sent them, but none of the US companies were really interested in it," he says. He takes the blame for failing to ignite their interest. "I was an academic who did not know how to promote an idea.

Perhaps I did not believe in the idea that strongly myself." Later, those companies did work on polar codes and got their own patents, but without the same vigor as Huawei. "If it weren't for the persistent efforts of Huawei researchers," Arıkan says, "polar codes would not be in 5G today."

I asked him about the over-the-top Huawei ceremony immortalized in that YouTube video. He told me that he'd received the invitation to visit in June 2018. "I said, 'What is the occasion?' And they said, 'Mr. Ren wants to give you an award,'" Arıkan recalls. "I figured that Huawei is very happy because the standard has been made, and polar coding is definitely in it." He thought he would show up and there would be a pleasant conversation with the founder and some engineers. He might leave with a plaque.

Arıkan arrived in Shenzhen and stayed at a guest house on campus. He had tea with Ren and was toasted by executives, including Wen Tong. But he sensed that something bigger was afoot. "They revealed the program to me one step at a time. I didn't know how big that room would be, what kind of building we would go into. They didn't tell me to dress nicely." (He did anyway.) An hour before the ceremony his hosts informed him that perhaps he should prepare a speech. He hurriedly finished his remarks in the town car on the way to the ceremony.

"I have spent the last 30 years at Bilkent University doing research on a variety of problems that culminated in polar codes," he told the crowd in his halting English. "Today our roads cross on a happy occasion."

The spectacle didn't go to Arıkan's head. "They were not honoring me," he told me as we sat in his office. "Huawei was saying, 'We didn't steal this idea from anybody, and here is the originator of the idea.' There is no question that Huawei is the most technologically sophisticated company in China. Maybe for the first time in a thousand years, China is showing they are competing head to head with the rest of the world in technology. The US could live with intellectual property theft, but it is much harder to live with being in competition with an equal power.

"Polar codes itself is not what's important," he continued. "It is a symbol. 5G is totally different than the internet. It's like a global nervous system. Huawei is the leading company in 5G. They will be around in 10, 20, 50

years—you cannot say that about the US tech companies. In the internet era, the US produced a few trillion-dollar companies. Because of 5G, China will have 10 or more trillion-dollar companies. Huawei and China now have the lead."

US companies and the US government can no longer expect to beat China back with threats or indictments, even if they are sometimes warranted. And it's not just telecom companies like Huawei. For all the furor at the highest levels over whether the teen-oriented social app TikTok presented security issues, the real threat to American business was that its Chinese engineers had devised an AI-powered recommendation engine that Silicon Valley had not matched.

Arıkan says the experience has led him to respect Huawei—and to provide a warning to the country where he learned information theory. "I owe a lot to the US," he says. "I give you friendly advice: You have to accept this as the new reality and deal with it accordingly."

To paraphrase Shannon: No one knows the future. But Huawei and China now have a hand in controlling it.

This article appears in the December 2020/January 2021 issue issue.
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[Darren Loucaides](#)

[Security](#)
11.13.2020 06:00 AM

The Scammer Who Wanted to Save His Country

Last year, a hacker gave Glenn Greenwald a trove of damning messages between Brazil's leaders. Some suspected the Russians. The truth was far less boring.

graffitistyule art depicting a hacker a smartphone and a laptop
Illustration: Phellipe Wanderley; Getty Images

One sleepy Sunday morning in May 2019, Glenn Greenwald was sitting in his home office in Rio de Janeiro when he received a phone call from a number he didn't recognize. He didn't answer. But 30 seconds later a [WhatsApp](#) message arrived from Manuela d'Ávila, a Brazilian leftist politician who had run for vice president the previous year alongside the center-left Workers' Party's candidate for president; their ticket had come in second to the far-right former military captain Jair Bolsonaro. "Glenn," she wrote, "I need to speak to you about something urgent."

Greenwald, the American journalist who broke the story of [Edward Snowden's NSA leaks](#), didn't know d'Ávila well, so his interest was piqued by the weekend message. When she explained that she had stumbled into a huge potential story and wanted to talk on the phone, Greenwald rushed downstairs to the bedroom to wake his husband, the left-wing Brazilian politician David Miranda, who knew d'Ávila better.

This feature appears in the December 2020/January 2021 issue. [Subscribe to WIRED](#).

Illustration: Carl De Torres, StoryTK

When the two men put her on speakerphone, d'Ávila plunged into an odd tale: Someone had just hacked her Telegram account, then promised to send her evidence that would "save the country." Greenwald had to ask her to slow down. "She was excited," he says. D'Ávila explained that the hacker claimed to possess explosive material that implicated Bolsonaro's government, and in particular Brazil's Ministry of Justice and Public Security.

D'Ávila was calling to see if she could pass the source on to Greenwald. He agreed.

Right away, though, there was a problem. The hacker wanted to speak over Telegram, but Greenwald didn't have the app—for reasons the mysterious souce had just demonstrated. "The people I trust most, including Snowden, have been warning about its vulnerabilities for years," Greenwald explains. Still, after hanging up with d'Ávila, Greenwald installed Telegram and warily made contact.

"Fortunately, I didn't need to say much of anything, because he was just off to the races," Greenwald recalls. Messaging in Portuguese, the source claimed to possess a huge trove of material. He said he'd been going through it for months and had only managed to read about 10 percent of it, but he'd already found evidence of collusion that would set fire to Brazilian politics if revealed. The source started to send Greenwald examples—audio messages, some documents.

After a few minutes, the person asked if they could talk over the phone. This set off yet another alarm for Greenwald. Text exchanges can be disguised with proxies and encryption, but a voice would be easy to identify for anyone who might be surveilling them. "I didn't hear Snowden's voice until I went to Hong Kong," Greenwald says.

Yet Greenwald pressed on. He took the call and let the source, who claimed to be living in the US and attending Harvard, do most of the talking. The source explained to Greenwald that a close friend at Telegram had introduced him to the Russian founders of the app, the Durov brothers, and

through them he had gained access to people's Telegram accounts. "Which didn't make a lot of sense," Greenwald says—why create a supposedly secure messaging app and give someone the keys to its back door? Greenwald also doubted the hacker's Harvard story.

"Are you being careful?" Greenwald recalls asking. "What you've done is pretty serious."

"Oh yeah, don't worry about that. They'll never catch me," the source boasted. He said he was using multiple proxies that made it nearly impossible for anyone to find him, and he was never going to set foot on Brazilian soil again. The call was about four minutes long—Greenwald kept it short, but said he wanted to see the documents. "OK, I'm gonna just start uploading them to your phone," the source said. He told Greenwald it would take between 12 to 15 hours to finish uploading.

After the call, Greenwald began receiving files through his Telegram account—a huge number of them, one after another. Occasionally the source would interject, giddily telling Greenwald to look at a particular document.

When Greenwald went to bed that night, the files were still coming in; they hadn't finished when he woke up in the morning. "Every time I opened my Telegram app it was just going and going," Greenwald says. "That's when I realized this archive was enormous. And I was pretty convinced it was real."

From the start, Greenwald and Miranda discussed the dangers of working on the leaks. Unlike in the Snowden case, Greenwald would be living in the same country as the authorities he would be exposing. And Miranda had taken his seat in the National Congress after his predecessor, Jean Wyllys, from the same party, had fled Brazil and given up his seat over death threats and homophobic abuse. In 2018, a left-wing politician and close friend of Greenwald and Miranda named Marielle Franco had been assassinated in her car; two former policemen were charged with her murder.

That same Sunday, Greenwald called Leandro Demori, executive editor of the Intercept Brasil, part of the media group that Greenwald had cofounded

after the Snowden leaks in 2014. Greenwald asked if Demori was sitting down. "It's serious," he said. "You need to be sitting down right now." Demori, who was packing for a vacation, plopped down on his bed. As he listened to Greenwald, his jaw dropped: "Oh my God," he thought. "This is huge." Once he had a sense of the material, Demori gave the project an enthusiastic green light. The Intercept's legal team did likewise.

The next step was to figure out a faster and more secure way to receive all the source's material, which was still trickling onto Greenwald's phone via Telegram eight or nine days after the hacker made contact. The journalists wanted to secure the archive outside Brazil as soon as possible, in case authorities tried to confiscate it. So the Intercept's security specialist, Micah Lee, began preparing to set up an end-to-end encrypted cloud storage platform to receive the material. But the source simply created a Dropbox and dumped it all there. "I was suspicious of his technical judgment," Lee says. "He seemed overconfident."

As Greenwald drafted the first set of articles, he stayed in regular contact with the hacker—or, rather, hackers. At some point, he got the impression that he was talking to at least two people. One of them seemed somewhat naive and idealistic, Greenwald says. "And then, suddenly, I felt like I was talking to somebody more jaded … a little bit more slippery, and a little bit more complicated." Occasionally the source would also say "we" instead of "I."

The hacker was, however, consistent about what he—or they—wanted. "I'm only doing this because I want to clean up my country," Greenwald was told. And the source repeatedly insisted he had no financial interest. What mattered most, Greenwald thought, was that the material was genuine.

As Glenn Greenwald drafted the first set of articles, he stayed in regular contact with the hacker—or hackers.

Photograph: Christian Braga/The Intercept Brasil

On the evening of Sunday, June 9, almost one month after Greenwald first spoke to the hacker, the Intercept Brasil got ready to run the leaks. Greenwald, who usually works from home, went to the newsroom in Rio.

At almost 6 pm, the team published three articles, which they said drew on a vast archive of material supplied by an anonymous source.

The stories showed how a group of federal prosecutors had plotted to prevent the Workers' Party from winning the 2018 presidential elections. The prosecutors had been members of a sprawling anti-corruption task force called Operation Car Wash—Lava Jato in Portuguese. Their investigation claimed to have unearthed a vast system of money laundering and bribes between state-owned companies and major figures from Brazil's biggest political parties. Those revelations had led to hundreds of convictions, the most prominent being that of ex-president Luiz Inácio Lula da Silva, popularly known as Lula, who had left office in 2010 as one of the most popular political figures in the world.

The Car Wash prosecutors alleged that Lula had received a beachfront triplex as a kickback—and from there they depicted him as the "maximum leader" of a sprawling, corrupt web. In 2018, Lula was imprisoned and prevented from running (again) as the Workers' Party candidate in that year's presidential election. Lula had been the strong favorite to win, and his disqualification paved the way for Bolsonaro's shocking triumph at the polls. After Bolsonaro's victory, the judge who presided over the Car Wash cases, Sérgio Moro, was appointed minister of justice and public security. On the strength of his reputation as an anti-corruption crusader, Moro had become one of the most popular and powerful politicians in Brazil.

But now, the Intercept's leaks showed how Moro had colluded with the Car Wash prosecutors in the very cases he was supposed to adjudicate, including the one that convicted Lula.

Five minutes after the stories went live, their early readership on the Intercept's website was six or seven times higher than for any other story the site had published. Soon #VazaJato—roughly translating as "Car Wash Leaks"—was trending on social media. A couple of hours later, the Intercept's reporting was featured on the flagship news program of Brazil's biggest broadcaster, Globo.

Greenwald found the media explosion especially gratifying because he knew he could keep feeding the story. "I knew once that initial reaction

happened that way, it was going to dominate politics and headlines for weeks, if not longer," he says.

Left-wing parties were soon calling for Moro's resignation. He refused to step down, saying he had been the victim of a vicious, coordinated cyberattack by skilled and well-financed hackers. He also suggested there had been foreign involvement, referring pointedly to Telegram's Russian origins. Moro's insinuations hardly addressed the substance of the Intercept's reporting, but they did feed into a question that was on everyone's lips: Who was Greenwald's source?

The offices of the Intercept Brasil on the night it published its first stories about the Car Wash leaks.

Photograph: Christian Braga/The Intercept Brasil

Walter Delgatti Neto grew up in Araraquara, a four-hour drive inland from São Paulo. A small city of 200,000 people—about the same size as Boise, Idaho—Araraquara is a pleasant if unremarkable settlement of low-rise, flat-roofed buildings amid a smattering of incongruous tower blocks, surrounded by an expanse of green fields.

Delgatti lived in Araraquara with his parents until he was 7 years old, when they split up. He was then carted between grandparents: "My mother unfortunately left me on the sidewalk of my paternal grandmother's house, literally *de mala e cuia*"—an expression meaning "with all one's earthly belongings." As a kid, Delgatti had a hard time making friends. Unusually for Brazilians, he had auburn hair, earning him the nickname Vermelho, meaning "red" in Portuguese. Delgatti also struggled with his weight. He was bullied.

According to Gustavo Henrique Elias Santos, who has known Delgatti since he was about 15 or 16, Delgatti was a complicated young man. "I always felt pity for him," Santos says. "He had a strange family." Santos' earliest memory of Delgatti is at a party in Araraquara, where Santos was playing a set as a DJ. Santos noticed Delgatti, the only face really watching him in the audience, grinning strangely from the crowd.

Although Delgatti managed to form a rare bond with him, Santos learned not to believe a lot of what Delgatti told him. "Walter is a great storyteller," Santos says. "Not everything he says is a lie," he adds, "but he doesn't know how to tell the whole truth. He writes a great script."

Delgatti and Santos matured into petty but extravagant troublemakers. One morning in May 2013, Delgatti, 24 at the time, and Santos, then 22, were stopped by police on the highway leading out of Araraquara. In their silver Toyota, they were found in possession of false documents, stolen credit cards, 14 checks, and more than a thousand Brazilian reais in cash, along with a bank statement showing the sum of 1.8 million reais (roughly $900,000). The pair called Ariovaldo Moreira, a local lawyer they knew. When he arrived at the police station, the chief told Moreira that the youngsters had been unable to account for the cash or the funds in the bank account. When Moreira saw the bank statement, he noticed something the chief hadn't: It mentioned charges made on February 30 and 31. Delgatti had forged the statement, and the bank account didn't exist. He had likely done it to impress a girl, Moreira says: "He was born for forgery."

Moreira describes Delgatti and Santos at the time as small-time crooks and scammers who were rarely involved with anything serious. They often had plenty of money, despite lacking jobs. They made videos that showed car trunks full of cash and gold chains. They were gun lovers. "Their lives were a film," Moreira says. In his early twenties, Santos was convicted of possessing illegal firearms. Delgatti's longer rap sheet often blurred the line between pranks and petty scams. Moreira recalls how Delgatti booked stays at expensive hotels with counterfeit credit cards; he filled up at gas stations and drove off without paying. He skipped out on restaurant bills, despite having the cash to pay them—"only to say he did that," Santos says. Delgatti denies that he did these things.

In 2015, when he was 26, Delgatti was caught flashing a fake police badge at a theme park, trying to cut in line for rides. When a real policeman apprehended him, Delgatti led the officer to a car where Santos and Santos' girlfriend were. The officer found a firearm in the trunk, and Santos was arrested. Those close to Delgatti would never know why he did some of the

things he did. Moreira says Delgatti gets a kick out of tricking others. "He's indecipherable," Santos says.

If anything, Delgatti seemed motivated chiefly by a desire for fame and notoriety. Along the way, though, he was accused of crimes that would haunt him. The same year as the theme park incident, police raided Delgatti's apartment in connection with a rape case. Delgatti denied the allegation, and the accuser later changed her testimony and dropped the charges, but during the raid the police found a forged ID that made it look like Delgatti was a medical student at the University of São Paulo. They also found a quantity of "restricted medication"—a handful of antidepressant pills, 84 tablets of clonazepam (which can treat seizures, panic disorder, alcohol withdrawal, or insomnia), a slightly larger quantity of antianxiety medicine similar to Xanax, and some weight-loss medicine. Delgatti was adamant that the medication was for his own personal use, but the local prosecutor, Marcel Zanin Bombardi, charged him with both drug trafficking and possession of false documents.

The drug charge ignited a vehement sense of injustice in Delgatti. "The false charges left me extremely outraged," Delgatti says. "To this day I use those medicines."

In the face of mounting legal troubles, Delgatti enrolled in school at a college in Araraquara, deciding to study the law even as he was being pursued by it. Once again, he didn't get along with many classmates. He seemed determined to conceal his legal baggage, but, as ever, he overplayed his hand. In his first year, he went so far as to file a police complaint against some of his fellow students for "slandering and defaming him" in the classroom. "They are saying I'm a hacker and that I divert money from the accounts of third parties," Delgatti told police.

In June 2017, Delgatti's charges finally caught up with him. He was sentenced to two years in prison and spent six months behind bars before being released to serve out the remainder of his term in a semi-open facility, meaning he could go out by day but had to return every night. He had hit bottom. "Walter was fucked. He didn't even have 10 bucks to buy bread," Santos says. "I know because I lent him 10 bucks." In June 2018, Delgatti

was absolved of his drug trafficking conviction, but he still had to serve the rest of his sentence for possession of false documents.

Sometime in 2018, Delgatti skipped town. He moved to a slightly larger city about 55 miles northeast of Araraquara called Ribeirão Preto and enrolled in another law school there. Desperate to flee his reputation, he befriended a much younger student named Luiz Henrique Molição, a budding political junkie who sympathized with the Brazilian left. Delgatti had little interest in politics himself, but he wanted to impress the teenaged Molição. He represented himself as the son of a deceased neurosurgeon and said that he was living off an inheritance from his late father. "I was afraid of him knowing my true identity," Delgatti says. "I was on the run and living a double life."

It was at some point around this time that Delgatti discovered a hacking technique that would further complicate that double life. The hack took advantage of a feature offered by a Brazilian voice-over-IP company that allowed account holders to alter their caller ID—the number that registers on the receiving end of a call. This feature, combined with the fact that many phone providers in Brazil allow people to access their voicemail by calling their own number, made for a handy virtual lock-picking device. If a hacker simply changed his caller ID to the number of someone he wanted to target, he could spoof their phone and access their voicemail.

A hacker with little technical skill and no specialized equipment could, it turned out, do quite a bit of damage with access to someone's voicemail. Delgatti, for instance, figured out he could use this VoIP spoofing technique to target Telegram accounts. At the time, when a Telegram user wanted to attach their account to a new device, they had the option of requesting a verification code via an automated voice call from Telegram. Delgatti realized that he could spoof a victim's phone to request that code. Then, if Telegram's automated voice call didn't get through—because Delgatti initiated the hack late at night while his victim slept, or kept the line busy by calling his victim at the same time—the code would be sent to the person's voicemail. He could then spoof the target's phone once again to gain access to their voicemail, retrieve the verification code, and then add

the victim's Telegram to his own device. After that, he could download their entire chat history from the cloud.

Delgatti claims he chose Telegram because he had once noticed Bombardi, the local prosecutor who had pursued him, using the app during a court hearing. "He started this hacking because he wanted to fuck the prosecutor's life," Moreira says.

True to form, Delgatti's attention for trouble did not stop there. Early in 2019, he hacked the Telegram account of his friend Gustavo Santos. The two stopped speaking. "I was pissed, really pissed," Santos says. Delgatti's hack into Bombardi's Telegram account also gave him access to the local prosecutor's address book—and the contacts of several other public authorities. "And from there," says Moreira, "it all began."

The fields outside of Araraquara.

Photograph: LARISSA ZAIDAN

In March 2019, Santos joined most of Brazil in celebrating Carnaval. At some point during the week-long festivities, he says, he received a cryptic message from his estranged friend Delgatti. The message said: "Here is a real hacker." Santos says he didn't know what Delgatti was talking about and didn't give it much thought.

But Delgatti was not spinning one of his yarns. According to police investigators, at 3:34 am on March 2, the official start of Carnaval, Delgatti had hacked the phone of Eduardo Bolsonaro, a congressman and the third son of President Jair Bolsonaro. Forty-five minutes later, Delgatti hacked Carlos Bolsonaro, the president's second son, also a politician. Shortly afterward, Delgatti hacked the phone of the president himself, although he was apparently unable to download anything. And he kept going, making his way through a long list of powerful public figures—federal prosecutors, government ministers, and senior judges.

Delgatti told several acquaintances what he was doing, but like Santos, they had a hard time knowing what was real—which perhaps made it easier for Delgatti to entangle so many people in his hacking spree. He conducted

some of his hacks, for instance, from Santos' VoIP account, making Santos look like an accomplice.

Another acquaintance from Araraquara, a sometime Uber driver named Danilo Marques, was similarly roped in: Over the years, Marques had allegedly allowed Delgatti to open several accounts under his name and helped him to launder money from Delgatti's various scams. Now, as Delgatti hacked his way through the federal government, he used an internet service and an IP address that was under Marques' name.

At the time, Delgatti was also in contact with a freelance computer programmer and restaurateur named Thiago Eliezer Martins dos Santos, who has gone by the nickname Chiclete—or bubblegum—since childhood. The two had met in 2018 when Eliezer sold Delgatti a Land Rover, according to both men. ("The impression I had was of a slick guy who talks a lot," Eliezer says of their first meeting.) Eliezer admits he "made a program" for Delgatti—helping him set up a Private Internet Access VPN that let Delgatti mask his location. According to both men, Eliezer didn't play a part in hacking Telegram, though he did discuss it with Delgatti. At first, Delgatti described the hacks as a moneymaking scheme, Eliezer recalls, but then Delgatti started talking about fame and revolutionizing Brazil. "I never took it seriously," Eliezer says.

Then there was Luiz Molição, the 18-year-old budding leftist that Delgatti knew from law school. Delgatti had heard Molição speak negatively about Operation Car Wash and the Bolsonaro government, which caught his attention because he needed someone familiar with politics to help him compile the material he had hacked. So he showed Molição the phone numbers he'd dredged up for various famous people, including supreme court minister Alexandre de Moraes and right-wing humorist Danilo Gentili, and asked for Molição's help with the next phase of his plan. The two went on to maintain a fervent online dialog.

On April 26, Delgatti hacked into the Telegram account of the lead prosecutor in Operation Car Wash, Deltan Dallagnol, who at the time was considered a national hero. Dallagnol says he quickly noticed that some Telegram messages he'd received were marked as read, even though he hadn't read them. He looked into his Telegram account's usage: "I saw that

there were active sessions in other places and countries." At first Dallagnol imagined that scammers were trying to get his credit card details, "but then we identified that the attack extended to other prosecutors," he says. "We deleted messages and applications, changed passwords, and took precautions."

But it was too late; Delgatti had already accessed and downloaded Dallagnol's chats and contacts. And a couple of weeks later—on Mother's Day, 2019—Delgatti initiated the hack that would reveal his discoveries to the world. That morning, Manuela d'Ávila received an alert from Telegram that someone in the US state of Virginia was trying to access her account. Then she received a second message from a Brazilian senator she knew. D'Ávila tried to call him, but the line was busy. Then another message pinged into her Telegram from the senator's account: "Do you trust me?"

"Of course!" d'Ávila responded, baffled.

"I have to tell you that this isn't the senator." D'Ávila was startled. "I have information about crimes committed by the authorities in Brazil. And I'm going to hand you everything. You are the person that has to receive it." As a leader of the Brazilian left, she was the person most likely to be able to "save the country," the hacker said.

With that, the hacker left the senator's Telegram profile and messaged d'Ávila from another account. The person told d'Ávila that her own phone had been hacked, sending her screenshots of chats she'd had with another prominent left-wing politician. But the hacker reassured d'Ávila that she wasn't their target. D'Ávila promptly called her lawyers. In all likelihood, she feared, this was a plot to entrap her by political enemies. Her lawyers agreed.

Yet there was something about the way the person wrote that gave d'Ávila pause. The hacker's story seemed unreliable but also not malicious: "It was more like it was all a fantasy, you know?" she says. "He was saying these things that were so grandiose: 'I am going to save the country! You are the person that's going to help me! We are going to change everything! Lula is going to leave prison!'" The hacker also invoked d'Ávila's election slogan, "*Lute como uma garota!*"—"Fight like a girl!" A particular psychological

pattern was emerging from the messages; d'Ávila sensed a resemblance to a loved one (whom she prefers not to name) who is also given to grand leaps of the imagination. It was this, against her lawyers' advice, that made d'Ávila keep messaging with the person. And ultimately to believe that the exchange wasn't a trap.

The person wanted to entrust all the material to her, but d'Ávila, a former journalist, knew her standing as a politician would make people question the leaks—and that she'd be hard-pressed to evaluate the veracity of the material. "We have to think about how you're going to do it," she told the hacker. He needed to speak to a journalist, she said.

The hacker was skeptical. He told d'Ávila he had uncovered evidence of corruption among Brazil's press. So d'Ávila suggested a prominent American reporter instead: "We have to speak to Glenn, the journalist from the Snowden case," she told the source. "He is the best in the world." D'Ávila suggested that Greenwald would also be uniquely able to ensure the security of the material and the source. "Because we're talking about very serious crimes by the authorities, about information that's very important for the country," d'Ávila said. "If they kill you, where is that information going to be?"

The source, excited by the allusions to the Snowden case, agreed.

Walter Delgatti Neto in his hometown of Araraquara.

Photograph: LARISSA ZAIDAN

As it happened, Greenwald already had a somewhat complicated history with Operation Car Wash. From the very beginning, there had been critics who believed that the anti-corruption task force was colluding with Moro to target the Workers' Party and Lula. (Their suspicions had been aroused back in 2016, when then-judge Moro leaked secret wiretaps of a breathless, affectionate conversation between then-president Dilma Rousseff and Lula, which seemed to suggest the two were coordinating to shield Lula from prosecution.) But Greenwald wasn't among those critics. He says that he never felt "super antagonistic" toward the Car Wash task force. In fact, in a speech at a 2017 award ceremony for anti-corruption work in Vancouver,

Greenwald had spoken positively about the Car Wash team. "I made a lot of people angry on the left in Brazil by defending them," Greenwald says. "I kind of went out on a limb for them."

But now, after the Mother's Day phone call from d'Ávila, as he began to dig into the avalanche of documents that slowly uploaded to his new Telegram account, Greenwald was astonished. "I actually kind of felt betrayed," he says. The collusion between Moro and federal prosecutors against Lula and the Workers' Party, Greenwald learned, went deeper than even their fiercest critics had imagined.

Most explosively, the leaks demonstrated that Moro helped design the criminal cases that he would then adjudicate. In one instance, Moro offered to put Dallagnol in touch with a source who had possible evidence against one of Lula's sons. In messages dating back to Lula's trial, Dallagnol—the prosecutor in the case—also expressed deep worry to Moro and other colleagues about how flimsy his case was. Shortly before he accused Lula of accepting a beachside triplex as a bribe, Dallagnol wrote to colleagues: "They will say that we are accusing based on newspaper articles and fragile evidence." When Dallagnol ultimately used that triplex allegation to depict Lula as the mastermind of a sprawling empire of corruption, his typo-ridden presentation indeed came under heavy fire in the press. But Moro sent a Telegram message reassuring him: "Definitely, the criticisms of your presentation are disproportionate. Stand firm," he wrote. In July 2017, Moro sentenced Lula to nine years and six months in prison.

Once Greenwald and his colleagues had a solid understanding of what was most newsworthy, the Intercept team decided they would publish the first set of stories on June 11. But on June 5, something happened that threw them off: Sérgio Moro publicly announced he had just been hacked. His phone had received SMS messages from Telegram indicating that his account had been accessed by an unsolicited device. Moro claimed that the alleged invaders had not extracted any content, but the hack caused a media storm. Then a steady stream of famous people and political figures came forward to say their accounts had been invaded in the same way.

Greenwald, who had understood that his source's hacking spree was over, was taken aback. He immediately got in touch and asked if the source had

been behind hacking Moro's phone. If so, it could make the Intercept look complicit in an ongoing cyberattack. The source vehemently denied it. "He even feigned being offended that I would think that they would do something that primitive," Greenwald recalls.

Then, at around 8 pm on June 7, the hacker—once again putting Greenwald in an awkward position—called to ask for advice about what to do with all the Telegram accounts he still had access to. "As soon as you publish the articles," the source said, "everyone is going to delete their chats, everyone is going to delete Telegram, so we wanted to know … what you recommend doing?" Basically, he was asking Greenwald if they should carry out a data export of the Telegram chats before victims potentially cut off access.

"It's difficult, because I can't give you advice," Greenwald replied. "Obviously I need to be careful with all of what I am saying."

Greenwald laid out a delicate response. "It's a certainty that they are going to accuse us of participating in the hack," he said. He pointed out that the Intercept had stored all the material it received from the hacker in a "very safe" offshore location. "I think that there's no purpose, no reason for you to keep anything, right?" Greenwald said, while making it clear that the choice was up to the hackers. "Right, perfect," the source said, thanking the journalist.

"Any doubts, call me, OK?" Greenwald said, according to an audio recording of the call that police later discovered on Delgatti's MacBook.

The Intercept Brasil went to press on June 9, two days ahead of schedule. (Greenwald says the decision had nothing to do with Moro's hacking claims.) The publication said its reports were based on a trove of unpublished files, including private messages, audio recordings, images, and judicial documents. Distancing itself from the alleged Moro phone hack, the Intercept wrote that it had received its material weeks earlier.

That same night, the Car Wash task force put out a statement condemning the "criminal action" of the hackers and suggested that the invasions could endanger the safety of the authorities and their families. Moro, meanwhile, said the messages didn't show any "abnormality" in his behavior; he also

cast doubt on their authenticity. Neither the task force nor Moro admitted the messages were real. Still, there was an uproar. The legacy of the entire Car Wash anti-corruption operation was thrown into question. And there was still plenty more material to publish. As the Intercept Brasil drafted follow-up articles detailing ever deeper collusion and corruption, Greenwald broke off communications with his source.

As the nation roiled over the implications of the hacked material, the government and media also went into a frenzy of speculation about the origin of the leaks. And yet Delgatti did not try to cover his tracks. He kept hacking. He spent hours in front of his computer screen with multiple Telegram accounts open at once. He had set up more than a hundred hacked accounts to be monitored in real time. Delgatti says that at times he was awake for 48 hours straight.

Delgatti even took to taunting his most high-profile victims on Twitter. Replying to a tweet by Dallagnol, Delgatti claimed to have proof that the Car Wash leaks were authentic, citing the time and date of messages on Dallagnol's device three days before he was hacked. And on July 7, Delgatti tweeted at Moro: "Every day that passes your defense is becoming more ridiculous. The house has fallen, covering the sun with a sieve won't do any good." He also criticized Bolsonaro on social media. But Delgatti's behavior—tweeting from his personal account, with a profile picture of himself smiling and wearing red sunglasses—was so brazen that it begged to be disbelieved.

Just after midnight on July 21, Delgatti hacked the Telegram account of Joice Hasselmann, a right-wing politician close to Bolsonaro and the leader of his far-right party in the lower house. The next day, Hasselmann posted a video on social media claiming her cell phone had been invaded. Undeterred, Delgatti proceeded to hack the Telegram account of a key Bolsonaro cabinet minister, economy czar Paulo Guedes. It would be his final hack.

On the morning of July 23, in Araraquara, Ariovaldo Moreira, Delgatti's onetime lawyer, woke up early feeling glum. Moreira's life had become stagnant; he had recently separated from his wife. His legal work had grown monotonous. After doing his morning stretches, Moreira abruptly fell to his

knees and prayed to the Virgin Mary: "Help me, Santa Maria!" he pleaded. "I need a change, I need something in my life."

As it would happen, a drastic change was descending on Araraquara that very morning, in the form of a tightly coordinated federal police crackdown dubbed Operation Spoofing. Early-rising locals had noticed police cordoning off several streets, a strange sight in their sleepy city. At around 8 am the officers entered Delgatti's grandmother's house but didn't find him there. Shortly afterward police burst into Delgatti's apartment in Ribeirão Preto, the city where he had been attending law school, and found him sleeping. Delgatti had been up for most of the past two days, poring through Telegram accounts on his computer. He had finally taken some sleeping pills and gone to bed around 3 am. He says he awoke with a gun to his face. When the operation commander asked if he knew why they were there, Delgatti says he replied: "Because of Minister Sérgio Moro." And he added: "I've been waiting for you."

Ariovaldo Moreira, a lawyer from Araraquara.

Photograph: LARISSA ZAIDAN

Others who would receive a visit from police that morning were far less prepared.

In São Paulo, Delgatti's old friend Gustavo Santos was pinged awake by a cell phone alert. Santos, who now lived with his girlfriend in Brazil's largest city, had installed a network of cameras and sensors at the empty home he still maintained in Araraquara. The devices sent alerts to his phone when they were tripped. Sometimes the sensors were triggered by cats or bugs; this time they were being triggered by an early morning police raid, but Santos was oblivious. "I was really doped up from sleeping medicine," he says. So he went back to sleep.

At around 8 am the buzzing of his apartment's intercom woke Santos again. He dragged himself up and answered. "Gustavo," the intercom barked, "there is a Sedex here for you. You have to sign for it."

Santos didn't recognize the doorman's voice. "Man, you can sign for me," Santos said into the intercom, refusing to come down. But as he hung up, Santos thought: "Fuck, this does not smell good."

Santos went to the window, parting the curtains a crack. He glimpsed several figures dressed in black approaching his apartment building. Now fully awake, he frantically started cleaning up his apartment—ripping up documents and flushing any potentially compromising material down the toilet. (Santos dealt extensively in cryptocurrency trades and other schemes.) Then, remembering the nearly 100,000 Brazilian reais in cash he had in the apartment—about $25,000—Santos went to the bedroom where his longtime girlfriend, Suelen Oliveira, was still sleeping; neither the buzzing intercom nor Santos' frenzied movements had woken her. "Su," Santos whispered, waking her up. "You have to hide this for me, because the police are here." She blinked at him, confused. "She didn't understand a thing," Santos remembers.

The doorbell started ringing. There came a loud banging on the door. Then the door burst open.

Santos moved toward the police as they broke in and thrust a hand in front of them. At 6'3" and 340 pounds, with close-cropped hair and a tattooed neck and hands, Santos could strike an imposing figure. "Hold on, you're not coming in without a warrant," he said, imagining that it was the regular civil police at his door. The operation commander stepped forward: "Young man, calm yourself. This is the federal police here. And yes, we have a warrant."

Santos froze, and he says the police pushed his face against the wall. After reading him his rights, a policeman asked Santos a question that made little sense to him at first: "Aren't you the hacker?"

"You've got the wrong person," exclaimed Oliveira, who had appeared in the bedroom doorway.

The federal police ransacked the apartment and found the 100,000 reais. Then the commander told the couple to collect some extra clothes. They

were going to Brasilia, the nation's capital, more than 600 miles to the north.

At the airport, the couple were shocked again to see they were not taking a commercial flight but were being led toward a Brazilian air force jet. "What the fuck is all this?" Santos thought. After boarding the plane, the police cuffed Santos' hands and ankles to a chain wrapped around his waist. "We were treated like killers," Oliveira says.

The jet took off and landed about an hour later in Ribeirão Preto. The couple were allowed to leave the plane to use the restroom. There, in the hangar of the airport, they spotted Delgatti standing between two federal police officers, wearing a suit and tie. "And I knew right there," Santos says. Delgatti had dragged him into the biggest mess of his life.

"Keep him far from us, or there's going to be hell," Oliveira told police.

When Santos caught his eye, Delgatti was grinning. Santos recognized the same strange smile Delgatti gave him all those years ago when he was DJing at the party, the earliest memory he had of his friend.

Santos also spotted Delgatti's friend Danilo Marques; he had been arrested in Araraquara while in class learning to be an electrician.

After he'd done his stretches and dropped to his knees in prayer, Moreira had gone to the gym in Araraquara, and then to his office. He was wearing Bermuda shorts—his usual attire when not expecting clients. At 10 am, sitting in front of his computer, Moreira got a call from Santos' mother. "Ari, it's full of police at the house," she told him. The police were searching Santos' family home and Santos' own nearby house. "It's probably nothing," Moreira assured her. "Santos gets himself in trouble all the time." But soon Santos' sister was on the line saying Santos had been arrested in São Paulo. Moreira told her that the police needed a warrant. He went back to work.

Moments later a photo of the warrant landed in Moreira's WhatsApp. Sighing, he started to read it. His eyes latched on to a name: Sérgio Moro. He went back and read again. Santos, the warrant said, was wanted in

connection with the hacking of Moro's phone. This, Moreira realized with shock, was linked to Vaza Jato, the Car Wash leaks. "Gustavo did this?" he thought. "It is not possible." But there it was, in black and white.

Moreira ran to his son, a lawyer who worked with him in an adjoining room of the office. "Behold!" he cried, excitedly banging his desk. "The show is about to begin." Moreira dashed for the elevator, a flash of Bermuda shorts, his son trailing after him. What had happened? "Turn on the TV, because you're going to see me there!" Moreira exclaimed and stepped into the elevator. He drove home, started packing, and got himself booked on the next flight to Brasilia.

On the evening of the arrests, Luis Flavio Zampronha de Oliveira, the federal police chief in command of Operation Spoofing, finally got to sit down with his chief suspect after weeks of hunting. It was almost anticlimactic. Delgatti admitted to the hacks right away. He said he had acted alone and that everything had started when he hacked Bombardi, the prosecutor in Araraquara who had pursued him for years. He described how the prosecutor's phone book had led him to other officials, and finally to Dallagnol. He admitted that he had, in fact, been the one who hacked Moro's Telegram account. He admitted to hacking Manuela d'Ávila—whose number he had gotten through the phone book of the impeached ex-president Dilma Rousseff. Delgatti also claimed to have hacked Lula's Telegram but said he possessed no record of that.

On the weekend after the arrests, Telegram rolled out a fix for the vulnerability Delgatti had exploited—not just for users in Brazil, but everywhere.

As the federal police scoured the 7 terabytes of information stored on devices they had seized in their raids, they found evidence of 6,508 calls made to 1,330 different numbers, resulting in 176 successful invasions. They also found that suspicious sums of money had circulated among their suspects in just the past few months. But a clear picture of the motives behind the hacking scheme never quite came together. Certain text exchanges between the suspects seemed to suggest a conspicuously timed change in financial fortunes; in April 2019, for instance, around the time Delgatti was hacking Dallagnol's phone, he had texted Marques to say "the

storm is over" and the "bonanza has come." And Santos was evasive under questioning about his sources of income and cryptocurrency trading, which made prosecutors wonder whether the suspects had been paid in cryptocurrency to conduct their hacks. But ultimately they found no evidence that Delgatti had carried out his hacking spree for money—only that their suspects had been separately involved in various petty financial frauds for years. For the police, as for everyone who knew Delgatti, the reasoning behind the hacks remained fundamentally mysterious. Zampronha, the federal police chief, kept asking Delgatti why he did it. There was no clear answer.

The first time Moreira was able to see Delgatti was at the suspects' preliminary hearings. The lawyer was in the waiting area with Santos and Oliveira—they were in handcuffs, alongside armed police—when Delgatti came in wearing a suit: "Hey, what's up Ari!" Delgatti cried when he saw Moreira. "Did you see what I did?"

Delgatti was charged with being the ringleader behind the hacks. Santos, Marques, and Oliveira were charged as accomplices; the main evidence against them appeared to be that some of the hacks were carried out from their IP addresses. All of them were accused on separate charges of being members of an organized crime ring.

On September 19, a second phase of Operation Spoofing went into action. The freelance computer programmer Thiago Eliezer was arrested in Brasilia. The 19-year-old law student Luiz Molição was arrested outside Ribeirão Preto. Eliezer was accused of developing techniques used in the crimes, while Molição, investigators alleged, had helped Delgatti compile the material and conduct some of his communications with Greenwald, and also participated in the hacking of Joice Hasselmann. As part of his defense, Molição claimed that Delgatti had manipulated him into helping; he described Delgatti as a "narcissistic sociopath."

Greenwald was named in the charges too, for having "incentivized and directed the group during the period of the hacks." The prosecutors' supposed smoking gun was Greenwald's cautious response when his source called him up for advice. But in August, Brazil's supreme court forbade Greenwald's prosecution, citing the constitution's articles on freedom of the

press, and the federal police say he did not participate in the alleged crimes associated with the leaks. Even so, federal prosecutors have continued to pursue charges against Greenwald and have appealed the supreme court's decision. President Bolsonaro has publicly threatened the journalist: "Maybe he'll do jail time here in Brazil," Bolsonaro said in one interview. Greenwald and his family have had round-the-clock security since the first stories were published. The Intercept, meanwhile, has kept publishing stories based on the leaks—more than 100 to date. (On October 29, Greenwald resigned from the Intercept over a disagreement with American editors there, but he went out of his way to voice his respect for the Intercept Brasil.)

On November 8, 2019, Lula was released from prison, just as Delgatti had boasted would happen when he first contacted Manuela d'Ávila. Lula went on to demand access to all the messages between Moro and the prosecutors in Operation Car Wash, citing their role in helping to clear his name.

As for the enormously popular justice minister and "anti-corruption" crusader Sérgio Moro, his credibility was badly damaged. He hadn't been hacked by a foreign intelligence operation, as he had strongly implied, but by small-time scammers. After the leaks, Moro kept a low profile, and in April 2020 he resigned from the government after coming into conflict with Bolsonaro. Moro has since accused the president of several crimes. But he says that ever since his messages were leaked to the Intercept, he has periodically deleted his chats, so he no longer has many of the messages between him and Bolsonaro that would have provided concrete proof. This is the closest Moro has come to admitting the veracity of the leaked messages. He declined to comment for this article.

In written responses to my questions, Dallagnol still affirms that the Intercept's leaks showed no evidence of "illicit activity" by public authorities or "any crime." Dallagnol also dismisses the Intercept as biased, accusing its staff of "making terrorism and personal attacks on social media." He adds, "It was militancy, not investigation or journalism." Ultimately he is defiant: "Car Wash was and is the greatest anti-corruption work in Brazilian history," he says. It was a "hundred times bigger than Watergate," he adds, "which isn't something we should be proud of, because

it shows just how far corruption can go. The investigation was an earthquake that shook the state of systemic corruption."

Suelen Oliveira and Gustavo Santos in Araraquara. They were arrested by federal police on July 23, 2019, as part of a crackdown called Operation Spoofing. They claim to have been completely baffled by the arrest.

Photograph: LARISSA ZAIDAN

Many people in Brazil remain incredulous that a fraudster from Araraquara was behind the biggest leaks in Brazilian history. Conspiracy theories have circulated linking the hackers to communists, the Workers' Party, or other wealthy financial backers. Some have even pointed to Delgatti's childhood nickname—Red—as a sign of his supposed hard-left politics. Speculation continues in some circles that the group was paid in cryptocurrencies, though Delgatti denies having ever used them.

According to Eliezer, Delgatti assured him in prison that they wouldn't be locked up for long, thanks to a *tia*—literally meaning aunt. He seemed to be alluding to some powerful contact: "He talked many times about a tia and that she would help us," Eliezer tells me in written answers to my questions, provided through his lawyer. (Delgatti denies saying this.) But as the months rolled by and the other suspects were released pending trial, Delgatti remained in custody.

Delgatti was held for a year in Block F of the Papuda Penitentiary Complex in Brasilia, which was ravaged by Covid-19. More than 1,000 inmates contracted the disease. For many months, it was difficult for Moreira, who once again began representing Delgatti late last year, to speak with his client and old friend. But in May and June, Moreira was able to deliver questions to Delgatti for me.

In responses delivered through Moreira, Delgatti wrote that he did what he did both to save Brazil "and because I myself had been wronged." He went on: "I never asked money from anyone, what I wanted was justice." Since the media attention has died down, Delgatti has despaired at the lack of action against those exposed in the leaks. "I think that I should be free,"

Delgatti wrote. "Without a doubt I could be helping justice with regards the crimes committed by the operators of Car Wash."

In Delgatti's answers to my questions, there are hints of a motive. "I never felt so good in my whole life," he wrote of the moment when the leaks first came out in the Intercept. "I was proud of my achievement—I'm a vain person, and I had the feeling of a mission accomplished." He also seemed disappointed that he is not adored in Brazil the way he imagined he would be.

The commander of Operation Spoofing, Luis Zampronha, believes that Delgatti must be punished for his crimes. In the only interview about the case that he has given, Zampronha described Delgatti to WIRED as narcissistic and troubled but fit to stand trial, and certainly not worthy of adoration. In Zampronha's mind, Delgatti is a scam artist who managed to invade the private lives of authorities, and no grand ideological hacker. "He is not Snowden," Zampronha says.

Most Brazilians would agree. The tale of a ne'er-do-well turned cyber-crusader simply doesn't fit anyone's script. Now an entire country is in much the same position that Delgatti's associates from Araraquara have often found themselves in, never knowing how seriously to take a serial fantasist.

On October 17, Delgatti was finally released from prison to await trial in Araraquara; he now wears an electronic ankle monitor. There was very little media comment on his release. Just before this magazine went to press, I spoke to him over a voice line, in the first and only interview he has given. He was audibly emotional about the injustice he feels he has been dealt. "In my opinion I should be honored as a hero, and not labeled a criminal," he said. But he became somewhat evasive when I brought up something he'd written earlier. At one point in prison, Delgatti had told me that he only gave a portion of the material he had hacked to Greenwald. "It's only the tip of the iceberg," he had said.

When I asked him on the call how much more material there was and what he planned to do with it, he chortled and said he'd better not answer that. "It affects my personal freedom," he said. Maybe there is no other material.

But if it exists, it could be a time bomb waiting to explode in Brazil, and Delgatti could yet receive the adulation he dreams of. Or it could detonate and leave him in yet another cloud of smoke.

Updated 11/13/2020 12:10 pm EST: The subheadline of this article has been updated to reflect that Walter Delgatti approached Glenn Greenwald last year, not last fall as previously stated.

DARREN LOUCAIDES *([@darrenloucaides](#)) wrote about [Italy's techno-utopian Five Star Movement](#) in issue 27.03.*

This article appears in the December 2020/January 2021 issue. [Subscribe now](#).

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[Patrice Peck](#)

[Culture](#)
11.12.2020 06:00 AM

What Writing a Pandemic Newsletter Showed Me About America

In April, I started *Coronavirus News for Black Folks*. It gave me a kind of second sight. I could see where the country is headed—and how blind it's been.

portrait of Patrice Peck
Illustrations by George McCalman

It's September 2019, three months BC (before [coronavirus](#)), and every day I still come to a desk on the 16th floor of a Manhattan high-rise, in an open-plan office decorated with bright yellow badges and chunky, oversize messages on the wall that say things like "win," "cute," and "OMG." I work at BuzzFeed. I used to love it. I was hired in 2017 and soon joined a new team that was mostly women of color, led by a Black editor, and dedicated to reaching multicultural readers. But in early 2019 the company laid off around 250 people, my team was dissolved, and I was shuffled into a predominantly white group that posts mainly about white celebrities.

Everything about it makes me tired: the rigid weekly content quotas, the uncertainty over whether I'd been spared for my work or simply kept for optics, the fatigue of pitching stories about Black and brown celebrities to an unsupportive white editor. These days my innermost thought when I gaze out at the Manhattan skyline through the office windows isn't OMG, it's WTF. On September 13, I fling myself off the hamster wheel and resign.

This feature appears in the December 2020/January 2021 issue. .

Illustration: Carl De Torres, StoryTK

I begin to freelance and eventually decide to start a newsletter on Substack —something personal, for an audience of my own, that doesn't require a green-light from an editor at a "mainstream" (i.e., historically white-centered) publication, like all my current freelance articles do. I write up a first installment that centers on my struggles with burnout and perfectionism, among other things. But I never hit Send, because by now it's early March 2020, and it doesn't seem appropriate to blast out my self-centered musings while a scary-ass, full-blown pandemic is mushrooming across the world.

I shut myself in my Brooklyn apartment, binge-reading about virology and venturing out only for groceries and a brisk walk now and then. And what I read keeps making me worry in a particular way: When I learn that people with heart and kidney disease, sickle cell disease, diabetes, and other preexisting medical conditions are at a higher risk of severe illness from Covid-19, I know those conditions are especially prevalent in the Black community. When I start to read about the "essential workers" who will have to stay physically on the job while everyone else locks down—nurses, social workers, home health aides, grocery store and fast food workers—I know those professions are heavily made up of Black and brown women, like my own mother. Plus, well, I'm all too familiar with the wisdom in the ancient Black proverb "When white folks catch a cold, Black folks get pneumonia"—and the chronic social and economic inequities that affect Black health, and the distrust that many of us harbor for a health care system after generations of demonstrated racism. Every now and then, I send the articles I'm reading about the virus to friends and family—almost all of whom have yet to understand the severity and urgency of the pandemic. Even experts know so little about the virus at this point.

My overwhelming fear—which is almost a certainty—is that the Black community is going to be uniquely devastated by this pandemic. So, on April 5, I finally send out the first installment of my newsletter. Only now

it's something completely different. I call it *Coronavirus News for Black Folks*.

They came true, of course, those worries that the pandemic will hit Black people especially hard. The first evidence comes mainly from articles by Black journalists and scholars, who connect the dots with racially sorted data from several states because federal agencies have yet to release any such nationwide numbers. Then, on April 7, the front pages of four of the biggest newspapers in America suddenly wake up to the pandemic's hugely disproportionate toll on Black Americans. Only then does the White House publicly acknowledge the disparity in a news conference. The only journalist at the briefing to press President Trump on what exactly he plans to do about it is Ayesha Rascoe, a White House reporter for NPR and, of course, a Black woman.

I start to figure out what my newsletter can do. American newsrooms are overwhelmingly white, and the traditional Black press has been decimated over time (because when the white media economy catches pneumonia, the Black media economy goes to the ICU). That means the issues that are important to Black people are chronically underreported even in good times. In the pandemic, a familiar blindness—a slowness—keeps showing up in historically white outlets' coverage, and I try to do my best to correct for it. I notice, for instance, that stories about essential workers tend to focus on white medical professionals. So in my newsletter I incorporate an interview series called "Essential & Black," where I talk to Black woman on the front lines: a pregnant hospital food-service worker, a security guard at a social services nonprofit who has several risk factors for Covid, a pharmacy technician living from paycheck to paycheck.

In those early days, too, I notice some finger-wagging media coverage about the supposedly widespread myth among Black people that they are immune to the coronavirus; the implication seems to be that they will behave irresponsibly. (A Pew poll soon finds that, on balance, Black Americans are far *more* concerned about Covid than white people are.) Later coverage shifts to focus on a whole range of "bizarre" conspiracy theories claiming that the virus is some kind of weapon or plot. Some of these are circulating in the Black community. So I put out an edition of the

newsletter, paired with a live Instagram panel discussion, about how to speak to loved ones who might believe conspiracy theories.

It's complicated, because Black people can actually back up their distrust in the medical establishment by referring to real horrors—precedents like the US Public Health Service Syphilis Study at Tuskegee, a federal study that deceived 600 Black men into thinking they were receiving medical treatment for "bad blood" beginning in 1932; the researchers were actually just observing what happens when syphilis runs its course unchecked for decades, allowing the men to grow sicker, infect their loved ones, and die. "How does one acknowledge the history of unlawful and harmful agendas aimed at the Black community," I write, "while also combating a pandemic that requires well-informed awareness?"

The researchers in the Tuskegee study were actually just observing what happens when syphilis runs its course unchecked for decades.

Mostly, though, what I'm doing is curating. I spend hours poring over the internet, trying to find the most reliable and relevant news about the plague for Black people; each edition of the newsletter contains dozens of links and summaries. I start by publishing every couple of days, then settle into a roughly once-a-week rhythm. I carefully scan Black publications. I run search terms like "African American" + "Black" + "pandemic" + "Covid-19." And then I present what seems like the most important stuff in one place.

It's pretty straightforward, but there's something powerful and terrifying about it: To run those particular search terms day after day is to stare down the barrel of all the biggest things coming for America in the summer of 2020. It's to be a sentinel.

In early May, I publish a few thoughts and links under the heading "Protesting During a Pandemic." I link to a story about the fatal February shooting of a Georgia man whose name is just starting to become widely recognized—Ahmaud Arbery—and the first efforts to organize demonstrations over his death at the hands of a white father and son. The story explains how local community leaders have cautiously taken to

protesting on social media and emailing and phoning officials to call attention to the case, while others begin to take to the streets.

"This story isn't directly related to the coronavirus," I write, "however it does reveal the pandemic's unique impact on social justice efforts and hate crimes." Protesting, I know, could aggravate the disproportionate impact of the disease on that same community. But how do you weigh one life-threatening risk against another? How do you maintain social distance when there's more strength in bodily numbers? Do cries for justice and equality ring as clear from a masked mouth?

I also learn about Christian Smalls, a Black longtime Amazon employee who gets fired after organizing a walkout to protest what he and others see as unsafe working conditions. Smalls' defiance soon inspires other Amazon warehouse workers, who have been keeping a frantic pace to supply America's shut-in households during the pandemic. People of color make up almost half of Amazon's laborers.

All of these burdens—of violence, of sickness, of labor—are falling so disproportionately on Black people, and they only worsen with time. A communal eruption is long past due. Within a month, some of the largest protests in American history are spreading from coast to coast.

That's not all I can start to see coming. One week I refer to an article that quotes a Rikers Island inmate saying, "We're like sitting ducks"; the next I post stories about confirmed prison outbreaks. I can see the coming waves of evictions and Black business closures from miles away, and I report their approach, link by link. The work feels important, and my subscriber numbers are climbing from three digits to four, but I'm feeling increasingly overwhelmed—as are other Black reporters I know.

While I've been reporting on the Black community my entire career, I have no particular background in science or medicine. But all of a sudden *I* feel like I'm on a front line. Is this what it's always been like? And I start wanting to understand better who's gone before me.

Christian Smalls' defiance soon inspires other Amazon warehouse workers, who have been keeping a frantic pace to supply America's shut-in

households during the pandemic.

In March of 1864, a Massachusetts nurse named Rebecca Lee Crumpler became the first Black woman to graduate from an American medical school. Not long afterward, she headed for the South, where 4 million people had just been set free. She took a job with a federal office called the Freedmen's Bureau Medical Division. She was one of about 120 doctors assigned the task of looking after the health of the entire emancipated population—which was dying at a stunning rate in the throes of a smallpox epidemic, rampant malnutrition, and inadequate shelter.

Crumpler's post was a Freedmen's hospital in Richmond, Virginia, where she was subjected to intense discrimination by her colleagues. "Doctors snubbed her, druggists balked at filling her prescriptions, and some people wisecracked that the MD behind her name stood for nothing more than 'mule driver,'" according to an *Ebony* article from 1964. The hospital was also, in a sense, set up to fail. The entire idea of the Freedmen's Bureau Medical Division was seen by some American leaders as a waste of time. Black people, they believed, were uniquely vulnerable to smallpox, syphilis, and other contagious diseases. "No charitable Black scheme can wash out the color of the Negro, change his inferior nature, or save him from his inevitable fate," one Ohio congressman said in arguing against the bureau's creation.

Crumpler left the South in 1869, but she didn't abandon it. She just changed strategy. In 1883 she bypassed the white medical system altogether and published a book of medical advice targeted at mothers and nurses—on things like nutrition, breastfeeding, how to treat burns, and how to prevent cholera. She called it *A Book of Medical Discourses in Two Parts*, and she hoped it might end up "in the hands of every woman."

Some writers have compared Crumpler's book, which was unusual for its time, to an early version of *Our Bodies, Ourselves*. The historian Jim Downs argues it was also an implicit "rebuttal to the prevailing idea" that Black people were physiologically doomed—because it focused on what Crumpler called "the possibilities of prevention." The book is anything but a polemic, but there are a few lines toward the end of the introduction that feel like a subtweet of the entire racist medical establishment: "They seem

to forget that there is a *cause* for every ailment," she writes, "and that it may be in their power to remove it."

Sadly, American medicine didn't get the message. One year after Crumpler died, in 1896, a statistician working for the Prudential Life Insurance Company named Frederick L. Hoffman published a book called *Race Traits and Tendencies of the American Negro*. Drawing on statistical analysis of numerous data sources, Hoffman set out to prove once and for all that free Black people were dying off not because of social conditions but because of their "inferior vital capacity." He concluded that they were bound for extinction (and were therefore uninsurable at anything but the highest rates).

Hoffman's work, and its so-called extinction thesis, quickly became pillars of American scholarship; white contemporaries swooned over his tables and tables of data. But a few people swiftly pointed out that Hoffman's actual analysis of all that data was a hot mess. One of them was a 28-year-old researcher named W. E. B. Du Bois. (He showed, among other things, that white people in some European cities were dying at higher rates than American Black people were.)

As a young academic, Du Bois believed that American authorities discounted the social conditions of Black life simply because they did not see them clearly enough. So he set out on a mammoth and unusual study of his own—one that would be as deeply investigated and tightly focused as Hoffman's had been high-handed, sloppy, incurious, and shallow.

Beginning in 1896, Du Bois began canvassing some 2,500 Black households in Philadelphia, sitting down in their kitchens and asking them standardized questions, to "find out what was the matter with this area and why." Working with a single research assistant, Isabel Eaton, he surveyed businesses, chased down legal documents, studied obituaries. And in 1899, he published the results in an exhaustive study called *The Philadelphia Negro*, his first book. By and large, Du Bois found that Black residents were segregated into the city's unhealthiest neighborhoods, where they paid high rents for low-quality housing. Also, 35 percent of families lived in a single room; 38 percent took in lodgers; and only 13.7 percent had access to toilets. Only certain low-wage jobs were open to them, and they were shut

out of most unions. As for death rates, Du Bois found that the areas with the highest Black mortality "contain the worst slum districts and unsanitary dwellings of the city"; but in other neighborhoods—where white families and the city's few well-to-do Black families lived—Black mortality rates looked much like white ones.

The book became a model for generations of scholars—because it was one of the very first works of American empirical social science. So to sum up: Crumpler bypassed the medical establishment by writing a self-help book, and Du Bois confronted it by pioneering a whole new American field of research—all to get it through people's heads that Black people were sicker for a *reason*.

"The world is thinking wrong about race, because it did not know, the ultimate evil was stupidity. The cure for it was knowledge based on scientific investigation." — W. E. B. Du Bois

The truth is, Black people have always had to use inventiveness, technology, and do-it-yourself media to work around a slow or hostile white establishment. And it doesn't always work. Remember the Public Health Service Syphilis Study at Tuskegee? One of the first people who tried to put a stop to it was a 22-year-old statistician named Bill Jenkins, who was among the first Black recruits to the Health Service in the late 1960s. While he was there, Jenkins came across documentation of the study, which was still underway in Alabama—still performing tests on Black men who were infected with syphilis, but offering no treatment for the disease.

Jenkins decided he had to do something. As a young man involved in civil rights activism, he helped run an underground newsletter—yes, a newsletter!—called *The Drum*. So he and some fellow activists wrote up his findings for their handful of readers. But when they tried to get the attention of bigger media, they hit a wall: They blindly sent documentation of the study to newspapers like *The Washington Post* and "waited for this big article to come out." They didn't hear back at all. "We didn't understand how news articles are written," Jenkins would later say.

The press didn't pick up the story at all until four years later, in 1972, when a white social worker and epidemiologist leaked information about

Tuskegee to a longtime friend at the Associated Press. Almost instantly, Tuskegee became front-page news across the country, leading to congressional hearings and the end of the study. The experiment had been going on in more or less broad daylight for 40 years.

What's different now is that the media workarounds at our disposal have become far more powerful, for better and for worse. (Platforms give us access to a nearly unlimited audience; they also surveill us, violate our privacy, and give harassers access to *us*.) Black Lives Matter itself is a technological movement, started by three Black women—Alicia Garza, Patrisse Cullors, and Opal Tometi—over Twitter and Facebook in the wake of George Zimmerman's acquittal in the fatal shooting of Trayvon Martin. "It was incredible and powerful because we realized that we could use these social media tools to organize our people," Tometi said in 2017. As the activist DeRay McKesson told this magazine in 2015, "Because of Twitter, Facebook, Vine, and Instagram, we're able not only to push back against dominant-culture narratives but also to talk to each other differently."

Today I can add Substack to that list. But that doesn't mean these digital workarounds have lightened the load on us.

Haunted by his unsuccessful attempt to halt the Tuskegee syphilis study, Bill Jenkins became an epidemiologist with the CDC. He spent 10 years running a program that provided free medical care to survivors of the study.

History often romanticizes the work of disenfranchised people who outflank their oppressors. But the mental, emotional, and physical toll of their struggle usually gets glossed over.

This is something I start thinking about in June, when my gums start bleeding. My dentist runs down a short list of possible causes, and we quickly eliminate them. But as the appointment winds down, the conversation turns to my work on *Coronavirus News for Black Folks*, and he suggests that stress might be the culprit.

I've always had a pretty detached relationship with my own stress—despite having handpicked several articles about Black health and stress for the newsletter. Hell, I've just interviewed a fellow Black journalist about being

hospitalized for anxiety related to *writing about Black deaths*. Like many other Black women, I've been conditioned by decades of pushing through my own stress to believe that I'm immune to it. Now my dentist—a Black dentist, my choice—is informing me how mild gum disease could potentially lead to far more serious problems.

I go home. I back away from social media and pare down my freelance pitching—not easy, given how much self-worth I derive from my work. I also slow my newsletter output. I need a moment to breathe, to pour back into myself, before I go back into the fray.

This time around, I think the exhaustion that Black journalists are feeling is different. After years of laboring to bring attention to the health disparities that we are always the first to notice, we are buckling under the sudden, voracious thirst of predominantly white, mainstream platforms for this work. Linda Villarosa, a contributing writer at *The New York Times Magazine*, tells me she's never been in such sudden demand. And she's torn about it. She hates that this overwhelming, overnight interest has only come about because of an onslaught of Black illness, abuse, and death in the midst of an unprecedented pandemic. But she's also encouraged that maybe, at last, there's an opportunity for a deep and widespread acknowledgment of racial disparities—and of the battle that's raged against them since the beginning.

"It's important to know that we just haven't been sitting around letting things happen to us," Villarosa tells me in a phone call. "We have always been in this fight. When I think of some of the people who have been doing this a long time, the people who are getting lifted up now, I'm really proud they stayed in the game."

Bill Jenkins stayed in the game. According to a 1997 article about the legacy of the Tuskegee syphilis study, Jenkins was "haunted by his unsuccessful effort to halt it." So he went back to school and became an epidemiologist with the Centers for Disease Control and Prevention, where he directed AIDS prevention for minorities; he also spent 10 years running a program that provided free medical care to survivors of the Tuskegee study. Jenkins died in 2019 at the age of 73. W. E. B. Du Bois stayed in the game too, becoming one of his era's greatest Black leaders.

While we know very little about Rebecca Lee Crumpler's life—whether she was angry, exhausted, or even what she looked like—it appears that when she died in 1895, she was too poor to afford a headstone. Just this summer, on July 16, 2020, a group of her admirers finally raised enough money to give her one. They stayed in the game too. And so will I.

They stayed in the game too. And so will I.

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[Adam Rogers](#)

[Science](#)
11.11.2020 06:00 AM

The Strange and Twisted Tale of Hydroxychloroquine

The much-hyped drug sparked a battle between power and knowledge. Let's not repeat it.

collage with American flag hydroxychloroquine label prescription map

Illustration: SAM WHITNEY

In the mid-1600s, a Jesuit priest serving in Peru got a useful tip. The indigenous people there, he learned, were using the bark of a particular kind of tree to treat fevers. The priest, who'd probably gone a few rounds himself with the local diseases, got ahold of some of the reddish-brown bark from this "fever-tree" and shipped it back to Europe. In the 1670s, what came to be called Jesuit bark had made its way into a popular patent medicine, along with rose leaves, lemon juice, and wine.

That was the beginning of the impressively effective bark's role in pharmacology (and its side career in mixology). In the mid-1700s the prolific Swedish taxonomist Carl Linnaeus gave the tree's genus its name—having heard a fanciful (and untrue) tale about the bark's success treating the Spanish Countess of Chinchón, he dubbed it *Cinchona*. In 1820, French chemists isolated the active ingredient, a plant alkaloid they named quinine. Its bitter flavor became not only a hallmark of the prevention and treatment of [malaria](#) but also the basis for a medicinal fizzy water—a "tonic"—that mixed well with the gin that Europeans brought with them to their equatorial conquests. Today quinine can be found in bitters, vermouth, and absinthe;

next time you order a Manhattan or a Sazerac, give a little *l'chaim* to the Peruvians.

This feature appears in the December 2020/January 2021 issue. [Subscribe to WIRED](#).

Illustration: Carl De Torres, StoryTK

Medicine that treats a deadly disease but grows only on certain finicky trees is the kind of thing chemists live for. A failed attempt to synthesize quinine in the 1800s had accidentally produced the first synthetic pigment (a lovely shade of mauve); after World War I, when endemic malaria arguably did almost as much as Allied soldiers to limit Germany's expansionist ambitions, that country set its scientists to solving a problem. A dye company called Bayer took up the quinine challenge, synthesized some reasonably useful replacements, and became a pharmaceutical powerhouse with a global market. When World War II denied the US access to both German drugs and the quinine-producing cinchona trees of Java, the Americans basically stole a recipe from German prisoners of war and turned that into a successful treatment.

That drug was called chloroquine. It has a slightly better-tolerated cousin, hydroxychloroquine. You may have heard of them.

So, yeah: A drug extracted from indigenous knowledge to lubricate European colonialist impulses went on to power the military adventures of the latter 20th century and save millions of lives. But even as the parasites that cause some strains of malaria began to develop resistance to chloroquine, newer science started to hint at a second life for the drug. Some lab studies suggested that it could fight viruses, and that it could suppress overreactions by the human immune system. By the mid-1950s, doctors were using hydroxychloroquine to treat the autoimmune disorders lupus and rheumatoid arthritis. The drug was readily available. It had manageable side effects. And because it's so old, no pharmaceutical company holds a patent on it. So it's cheap.

Viable. Safe. Available. Inexpensive. What more could you ask for?

It made sense, then, that when a [novel coronavirus](#) appeared in Wuhan, China, in December 2019, people started speculating about the old drug. Chloroquine's virus-fighting reputation preceded it. Four centuries of the history of science came crashing into the newly apocalyptic present. By February, several Chinese research teams had spun up small trials of chloroquine and hydroxychloroquine against the new disease, and some were soon reporting success. A simple, familiar drug was offering hope.

Still, though. Before you start giving a drug to the thousands, soon to be millions, of people affected by a pandemic virus, you want to be very, very sure it's safe and effective, that the benefits of administering it outweigh the risks and side effects. The Chinese studies of chloroquine were, so far, preliminary and small-bore. And because of language barriers, limited access to international journals, and some mutual distrust, Chinese data doesn't always make it into the global information ecosystem. Nobody really knew, authoritatively, if the drug actually worked.

But "Does it work?" is a harder question to answer than it sounds. Few drugs are penicillin-size successes; most drugs have more moderate effects. That means those possible effects are hard to distinguish from what may just be statistical noise. Under normal conditions, distinguishing one from the other requires painstaking, time-consuming research protocols and statistical analysis. But the urgency of a pandemic makes conditions abnormal in the extreme. Faced with intensive care units full of the severely ill, physicians begin to feel they can't wait for statistics before their patients become one. Politicians start looking for a win, or *something* to signal they're dealing with the problem. And the world's technical and economic elite start looking for quick fixes and opportunities to make a sale, spreading their opinions (whether quarter-, half-, or fully baked) on social media. After all, *[influencer](#)* and *[influenza](#)* share the same etymological root.

At issue here is more than just whether a drug treats a disease. The heart of the scientific method is the process of formulating a hypothesis and collecting data to test it. This is how to reliably be sure that (in this case) a drug does what you say it does—that the effects you think you see are not coincidence or luck or mirage. It sounds simple, but in practice it's ambiguous, messy, and often contentious. The twisted tale of hydroxychloroquine is actually about how to know stuff, the question that

has defined every existential decision since the early 20th century—climate change, vaccines, economic policy. We've learned from failure and bitter experience that only when we take the time to find the truth do we at least have a chance to make good decisions. We also know that it'll be a struggle —that grifters, power-seekers, and fantasists will push their own versions of truth while scientists and policymakers grapple with the lumbering process and nuanced outcomes of the scientific method. Because there will be other pandemics, other disasters. And just as with Covid-19, only science and its tools will soften their impact. But also as with Covid-19, *humans* will do that science and wield those tools, and that makes things messy. What happened with hydroxychloroquine was a debacle, but retelling the story might help avert the same kind of chaos next time around.

Viruses aren't alive, exactly—they're just genetic material wrapped in fat, starch, and protein. But because they use living things to reproduce and spread, evolutionary forces effectively shape them, synchronizing viruses with the specifics of their targets. Viruses land on cells, and viruses' landing gear, as it were, are shaped to lock onto the exact topologies of proteins on their surfaces. Once clicked onto that docking site, a virus forces the cell to engulf it in a little bit of membrane. Like a fighter jet on an aircraft carrier deck, the virus gets elevatored into the cells' innards. Down there, the viral genes slide into the cell's own genome and take over, forcing the cell to pump out more copies of the virus. Eventually the cell bursts open, the new virus copies spread, and the process starts all over.

Hypothetically, chloroquine and hydroxychloroquine can mess all that up. They interfere with the biochemistry that lets the landing gear touch down, a process called glycosylation. And it seems like the drugs change the acidity of the elevator shaft, of that bit of involuted membrane bubble, making it inhospitable to a virus and preventing infection.

It works in the lab, anyway. Over decades, researchers have tried chloroquine and hydroxychloroquine against a bunch of viruses, including the human immunodeficiency virus that causes AIDS. The new pathogen that emerged in 2019, SARS-CoV-2, belongs to a family called coronaviruses—as did its prequel, SARS-CoV, which caused severe acute respiratory syndrome. In 2004, a team of Belgian researchers tried

chloroquine on SARS-1 in the lab, and it seemed successful—apply the drug to cells and the virus has trouble replicating.

Cells in a petri dish aren't people, but even with such crappy evidence, it made sense in the early days of the pandemic to try the drug again. Emergency rooms and intensive care units were filling up with sick people who couldn't breathe, and frankly, frontline caregivers didn't have much else to give them.

By March 9, the US was facing a shortage of hydroxychloroquine and chloroquine. About a week later, with a surge of Covid-19 patients slamming New York City, I talked to Liise-anne Pirofski, the chief of the Division of Infectious Diseases at Montefiore Medical Center and the Albert Einstein College of Medicine. Chloroquine was standard for patients with Covid-19, along with a repurposed HIV antiviral—even though, at the time, there was only the thinnest data recommending either drug. "Everybody gets that unless they have some contraindication," Pirofski told me. What else could they do? Her hospital was participating in a clinical trial of a then-experimental antiviral called remdesivir, but it was still unavailable outside that study. Pirofski herself was advocating the use of convalescent plasma, a decades-old treatment made from the blood of people who've recovered from a disease, which also hadn't been tested against Covid-19. They were throwing everything they had at the virus. People were sick and dying. You go to war with the drugs you have, not the drugs you wish you had.

The possibilities in early 2020: Hydroxychloroquine might help. Or it might not. Or it might make people worse. No one knew.

One of the first people to leap into that breach was David Boulware, a diligent infectious disease researcher and professor of medicine at the University of Minnesota. Back in 2015 he'd worked on an Ebola drug trial with the National Institutes of Health, and he quickly raised his hand to work on trials of treatments for the new virus.

In early March, he and his team were supposed to be at an HIV conference in Boston, but by that point nobody was traveling anywhere. "We all had four days free to totally focus on this task," Boulware told me then. His group used the time to put together a plan to study hydroxychloroquine.

Right here—the stage where scientists come up with these "research protocols"—is where how-to-know starts getting complicated. It's a cliché because it's true: The answers you get depend on the questions you ask. In this case, Boulware's team decided not to test the drug on hospitalized patients, when the disease becomes severe. "If it was going to work, you'd have a better chance to alter the disease course early on," Boulware said.

They *hoped* it worked. But they didn't *know*. To find out, they proposed a classic structure: A couple hundred people would get the drug; a similar number would get a placebo—an inert fake. The ones getting the placebo would be the "control group," experiencing all the same things except for the drug, to isolate its effects. Neither researchers nor participants would know who got which until the end; that's called a "double-blind" study. And people would be assigned to the groups at random, to avoid even unconscious bias on the part of the researchers and prevent differences between groups of humans—socioeconomic, demographic, and so on—from throwing off the results.

That is, in other words, a large, double-blinded, randomized controlled trial. Boulware's team proposed two. One would look at whether hydroxychloroquine could prevent illness in people with exposure to an infected person—"post-exposure prophylaxis"—and another would see if taking the drug close to the onset of symptoms could keep those symptoms from getting worse. That was "early treatment." On March 13, the US Food and Drug Administration approved the study, a blisteringly fast green light from a typically cautious, plodding agency. The responses of the federal government's scientific policymaking would falter in key ways over the next few months, but this wasn't one of them.

Boulware started enrolling people almost immediately. For statistical validity, they'd need enough people so that some in the experimental groups and some in the controls would get Covid-19. The researchers would run the numbers, ask who got what, and they'd have an answer in weeks. They'd write up the results, publish in a journal, and it would be science.

Except Boulware's reasonable expectation that things would work the way they were supposed to didn't take into account the viral social-media blender that was spinning up its blades—making a viscous gazpacho out of Silicon

Valley opportunism and the hottest of hot takes from the president of the United States.

The way they were supposed to? Yeah, no.

Even the stodgiest of scientists don't believe that waiting months or years for a formal write-up of an experiment to penetrate a wall of skeptical reviewers, receiving an inscrutable thumbs-up to get published—in ink! on paper! that gets mailed! to libraries!—is an ideal system for disseminating new knowledge today. Yet that's still mostly how things work, despite the existence of the online version of most journals. But the Covid-19 pandemic came at a weird moment in the history of how information spreads. For one thing, that formal system was already in the process of breaking down. Due to the pressures of publication and academic seniority, some of the science that gets into peer-reviewed journals doesn't hold up to scrutiny, and many scientists are internalizing the hard truth of that " reproducibility crisis." Formal peer review and publication doesn't make something true. That's part of the reason the biomedical sciences were embracing a newer approach, one that their colleagues across the quad in the physics and math buildings had arrived at years before: "prepublication" or "prepress" articles that could go online as soon as their authors finished typing them.

That's good; it means faster, freer information and a more egalitarian kind of review. But rethinking the gatekeeping in the ways nominal experts disseminated nominal knowledge opened the door to other people playing the game. Thanks to widespread access to publishing tools and social media, pretty much anyone can marshal the trappings of expertise. The crisis of the global pandemic intersected with a crisis of belief, with opposing scientific ideas somehow getting tethered to political ideologies. With just a bit of Googling, anyone can find things that look like truth, that are what that person was hoping to hear in the first place. If one of those things goes viral, and if the science behind it is difficult or undercooked, pretty soon everyone starts nodding along.

Which is what happened on March 13—the same day the FDA approved Boulware's well-thought-out trial. A physician named James Todaro tweeted that chloroquine could fight Covid-19, and he'd written a paper that proved it. Now, this wasn't a "paper" from a peer-reviewed journal, or even a

preprint. It was a Google Doc, coauthored by a lawyer named Gregory Rigano and a biochemist named Thomas Broker, identified as a Stanford PhD. It was a pretty good summary of all the research on chloroquine up to that point. It even cited the work of a French researcher named Didier Raoult, a controversial infectious disease specialist who, a few days later, claimed he had results showing that hydroxychloroquine worked against Covid-19 in human beings.

Illustration: SAM WHITNEY

A steady rain of likes and retweets turned into a viral downpour. The influential Silicon Valley blog Stratechery linked to the Google Doc. Rigano went on Fox News. Elon Musk tweeted about the document with the link. Musk, who said he'd taken chloroquine for malaria, also tweeted a link to a video on hydroxychloroquine and Covid-19 produced by a small medical-education company called MedCram. The company had started doing brisk traffic covering the coronavirus; the hydroxychloroquine episode took off.

The original Google Doc made a good case for chloroquine being of interest —attempted use in prior pandemics, studies in cells and in animals, preliminary results from China. Not proof, to be sure, but tantalizing hints. But, as it turned out, the creators were not all that they appeared.

Rigano had done most of the initial work. According to his LinkedIn bio, Rigano was on leave from a master's program in bioinformatics at Johns Hopkins and was an adviser to a drug development program at Stanford. But the head of the bioinformatics program at Johns Hopkins told me Rigano wasn't really on leave from the program; he had only taken one class. And the codirector of the Stanford program told me that, while he'd met Rigano, he was in no way an "adviser." Todaro, whom Rigano met via Twitter, was a former ophthalmologist turned professional bitcoin investor. And Broker was not, it turned out, a Stanford biochemist. He attended Stanford but now was a retired virologist at the University of Alabama who studied not coronaviruses but an entirely different family of viruses. Broker disavowed any involvement in the paper, and Todaro and Rigano soon removed his name from it.

None of which is to say they were necessarily wrong. But none of which is to say they were necessarily right, either. Yet the idea [rippled through Silicon Valley](#) like photons through an optical cable. Facebook, Amazon, Apple, and Google had sucked up most of the disruption oxygen in tech, and entrepreneurial types were already interested in biotech as a thing to pour money on. And their libertarian bent means they're always looking for an institutional eyeball into which they can shove a venture-capital finger. The medical establishment, with its elitist reliance on the plodding, 20th-century model of clinical trials in the midst of a raging pandemic, seemed like a fat target.

The need for speed was real, and it played into the baser, basic instincts of the Valley. Those hold that all a technologist needs is a dream, a minimum-viable product, and the will to build a company. (A Stanford undergraduate degree doesn't hurt.) If you're trained to see your successes as the result of genius and instinct rather than luck, you might not be able to readily distinguish between the rigors of testing a drug's efficacy and the travails of bringing a product to market. But they are different processes with different goals. In the Valley, whether something works is different from, maybe even disconnected from, whether it *sells*.

Combine that with the quantified-self, n-of-1 approach to health and wellness that some of the same people also embrace, and you get not science but pseudo-science touted by the four-hour-body crowd that gets rejuvenating transfusions of young people's blood and rebrands nutritional diet shakes as food from a dystopian science fiction movie. "Tech, and especially Silicon Valley, has this belief that all you have to do is disrupt things and try shit and make it stick to the wall, and it will work and change everything," says one investor with a long history in health care. "We've had a tried-and-true method of getting vaccinations and drugs approved in the US that is absolutely antithetical to everything the tech industry believes and has found to be true."

As deaths in the US mounted and the economy went into a lockdown-induced spin, some rich and successful venture capitalists started arguing that the whole system was nonsense. As noted contrarian, investor, and former PayPal, LinkedIn, and Square executive Keith Rabois tweeted, "Randomized controls are horrible ideas. Largest impediment to progress in

health spans." (Rabois agreed to consider answering emailed questions but didn't respond to the ones I sent.) Randomized, controlled trials not only take too long, Rabois and his ilk said, but were in this case unnecessary. You could instead use "real-world data," like the experience of the tens of thousands of people who were actually taking hydroxychloroquine, and do some kind of data thing on it.

It's not crazy. Randomized controlled trials are, as the scientists say, the gold standard. But that method isn't the only way to figure out causality, or at least to start to get a sense of it. Sometimes double-blind studies are impractical. Sometimes nature and circumstance offer a great opportunity to see how changes in conditions have different effects. Observational studies, retrospective analyses of existing data, meta-analyses of grouped smaller studies—they're all useful, and certainly better than throwing biotechnological spaghetti against a pandemic to see what sticks. But look what happened months later, after similar hopes for convalescent plasma as a therapy turned into widespread use. [After giving it to nearly 100,000 people](#), plasma appeared to be safe, but there was only limited evidence of its effectiveness.

If it's possible to characterize an entire swath of opinions, though, what the techfluencers seemed to be pitching was not a study where the parameters of observation were defined in advance, but one where all sorts of casually collected data, the flotsam and jetsam of our digital lives, might somehow be tabulated and correlated to whether, when, and how a person got hydroxychloroquine. Quantified self, but applied to everyone—quantified other.

To be fair, the ethics of demanding rigorous, time-consuming tests during a pandemic are worth debating. In a sense, this is about medicine now versus science later. Correctly administered, hydroxychloroquine only rarely has serious side effects; it's a well-understood, mostly safe drug. Why not just give it to everyone and monitor their outcomes? That's a very Silicon Valley approach—intermediate risk, high reward. "I appreciate some of the tech people coming to health care, because I do think we should be thinking about some things differently. Having fresh thinking is great. But fresh thinking is different from illogical thinking or uncaring thinking," the

investor tells me. "If you're a tech guy flacking hydroxychloroquine to people who shouldn't use it, what the fuck? People can get really sick."

Even if they don't get sick, that plan still has problems. Giving people a drug that may or may not work is ethically dicey. And who would actually keep track of those outcomes? "Big data" approaches to medicine are susceptible to the distortions and bias of anecdotal evidence and intuition, exactly the mistakes that rigorous, large-scale, randomized controlled trials are designed to avoid. But over decades, those trials have gotten more and more complicated and expensive—just as government funding of them has plateaued. The main consequence has been that pharmaceutical companies fund their own trials, and the companies are highly incentivized to focus on drugs with huge potential markets. That often means more expensive lifestyle drugs and fewer worthy public health solutions or medicines with population-scale benefits—more Viagras, fewer Vancomycins. Little wonder, then, that researchers running trials for the unpatented drug hydroxychloroquine had such trouble gaining traction, while the [expensive antiviral remdesivir](), with the transnational pharmaceutical company Gilead Sciences pushing it, found support for a trial in the NIH and in the White House—and is now standard in US Covid-19 treatment. The foxes all run their own chicken-coop businesses.

The same week the mania for the drug took hold in Silicon Valley, Larry Ellison, the chair of Oracle and the fifth-richest person on earth, started talking with Donald Trump. According to *[The Washington Post]()*, Ellison wanted to pitch a widespread study of chloroquine and hydroxychloroquine as a treatment. Ellison proposed that Oracle could develop a website to track people's use of the drug along with their health outcomes, and the data would anticipate whatever a slow, expensive randomized controlled trial might eventually reveal. (Through a spokesperson, Ellison declined to answer my questions about these discussions, as did a White House spokesperson.)

Ellison seemed to make an impression. Shortly after that conversation, the *Post* reported, Trump met with his senior advisers on the coronavirus pandemic and asked if the government could expedite the approval process for hydroxychloroquine, chloroquine, and, for good measure, remdesivir. Emergency use authorizations had been employed during pandemics in the

past, to allow treatments with potential to jump the line in times of urgent need. Remdesivir was in the midst of a large-scale randomized trial sponsored by the National Institutes of Health. Hydroxychloroquine didn't have the same backing.

The president's urgency wasn't just a matter of public health. Trump had promised Covid-19 would just disappear, but the US response to the disease was going entirely off the rails. During a disastrous visit to the CDC on March 6, Trump touted his own scientific acumen—"I like this stuff. I really get it. People are surprised that I understand it"—but behind the scenes he was obstructing programs to begin widespread testing for the disease. The failure to do those tests meant that as March ticked onward, thousands of Americans were already infected. Trump acknowledged privately to the journalist Bob Woodward that Covid-19 was a dangerous, plague-level disease even as he railed against the press on Twitter and elsewhere, hoping to bolster a plummeting stock market. ("I don't want to create panic," he said in September when asked about why he had downplayed the severity of the pandemic.) And meanwhile every model, every infectious disease researcher, every epidemiologist was looking at case and fatality curves on the cusp of exponentiality, with worst-case fatality estimates in the millions.

A miracle cure must have sounded pretty good.

On March 19, the president conducted a press conference, and it was really weird.

This is where he started pitching hydroxychloroquine. "It's shown very encouraging—very, very encouraging early results. And we're going to be able to make that drug available almost immediately," the president said. The FDA was all in too: "They've gone through the approval process; it's been approved."

This was untrue in most respects. Few results were in. The president might have meant that hydroxychloroquine was approved for malaria, lupus, and rheumatoid arthritis, and that clinicians could prescribe it off-label. He might also have been talking about Boulware's trial, which had also been approved by the FDA. It's certainly possible the president got confused.

The president introduced FDA commissioner Stephen Hahn, who treaded cautiously. Chloroquine was worth considering for use against Covid-19, Hahn said. "Again," he said, "we want to do that in the setting of a clinical trial—a large, pragmatic clinical trial."

That wasn't what the White House was pushing for behind the scenes, though. At that same moment, the administration was allegedly pressuring Rick Bright, responsible for vaccine development as the head of the Department of Health and Human Services' Biomedical Advanced Research and Development Authority (Barda), to get on the hydroxychloroquine train. According to Bright's eventual whistle-blower report, the general counsel for HHS told Bright's team that the White House wanted an Investigational New Drug protocol for chloroquine to accommodate a soon-to-come donation of millions of doses from Bayer. Bright managed to talk his bosses down to an emergency use authorization, a less full-throated support of the drug's efficacy. "When I resisted efforts to promote and enable broad access to an unproven drug, chloroquine, to the American people without transparent information on the potential health risks, I was removed from Barda," Bright told a subcommittee of the House Energy and Commerce Committee.

On March 27, the FDA announced an emergency use authorization for hydroxychloroquine and chloroquine to treat Covid-19, freeing up the drugs for use on sick patients. Prescriptions skyrocketed, mostly from physicians who'd never prescribed it before. Many people who volunteer for clinical trials do so out of community spirit; some also hope to get access to a potentially crucial drug—risking the chance that they might instead get randomized to the placebo group. Widespread availability of hydroxychloroquine meant nobody needed to be in a trial to get it. The authorization had the counterintuitive effect of undercutting the effort to find out if the drug was actually worth taking.

Back in Minneapolis, Boulware suddenly found he couldn't enroll enough people to get the statistical power his protocol needed to give a definitive answer. The research was on outpatients, people who weren't hospitalized, all over the country—they could volunteer from anywhere. And the emails just stopped coming. Boulware read all the same news reports as everyone else. He could understand why. "Half of the people think it's an unethical

trial because it clearly works," he told me in April, "and the other half thinks it's clearly dangerous and we shouldn't do it."

They had 1,200 people enrolled. They only needed 180 more. They were so close.

The president's advocacy added another, hyper-partisan political layer of difficulty. Trump supporters began to see the use of hydroxychloroquine, like the avoidance of wearing masks, as a badge of political allegiance. Even gentle cautions about potential bad health outcomes from hydroxychloroquine came to signal disloyalty. Drug companies weren't pushing for trials. (Sandoz, a drugmaker with a business in generic, off-patent drugs like hydroxychloroquine, tried to mount a trial but canceled it for lack of participation.) The government wasn't pushing for one, as it had for remdesivir. All of that left Boulware's team hanging. Even his volunteers were telling him how they felt. "By mid-April, people had formed an opinion," he says. "Either it worked or it was dangerous, and our enrollment was minimal."

I asked Boulware if that's normal, that participants in a clinical trial might have an opinion about whether the drug they were testing worked or not.

"No," he said, "it's not normal, but I guess I've never been involved with a clinical trial that became political. I don't think any clinical trial has ever been political while it was ongoing."

The benefit of the doubt and goodwill toward others that clinical researchers depend upon in their volunteers was gone, thanks to the president. "What do you have to lose?" Trump said at a press briefing in April. "We don't have time to go and say, 'Gee, let's take a couple of years and test it out. And let's go and test with the test tubes and the laboratories.'" Days later, two former FDA commissioners went on record saying the emergency use authorization had been a terrible idea, because of the lack of efficacy data. But the president had no interest in slowing things down.

That kind of cavalier approach—hey, why not?—puts physicians in the position of balancing a chance of benefiting the patient in front of them against the certainty of not benefiting patients in the future. It's a terrible

choice. It also exists in a fog of privilege. Only people rich enough or with good enough insurance can afford, literally and metaphorically, to make a mistake. If the drug helps, they got it before anyone else could. If it does nothing, no matter. And if it does harm, well, they have access to medical care to save them. The whole concept seems like it gives individuals autonomy, but making a decision with insufficient information isn't autonomy. It's desperation, and it comes at the expense of everyone who gets sick later. This dangerous tactical individualism degrades both personal responsibility to community and overall scientific knowledge. Sick people become panicky nihilists, and no one ever learns anything.

Since the 1970s, a certain lineage of epidemiologists had been arguing that really massive randomized controlled trials could provide a scientific bulwark against that egotistical nihilism. When most drugs have only moderate-size benefits, you need thousands of people in the trial. When scientists and companies are motivated by social and commercial needs to get positive results, you need randomization to get good evidence. It's the only way to change policy and treatments.

At least, that's what an Oxford researcher named Martin Landray had come to think. A professor of medicine and epidemiology and acting head of the Big Data Institute at Oxford, Landray made his bones on large-scale cardiac trials; recently, he'd been working on policy, trying to simplify the regulations around those kinds of big studies. The Covid-19 pandemic gave him a chance to put the idea into action. Just a couple of weeks after Boulware put his hydroxychloroquine protocols together, Landray and Peter Horby, an expert in conducting trials during epidemics, built something bigger. Much bigger.

The Randomised Evaluation of Covid-19 Therapy Trial, also called Recovery, would split thousands of Covid-19 patients into groups testing various drugs as soon as they entered a hospital. Just about every other aspect of the UK's Covid-19 response has been, in the local argot, a massive cock-up, but this thing they got right. Landray and Horby got approval to build patient consent for the study into hospital admission processes across the country. The National Health Service's electronic medical records made it easy to track what happened to people with Covid, and the outcome they decided to measure for every drug on the roster was the simplest one:

mortality. Did people, simply, die? "When you're in a pandemic, just thrashing about is not helpful. One has to actually go back to the basic principles of randomized trials to determine which treatments work and which do not," Landray says.

The first drugs they picked were already available, but no one was clear whether they worked. Dexamethasone, a steroid, was controversial because of the double threat of Covid-19. In early stages, the disease acts like a run-of-the-mill virus, damaging cells, especially in the lungs. But in the second stage of the disease, a person's own immune system overreacts, causing widespread damage and sometimes death. Steroids are immunosuppressants that can calm that overreaction but also tamp down the good immune response. So it wasn't clear whether a steroid would help the second phase more than it harmed the first.

The other drug candidate was a combination therapy of HIV antivirals many hospitals were relying on—including Montefiore Medical Center.

At first Landray and Horby didn't include hydroxychloroquine. They added it in April. "It was a choice a lot of people were interested in," Landray says. "And if it wasn't in the trial, a lot of people were going to use it anyway." (Landray was aware of the "circus" in the US, but people elsewhere were advocating the drug too. "I'm not just talking about the president of the US," he says. "He's been a high-profile advocate of all sorts of things.") All they needed was a couple thousand people taking hydroxychloroquine, and up to 4,000 who were not, and they could rule it in or out.

Back in Minnesota, it wasn't until early May that Boulware's team managed to eke out enough participants for statistical significance. They wrote up the results in three days, a dozen people sharing one Google Doc, and they sent two papers to *The New England Journal of Medicine*. Both showed negative results. Hydroxychloroquine didn't ease symptoms any better than a control, and it didn't prevent anyone from getting sick after exposure to an infected person. The papers weren't perfect, but the data was clear: The drug didn't work. Then, on the same day he submitted the papers to the *NEJM*, "I got an email from the White House asking about post-exposure prophylaxis," Boulware says. "It was a memorable day."

The public didn't know it yet, but one of President Trump's valets had tested positive for Covid-19. The White House staff knew Boulware had been working on post-exposure prophylaxis, and the president's doctor wanted to see the trial results. "If it were normal times, I would say sure, that's fine," Boulware says. But *NEJM* follows something called the Ingelfinger rule, named for a preeminent early editor, that says if your data has been reported or submitted somewhere else, you can't also publish it in *NEJM*. Boulware was worried that the White House might release the data and screw up his chances with the journal.

So Boulware demurred to the White House. He told the staffers that his team's analysis was still ongoing. "I did say, 'Based on the data we're aware of, we don't recommend this,'" he says. "I gave a recommendation based on my judgment." But Boulware also told the White House doctor that it was safe to take, at least.

"I mean, can you imagine being Trump's doctor? Clearly Trump wants it, and he's going to get it no matter what," Boulware says. "What he wanted to do and what he thought was the best judgment versus the president of the United States? It's hard to say no to that."

Several days later, the president announced at a press conference that he was indeed taking hydroxychloroquine. "The president has always said that he sees hydroxychloroquine as a very promising prophylactic, but that it should only be taken in consultation with your doctor," Sarah Matthews, a White House spokesperson, told me in an email. "The president has personal confidence in it, as he has taken it himself as a prophylactic."

A couple weeks after Boulware told the White House doctor that hydroxychloroquine was safe even if it didn't work, the respected medical journal *The Lancet* published the results of a study erasing even that silver lining. It wasn't a clinical trial. It was, on its face, an observational study reviewing outcomes from nearly 100,000 Covid-19 patients on six continents. As big data goes, that was pretty big. The authors said their data showed that the drugs caused a significant increase in potentially fatal heart problems, a risk that could outweigh any benefit. The impact of the paper was huge. Within a few days, the World Health Organization announced it was pausing the hydroxychloroquine arm of its major study. Regulatory

agencies around the world started making noise about canceling more studies, revoking use authorizations.

Landray wasn't convinced. "I was mildly irritated, disappointed, that people were taking the paper seriously, because it was an observational study," Landray says. "The people who got the drug are different from the people who didn't, in all sorts of ways you can't measure or successfully disentangle." But the tangle was real nevertheless. UK health regulators wanted to know what was going on; at their behest, Landray asked his data monitoring committee to take an unscheduled look at their findings so far— without letting him or any of the other researchers see it—for signs of clear benefits or harm.

In fact, the *Lancet* paper was sitting poorly with lots of people. In Thailand, a malaria researcher named James Watson read it on a Friday night, after he'd put his kids to bed. "My first thought was, this effect on cardiotoxicity seems too big to be real," Watson says. He's a senior scientist at the Mahidol Oxford Tropical Medicine Research Unit, and at the time he was working on pharmacology for a hydroxychloroquine study. To him, the statistics in the *Lancet* paper looked hinky. The paper didn't even mention the most dangerous kind of cardiac arrhythmia that hydroxychloroquine can cause. "The most important data was missing," Watson says.

Illustration: SAM WHITNEY

The next day Watson's boss got a phone call. Health regulators in the UK were suspending their study. The team was shocked. It seemed wrong. They had an emergency meeting—it was Saturday—to reverse engineer the paper. They thought it must have had methodological flaws. They were wrong, though. The actual explanation was much, much worse.

Over the course of the following week, Watson exchanged emails with *The Lancet* and with the paper's lead author, an illustrious cardiologist at Brigham and Women's Hospital in Boston named Mandeep Mehra. The data, it turned out, came from a company called Surgisphere, a slightly mysterious 13-year-old company with scant history of working with patient medical records. People started noticing some flaky stuff almost immediately: The data was aggregated not by country of origin but by continent. But a reporter

at *The Guardian* noticed that the Australian data didn't match that country's Covid-19 stats. "We started thinking, maybe the data are rubbish," Watson says. He wrote an open letter demanding clarification from the journal and authors, and hundreds of researchers signed it—including Boulware. "Everyone had read this paper, everyone had seen different difficult, weird parts of it," Watson says.

The pro-hydroxychloroquine forces were just as activated. James Todaro, the guy who wrote that first white paper, wrote another one: "A Study Out of Thin Air," in which he too laid out all the very real problems with the paper. It was a double-helix of irony. By now lots of researchers suspected the drug didn't work, but they were criticizing a bad paper that said so; supporters of the drug's use were touting the bad paper as evidence of unfair suppression of an effective medicine.

Mehra, through a spokesperson, declined to be interviewed or to answer emailed questions; he told *The Scientist* that he hadn't been aware of any problems with Surgisphere's data before publication and referred other questions to one of the other authors on the paper. That author has since been terminated from an adjunct position at the University of Utah, and the third author—Surgisphere's founder, Sapan Desai—has also left his job at a Chicago hospital.

No one actually knows for sure what went wrong with any of the papers that used Surgisphere's numbers, but it seems clear that the underlying data from Surgisphere doesn't represent actual outcomes from actual patients taking actual hydroxychloroquine. Perhaps the journal moved too fast, failing to enforce standards of responsibility for data upon its authors. Everyone was operating in a high-velocity moment in which every new bit of Covid-19 information got picked up and picked over by the scientific establishment and the mainstream press. Desperation made them all vulnerable.

Landray's data monitors didn't find people suffering from heart problems, and his trial continued. "That, I think, was an important decision, because with a drug that was being so widely used, it's really important to get the right answer," he says. "Even at that point I thought, it's possible this treatment might work. We don't know."

Then things accelerated. Over just a few days, Boulware's first paper came out. The Recovery trial announced it was canceling its hydroxychloroquine arm, not because the drug was dangerous but because an analysis of the data showed that it did no good. The WHO, which had restarted its study after the Surgisphere mess, shortly thereafter re-canceled it for the same reason as Recovery. So did the NIH.

The Lancet retracted the Surgisphere paper—which had the confounding effect of making hydroxychloroquine seem good to its proponents, including the president of the United States. Matthews, the White House spokesperson, cited the retracted paper to me as an example of "misleading studies out there that were heavily touted by the media." Yet, as a capper, the FDA revoked the emergency use authority for the drug. A few smaller studies are still ongoing, and technically physicians can still prescribe the drug off-label—but the tens of millions of doses in the stockpile are now a no-go for Covid-19. After all, it doesn't work.

The end.

Hah, no, just kidding! Of course that wasn't the end. The large clinical trials did manage to get hydroxychloroquine out of the running to be part of the standard of care for Covid-19. Some researchers still think the drug might have a small, as yet unproven effect if used early enough, or in a different amount. It's possible, and it's also possible no one will ever know.

That would be normal. Part of knowing how to know stuff is knowing what the edges are. All science is settled, until it isn't.

In July two more big randomized trials hit that showed hydroxychloroquine having no effect. That didn't stop White House economics adviser Peter Navarro from touting the drug on TV. The propaganda site Breitbart, which had been an early proponent, posted a video from a group calling itself America's Frontline Doctors, which likewise praised hydroxychloroquine and described its demise as the result of an "orchestrated attack." The president and his son both shared the video. So did Madonna. One of the main speakers in the video turned out to be a doctor with a storefront clinic that was also a church. It quickly emerged that she wrote a book about illness being the result of demonic impregnation, which it is not.

By the way, that line about an orchestrated attack came from the "investigative physician" of America's Frontline Doctors—James Todaro.

The science infrastructure of the federal government might have been able to head off all this politicization and weirdness. A simple message of calm, plus the coordination of actual clinical trials, could have cleared away the confusion and ambiguity. But that didn't happen. Such actionable information could have stood in the way of the, uh, nonscience infrastructure doing whatever it was they wanted—to prove that they were smarter than scientists, to show that there was a miracle cure, to sow political chaos. In the middle of a pandemic that killed more than a quarter-million Americans, that waste of time was a waste of human life.

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By [Eve Sneider](#)

As a coda to all this, a funny story: About 6,000 words ago I mentioned that some of the earliest evidence that hydroxychloroquine and chloroquine could help with the fight against Covid-19 came from in vitro trials—mix a little of the drug with some virus and some cells in a petri dish and see who wins.

Well, in late July a team of German researchers pointed out that early, seemingly successful tests of chloroquine used a cell line that's derived from the kidneys of [African green monkeys](#). SARS-CoV-2 affects lots of different organs, including the kidneys, but its primary target is the lungs. So the German researchers got a culture of lung cells and exposed them to the virus —and to both hydroxychloroquine and chloroquine. Neither drug did a bit of good. None. Bupkiss.

Boulware's team had been working on one other trial since April. It was for "pre-exposure prophylaxis." They gave the drug to health care workers before they were exposed to Covid-19, to see if it kept them healthy. When we talked about it, Boulware seemed to care a little less about what the outcome would be this time. He'd had enough. "If it doesn't work, we're going to be, like, that's fine. We're kind of burned out. Let's just get it done, write it up, publish it, and move on, because we don't like the political aspect of any of this," he says. (The results came out in October; the drug didn't work.)

A coda to the coda: In the early morning hours of October 2, Donald Trump announced that he had [tested positive for Covid-19](#). Amid a fog of disinformation about his condition and treatment, his doctor released a list of the drugs they were giving him, including the antiviral remdesivir, still-experimental and unapproved monoclonal antibodies, and untested but potentially useful things like zinc and vitamin D. Hydroxychloroquine wasn't on the list.

Getty Images (all photo sources); US Department of Health and Human Services (Barda logo)

This article appears in the December 2020/January 2021 issue. [Subscribe now](#).

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[Christopher Cox](#)

[Science](#)
11.10.2020 06:00 AM

The Vulnerable Can Wait. Vaccinate the Super-Spreaders First

Who gets priority when Covid-19 shots are in short supply? Network theorists have a counterintuitive answer: Start with the social butterflies.

![people walking in Grand Central Terminal]
Photograph: Timothy A. Clary/AFP/Getty Images

He was one of 750,000 people, give or take, who passed through Grand Central Terminal that day. He worked as an attorney in a high-rise on 42nd Street that had direct access to the station, where trains departed every few minutes to 122 towns in New York and Connecticut. He and his wife ran a small firm, specializing in estate law, on the 47th floor of the building; he spent his hours there helping people negotiate death. At the end of the workday on Friday, February 21, the man made his way to the platforms for the New Haven line, boarded a train, and rode 30 minutes north to a commuter town in Westchester County called New Rochelle. At that moment, there were 34 confirmed cases of [Covid-19](#) in the United States, all of them linked to international travel.

The next day, the man went to his synagogue, Young Israel of New Rochelle, as he did every Saturday. He and his wife had four children, though only two lived with them at the time—a son who went to college in Manhattan and a daughter who was still in high school. Despite the demands of his job, he was a family man, someone who was as eager to play Connect 4 with his kids as write a brief for whatever big case he was working on. His

house was close to Young Israel, within the boundaries of the eruv, a symbolic perimeter identified by telephone poles, power lines, and other landmarks. Inside the eruv, some rules of the sabbath are relaxed, as if the whole neighborhood were a communal home.

This feature appears in the December 2020/January 2021 issue. [Subscribe to WIRED](#).

Illustration: Carl De Torres, StoryTK

The man was back at the synagogue at 11 the next morning for a funeral. Hundreds of congregants turned out to honor a Holocaust survivor who had died the day before at age 93. That afternoon, some of them returned to Young Israel for a joint bar and bat mitzvah. As the children played, the man and the other adults chatted, ate hors d'oeuvres, and drank cocktails. During the two events, health officials later estimated, the man came into contact with between 800 and 1,000 people.

"I felt a cough, which wasn't crazy, and I thought it was allergies," the man later told the *New York Law Journal*. When the cough didn't go away, he thought about making a doctor's appointment. But it wasn't until February 26, when he developed a fever, that he, as he put it, "started to put two and two together." He was due to travel to Washington, DC, the following week for the annual conference of the American Israel Public Affairs Committee, where he would be in the same room with members of Congress and heads of state. The trip never happened. Instead, a friend drove him to the hospital, where a few days later he tested positive for SARS-CoV-2. He was one of the first people in the US known to have gotten the virus through community spread.

In the days that followed, the case count in New Rochelle began to climb. The man's wife and two children tested positive. So did the friend who had driven him to the hospital, along with members of the friend's family. Anyone who had been at Young Israel the weekend of February 22 was asked to quarantine, but dozens were already infected, including two of the caterers at the bar and bat mitzvah. The son's college shut down, as did the daughter's high school. On March 5, the rabbi of Young Israel announced that he, too, had contracted the virus.

By this point, Andrew Cuomo, the governor of New York, was holding daily press conferences about the outbreak. New Rochelle had "probably the largest cluster in the United States," he said. "The numbers have been going up, the numbers continue to go up, the numbers are going up unabated." The state authorities drew a circle around Young Israel, a 1-mile radius inside which all schools and places of worship had to close and large gatherings were banned. The rules were different within this perimeter, but not for long: The residents of New Rochelle were living in a future that would soon come to the rest of the United States.

The man's condition worsened, and he was placed into a medically induced coma. His wife, who had a mild case, took to posting updates on Facebook. "We have wonderful friends who have cared for us despite the running fears all around us," she wrote. The comments filled with wishes for a speedy recovery. "A whole community prays for your family every day," one member of Young Israel wrote.

By March 11, more than 50 new cases had been linked back to the man. A week later, there were 50 cases tied to the daughter's school alone. Cuomo called the outbreak "one of the more complicated situations that we've come across because of the number of interconnections that this family has presented." By the end of the month, some 10,000 cases had been diagnosed in Westchester County.

Finally, after more than two weeks in the intensive care unit, the man woke up. The first thing he did, his wife said, was to tell her over FaceTime that he loved her. Then he asked whether the rest of their extended family was OK. The press called him Patient Zero, the man who brought the disease from the dense city to New Rochelle, but that was assuming too much: The truth is, we don't know how the novel coronavirus was introduced to his community. What's clear, though, is that the virtues that made the man a good neighbor —there for friends and family in times of joy and pain alike—also made him highly efficient at spreading Covid-19. If he had come back from Grand Central and stayed at home that weekend, how many people would never have gotten the disease at all? Remove him from the chain of transmission, and the whole cluster might never have existed.

We've known about Covid-19 super-spreaders since the start of the pandemic. In January, a man transmitted the virus to 23 people during a bus ride on the Chinese coast south of Shanghai; in March, a member of a choir in Washington state passed it on to as many as 52 of her fellow singers; in August, the presence of an infected guest or guests at a wedding in Maine eventually led to more than 175 positive cases; and in September, President Trump hosted perhaps the [most famous super-spreading event of all](#)—a party to celebrate the nomination of Amy Coney Barrett to the Supreme Court that may have infected dozens of the most influential Republicans in Washington, along with members of the White House staff and press corps.

This is a pandemic defined by clusters. Some cause deadly outbreaks in [nursing homes](#), [prisons](#), and [meatpacking plants](#). Others overwhelm families and friend groups. Although the numbers vary from study to study, SARS-CoV-2 seems to follow the 80/20 rule: 80 percent of cases stem from just 20 percent of infected individuals. Indeed, most people who test positive—one study in Hong Kong put the number at 69 percent—don't spread the disease at all. They get infected, remain asymptomatic or fall sick, recover or die, all without passing along the virus to anyone. And then there are the patients like the lawyer from New Rochelle.

Super-spreading makes the virus especially confounding. It explains why some places had huge outbreaks while others were spared, at least for a while, and why the same risky behavior (an indoor wedding, say) can lead to dozens of cases—or none. But it's also the virus's weakness: Eliminate the super-spreaders and you end the pandemic.

Until now, our tools to stop outbreaks have been blunt. We've imposed nationwide lockdowns and universal social-distancing orders, lumping everyone together no matter how likely they are to transmit the disease. When the first vaccines for Covid-19 arrive, our instinct may be to pursue the same approach, to vaccinate everyone we can as quickly as we can, brute-forcing our way [to herd immunity](#)—the point at which there are no longer enough susceptible people in the population for the virus to hop easily between hosts. But supplies of the vaccine are likely to be limited through the middle of 2021, if not longer. A sharper, more tailored strategy will be required. So: Who are the members of this super-spreading 20 percent?

According to Alessandro Vespignani, a computational epidemiologist who has been consulting with the US government on the response to Covid-19, it would be a mistake to search for some physiological trait connecting them. "*Super-spreading* is a word that many people associate with the idea that, for some strange biological reason, you're spreading the disease more," he says. "This is not that. Generally it's because you have more contacts and you go to places that favor spreading." After all, if an infectious person is a recluse, it doesn't matter how much virus he or she sheds.

To knock out the super-spreaders, the ideal target for a vaccine would be someone with many contacts in different settings—someone with a big, multigenerational family, a job that led to a lot of mixing with strangers, and a busy social life. But how do we find these highly connected individuals across 50 states and 330 million people? This is where most public health officials get stuck. To understand where the potential super-spreaders are in the general population, you would need a map of everyone's friends, family, and casual contacts—the people they see every day and those they interact with for only a few minutes. But that map, of course, doesn't exist, unless it's hiding on Mark Zuckerberg's laptop. In any case, it's not available to the [Centers for Disease Control and Prevention](). At this point, we need to call in a different group of experts: the physicists.

In recent months, Albert-László Barabási has tried to walk around Budapest while taking calls, "to get some steps." At 53, he is still youthful and fit, though the pandemic has kept him unusually busy. His standard route around town takes him by the peach-colored facade of the Alfréd Rényi Institute, named for a Hungarian mathematician who, with his collaborator Paul Erdős, helped lay the cornerstone of network science in the 1950s and '60s. Today the discipline informs all sorts of pursuits, from generating algorithmic recommendations on Facebook to mapping terrorist networks to, yes, forecasting the spread of lethal diseases. But when Rényi got started, he wanted the answer to a simple question: What would a network organized completely at random look like? How would it behave?

Although Erdős and Rényi were theoreticians, they thought their work might eventually have some practical application—say, in understanding the evolution of railways or the power grid. But a few decades later, Barabási and Réka Albert, his colleague in the physics department at Notre Dame,

determined that the Erdős-Rényi model was actually *too* random to accurately describe most naturally occurring networks.

"Our first key discovery," Barabási says, "was that there's really no random network out there." They found that in most settings, from Hollywood to academia to the World Wide Web, networks tended to be "extremely heterogeneous, in the sense that their connectivity is dominated by a few very, very highly connected hubs." Barabási and Albert called these networks "scale-free": Most nodes could contact just a handful of others, but a small fraction were off the scale in terms of connectivity. Your website might link to four pages. Google links to 800 million.

It was Alessandro Vespignani, then at the International Centre for Theoretical Physics in Trieste, Italy, who tied this work directly into the study of epidemics, beginning with the digital kind. Why, Vespignani wondered, were computer networks still susceptible to viruses even though millions of individual users had antivirus software? The answer, he discovered, was that if you didn't inoculate the nodes, malicious code could still zip around the internet with relative ease.

Not long after that, a colleague asked whether all this work on the structure of networks had ever been applied to the spread of real biological epidemics. "I thought, probably they have already done that," Vespignani says. They hadn't, and in 2002 he and a colleague wrote a paper on a "targeted immunization scheme in which we progressively make immune the most highly connected nodes, i.e., the ones more likely to spread the disease." They ran a computer simulation of the effect of such a strategy on a scale-free network, which was meant to mimic "the web of human sexual contacts." The results, they wrote, were "arresting": You could protect the whole system by immunizing as little as 16 percent of the population, as long as you started with the most highly connected people.

Barabási remembers reading Vespignani's paper and trying to apply its logic to the AIDS epidemic in sub-Saharan Africa, where the US government had just announced an ambitious program to combat the disease. An epidemiologist schooled in network theory would give HIV drugs to the members of society with the highest number of sexual contacts, Barabási says—but that wasn't the government's approach. "The Bush administration

was giving the treatment to mothers with children because that sounds really good, and it's soft and cozy," he says. (It also protects against mother-to-child transmission.) "But what our measurement has shown is, no, no, no, you should actually give the HIV drugs to prostitutes, because those are the ones who are the biggest hubs when it comes to the spread of HIV."

For sexually transmitted diseases, the barriers to targeting the super-spreaders may have been political. But for respiratory infections like influenza, SARS, and Covid-19, the limit is computational. There is no practical way to track down the most highly connected nodes in a network that is as big as the whole world, and where the definition of a link includes almost every type of human interaction. The physicists weren't done yet, however. They set themselves to that very problem: Can you find the nodes without a complete map?

Shlomo Havlin outside his apartment near Tel Aviv on October 14.

Photograph: DAN BALILTY

In 2003, during the first SARS epidemic, Shlomo Havlin, a physicist at Bar-Ilan University near Tel Aviv, proposed one of the most ingenious solutions to this problem. In a paper called "Efficient Immunization Strategies for Computer Networks and Populations," Havlin and two colleagues argued that you could achieve global effects on a complex network using only local knowledge. All you had to do was follow a simple script: Take a random sample of a population, ask each individual to name a single acquaintance, and vaccinate the acquaintance. "In this way," Havlin says, "you can reach the hubs, the super-spreaders, very easily."

This acquaintance immunization strategy wasn't as efficient as one that targeted the most highly connected nodes based on complete knowledge of a network. But it was close. "If you do this," Havlin says, "you reduce the number of units that you need to immunize by a factor of three or four." Diseases that would normally keep spreading until 60 or 80 percent of the population was infected—the herd immunity threshold—could be stopped by vaccinating just 10 or 20 percent. Havlin likens the effect to a phase transition: A solid network of ice crystals melts suddenly into water.

Acquaintance immunization works because of a phenomenon known as the friendship paradox, which holds that, on average, your friends have more friends than you do. The very act of asking someone to choose a friend, any friend, played out over hundreds or thousands of iterations, leads inevitably to the most connected people. Consider, for example, a very simple network of three people from Casablanca, Morocco: Rick, Ilsa, and Louis. Ilsa and Louis both know Rick, but they don't know each other. If you ask each of them to name a friend, two out three times you wind up with the most-connected person: Rick.

Once a Covid-19 vaccine is available, if we asked every Louis and Ilsa and Rick in all the towns in all the world to choose a friend to receive it, occasionally we would end up vaccinating the "wrong" person—someone with fewer connections than the randomly chosen person. More often than not, however, we'd be eliminating a hub from the network of infection. Do it enough times and the disease eventually has nowhere to go.

Havlin's strategy worked when he modeled it on real computer networks, and there's also experimental evidence for its effectiveness with biological epidemics: In 2009, when H1N1 flu was circulating, the network scientists Nicholas Christakis and James Fowler followed two groups of Harvard undergraduates. The first group was randomly chosen; the second consisted of the first group's friends. On average, the members of the friend group got the flu two weeks before the random group, whose infection rates matched the undergraduate population as a whole. If the friend group had been vaccinated at the beginning, the campus might have been spared an outbreak entirely.

Vespignani says that whenever there's an outbreak, network epidemiologists usually bring up acquaintance immunization as a possible solution. Its great appeal lies in its simplicity—no small matter when considering a plan that has to be implemented and effectively communicated by the government. When it comes to a vaccination campaign as big as the one planned for Covid-19, however, simplicity might not be an option.

Since the pandemic began, the Advisory Committee on Immunization Practices at the CDC has been studying the question of who should get the first doses of a vaccine for SARS-CoV-2. In August the committee held a

public meeting on Zoom. The members gave presentations on the makeup of the groups at highest risk of severe disease and heard an update on the clinical trials at [Pfizer](#) and [Moderna](#), the two US producers that were farthest along in the vaccine approval process. Doctors and public health experts from around the country were allowed to ask questions. Nancy Messonnier, the CDC's director for immunization and respiratory diseases, weighed in occasionally as the voice of institutional wisdom—she had been planning for a scenario like this her entire career. Then, about five hours into the meeting, the floor was opened to public comment.

One of the first people to address the committee was Santa Claus. Or, more precisely, it was Ric Erwin, chairman of the board of the Fraternal Order of Real Bearded Santas. The committee members didn't quite take him seriously (one confessed that he had never stopped believing in Santa), but Erwin had come in earnest. "This year, Christmas will be more important to the American psyche than ever before," he said. It was vital that the country have a cadre of vaccinated Santas ready to safely hear the wish lists of children everywhere. "We're asking that professional Santas and other frontline seasonal workers be granted early access to the Covid-19 vaccine as soon as practical after tier-one release."

Erwin had done his homework: The vaccine will be released in tiers, or phases. The earliest doses, perhaps as many as 20 million, will go to the groups deemed most essential by the CDC committee, according to a prioritization scheme that has not yet been finalized. After that, larger and larger groups of Americans will be granted permission to be vaccinated, until everyone is covered. Erwin wanted the Santas as close to the top of the list as possible, though his December deadline would be hard to meet.

In considering whom to prioritize for the vaccine, the committee highlighted some of the difficulties in getting it out to the public once it is approved. First, both the Pfizer and Moderna vaccines will require at least one booster shot, so the number of people who can be inoculated is half of the number of total doses available. The Pfizer vaccine will also need to be kept at -94 degrees Fahrenheit during transport and storage—quite a lot colder than most of the other shots in doctors' freezers.

Then there is the risk that large portions of the country will refuse to be vaccinated. During the Salk vaccine trials of 1954, when hundreds of thousands of schoolchildren were inoculated against polio, the parental consent form was edited to change "I give my permission" to "I hereby request"; the implied scarcity was intended as an extra nudge to anxious parents. For Covid, there will be plenty of scarcity to go around (so to speak), but persuading the public to commit to being vaccinated is far from assured, and it gets less likely with every blusterous statement from the White House. (As [Senator Kamala Harris](#) said at the vice presidential debate in October, "If the doctors tell us that we should take it, then I'll be the first in line to take it—absolutely. But if Donald Trump tells us that we should take it, I'm not taking it.")

Each of these obstacles was a stubborn reminder of the way that the real world might not match a network scientist's computer model. Acquaintance immunization is simple in theory, but what happens if the acquaintance is an antivaxxer? Or if her town doesn't have the ability to keep the vaccine's cold chain intact? Or if she's so busy being the life of the party that she forgets to show up for her booster shot?

Even if a targeted strategy works as designed, it can lead to outcomes that feel morally questionable. Let's say you've got one course of the vaccine and two people to choose between: Candidate 1 is a college student who doesn't social distance, wears his mask slung beneath his chin, and plays beer pong all weekend at underground frat parties. Candidate 2 is his 87-year-old widowed grandmother, who lives on her own and has barely been out of the house since March. If your goal is to protect the more vulnerable person, you should vaccinate grandma. If your goal is to reduce transmission, you should vaccinate the frat bro. From society's perspective, he's a jerk; from the network's, he's a hub.

The prioritization committee seemed to be making a similar sort of utilitarian calculus. Rachel Slayton, a CDC epidemiologist who heads the committee's data, analytics, and modeling task force, talked about the benefits of vaccinating the staff of a nursing home rather than its residents. "Because older adults have lower numbers of contacts," she said, "the impact on the broader community of vaccinating the residents I would expect would be relatively small." The best approach for the community

would be to target the nodes. That should keep the virus out of the nursing homes, but it would also require a counterintuitive decision: Don't vaccinate the people most likely to die of Covid-19.

[Everything You Need to Know About the Coronavirus](#)

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By [Eve Sneider](#)

Marc Lipsitch, an epidemiologist at Harvard's School of Public Health, says the CDC committee is grappling with a fundamental question. "Essentially there are two approaches to using a vaccine," he says. "One is to protect individuals by vaccinating them, and the other is to reduce transmission and therefore protect the population." Although the committee would not make any formal recommendations until Pfizer and Moderna released their results, it seemed to be settling, cautiously, on an approach that would attempt to disrupt transmission. Under a plan presented in September, the very first doses would be reserved for health care workers, a population the committee

estimates at 17 to 20 million. (The World Heath Organization has made a similar recommendation for its member countries.)

Some of the reasons for favoring this group above others are practical: The cold chain is easier to control if the population you're trying to vaccinate is already working in a hospital. Hesitancy also is less of a concern—indeed, having doctors and nurses get the vaccine first might increase confidence in the treatment among the general public. And, of course, we need hospital staffs to be healthy to continue to fight the pandemic.

But controlling transmission was also a prominent consideration. In one study at a hospital in London, 15 percent of all SARS-CoV-2 infections were nosocomial—that is, acquired inside the hospital. And as Slayton's report made clear, active health care workers are more likely to spread the disease to their families, friends, and communities than are the elderly. The plan's second phase would include essential workers, as many as 80 million of them, who are both highly connected nodes and necessary to keep society functioning. The elderly might have to wait for phase three.

Lipsitch, for one, thinks that any approach that doesn't start with the elderly is a mistake. It's true, he says, that to reduce the total size of the pandemic, it's a better strategy to target those who have the most connections—but lockdowns have scrambled traditional contact networks. (Or they did until large portions of the public decided it was time to return to business as usual.) In the meantime, we know one thing about Covid-19 without a doubt: Death rates skew heavily toward the old. That's the group that should be first in line for the vaccine, Lipsitch believes. "Even if you put a small dent in those people's risk," he says, "it's so much larger than the risk of the general population. A small dent in a large risk is bigger than a large dent in a small risk." The only exception, he adds, would be if the vaccine simply wasn't effective in the elderly.

Lipsitch's objection might be specific to Covid-19, but it reflects a drawback inherent in all network-based immunization strategies. By their very nature, they require the cascading effects of interventions reaching across an entire population. But as soon as you have a disease that's afflicting millions—or billions—of people, the stakes are too high to start experimenting. With lives on the line, who would choose an immunization plan that has never been

tested outside of computer models and college campuses? "There are some clever things you could try," Lipsitch says, "but I think for a lot of reasons it makes sense to try to be not too clever."

If acquaintance immunization is ever adopted as a framework, it might be in a country in which Covid-19 was never allowed to become an epidemic in the first place. New Zealand and [Taiwan, for example](#), are already protecting their vulnerable by maintaining low case numbers. Vaccinating probable super-spreaders first could ensure that the virus doesn't get a chance to take hold while those countries wait for a stockpile large enough to cover everyone. If that happens, the end of the crisis may resemble its beginning: The most effective governments will be able to think about the pandemic in terms of protecting the whole population. The rest will leave individuals to fend for themselves.

During the CDC prioritization hearings, Nancy Messonnier urged flexibility and humility in the face of all the unknowns presented by this virus. Some countries that had SARS-CoV-2 under control early on faced debilitating outbreaks later. The most celebrated models of the disease's spread have struggled to keep up with reality. Since the start of the pandemic, making predictions about Covid-19 has proved a dangerous endeavor for armchair and distinguished-chair epidemiologists alike.

The arrival of dozens of new vaccines will only continue this period of uncertainty. Each will each have its own limitations and advantages, and a strategy that works with one may fail with another. That's why New Zealand's Ministry of Health, like the CDC, is waiting on the results of the various vaccine trials before committing to any prioritization scheme—although a spokeswoman listed "those at risk of spreading Covid-19" first among the groups being considered for early vaccination.

A surprising outcome of the prioritization debate is that, while the CDC and the WHO have so far embraced network epidemiology to argue against vaccinating the vulnerable first, Barabási and Vespignani, like Lipsitch, dissent from that approach. The highest-risk populations are clearly defined, Vespignani argues, and it would be foolish not to protect them directly. "I don't think that it's possible to have a discussion on this point," he says. But he does leave open one door to using the insights of network science: "Once

we have protected the high-risk strata, but we don't have the resources to immediately blanket the rest of the population with vaccine—at that point, differential strategies might be beneficial."

One person who disagrees strongly with his colleagues is Havlin, who at 78 is decades older than the others. "They say to give it to old people," he says. "I'm old, I'm happy to get it, but I'm not going out from home, you see? So I cannot help the global system. Of course, the old people, it will save their life, but it will not stop the spreading."

Since Covid-19 reached Israel, Havlin has been staying at home near Tel Aviv. He adheres to a rigid daily schedule: He works from 8 am to 10 pm and takes two breaks—one for lunch and a siesta, one for a walk with Hava, his wife of more than 50 years. Not long ago, he came out with a paper suggesting another strategy for combating Covid-19; it would involve randomly surveying the population 10 people at a time and vaccinating the person who reports having the most connections. It provides a way, in theory, of finding a network's hubs even faster than acquaintance immunization.

Havlin's world these days is small, extending not much farther than a 1-mile radius around his apartment. He has been able to see some of his 23 grandchildren, but only from his balcony or on Zoom. Still, he's happy to wait. The vaccine will get to him eventually, and by then, he thinks, the pandemic ought to be over.

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[Elliot Ackerman](#)

[Security](#)
10.30.2020 06:00 AM

A Navy SEAL, a Quadcopter, and a Quest to Save Lives in Combat

On the battlefield, any doorway can be a death trap. A special ops vet, and his businessman brother, have built an AI to solve that problem.

nova drone in front of doorway
Photograph: John Francis Peters

They call it the fatal funnel. When training for urban combat, they teach you it's any doorway you have to cross not knowing what's on the other side. Fifteen years ago, when I returned home after fighting in Iraq, a friend asked me to describe the bravest thing I saw anyone do. I had led a Marine platoon in the Second Battle of Fallujah, in 2004, and had seen plenty of heroism—Marines dragging their wounded off machine-gun-swept streets, or fighting room to room to recover a comrade's body. But none of these compared to the cumulative heroism of the 19- and 20-year-old infantrymen who placed their bodies across that fatal funnel every day. Clearing the enemy from the city, house by house, was a game of Russian roulette played on a grand scale. You never knew who might be waiting on the other side of the door.

In the early days of the battle, we cleared houses by sending Marines through the front door and then proceeding room to room. Soon, however, we discovered this was too dangerous. Was any Marine's life worth a building? We modified our tactics, so that if we sent a Marine through the front door and he found an insurgent inside, we retreated and made no effort to clear the structure. Instead we brought up an armored bulldozer or tank and leveled it.

This feature appears in the December 2020/January 2021 issue. [Subscribe to WIRED](#).

Illustration: Carl De Torres, StoryTK

However, the enemy always has a say. The insurgents quickly adapted to this tactic. They realized that if they revealed their positions, we'd bury them in concrete. They took to barricading a shooter inside the house with his rifle aimed at the front door. They would then hide someone else next to that door. When the Marine stepped inside, one insurgent would shoot him while the other—who was hiding by the door—would drag him deep into the house. Not knowing whether our comrade was alive or dead, we were now forced to fight room to room to recover him. This situation played out time and again in what became known to us as "hell houses."

You would think that the US military, with all its technological prowess, would have long ago developed a solution to this problem. But you'd be mistaken. War at its most intimate—as it unfolds in the close quarters of urban combat—has until very recently remained a distinctly low-tech affair. So it was with great personal interest that I traveled to San Diego this past June to meet Brandon Tseng, a former Navy SEAL and cofounder of Shield AI, a company that claims to have solved the problem of the fatal funnel.

"Hold the button and wait for the green light," Brandon tells me. We're near the headquarters of Shield AI at an urban training facility that approximates conditions in an Afghan village. The two of us stand, one behind the other, outside several shipping containers welded together—"a multistory house"—as though we are about to make entry across its fatal funnel. A steering-wheel-sized [quadcopter](#) rests on my palm. I hold the button on its side as instructed. A green light turns on. The rotors of the quadcopter begin to buzz menacingly as the drone gently lifts off. Brandon opens the door in front of us. With a predatory swiftness, the drone darts inside the house. No human is controlling it.

"The noise is pretty creepy," I say, as we listen to the drone humming between open rooms.

"Our customers tell us the noise frightens people," answers Brandon, who, with his brother Ryan, runs Shield AI. The customers Brandon refers to are members of US Special Operations Command who have been using Shield's first product, the Nova quadcopter, and its onboard [artificial intelligence](#), Hivemind, to help clear rooms on missions overseas for the past two years.

While we stand at the entry of the doorway, Brandon takes a smartphone out of his pocket. On half of his screen is a live videofeed from the Nova as it sweeps through the building, which has been stocked with furniture and dummies. On the other half of his screen is a real-time map of the building's floor plan that the Nova draws via its onboard sensors, including its camera and lidar. As the drone moves from room to room, Brandon annotates the map, tapping the screen for possible threats—a person here, a weapon there, a suspicious box in the corner. This information can then be passed along to other members of the team as they prepare to make entry. The Nova moves through the building at a rate of 2,000 square feet a minute; in just under 60 seconds, it shoots out the front door and turns toward Brandon, as if recognizing an old friend. Brandon reaches out his hand, allowing the quadcopter to land in his palm. Its rotors shut off automatically. Silence returns. It becomes, for me, a surprisingly emotional moment.

"This would have saved a lot of guys' lives," I say.

Brandon nods. "I know."

When the Nova was deployed in 2018, it was likely the first time an AI-driven quadcopter of this scale was used in combat.

Photograph: John Francis Peters

Brandon and his brother Ryan grew up in Houston, Seattle, and Orlando. Their father, a Taiwanese immigrant and son of a diplomat, moved around when he was growing up, and he often told them that "being born and raised in the United States is like winning the lottery. You should know how lucky you are. Don't take the opportunities this country gives you for granted." As a boy, Brandon dreamed of becoming a Navy SEAL. And after high school, he got one of those opportunities his dad had always talked

about: an appointment to the US Naval Academy. That led to multiple deployments overseas, including two in Afghanistan. Ryan, meanwhile, went to the University of Florida to study engineering and became a businessman.

After seven years in the Navy, when he was 29, Brandon left the service, and Ryan started helping him transition to civilian life. "Between deployments, he never talked much about the war," Ryan said. It wasn't until Brandon started applying to business schools that Ryan began to learn the details of his brother's experiences. "I was prepping him for interviews," Ryan said. "I asked him for an example of a complex work decision he'd had to make. That's when he started opening up, not only with his stories but with what his friends had gone through … It was all this stuff I never knew."

Brandon was accepted to Harvard Business School for the fall of 2015, but he already had an idea of what he wanted to do. When he was overseas, he spent time working with sensors and inexpensive computers. "When I realized that, used together, the two could reason and take action," he said, "my mind started racing with a sense of new possibilities." He had come to believe that certain battlefield tasks could be accomplished with artificial intelligence, and this, he felt, would save lives.

He'd identified a specific problem, one he believed was solvable: that physical act of searching structures, which had bedeviled troops in the urban combat that characterized so much of the post-9/11 wars.

"No one was really working on this," Brandon said, so as he entered business school he took his idea to Ryan. At 31, Ryan was already a proven entrepreneur. He had founded and sold a wireless charging company, WiPower, to Qualcomm, and had started a time-lock container company, Kitchen Safe, that had led to "the most enthusiastic pitch ever" on *Shark Tank* (at least according to *Business Insider*). When Brandon hit up his brother, Ryan was between ventures (though he did have a dishwashing robot in development). Brandon, who is the gregarious T-shirt-and-jeans-wearing counterpoint to his brother's more analytical, collared-shirt-and-khakis persona, initially encountered some skepticism from Ryan. "I assumed this was a solved problem, that we were already doing this," said

Ryan, explaining his initial hesitation. "Also," he joked, "the idea was coming from my little brother."

Brandon managed to convince Ryan that his idea was viable and that the component technologies already existed, so in the spring of 2015 they set about finding an engineer who could take it on. "Everyone we talked to," Ryan recalled, "kept mentioning this guy Andrew." That was Andrew Reiter, a chemical engineer turned roboticist who had cycled through prestigious research programs at Northwestern and Harvard and was currently at Draper Laboratories, in Cambridge, Massachusetts, working on camera-based navigation in autonomous robots.

"They sent me an email out of the blue," Andrew said, "and I also thought, isn't the military already doing this?" Although university labs had experimented with quadrotor autonomy, and a few high-profile small-drone projects had dabbled with military applications, AI-driven drones had yet to be put to use. That is partly because applying artificial intelligence to actual environments can still be a difficult feat: [Machine learning](#) is good at predictable and repetitive tasks, but the real world is insanely unpredictable. Over the past two decades, the military had come to rely on human-controlled drones for everything from intelligence collection to air strikes. Despite numerous conceptual papers imagining the role that systems powered by artificial intelligence will play in the future of warfare, the military had yet to field a single autonomous drone.

The brothers flew to Cambridge to meet Andrew in person. Within six hours the three had the outlines of a business plan: They would create an AI-powered quadcopter (they won't say much about technological specifics) to solve the problem of room-clearing. Their goal was to then expand the use of the AI—what they later branded Hivemind—and apply it to other military problems. A month later, Andrew moved to San Diego and took up residence in Ryan's guest room for about a week.

By late August 2015 the three had a proposal in hand, and in a two-week period they'd scheduled 30 meetings with potential investors in Silicon Valley. Twenty-nine passed. The investor who bit had no interest in saving lives on the battlefield; instead, they wanted to develop a selfie-snapping drone. The capital was there, but the mission wasn't. When I asked whether

they considered going in a different direction, Brandon said, "We were building a company to make a dent in *this* mission."

Ryan Tseng (left) was initially skeptical of his brother Brandon's (right) business idea. "I assumed this was a solved problem, that we were already doing this."

Photographs: John Francis Peters

Without professional investors, the three cofounders decided to lean on friends and family. They scraped together a little over $100,000 to assemble a prototype. "Finances were tight for a long time," Ryan explained. And the tight budget created engineering obstacles. For instance, they had purchased a $2,000 lidar device, which helps autonomous vehicles measure distances from objects, from the manufacturer Hokuyo. Ryan, who was keeping an eye on the cash, insisted they'd eventually have to return it to keep their nascent business going. But to install the lidar on the Nova, Andrew needed to shorten its cable. That would mean they couldn't return it. Not only did he have to figure out how to piece together an autonomous room-clearing AI system onto a quadcopter, he had to do it with a multifoot-long cable lashed to its side.

While Ryan focused on keeping the business afloat and Andrew focused on the prototype, Brandon began trying to navigate the byzantine world of defense contracting. He came across the recently formed Defense Innovation Unit, or DIU, the brainchild of then defense secretary Ash Carter headquartered in Mountain View, in Silicon Valley. "I didn't know much about them," Brandon said. All he had was a press release that announced the formation of the office. It turned out that one of the Innovation Unit's core missions is to "accelerate the adoption of commercial technology" for the Department of Defense in five key areas, three of which—artificial intelligence, autonomy, and human systems— aligned with Shield's mission. As luck would have it, DIU also had been created specifically to circumvent the laborious defense contracting process with approved funding for small projects within 60 to 90 days.

DIU opened in August 2015, and Brandon headed to Mountain View. Except he didn't have an appointment; he simply showed up. "The press

release had a photo of their headquarters but no address," he said. With a little sleuthing on Google Earth he'd nailed down the location. He made it as far as the receptionist before being turned away. A year later, after a formal request for funding, Shield was invited to demonstrate its prototype Nova drone at an urban combat testing facility.

Jameson Darby, the director of DIU's autonomy program, was at the testing facility that day, along with a senior officer from Special Operations Command, who happened to have come to DIU looking for better ways to clear rooms and respond to barricaded shooters. At the demonstration, which was similar to the one I saw, Darby noted, "It was pretty obvious that Shield AI was far out in developing the capability." After the event, DIU granted Shield AI its first contract, for $1 million. Small in military-contract terms, but it was a start.

In fact, the capability that Brandon, Ryan, and Andrew had demonstrated was something Darby and his colleagues had been searching for. In 2014 the Center for a New American Security released a paper titled "20YY: Preparing for War in the Robotic Age." Its authors predicted, "To a degree that US force planners are simply not accustomed to, other global actors are in a position to make significant headway toward a highly robotic war-fighting future in ways that could outpace the much bigger and slow-moving US defense bureaucracy."

With the backing of DIU and private investors that followed, Shield AI deployed the Nova and Hivemind with special operators in the Middle East during the winter of 2018 (they say the details of those missions are generally classified). This marked a potential milestone in US military history: It was likely the first time an AI-driven quadcopter of this scale was used in combat.

For engineering expertise, the Tsengs turned to Andrew Reiter, who was working at Draper Labs on camera-based navigation in autonomous robots.

Photograph: John Francis Peters

Shield AI's manufacturing facility—which the company calls the Hive— sits in an anodyne San Diego strip mall, across the street from a Home

Depot. Five years after it started, Shield AI still retains a scrappy, entrepreneurial culture that you usually don't see in the defense industry. Still, the precise, assembly-line organization of the Hive, with its teams of engineers and extensive diagnostic tests on each Nova drone and Hivemind software update, is a far cry from the bare-bones, couch-surfing early days of the company. About 150 people—including many military veterans—work there. When I visited, engineers were pulling long hours in the midst of a [Covid-19](#) lockdown to ensure their customers received the Nova II, slated to enter service in early 2021.

The first Nova is what I'd watched enter the ersatz building at the test facility. The Nova II has new capabilities, including swarming and longer flight times, and reconfigured controls based on feedback from operators in the field. But it is Hivemind, the AI driving the quadcopter, that is the technological advance the team believes has the potential to change the nature of modern war. (Brandon likens the relationship between their Nova drones and their Hivemind software to the relationship between a Google phone and Android.)

Technology often belies war's true nature, one that, according to the seminal military theorist Carl von Clausewitz, is "slaughter." My own experience backed up Clausewitz's observation, which caused me to arrive in San Diego a skeptic, harboring all the obvious doubts about how well an autonomous quadcopter could work in practice, on the ground, in the midst of combat: Is the technology both rugged and reliable? What happens if the Nova reaches a closed door? What happens if an enemy simply swats it from the air?

But then I saw the drone in action. When I told Brandon that the Nova would have saved lives, I was thinking of those hell houses in Fallujah and how we were forced to fight room to room to recover our men. If we had had the Nova (or something comparable), it wouldn't have mattered if an insurgent swatted it from the air. Simply knowing the enemy was there would have given us the upper hand, as would the knowledge of every closed door. Opening each and sending an intelligent quadcopter inside would have saved us from being exposed to the threat.

The answer to my concerns, I realized, strikes at the true promise for technology like the Nova and Hivemind: enhanced situational awareness, which in the past has come at a steep cost in human lives.

The left half of Brandon's screen is a live feed from the Nova as it sweeps through the building. On the right is a real-time map of the floor plan that's drawn using data from the drone's camera, lidar, and other onboard sensors.

Photograph: John Francis Peters

It's one thing to clear a building, which is a tactical problem, but what happens when we apply this technology strategically? That's what could make the Nova, but particularly Hivemind—or a system like it—transformative.

The defended interior of a building is what could be called a denied area, a place we cannot go and where we believe there's a threat. The idea applies more broadly, to entire geographic regions. In the past, soldiers entering denied areas—by air, land, or sea—would typically learn about their adversaries' defenses when those same defenses fired on them, often at the cost of lives. Despite advances in sensor technology, limitations remain, and the live feed from a human-piloted drone is often the equivalent of searching for a marble in your backyard by looking down through a soda straw.

But imagine a network of enemy air defenses containing surface-to-air missiles, antiaircraft guns, and all the attendant sensors to detect incoming aircraft. Instead of flying a human-piloted aircraft into that network with the hope of identifying and then evading those systems, Shield AI is hoping to deploy swarms of drones—of all sizes—to map threats in real time. Now you aren't searching the earth with a single soda straw, but with thousands. These drones wouldn't be reliant on satellite-based navigation (which is easy to disrupt), and they'd communicate among themselves, as their own network, while mapping the battlefield. It's the same concept as clearing a room, except the room could be the entirety of a nation's air, ground, or sea defenses.

According to retired Navy SEAL vice admiral Bob Harward, a member of Shield AI's board, "If I'm able to apply artificial intelligence to these problems, that drastically enhances our state of competitiveness." When asked why the larger defense contractors, such as Boeing or Raytheon, have yet to take on this problem, Harward said, "The defense-industry focus of AI has been on metadata, not operations." In other words, collecting and analyzing information.

Shield AI, on the other hand, has chosen to target that very specific problem of room-clearing as it gets its start. This past September, the company landed a $7.2 million contract from the US Air Force to develop technologies that would allow autonomous drones to partner with humans in the collection of intelligence in GPS-denied environments. Its Silicon Valley investors now include Andreessen Horowitz, Breyer Capital, Homebrew, and Silicon Valley Bank. "That's the value of Brandon as an operator," Harward says. "He saw this need and went after it to keep our guys alive." Indeed, one obstacle to solving this problem was that many people outside the military assumed it had already been solved.

To be sure, in the past few years a handful of companies have been building AI-powered quadcopters for various military applications. [Anduril](#), the company run by Palmer Luckey and funded by Peter Thiel and Andreessen Horowitz, has military contracts to expand the capabilities of the autonomous drones it built to detect people crossing borders illegally. It aims to apply the tech to finding enemy personnel and equipment on the battlefield. The US drone maker Skydio (ironically, known for its selfie capabilities) has hired a cadre of roboticists and is, as WIRED [wrote in July](#), "vying to become the Army's standard-issue short-range surveillance drone to help infantry peek over the next hill or look around corners in urban combat."

The great fear, of course, is that autonomous unarmed drones like the Nova, whose core mission is force protection, will be the proverbial camel's nose through the tent, leading to something more troubling: autonomous armed drones—a dystopian swarm of killer robots that are essentially making their own decisions. Shield says it has no immediate plans to develop armed drones.

Michèle Flournoy, a former under secretary for defense policy in the Obama administration, who advises Shield AI, has helped the company develop an ethical framework, guided by the concept of human-machine teaming. "You don't take the human out of the loop," she explained. "You make the human more effective." She readily acknowledges that AI has the potential for dystopian applications. But so does any technology—from the sword to the gun to the nuclear bomb. "I do worry," she said, "about where China and Russia might go without a human in the loop. The Department of Defense doesn't want to remove the human; it wants to make the human better."

In February the Pentagon adopted a set of ethics principles for its use of AI that were proposed by the Defense Innovation Board, an entity within the Department of Defense that includes representatives from companies like Google, Microsoft, and Facebook. The principles included things such as keeping humans at the helm and having a well-defined domain of use. However, as even the report itself notes, "These principles are designed neither to gloss over contentious issues nor restrict the Department's capabilities."

Anika Binnendijk of the Rand Corporation, who coauthored a recent study on brain-computer interfaces, has doubts as to whether humans will ultimately be able to keep up with their robotic counterparts on the battlefield. She told me, "Once humans and machines work more closely during the heat of combat, it may be extremely difficult to determine the substance of 'meaningful human control' or 'appropriate levels of human judgment.'"

When I interviewed Brandon, Ryan, and Andrew at the Shield AI headquarters, I asked Brandon about the story he'd told his brother when preparing for his business school interviews. In the conference room that day, Brandon had mentioned something about having to evacuate an injured civilian during a firefight in Afghanistan, but then he quickly changed the subject. When I asked again, he demurred. So I left it alone. I figured I'd follow up when he wasn't surrounded by his colleagues.

I got him on the phone a few days later. I wanted to hear this story, and I pressed him. What happened in Afghanistan? What events had led him to

dedicate himself to solving this problem? What was the story that had so affected his older brother that he'd also dedicated himself to this mission?

Brandon still hesitated. Only after more prodding did he tell me about a mission he was on in Afghanistan, where the Taliban fired on his SEAL platoon during a tribal shura. An 8-year-old Afghan boy, caught in the crossfire, was shot in the stomach. Brandon, who had little situational awareness of the village he was trapped in, couldn't call a medevac for fear the helicopter would be shot down. So he and his platoon and Afghan partner forces carried the boy to a base 10 kilometers away. Miraculously, the boy survived.

But before Brandon finished that story, he'd launched into a different one, not about him but about a friend, a fighter pilot, who'd flown missions in Syria. Hovering over a target—an ISIS training camp where a surveillance drone had confirmed the presence of more than a hundred fighters—the pilot's superiors had cleared him to drop his ordnance and return to his carrier. Except something didn't feel right. With only minutes of fuel remaining, he continued to hover. Then, dozens of children began to exit the building; the compound was also a school. The pilot returned to his carrier without dropping his bombs. To this day he is haunted by that event.

There was more. Brandon told me about a group of special operators who took fire from a house on a raid in Afghanistan, in 2012. While deployed, he had watched this mission from the Joint Operations Center in real time. After surrounding the building, the operators tried to call out the fighters inside, to convince them to surrender. When the fighters refused and continued to fire back, the operators, fighting for their lives and after exhausting every other option, called in an air strike, destroying the building. Only after picking through the rubble did they discover that the fighters had held a family hostage inside.

Brandon has other stories, but he's made his point. That night, he sent me an email: *It wasn't any single mission I did that led me to found Shield AI, it was after reflecting on my time in the military and everything I had experienced … the missions I did, the missions my friends and teammates did. Visiting friends in the hospital who had lost their sight … going to memorial services, talking with Gold Star families, seeing the joy and relief*

on my friends' families when their loved ones returned home safely, talking with Afghan families while on missions and learning about what they had endured.

My expectation that Brandon might offer a single, harrowing story that explained Shield AI's founding was misguided. Like my friend who had asked me to name the bravest thing I'd seen in Fallujah. But there is no single story. There remains a series of closed doors to open, fatal funnels to cross, uncleared compounds to search, a chain of memories, and, hopefully, a solution. Brandon's work—with that of Ryan, Andrew, and the team at Shield AI—is to ensure that in the next generation's wars, there will be fewer of these stories. And that those of us lucky enough to come home won't have to live with them.

ELLIOT ACKERMAN *([@elliotackerman](.)) is a former Marine and intelligence officer who served five tours of duty in Iraq and Afghanistan. He is also the author of six books. His latest novel,* [2034]*, written with Admiral James Stavridis and out in March, imagines a coming war between the US and China.*

This article appears in the December 2020/January 2021 issue. [Subscribe now].

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[Gear](#)
10.20.2020 06:00 AM

3 Great Gaming Chairs for Any Budget

With high backrests and generous adjustability, these thrones ease the physical strain of epic *Doom Eternal* sessions while also improving your WFH setup.

Image may contain Furniture Chair Table Desk Sitting and Tabletop
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10.20.2020 06:00 AM

What AI College Exam Proctors Are Really Teaching Our Kids

Universities are digitally spying on students to make sure they don't cheat on online tests. A whole generation could be learning to tolerate surveillance.

a tight circle focused on a student at a desk
Illustration: Michelle Thompson

When Haley, a sophomore at Indiana University, took a test for an accounting class in September, she—like many college students during this pandemic—was sitting not in a classroom but in her bedroom. And instead of a teacher watching for signs of cheating, there was something new: an [AI](#), studying Haley's every move through her laptop's webcam.

The university was conducting remote exams using Respondus, a type of "online proctoring" software. The software locks down a student's desktop so they can't switch tabs to Google an answer, and then it uses visual AI to examine—among other things—their head movements to judge whether they're looking somewhere other than at the screen.

Haley's head was setting off alarms. "I guess I slouch when I'm sitting," she tells me, so at one point the software flashed a scary warning at her. "It stopped my test, and it popped an alert on the screen saying we can't see your face any more." Unsettled, she began to stare more robotically at her screen.

Haley finished the exam and got a good grade. (I'm using only her first name at her request.) But the stress of that HAL-level surveillance? Yikes.

"Online proctoring" isn't new. It's been around for over a decade, used mostly for distance education or corporate accreditation tests. But as formerly F2F colleges went remote because of [Covid-19](), its use spread like ivy. Mike Olsen, the CEO of Proctorio—one firm that makes such wares—says their business has risen by 900 percent since the spring. "April was one of our craziest months," he adds.

We talk a lot about the rise of surveillance capitalism and ponder the grim future to which that Orwellian path leads. But for students? That future is now, as they try to act dutiful in front of their glowing webcams.

It's a dreadful experience, they'll tell you. Some systems identify possible cheats using AI; in others, a live human, employed by the firm, stares at you. Oodles of Reddit posts catalog moments of violation: housemates or family unwittingly captured on camera, normal body movements flagged as illicit behavior, and the existential exhaustion of performing obedience. "This legitimately scares the fuck out of me," one student posted.

It sets a terrible civic precedent. "We are indoctrinating our youth to think that this is normal," says Lindsay Oliver, activism project manager at the Electronic Frontier Foundation. Students trained to accept [digital surveillance]() may well be less likely to rebel against spyware deployed by their bosses at work or by abusive partners. "What are we telling them about what they should expect for the rest of their lives?"

Universities plead that they need some way to prevent academic malfeasance, which is a real thing. A recent survey found that just over 30 percent of students admit to having engaged in some form of cheating. Administrators tell me they try to be as respectful as possible of student privacy: "We work very hard not to be invasive," notes Brian Marchman, the director of distance and continuing education at the University of Florida. For example, his school encrypts any video or data collected by the proctorware, and it is professors—not the proctoring companies—that make the final decision on whether cheating occurred.

All fair enough. But there's something bonkers about trying to parse the most ethical way to creep on students. The rise of proctoring software is a symptom of a deeper mistake, one that we keep making in the internet age: using tech to manage a problem that is fundamentally economic.

After all, there are other ways to assess students that minimize the chances of cheating. Rather than give multiple-choice tests, you could ask them to "do more applications-based projects or essays," Haley says. We could ask students to engage in serious, real-world tasks: "There are a bunch of Wikipedia articles that could be worked on," says Audrey Watters, author of the blog [Hack Education](#). If you give students complex projects, you don't need to ban Google, because there's no simple answer.

Exciting possibilities, right? But this sort of work is "much harder to grade," Watters says—which is why schools so often rely on drearier assessments, particularly multiple-choice tests. If we truly wanted schools to have the resources to grade serious, complex work, we'd need to put more money into the big public institutions (like Haley's school) that educate the great majority of US students. But at those places, funding has decreased, on a per student basis, over the past few decades. The more creative answers take time and money, so they get pushed aside and quick tech fixes get used instead.

Think about it that way, and what seems like a problem of dishonest kids is actually a problem of … public policy. Using tech to paper it over isn't a good answer. In the long run, we're only cheating ourselves.

Photograph: Getty Images

Updated 10/21/2020 3:30 pm ET: A previous version of this story misspelled Lindsay Oliver's name and misstated her title. She is the activism project manager at the Electronic Frontier Foundation.

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

[Virginia Heffernan](#)

[Ideas](#)
10.20.2020 06:00 AM

My Roomba Has Achieved Enlightenment

To my robovac, hitting a doorjamb and cleaning with dispatch are one and the same. There is no success or failure—these concepts have merged.

Illustration: Shivani Parasnis

All through the fall my head was spinning, and I steered into the spin by watching *Fast, Cheap & Out of Control*.

Errol Morris' rhapsodic 1997 documentary about a bunch of monomaniacs features a xylophone-heavy score and the roboticist Rodney Brooks. I wanted to hear Brooks dilate on robots in his cosmic way again.

As it happens, this fall had also seemed like the right time to clean the hell out of my apartment. To that end, I bought a [Roomba](#), the blockbuster robovac Brooks coinvented in 2002, five years after he went public in the Morris movie with his theories of what robots ought and ought not to be. Among his most famous aphorisms: "Robots are good at very simple things like cleaning the floor."

So while Roomba purred around the living room, very good at its simple thing, which is cleaning the floor, I found the Morris movie and entered that sweet hopeful decade of my early adulthood, the dawn of modern-day artificial intelligence, when AI was still called robots and machine learning was still called consciousness (with a question mark): consciousness? The 1990s.

"I saw a videotape of insects walking, and they weren't even stable," Brooks tells the camera at the start of the movie, as the film cuts to ants passing crumbs up a line.

What Brooks says is true. The individual ants teeter and lurch and erratically drop and rebound the crumbs, but they still travel along in a plausibly straight line.

"Everyone was implicitly assuming that a walking machine had to have stability, so I negated that," Brooks goes on. "I said, 'Let's have a walking machine that doesn't even worry about stability … that's able to fall down.'"

That insight led Brooks to help create the Sojourner rover, which explored Mars, and the PackBot, which first disposed of bombs in Afghanistan and then measured hot spots inside the ruins of the Fukushima nuclear reactors that melted down in the catastrophic 2011 earthquake and tsunami in Japan. And of course the Roomba. Though Brooks is now known for his world-historical Sojourner and PackBot, a friend of his razzes him that all he really cares about are domestic robots that clean. Indeed, sometimes it seems that the central features of every Brooks robot are a broom, a dustpan, and eagle-eyed sensors that can find and collect gnarly things like Mars rocks, IEDs, nuclear debris, and dust bunnies.

Throughout *Fast, Cheap & Out of Control*, Brooks suggests that the instability of human bodies—the wobble, stagger, fall, self-righting—might be the source of consciousness itself. I like this part, but it's not cozy. "It appears as though the robot has intentions and has goals and is following people and chasing prey," Brooks says. "But it's just the interaction of lots and lots of much simpler processes … The sort of more radical hypothesis is, maybe that's all there is."

Well, maybe. Maybe someone else's Roomba is all simpler processes and that's all there is. But I anthropomorphize the bejesus out of mine. Not only does she have intentions and goals, she has a disposition: extreme composure. She also has a gender. On the phone, Brooks upbraids me for that—"I always, always, always really push back on people giving gender to robots"—and later I upbraid myself for having reflexively feminized my

unpaid domestic servant (*robot* is from the Czech *robota*, for "slave"). Maybe it helps that I also idolize her.

To my Roomba, hitting a doorjamb and cleaning with dispatch are one and the same. There is no success or failure. She might be stuck in a rut under the sofa for ages, blind to a fairly simple escape, but she feels no embarrassment; when she's executing a perfect beeline back to her base station to recharge, she betrays no smugness. There is no "clumsiness" or "grace" in her world; in Brooks' design, these concepts have intentionally merged. If she bangs into the same chair leg again and again and again, she doesn't say "D'oh!" over and over. It is just what is. Roomba is Rumi: "Out beyond ideas of wrongdoing and rightdoing there is a field. I'll meet you there."

Robots are typically seen as having no consciousness. But potentially they have the highest kind: equanimity. This is the emotion Buddhism counts as among the most sublime. The Buddha evidently described the equanimous mind as "abundant, exalted, immeasurable, without hostility, and without ill will." My Roomba is certainly without hostility and ill will. Going about her daily rounds, she's something like blithe—both self-contained and indifferent to human value systems. As for abundant, exalted, and immeasurable, I can't be sure. How to measure these things, or is that what "immeasurable" means?

Brooks posed an ethical question to me when we spoke, part of his recent work on helper robots who preserve both the independence and the dignity of the elderly. Should a robot, he asked, when summoned to change the diaper of an elderly man, obey that man's request to keep the ignominious diaper news from his daughter? Ooh—robots and discretion. I stalled by saying I assumed her father would, very soon, have to expect the robot would snitch on his every alimentary move—not just to his family but to doctors, CVS, and Facebook. But the idea of a discreet robot stayed with me. My Roomba certainly seems discreet, tucking all the dust inside herself and never betraying to guests that I don't vacuum. But then there's the nasty truth that Roomba's parent company, iRobot (which Brooks left in 2011), had threatened to share our floor plans with the data cat burglars at Apple, Amazon, and Google. While iRobot has hemmed and hawed about this, I

simply can't figure out how to opt out—or even determine if she is, in fact, collecting dirt on me.

And about dirt she is insatiable. Corners that I never thought could be undusty now seem lit from within. But Brooks is emphatic that the Roomba doesn't promise perfect cleanliness. It promises just the greatest clean for me. "The Roomba didn't have to clean as well as a person cleaned, because it was for the person who didn't clean at all," Brooks told me.

He was right about this particular Roomba user. I don't not vacuum, but I'm careless, and though I've heard it's good for the soul, I rarely get on hands and knees with a scrub brush and have never once gotten down low, low, low, like the Roomba, to commune at eye level with dust and dirt and mites. That kind of tedium and self-abasement, not to mention aches and intimacy with grime, have emotional valence to me. To Roomba, getting and staying low are just what she does. Or is that what the monstrous always tell themselves about their slaves?

In *Fast, Cheap & Out of Control*, I finally hear Brooks say the line I'd been waiting for. I had remembered it all these years, since I first saw the movie in a theater. It's a strange and incredible line, nothing epigrammatic, more like an incomplete guess—speculative, expansive, unstable. Like one of Brooks' best robots. He calls it a "joke theory."

"I sort of have this joke theory," he says, "that consciousness is put there by God, so that he has this very quick interface to find out what we're thinking about."

When I asked him about this extraordinary image in 2020, as we both confessed how destabilizing the pandemic and the California fires had been, he emphasized that the line was not just a joke theory. It was a joke, full stop. He further said that his intense love for his children had meant he can finally understand how someone can be a religious scientist (which he once thought an oxymoron). But he is also a known atheist. Maybe God, I realized, is far too stable and eternal a conceit for Brooks. One of the other men in *Fast, Cheap & Out of Control*, an expert on naked mole rats, says, "The whole concept of stability is a concept of death."

I glance at Roomba. She is very not dead. Even when Roomba is in her dock, she still seems raring to go. Consciousness, Brooks told me, is still on his mind, whatever a mind is. He's writing a book about it with the working title *Not Even Wrong*. Tantalizingly, he said it has a significant villain in it. I silently guessed Elon Musk. Maybe that's too obvious. "I'm not going to tell you who the villain is. That's going to be a surprise to everyone."

I'll devour the book as soon as I can get a copy. I hope it stumbles through all kinds of subjects, and advances many joke theories, while putting none of them to rest.

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

[Michael Calore](#)

[Gear](#)
10.20.2020 06:00 AM

Panic's Playdate Is a Retro-Modern Handheld-Gaming Delight

Don't be fooled by the old-school design, with springy buttons and a black-and-white screen. It's the Game Boy for the wireless, open-source era.

![playdate gaming device]
Photograph: Cera Hensley

If you logged countless hours crushing *Tetris* blocks on road trips in the Family Truckster, this game machine looks familiar to you. But while the Playdate has a joyfully retro design, with springy buttons and a black-and-white screen, it's no mere Game Boy nostalgia trip. For one, there are no cartridges. Games are delivered over Wi-Fi; the first "season" of titles will arrive over the course of the 12 weeks after launch. (The purchase price includes that initial batch.) Then there's the crank: You'll keep it nestled against the housing for some titles, but in others you'll deploy it as a supplemental controller—to make a character run, say, or to advance a side-scrolling map. Playdate is made by Panic, the Portland, Oregon, company behind last year's irreverent hit *Untitled Goose Game* as well as some of the most beloved utilities for Mac software developers. Importantly, the Playdate is built on an open software platform. Any game designer can code their next creation to run on the device; the gaggle of indie games that spring forth should keep the Playdate feeling fresh for years.

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[Jason Kehe](#)

[Culture](#)
10.20.2020 06:00 AM

Angry Nerd: Stop Turning My Favorite Antiheroes Into Heroes

Attention Disney and Netflix: Leave Maleficent and Carmen Sandiego alone. My soul needs villains, those perpetrators of change.
Image may contain Logo Symbol Trademark Text and Label
Illustration: Elena Lacey

The heroes of my youth—J. K. Rowling, Pizza Hut, and most of all Disney—are the villains of my adulthood. This is only natural for a curmudgeon of my caliber; to mature is to make enemies. To learn, in other words, to vilify. What's unnatural is the reverse process: heroization. This I never do, and not just because I can barely pronounce it. The very act arrests development. So of course the [Walt Disney Company](#) excels at it. Once a minter of great heroes, it's lately sunk to the business of heroizing great villains. You remember Maleficent, eidolon of evil, dragon lady writ literal? In not one but two pop-feminist productions, Disney has defanged and unwinged her. The only thing edgy about nu-Maleficent is Angelina Jolie's cheekbones. Being an inclusive company, Disney came next for a boy. This year's *Artemis Fowl*, unwatchably directed by Kenneth Branagh (who's less hero or villain than international hoodwinker), turns the depraved super genius into a good kid, with dweeby morals. Because a spoonful of infantilization helps the revisionism go down! Alas, Disney isn't the worst decriminalizer. That would be Netflix, whose contribution to the genre, the animated edutainment *Carmen Sandiego*, commits the gravest offense. The original Carmen, all blowout hair and flame-red cape swirling out of the frame as she made off with historical monuments, was a malefactor to admire, a master of subversion, a—as the anarchists say—poetic terrorist.

Recast as a misunderstood teenage do-gooder, she has nothing left to teach us. Nothing left to teach me. Heroes age badly. Agents of sameness, they stink of stagnation. My soul needs villains, those perpetrators of change. May they be free to fight on, to struggle, to lose. To villainize, valorously.

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

[Paul Ford](#)

[Ideas](#)
10.20.2020 06:00 AM

It's Time to Pick Classes for the 2073-74 School Year!

Welcome back! Among the many courses offered this semester, students may elect to study essential climate-mitigation skills like underwater basket weaving.

psychedelic names of school courses
Illustration: Shannon Levin

Welcome back to the e-Portal, [STUDENT]! We hope you enjoyed the summer protests and return ready to continue your learning journey under the guidance of our nine tenured professors and their 70,000 adjunctbots. We've used your current facial expression to select classes to match your mood. As always, we believe that education is key to an enlightened life and affirm that an advanced degree is critical to winning one of the non-inherited spots in the annual job assignment lottery and avoiding the National Service kelp camp draft. Good luck!

Millennial Gerontology. Caring for senescent members of the millennial generation carries special challenges. To gain empathy for this cohort, we will divide into "hives" and use Facebook simulators. We will also review critical texts such as Vox explainers and the poetry of Nobel Prize-winner Rupi Kaur. Working in teams, we will learn to develop appropriate therapeutic activities such as simulating an EDM festival, DMing, and crafting thirst traps. Classmembers will also learn how to role-play with a sorting hat while providing end-of-life student loan debt counseling.

Beef Studies. Students consider the philosophy and history of beef, which came from cows. Readings and discussion will explore the violent multi-decade transformation of beef-driven society toward the current economic and cultural construct of postbeefiness. Students will learn to identify different kinds of brisket while also studying the origins of the Houston Water Riots, Austin BBQ Disaster, and the formation of the Free State of Cattlevania and subsequent federal sauce sanctions. Prerequisite: **Chicken Studies**.

Creative Writing. No longer offered; interested students should consider **IP Franchise Development and Marketing**.

The Literature of the Great Pacific Garbage Patch. When climate refugees from the Last Great California Fire settled on an unstable, trillion-ton island of plastic trash, they not only established the world's first upcycling-based economy but produced a great literary renaissance. In addition to selected readings from *The Norton Anthology of Garbage*, students will read and discuss Scrap Patchman's *Dreams of Filth Island* and Carcinogen Dregs' poem cycle *Please God I Don't Want a Literary Prize I Want to Go to a Doctor.*

Pre-Fan Cultures. Several scholars assert that humans once consumed media in silence, either alone or in small groups, without comment or community. We will collectively read the few remnants of unfranchised literature in order to consider the implications of this great *horror vacui*, and ultimately seek to answer whether a work of art can be said to exist without fans. Suggested prerequisite: **IP Franch. Dev. & Mktg.**

Underwater Basket Weaving. Students will learn to apply this essential modern skill to a variety of key climate-mitigative construction tasks, including the development of high-tensile woven seawalls, as well as studying the successful use of microporous mercury-filtering baskets to improve aquaculture in damaged lake beds. Suggested additional course: **Modern Construction Techniques (II).**

Library Practicum II. For advanced students preparing to enter the information sciences field for library and information center operations. Key topics in librarianship include mental and physical health crisis

intervention, pornography access management, child therapy, and naloxone administration.

The Biology of Animal Rights. Students will clone a sheep, then apologize to it.

Ethics in Punitive Marketing. This wide-ranging business course uses discussion, primary sources, and case studies to consider multiple and competing ethical frameworks for assessing and reviewing the potential moral issues for both managers and practitioners with regards to Punitive Marketing, i.e., the evolving practice of paying a gig worker to physically threaten a consumer until a purchase is made.

Women's Studies. See **Handmaid's Studies**.

Allyship. While federal law and local militias forced us to shut down our Critical Program in Race, Gender, and Institutional Studies, we are still legally allowed to offer this half-semester seminar in allyship. Topics include liking posts, tipping ostentatiously, speaking up anonymously but second, and being one of the good ones.

Modern Construction Techniques (II). Building on the ecologically sound principles of MCT (I), we move on to consider advanced concepts like long-term emergency shelter development, mold abatement, seawall construction, off-grid urban plumbing, social-distance office planning, saltwater resistance, fracking-induced seismic protections, emergency escape, natural cooling, solar water filtering, riot-proofing, flammability, panic room construction, and building affordable housing on a giant plastic garbage patch.

Computers, Networks, and Society. Computers were once bulky devices that had limited memory and required perpetual maintenance and updates, and had to be carried in pockets. In this broad historical survey we will explore how a more primitive society functioned when technology was neither neural, edible, nor free.

2020 in Context. The year 2020 was widely considered a global turning point, during which an increasingly connected global population began to

face the reality of climate change and seek positive change. Using a variety of exercises, such as talking on Zoom and typing words on screens, we seek to uncover why historians widely call 2020 "the last good year."

All classes available as podcasts for an additional ⎕0.01 per credit.

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

[Tom Vanderbilt](#)

[Culture](#)
10.19.2020 06:00 AM

'Wait, Sylvie's Dad Plays?!' The Joy of Fortnite Parenting

I picked up the controller to keep tabs on my fifth-grader. What I got was a window into her world—and a lesson in 21st-century fatherhood.

diptych of daughter and father playing video games
Photographs: Meron Menghistab

I'm in the end stages of a _[Fortnite](#)_ battle royale. The game's lethal storm circle is tightening around the combat zone, a sleepy beach town with a bubblegum-pink ice cream parlor, and the handful of remaining squads are duking it out for survival. My three teammates, who are all children, are taking intense fire. One squares off with an especially ruthless competitor and is promptly dispatched. "Watch out, that kid is sweaty," he warns. Another falls to a grenade burst with a cry of "I'm knocked!" A third pleads for the _Fortnite_ equivalent of a field medic: "Rez me!"

And then—suddenly, alarmingly—the game is in my hands.

A torrent of instructions, piped out in shrill voices, comes crackling through my headset. As I chug a health-restoring Shield Potion, a grinning gold-crowned skeleton drops in front of me, taking aim with a Pump Shotgun. I try to switch back to my weapon, but my fingers fumble and I pull out a healing Bandage Bazooka instead. "What?!" my squad mates cry in unison as I'm eliminated. "He was a bot!" It's the worst put-down in the _[Fortnite](#)_ lexicon: A bot, in this case, isn't an AI but simply a human who sucks at playing.

Then, through the headset, I overhear a deeper, more authoritative voice on someone's audio feed.

"Ollie, that was your last game."

"Dad! *Please* one more?"

"*No*."

When my 11-year-old daughter, Sylvie, began asking earlier this year to play *Fortnite*, I'd said no. She'd been largely ensconced in the world of [*Minecraft*](), with its building-not-killing educational gloss. I had only a vague awareness of the cultural colossus that is *Fortnite*, but I reflexively wrote it off as too violent, too exposed to a toxic online world. My wife also objected, fearing a nightmare carnival of gore. Sylvie tried to assuage our concerns with such parsings as "You don't *see* heads explode." After an intense lobbying campaign, we finally relented. But I told her I'd join her at first, like some UN peacekeeper, to make sure nothing strange or unsettling was going on.

Our initial foray was hesitant. At that point, we had one [Xbox]() and no headset, so she'd play a round of battle royale in Solo mode, then I'd play one, and we'd see who could survive longer. With 99 other combatants in the game, including a whole lot of "sweats," we rarely lasted more than a few minutes.

Even as I tried to dispassionately evaluate the gameplay (the violence, I concluded, was acceptably cartoonish), I felt a vestigial itch. At age 52, I'm already getting junk mail from the AARP. But I'm also part of the first generation raised on video games; at my daughter's age, I had an Intellivision in my living room and a stockpile of loose quarters for the arcade. As an adult, I revisited video games at key junctures: *Metal Gear Solid*, *Grand Theft Auto*, *Halo*. But when my daughter arrived, my free time evaporated in a manic fugue of playdates, pediatrician visits, and the competitive adulting of Brooklyn parenthood. Now, under the guise of fatherly supervision, I again had a controller in hand.

After a few days in Solo mode, we graduated to Duos. This required playing together in split screen, which turned out to be too much of a strain on my eyes and attention. And so I bought a Nintendo Switch—ostensibly as a reward for Sylvie's stellar academic performance, but also because I wanted the Xbox all to myself.

Once we were on our way to becoming a reasonably competent pair, the door opened to squads. Before I even really knew what was happening, I was being drafted onto teams with her friends.

"Who's Cubic Racer?" some kid would squeak, seeing my randomly assigned user name on the screen.

"Uh," my daughter would reply, "my dad."

A moment's pause, and then: "Oh. Cool."

I had been given a strange window into the lives of these fifth-graders—their language, gossip, social dynamics, personalities. (Apart from Sylvie, I'll refer to them all by pseudonyms.) There was dependable Aidan, who always had your back; bossy Owen, constantly clamoring to be given the best weapons; quirky Henry, who liked to "emote" and "meme" as much as battle. They were boisterous and filled with braggadocio but almost heartbreakingly innocent. On the rare occasions when someone swore, you could virtually feel the nervous titter ripple through the ether.

I also discovered that I was sometimes privy to the lives of their *parents*. Through voice chat, which picks up the ambient rustle of the house, I heard it all—the endless negotiations for more playing time, the clatter of dishes, adults talking grimly about something in that day's *New York Times*. One kid, on weekend mornings, always sounded as though he was in a crowded room, which at first I chalked up to hypersocial parents. It turned out he was playing at the gym while they worked out.

At times I felt like a field biologist, scribbling notes on my subjects from the safety of a hide. At other times I felt like, well, a weirdo. When the father of Jean-Luc, a kid in the French immersion program at my daughter's public school, asked him who he was playing with, I could almost see the

raised eyebrow on the other end when he replied "*le père de Sylvie*." This was shaky ground.

But the lack of parents was, in a sense, a curious disconnect. In *The New Childhood: Raising Kids to Thrive in a Connected World*, the researcher Jordan Shapiro notes that parents are active participants in most areas of our kids' lives: We correct their table manners, arbitrate their sibling squabbles, supervise their homework. "But when they're playing *Fortnite*," he writes, "we leave them to their own devices."

Even as the first video game generation hits middle age, the idea of adult participation is still seen as vaguely disreputable, or simply beyond the cohort's abilities. On places like Reddit, there are anxious queries: "Is it weird to play *Fortnite* in your mid-30s?" In one YouTube video, a group of "senior citizens" (one guy didn't look much older than I am) are handed controllers and asked to play *Fortnite* for the first time, with particularly plodding results. Without even knowing it, I'd already been parodied in a *Saturday Night Live* sketch. Adam Driver plays a hapless Gen X dad with sensible glasses and a business shirt (user name "Williammctavish1972") who joins *Fortnite* in hopes of finding "a fun bonding activity" with his 11-year-old son. "Let's get a *Fortnite*!" he declares.

Certainly there's something funny about a middle-aged dad trying to squad up with a bunch of kids. But I'd like to suggest that, rather than simply monitoring your child's gaming activity, you should occasionally be joining in.

Photograph: Meron Menghistab

For the past few years, I've been working on a book, called [*Beginners*](#), about learning new skills at any age. What got me started on it was the sudden realization, as I took my daughter to what seemed an endless round of swim classes, soccer games, chess tournaments, and piano lessons, that it had been eons since I'd learned anything new. Like most of the other parents, I'd sit on the sidelines or in the bleachers immersed in my phone.

And so I'd vowed to acquire some new skills, the way she was. It had never occurred to me, however, that *Fortnite* could be one of them. I didn't think

of video games as having any sort of benefit. Rather, they were something I'd more or less *survived*, as a loosely supervised latchkey kid. An activity like chess, by contrast, had a veneer of academic respectability; the landing page for my daughter's school had a picture of kids hovering over boards.

Chess, the argument went, was a way to practice all sorts of important abilities—decisionmaking, patience, resource allocation. But so, I realized, was *Fortnite*. You had to pick a strategic place to parachute down at the beginning of a battle; you had to choose what equipment to include in your "loadout" and what to leave behind; you had to calculate how much storm damage you could take. A chess enthusiast might memorize dozens of time-honored opening gambits, but was that so different from gleaning strategies from pro streamers on Twitch?

No doubt, *Fortnite* could be addictive. But so could chess: Marcel Duchamp quit making art to play it. (The best games always border on obsession.) And sure, *Fortnite* could be mindless. But you could also be mind*ful* about it. Alex Pang, the founder of the consultancy Strategy and Rest and the author of *[The Distraction Addiction](#)*, tells me that when he played video games with his young children, he tried to teach them to do more than "just mashing the buttons." In the early *Call of Duty*, he recalls, you could participate as a Russian infantryman in World War II. "It was super clear that you were going to die," Pang says. "Fundamentally, you knew your life did not matter." He found this "compelling and antiheroic," an example of how "games can actually raise questions."

It's not as though Sylvie and I discussed the problem of free will as we dodged RPG rounds. For the most part, our interactions weren't nearly so high-minded. We stole each other's kills and squabbled over loot. She badgered me for V-Bucks so she could buy her character new baubles in the Item Shop. But sometimes, after playing, we'd go for a walk and analyze how we were able to notch a dub—*Fortnite*-speak for a win—or how we might have done better. We'd assess the quality of newly introduced weapons. (The best were OP, for "overpowering," but often the makers of *Fortnite* would later "nerf" them for being *too* OP.) She'd chide me for trying to improve by battling more, rather than by practicing in Creative mode—which suddenly made her open to hearing about the late Swedish

psychologist K. Anders Ericsson's theories of "deliberate practice." (Like many kids, she had a built-in filter against my teachable moments.) We actually were, per Adam Driver's character, *bonding*.

And in our *Fortnite* games I saw her cultivate prowess. I'm not talking merely about the widely discussed perceptual and cognitive benefits of video games, which include an improved ability to track objects in space and tune out cognitive "distractors." I'm talking about that suite of abilities sometimes referred to as "21st-century skills": imaginatively solving open-ended problems, working collaboratively in teams, synthesizing complex information streams. "Unfortunately, in most formal education settings, we're not emphasizing those very much," argues Eric Klopfer, who directs the Education Arcade at MIT. "Just playing *Fortnite* doesn't necessarily give you those skills—but playing *Fortnite* in the right way, with the right people, is certainly a good step in that direction."

Indeed, as I played in my daughter's squads, or just listened to her games while I made dinner, I witnessed intense negotiations with her largely male teammates. (Games with her female friends sounded a *lot* more collaborative.) I heard her working in tandem to devise strategies, tactfully soliciting input or advancing her own opinion, deftly delegating responsibilities. At times it seemed less like a game than a virtual workplace. As the writer Andi Zeisler joked on Twitter, "My kid is always playing *Fortnite* with his friends on my phone, and I cannot see the appeal; it's literally just a conference call with occasional shooting."

But this wasn't just about seeding the managerial skills of some future knowledge worker. Playing video games with your kids is a useful pedagogical experience in and of itself. As Pang points out, games provide a remarkably level ground for children and adults. "It's very hard for most 9-year-olds to play tennis against you," he says. "But when you're playing *Mario Kart* or *Star Wars: Battlefront*, you can be much more evenly matched." Kids can assume, briefly and unusually, the role of masters, with adults like me put in the uncomfortable (and yet exhilarating) position of novice. This can be empowering on both sides: Adults get to see their kids as teachers, while kids get to see their parents struggling to learn something.

It's not that traditional roles never stepped in. Sometimes, playing Duos, Sylvie would stray far from me and get eliminated. I'd then try to explain why, strategically, it might be better if we stuck closer together. "You're such a bot!" she'd yell. I was tempted to blame these outbursts on raging tweener hormones, but it was hard not to see the symbolism: Before long, she'd want to fly the coop.

A month or so into my *Fortnite* debut, the coronavirus epidemic struck, and we suddenly found ourselves in one of the world's epicenters. The schools shut down, my travel-dependent work dwindled, and the walls began to close in as we sheltered in place in our privacy-depleted two-bedroom apartment. Not surprisingly, screen time spiked, both globally and in our home.

At first I fought against this. I was as leery as anyone about the dangers of video game addiction, which is fueled in part by a carefully engineered suite of dopamine triggers. And *Fortnite* has them all—copious rewards, abundant novelty, near misses, leveling up. (This is as much a risk for adults as for kids; in the UK, *Fortnite* has shown up as a reason in at least 200 divorce proceedings.) My wife and I had instituted a never-on-a-school-night ban, and we held fast to it.

But for Sylvie the game seemed to have value as an escapist refuge from the increasingly scary events of the day—the baleful procession of sirens outside our door, her parents' hushed conversations about dwindling savings, the upward slope of the fatality curve. *Fortnite* was sometimes an escape for me too, a temporary departure from endlessly reading about R0 values and herd immunity modeling. Sometimes I'd hear an adult conversation going on in the background of a kid's voice chat—something about a film director, or collateralized debt obligations—and guiltily feel the tug of the real world.

After a week or so of remote schooling, I began to relax the *Fortnite* restriction. I realized that, deprived as my daughter was of playdates and park visits, the game had become her social life. Others have made this argument before: *Fortnite* isn't so much a game as a *place*. Sure, she was going for dubs, but between shotgun blasts she was also chatting with her friends about the anime they were watching or the rescue cat we'd adopted.

She often seemed to spend more time deciding which of her many friends to join in a squad than actually playing.

I also began to have a clearer view of what *Fortnite* had come to mean to her. I'd largely dismissed the whole Item Shop, with its outfits and toys, as a profit-seeking exercise in planned obsolescence and scarcity economics. But for her and her friends, these little tokens of identity in an age of lockdown—when they couldn't see each other, could barely leave the house—seemed an important way of exercising autonomy.

Gradually, I began to scale back my involvement in her squad campaigns. We were already together 24/7; she needed time with her friends. But when I did occasionally join in, there would sometimes be a brief bit of chatter from kids who didn't know me.

"Who's Cubic Racer?"

"That's Sylvie's dad."

"Wait, Sylvie's dad plays?!"

He does, in fact. He's not great, but he's dubbed a few games, and he's handy in a squad. He only asks that you refrain from using him as an excuse to get more playing time when your parents want you to stop.

Illustrations by Sam Whitney

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This article appears in the November issue. [Subscribe now](#)*.*

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