WIRED

NOV 2020 ■ PACKING HEAT

"In 10 or 15 years, we will have prepared the entire western slope of the Sierra Nevada to ignite in the greatest firestorm ever seen by human beings."

P. 36

THE FIRES NEXT TIME

by Daniel Duane

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IT ENDED UP BEING ESSENTIALLY A TOP-SECRET CARTOON.

P 70

Getty Images

TOTALLY WIRED

NOTES FROM OUR STAFF

"You earn public confidence in small drops," warned former FDA commissioner Scott Gottlieb in August, when the agency overstated the effects of convalescent plasma as a treatment for Covid-19. "And you lose it in buckets." Others share his sense that people's faith in scientific leadership may be foundering. Anthony Fauci, director of the National Institute of Allergy and Infectious Diseases, sees widespread suspicion of the process as "a looming problem" for the release of a vaccine. Bioethicist Zeke Emanuel worries that we've fallen into a "fever of distrust."

I'm not so sure they're right. Most data point the other way, toward the opposite problem: Public trust in science has been so unwavering in recent decades, so impervious to scandal or discredit, that it seems more apt to worry about whether members of the public are even paying attention.

The president has, by most accounts, spent the last 3.5 years in a posture of open hostility toward science. A long and devastating cover story in *The New York Times*, published last December, ran under the well-supported headline "Trump Eroding Role of Science in Government." Yet veneration of our scientific leaders has more than weathered this administration. A Pew Research survey conducted last spring found a large boost, since 2016, in the proportion of adults who report having "a great deal" of confidence that scientists will act in the best interests of the public.

Measured over the long term, our faith in science has maintained an eerie constancy: In 1974, 45 percent of surveyed adults reported having "a great deal of confidence" in the leaders of the scientific community; in 2018, it was 44 percent. What, if anything, could ever rattle this belief? We shrugged off the Republican "War on Science," as we did the overlapping "Science Wars" waged by postmodernist, left-wing academics. We forgave the research-integrity meltdown of the late 1980s, which led to congressional hearings on rampant scientific fraud, then took little notice of the reproducibility crisis of the 2010s. The meta-scientist John Ioannidis' demonstration, in 2005, that most published research findings are false did nothing to erode our trust. The open-science methods revolution that followed did nothing to enlarge it.

This should come as a relief. It's far better that our faith in science should persist in spite of everything than that it should collapse into the gutter. But the present moment may end up being an exception—not in the sense that public trust will, finally, erode (chances are it won't) but because, finally, it ought to. At least in certain spheres.

Americans who worry over the politicization of the vaccine-approval process have a solid read on what's been going on. It's true that political hacks were installed at the FDA, and it's true that the process for selecting and approving a vaccine has been opaque, suspicious, and at times misleading. It's also true that, more than once, the completion of important research on therapies for Covid-19 has been undercut by inefficiency and poor decisionmaking. If there ever was a time to be wary of our scientific institutions, it's now. If there ever was a time to wonder whether an approved vaccine has been fully vetted, it's today.

Here's another way to think about it: If our confidence in scientific institutions really does diminish in this moment of pandemic politics, that's not the fever—it's the cure. It means that Americans have examined all the evidence before them and adjusted their beliefs accordingly.

—Daniel Engber is WIRED*'s Ideas editor. Read an expanded version of this column at* WIRED*.com.*

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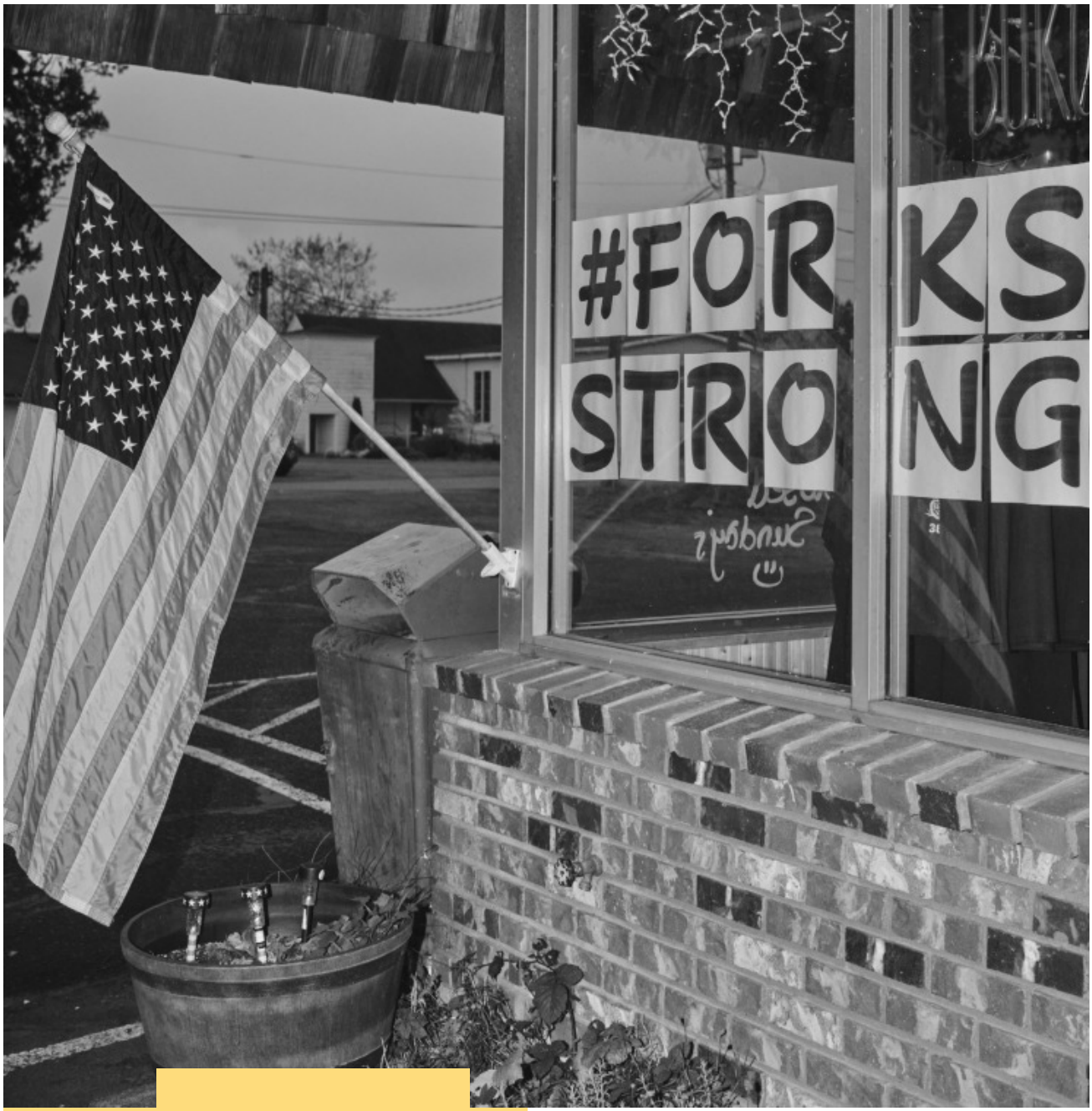


P.48 "THEY LOOK SKETCHY AS SHIT"

The rumor started on Twitter: Busloads of antifa were coming to "white hoods." It spread on Facebook, where the story exploded into a call to arms. Then a converted school bus, carrying a family and two dogs, rolled into a remote town in Washington. A social media parable.
by Lauren Smiley

P.28 FORTNITE: DAD INVASION
Squadding up with my 11-year-old was a joyful lesson in parenting.
by Tom Vanderbilt

P.36 THE FIRES NEXT TIME
Mass blazes are upending our sense of how wildfire works.
by Daniel Duane

P.62 O, ROBOT!
Lora DiCarlo's high-tech vibrator was supposed to redefine an industry. Instead, the hype did.
by Lux Alptraum

P.70 CIPHER IN CHIEF
Meet Paul Nakasone. He transformed the NSA and US cyberwarfare—very quietly.
by Garrett M. Graff

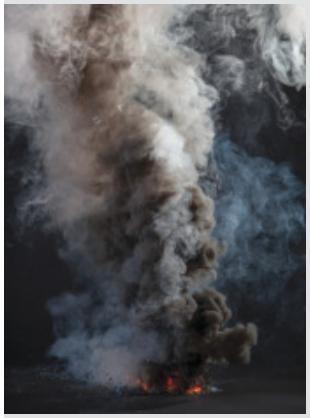
PHOTOGRAPH / IAN ALLEN

ELECTRIC WORD

P.2 Totally Wired

P.8 Rants & Raves

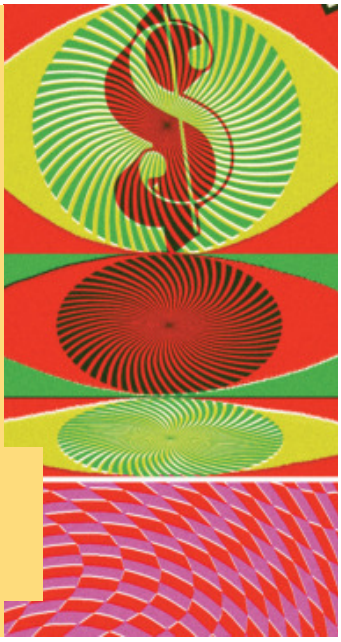
ON THE COVER



Photograph
by Kevin Cooley

Behind the Scenes
For his series *Controlled Burn*, Kevin Cooley was inspired by wildfire behavior and "a human desire to conquer and control nature." Guided by a trained pyrotechnist, he created the images in a studio using materials designed to generate lots of smoke, which he photographed in bursts under high-powered strobes. The swirling plumes on the cover conjure the pyrocumulonimbus clouds that can form during an intensely hot wildfire.

MIND GRENADES



P.11 The Buddha of My Roomba
by Virginia Heffernan

P.14 Your 2073-74 Course Selections
by Paul Ford

P.16 What AI-Powered Spying During Exams Is Teaching Our Kids
by Clive Thompson

GADGET LAB: VIDEO GAMES

P.19 **Fetish**
Playdate retro-modern game machine

P.20 **Head 2 Head**
Xbox Series X vs. PlayStation 5

P.22 **Level Up**
Gaming chairs

P.24 **Top 3**
Headphones for gamers

P.26 **How To**
Twitch-stream like a pro

SIX-WORD SCI-FI

P.88 Very Short Stories
by WIRED readers

Images, from top: Shannon Levin, Cera Hensley, Violet Reed

MISTY COPELAND
Principal Dancer
American Ballet Theatre

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RANTS AND RAVES

For our September issue, Jason Parham wrote about how TikTok thrives upon—and exploits—its Black creators. Daniel Duane traced San Francisco's successful pandemic response back to hard-won lessons from the HIV/AIDS crisis. Jack Hitt profiled an Ohio IT specialist—and his data-driven efforts to restore voting rights to citizens unduly purged from the rolls. And Yiren Lu gained more personal insight than she bargained for at a seminar for entrepreneurs in Beijing.

Readers share their thoughts on race and health care, and their insights from overseas.

RE: STOLEN MOMENTS

TikTok, like Vine before it, is a fertile ground for young Black creatives to cut their teeth. As Tr*mp interferes with the service, we have to protect and nurture young Black talent. —Rashad Robinson (@rashadrobinson), president, Color of Change, via Twitter

Culturally responsive teaching often involves awareness of youth culture, and in our current environment TikTok is at the center. Excellent piece on how race is impacting the experience of students of color on this platform. —Rahman A. Culver (@mrculverteaches), via Twitter

By insinuating that Black culture is best left "pure," ensconced, kept away from encroachment and exploitation, you are advocating a position very similar to an old, racist, white idea—"separate but equal," born out of systemic racism that was much more overt and powerful than the kind of systemic racism we face now. —name withheld by request, via mail@WIRED.com

RE: "SPREADSHEET PATRIOT"

"Patriots come in all types and walks of life. None of us is as smart as all of us."

—Hanlon's Razor (@danemadsen), via Twitter

RE: SAN FRANCISCO'S HARD-WON IMMUNE SYSTEM

This article makes a persuasive case for the unique success of San Francisco as a product of the city's management of a previous pandemic, HIV/AIDS. However, one serious problem is the omission of the Asian American community in the coverage, while "activists in the LGBTQ, Latinx, and Black communities" are given credit. Asian Americans are the single largest ethnic minority group, at 36 percent of San Francisco's population. Despite being a densely populated neighborhood full of vulnerable people, Chinatown was well prepared. —Robert Eng, via mail@WIRED.com

San Francisco's Department of Public Health is, charitably, falling flat and contributing directly to the disproportionate number of Latino and Latina essential workers' suffering, illness, and death. Mayor London Breed is still dining out on national media coverage of her early lockdown. Our community has attempted and failed to receive data from SFDPH in a timely enough manner to isolate coronavirus outbreaks and reduce human suffering. —RJ Sloan, SRO tenant representative, San Francisco Department of Building Inspection SRO Task Force, via mail@WIRED.com

RE: A CHINESE SELF-BREAKTHROUGH SEMINAR

Having spent 10 years in Shanghai, I am extremely happy that I left China. A lot of people in the world keep praising China for its technology innovations. But the great firewall of China conveniently excluded all possible competitors, before they had a chance to adapt to the Chinese tastes. There are hardly any Chinese companies capable of doing real innovation, and this is what a lot of people fail to recognize. Yiren Lu sings the praises of Zhen Academy's radical transparency, but if she had brought up the subject of Tiananmen Square, the class would have lost all its transparency in a second. This is the hard reality of China that I lived in for 10 years. I would suggest Lu pack her bags and move to China for three to five years, to experience what real China is like. —邱把卡 (@quibakaka), via mail@WIRED.com

The author mentions how proud the people seemed without mentioning the intense and intentional centering of the idea of China as a humiliated country restoring its former glory into the hearts and minds of schoolchildren. It's essentially a blood-and-soil view of the self. —dayundone, via Reddit

What a fantastic article. We need to understand China, not just rail at it. We'll never get off this rock until we know how to work together. —Christopher Allen, via mail@WIRED.com

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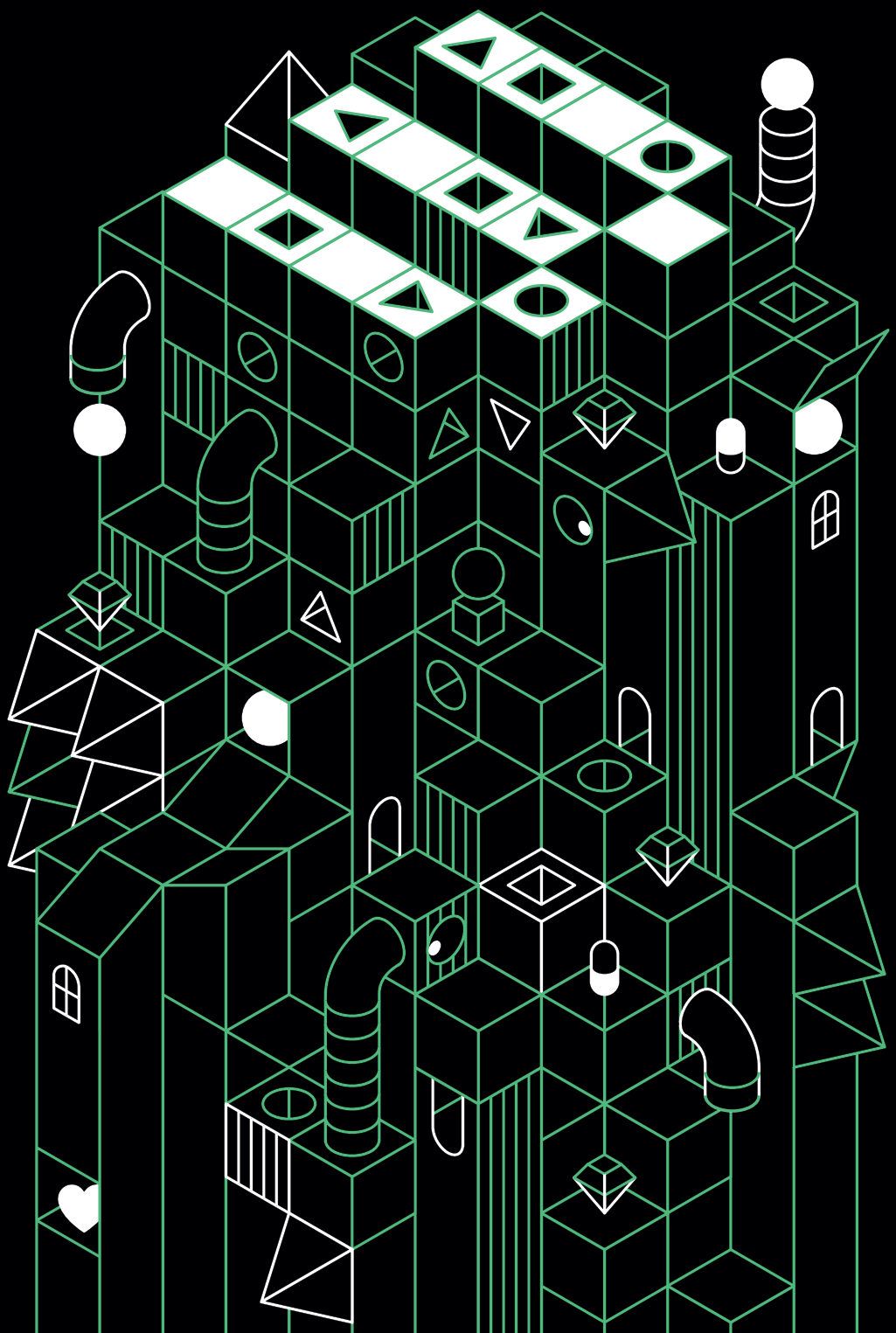
Jessica Pettway

COMING OCTOBER

WIREDGAMES



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CLEAN CONSCIENCE

The Buddha in my Roomba.

BY VIRGINIA HEFFERNAN

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 ➜

ILLUSTRATION / SHIVANI PARASNIS

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.'"

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

"I sort of have this joke theory," Brooks says, "that consciousness is put there by God, so that he has this very quick interface to find out what we're thinking about."

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

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."

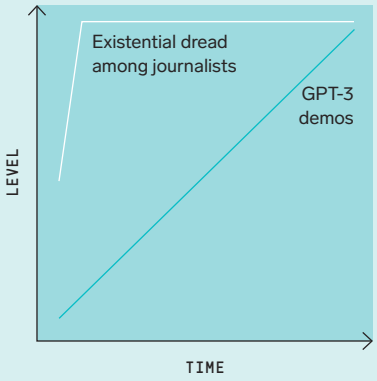
I'll devour the book as soon as I can get a copy. I hope it stumbles through all kinds of subjects, and advances many joke theories, while putting none of them to rest. W

VIRGINIA HEFFERNAN *(@page88) is a regular contributor to* WIRED.

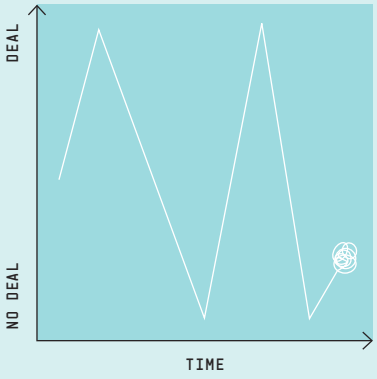
CHARTGEIST

BY JON J. EILENBERG

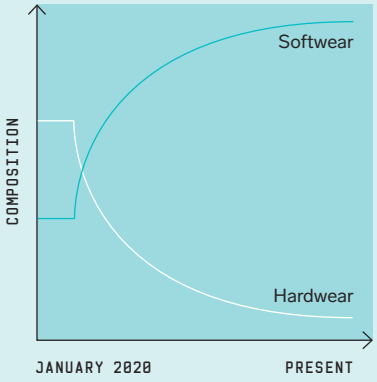
ARTIFICIAL INTELLIGENCE

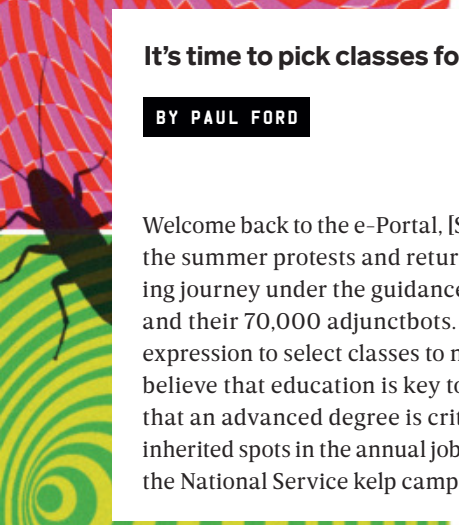


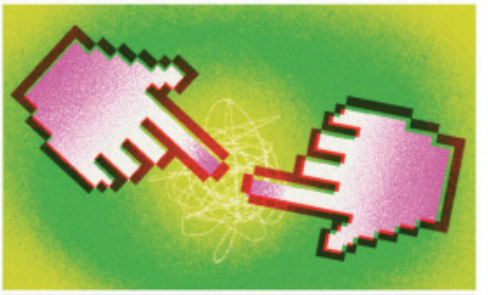
STATUS OF TIKTOK DEAL

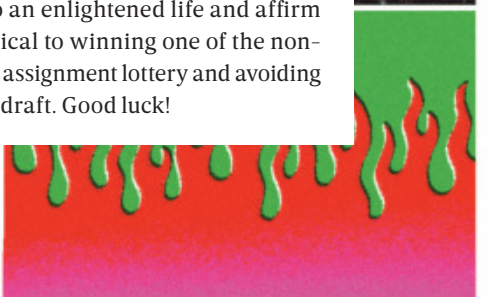


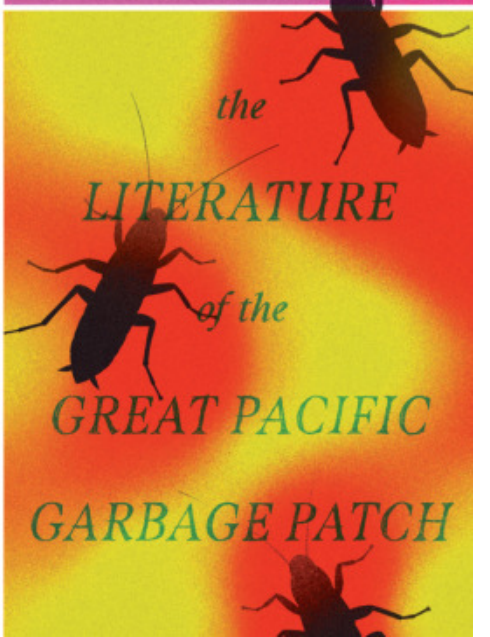
WORK WARDROBES











YOUR COURSE CATALOG

It's time to pick classes for the 2073-74 school year!

BY PAUL FORD

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.

Under the guidance of our nine tenured professors and 70,000 adjunctbots, students will learn about early, pre-fan cultures and essential climate-mitigation skills like underwater basket weaving.

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."

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PAUL FORD *(@ftrain) is a programmer, essayist, and cofounder of Postlight, a digital strategy firm.*

ILLUSTRATION / SHANNON LEVIN

SURVEILLANCE U

AI is spying on college kids to make sure they don't cheat on online exams. What is this teaching our students?

BY CLIVE 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 Linsday Oliver, head of activism 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.

Proctoring software is a symptom of a deeper mistake: Using tech to manage a problem that is fundamentally economic.

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. W

CLIVE THOMPSON *(@pomeranian99) is a* WIRED *contributing editor. Write to him at clive@clivethompson.net.*

ANGRY NERD

BY JASON KEHE

DO MORE EVIL

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.

Getty Images; Angry Nerd: Elena Lacey

ILLUSTRATION / MICHELLE THOMPSON

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Power Up

Thanks to Covid, you'll probably have more downtime than ever this winter. Our recommendation: Play tons of video games. Whatever your poison—console, PC, or mobile—we've got tips for your next hardware upgrade.

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FETISH

Playdate

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. $149 —Michael Calore

PHOTOGRAPHS / CERA HENSLEY

HEAD TO HEAD

Double PLAY

The reigning kings of high-end console gaming are both unleashing new hardware. With 8K support, ray tracing, and blazing performance, you can't go wrong with either. —Jeffrey Van Camp

BEST FOR: POWER SEEKERS

Microsoft Xbox Series X

The new Xbox looks as boring as the Dunder Mifflin building, but its dedication to speed and efficiency would please any executive board. It easily renders 4K games, with support for 8K too. Titles like *Madden NFL 21* load from its 1-terabyte solid-state drive faster than Tyreek Hill on a 50-yard run. It also does real-time ray tracing—positioning and drawing beams of light as they bounce off moving objects—which makes the sunlight glinting off the Ring in *Halo Infinite* seem just shy of reality. On a budget? Get the Series S for $300. It plays the same games but with less brawn, half the storage, only 1440p resolution, and no Blu-ray drive.

$500

BEST FOR: VIBE PLAYERS

Sony PlayStation 5

Just like the Xbox, the PS5 supports 4K gaming at an über-smooth 120 frames per second, has support for 8K TVs (if you have one), and gives games a boost of realism with real-time ray tracing. It bests the Xbox in one notable way: The PS5 streams data from its 825-gigabyte solid-state drive twice as quickly, so installed games appear in an instant, and menus and load screens feel ultra-snappy. Integral to the PS5 experience is Sony's new DualSense controller, which uses a haptic vibration engine to add intensity to games like *Godfall* and *Call of Duty*. You can buy the console with a Blu-ray disc drive, or save $100 and get the digital-only edition.

$500

TECH SUPPORT

Will My Old Stuff Work?

→ **Hardware:** Your aging official Xbox One controllers should work with new Series X games. Sony's DualShock 4 controller is compatible with the PS5 but only to play PS4 games. PlayStation VR headsets and controllers should work for older titles too. Your favorite headphones should work on either new console, though you may need a dongle to connect.

→ **Games:** Microsoft plans to support all Xbox One titles on its new machine, which includes a wide selection of older games. The PS5 will have some backward compatibility for old PlayStation games, but support will be more limited. Remember, if you want to play older games you own on disc, you'll need to pony up for the version with a Blu-ray drive.

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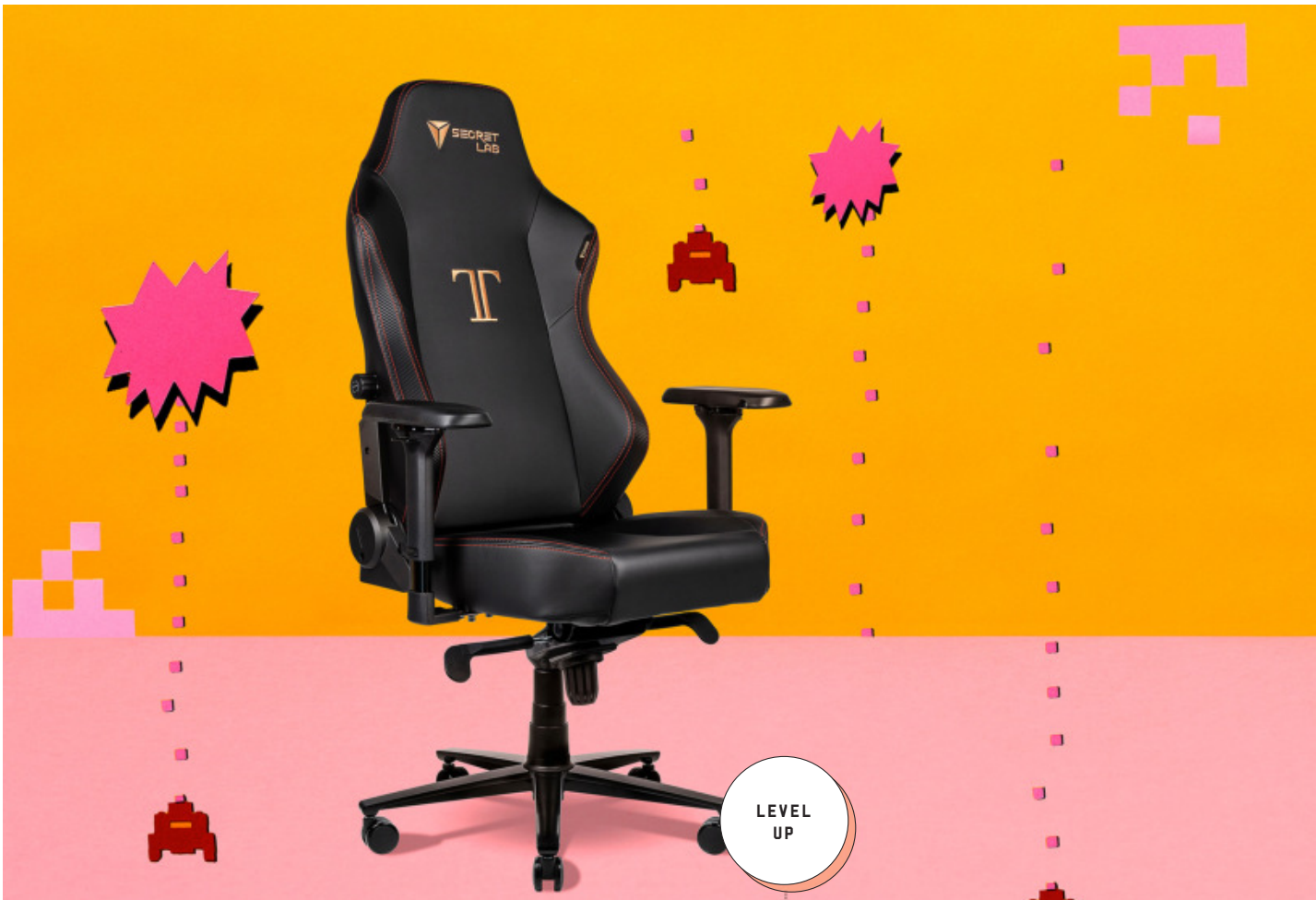


LEVEL UP

Thrones OF GAME

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

ECONOMY

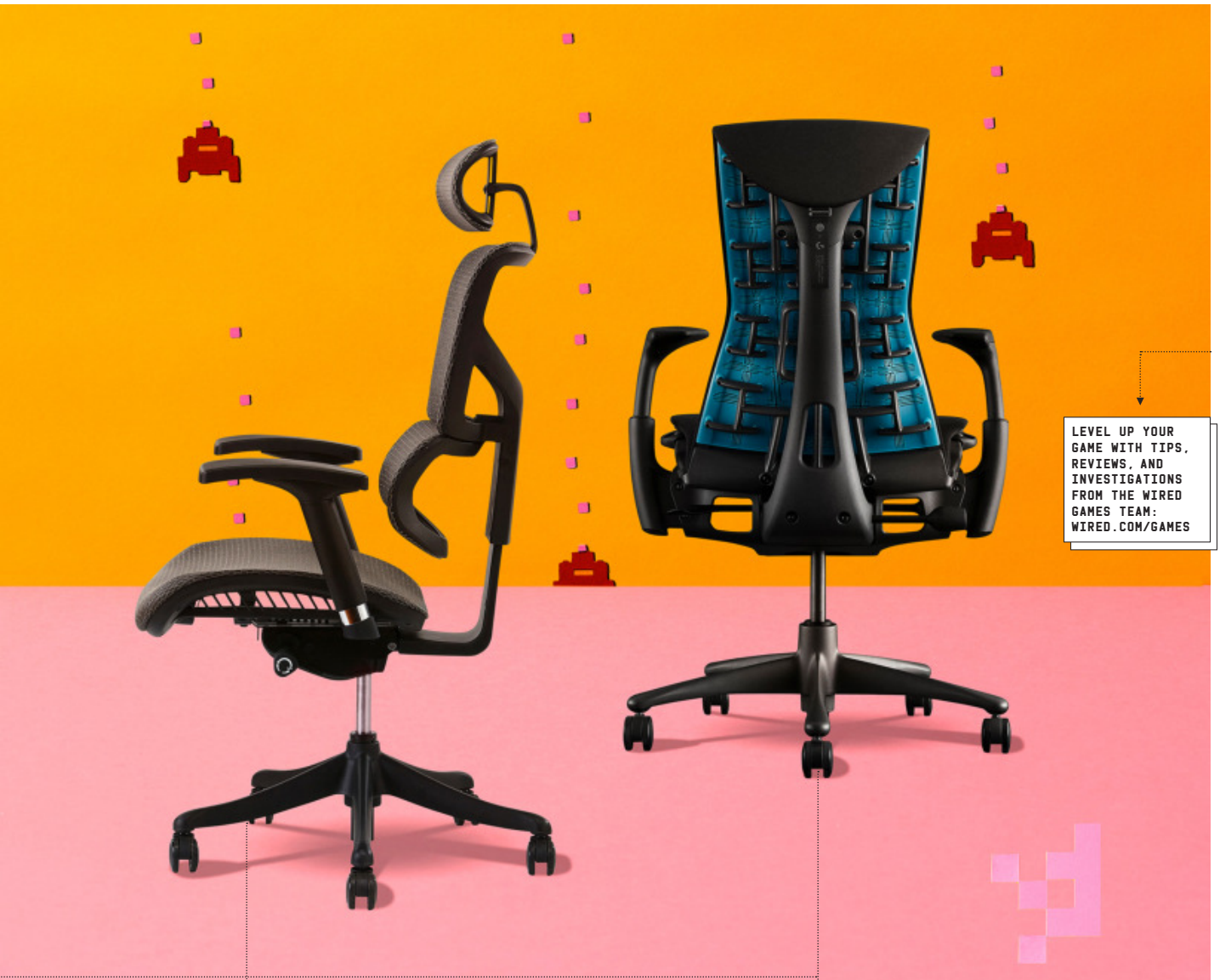
Secretlab Omega

Gaming chairs often mimic the contours you'd find in the seats of Formula 1 race cars, but with more ostentatious designs. Secretlab's Omega is a prime example, stitched Greek lettering and all. The polyurethane leather upholstery doesn't manage heat as well as our pricier picks, but it makes you feel snug as the chair wraps around your frame. The armrests adjust in six directions, and the backrest reclines up to 165 degrees so you can catch a power nap in between *Fortnite* rounds. Secretlab includes free memory foam lumbar and head pillows for extra cushioning when you ... Just. Can't. Stop. Playing.

$359 AND UP

STURDY METAL ARMRESTS

LOCK THE TILT MECHANISM IN ANY POSITION



LEVEL UP YOUR GAME WITH TIPS, REVIEWS, AND INVESTIGATIONS FROM THE WIRED GAMES TEAM: WIRED.COM/GAMES

BUSINESS

X-Chair X2 K-Sport Mgmt Chair

The X-Chair has the adjustability and supportive shape of a gaming chair, minus the frat-house vibe. It cradles the whole of your frame with its firm yet bouncy Aeron-esque mesh. The material is a step up from polyurethane because it vents heat away from you, so even if you're the sole survivor of a raid gone sideways, you'll never feel sweaty. The lumbar support section is mounted on a pivot spring, so it continues to do its job as you shift your weight forward and back. The adjustable headrest pivots too; you can even ease your head back if you need a moment to strategize. I recommend upgrading to the X-Wheel Blade Casters—they're like rollerblade wheels that glide silently on both hardwood and carpet. $800 AND UP

TIGHTLY WOVEN MESH IS SOFT TO THE TOUCH

BACKREST ADJUSTS UP AND DOWN 2.75 INCHES

HEADREST ADJUSTS UP AND DOWN 4 INCHES

FIRST-CLASS

Herman Miller X Logitech G Embody Gaming Chair

The renowned office-furniture giant has teamed up with the computer-peripheral maker Logitech to produce a gaming-optimized version of Herman Miller's popular Embody chair. The curved backrest hugs the contours of your spine, keeping your head upright without a headrest. That design also tricks your back into emulating a standing position, reducing strain on your lumbar region without requiring a separate supporting panel or pillow. It's gorgeous too, with a black and cyan scheme that stands out but isn't as boy-racer as our other picks. It's expensive, but it comes with a 12-year warranty, so you won't need another chair for three more presidential terms. $1,495 AND UP

COOLING COPPER MATERIAL IN THE SEAT FOAM

EXTEND THE SEAT LIP UP TO 3 INCHES

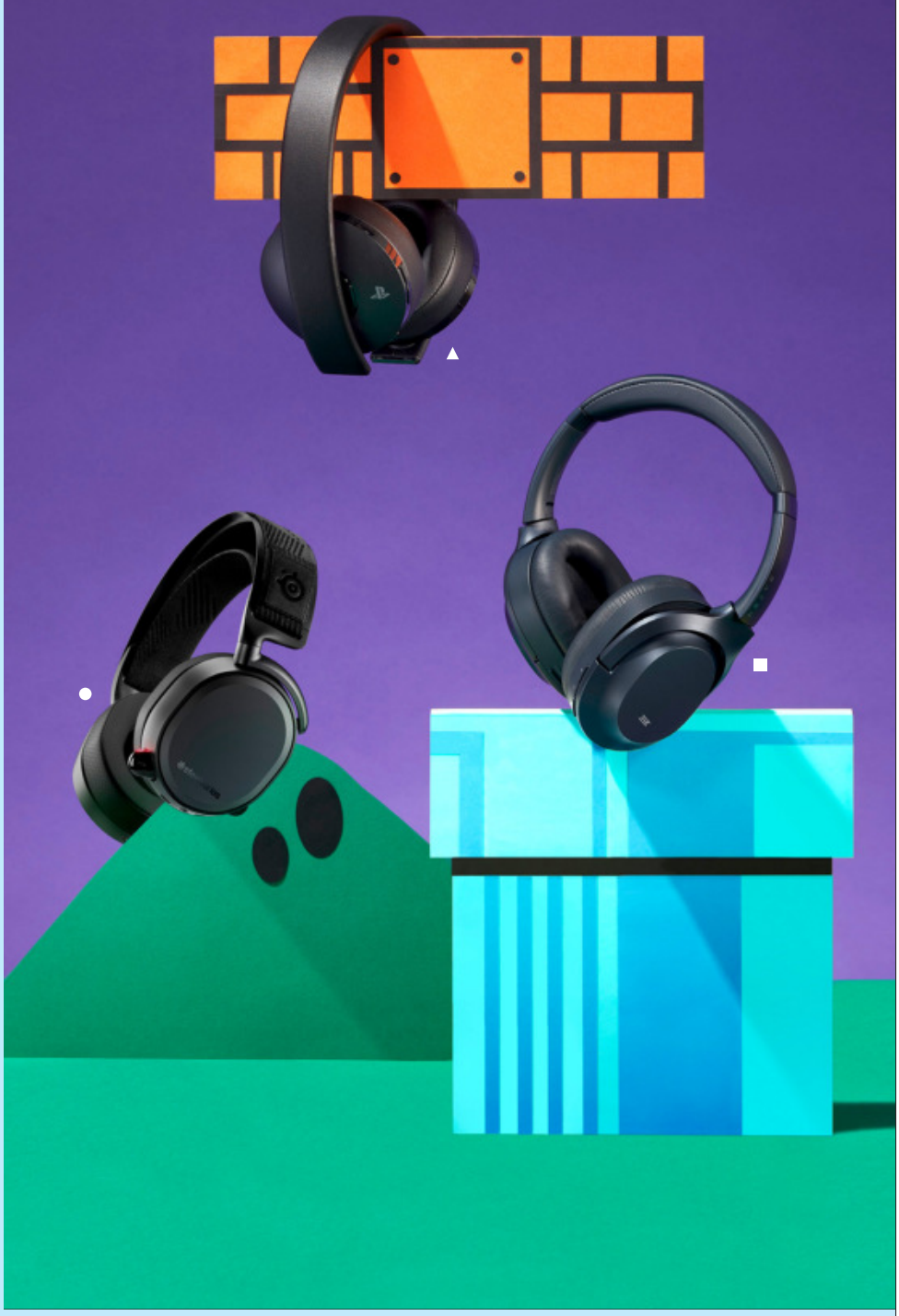
RESHAPE BACKREST TO MATCH YOUR SPINE

CHAIR IS 96 PERCENT RECYCLABLE

TOP 3

Sound UNBOUND

Turn down the volume on the outside world and crank up the exoplanet action with one of our favorite wireless gaming headphones. —Jess Grey



■ BEST OVERALL

Razer Opus

This is our top pick for gamers looking for a set of killer wireless cans, no matter the gaming system. Powerful active noise canceling eliminates distractions and keeps your head in the game, and THX-tuned audio brings an added dose of cinematic drama to whatever you're playing (or listening to—music sounds fantastic as well). Soft leatherette-wrapped memory foam earpads keep them cozy all day. They'll stay alive the whole time too, thanks to a battery that lasts around 25 hours. The mic isn't great, but the upsides make up for it. $200

● BEST FOR PC

SteelSeries Arctis Pro Wireless

The stretchy elastic headband and foam-padded earcups are a signature of the Arctis lineup, and they make for a comfy, snug fit. A built-in boom microphone extends from the left earcup with a tug and makes it easy to coordinate with teammates in PC games like *Overwatch* or *Apex Legends*. You can either plug the headset directly into your computer or use the included transmitter to go wireless. The 4-inch box sits on your desk and has physical controls for adjusting the balance between voice chatter and game sound effects—no more fiddling with onscreen sliders. $330

▲ BEST FOR PS4 AND PS5

Sony PlayStation Gold

If you're spending your hours in quarantine hauling packages across a blasted wasteland in *Death Stranding*, the PlayStation Gold headset would be a capable companion. After the rich, atmospheric audio, my favorite feature is the ability to hold down the mute button to modulate the volume level of my voice in my ears when I talk, keeping me from shouting into the mic during loud games. In addition to being a great value, the headset works with PlayStation 4 and 5, so it's a good choice whether you're upgrading your console or not. $100

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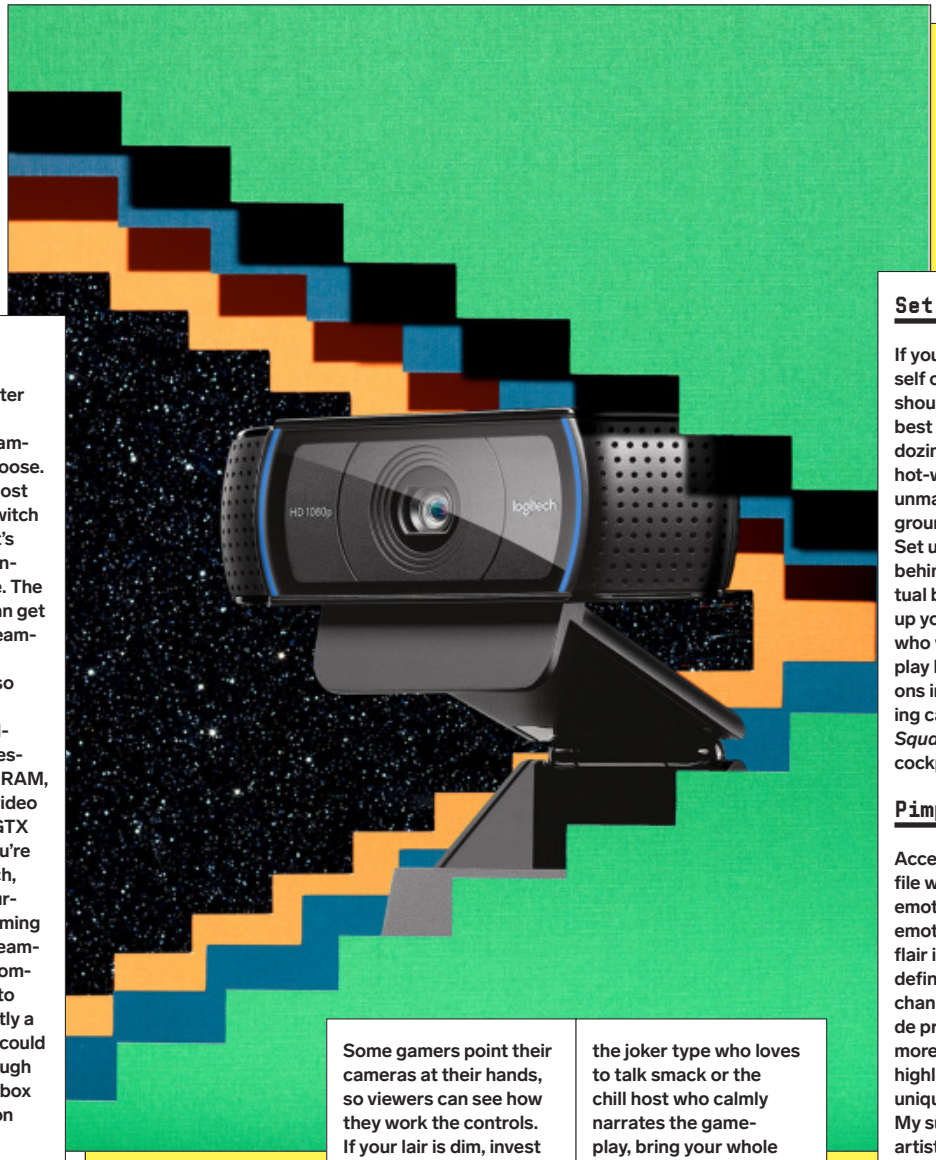
Twitch PERFECT

You don't have to be an esports pro to go live on the streaming platform. Here's how to dial in your setup to play games in front of your adoring fans. —Alan Henry

HOW TO



Prep Your PC

You'll need a computer that can handle the games *and* the streaming software you choose. OBS Studio is the most popular utility for Twitch broadcasting, and it's free for Mac and Windows, so start there. The strain on your PC can get intense if you're streaming high-resolution, high-detail games, so we'd recommend a machine with a modern quad-core processor, at least 8 GB of RAM, and an up-to-date video card like an Nvidia GTX 2060 or newer. If you're starting from scratch, plenty of manufacturers will sell you a gaming PC designed for streaming, with high-end components and specs to spare. If you're strictly a console gamer, you could stream directly through the Twitch app on Xbox or the Share menu on PlayStation.

Sharpen Your Image

You don't *need* a camera to stream games to Twitch, but many streamers like to show their face in the corner of the screen—and viewers appreciate seeing them. Nearly any high-quality webcam will work; I like Logitech's C920 Pro ($80, shown above). Some gamers point their cameras at their hands, so viewers can see how they work the controls. If your lair is dim, invest in some lighting. A good ring light—like Neewer's dimmable 18-incher ($100)—behind your screen pointed directly at your face will produce flattering footage.

Find Your Voice

The best streamers aren't shy; their personalities are a big part of why people watch them. Whether you're the joker type who loves to talk smack or the chill host who calmly narrates the gameplay, bring your whole self to your streams. To help your audience hear you clearly, get a good gaming headset with a built-in microphone. (See page 24 for our top picks.) When you're ready to upgrade to pro-level audio quality, consider mounting a dedicated microphone close to your mouth. A Blue Yeti ($130) is my go-to. It's relatively affordable and easy to set up.

Set Your Scene

If you are showing yourself on the stream, you should really put your best room forward. A dozing housemate, rusty hot-water heater, or unmade bed in the background screams amateur. Set up a green screen behind you and add a virtual background to liven up your stream. After all, who wouldn't want to play Dungeons & Dragons in front of an imposing castle, or *Star Wars: Squadrons* from the cockpit of an X-wing?

Pimp Your Feed

Accessorizing your profile with banners, custom emotes (Twitch-specific emoticons), and other flair is optional, but it definitely gives your channel a certain eau de pro. Also, Twitch is more likely to feature and highlight channels with unique art and designs. My suggestion: Find an artist on Twitter or Instagram that you love, and commission them to create some art for you. Of course, pay them well! You'll get something better than you could produce yourself, and your viewers will appreciate the lewk of your channel. Lastly, set a streaming schedule so fans know when to tune in, and stick to it. Consistency is key—it's almost as important as having fun.

STYLING / PAKAYLA BIEHN

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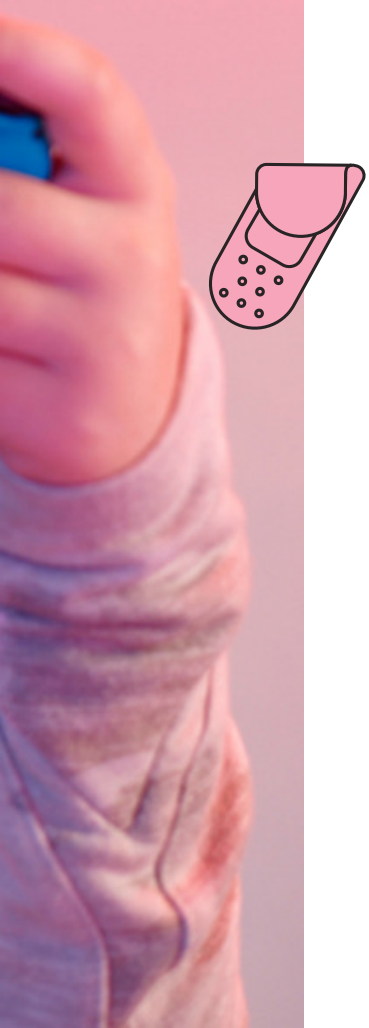
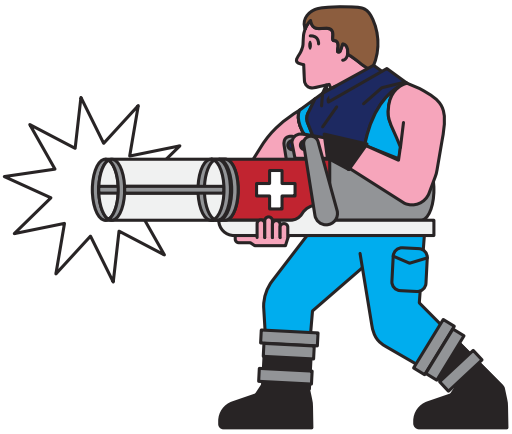
NINTENDO
SWITCH

FORTNITE: DAD INVASION

I started playing the video game to keep tabs on my fifth-grader. What I got was a window into her world—and a joyful lesson in 21st-century parenting.

BY TOM VANDERBILT





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?!"

PHOTOGRAPHS / MERON MENGHISTAB

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.

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

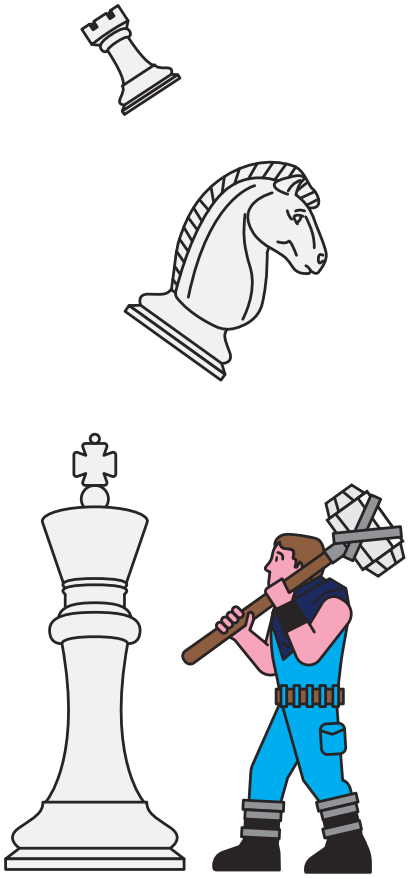


table manners, arbitrate their sibling squabbles, supervise their homework. "But when they're playing *Fortnite*," he writes, "we leave them to their own devices."

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.

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."

ILLUSTRATIONS / SAM WHITNEY

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

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*.

for me too, a temporary departure from endlessly reading about R_0 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.

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THE FIRES NEXT TIME

BY Daniel Duane

LETTERING BY

CYMONE WILDER

42,000-FOOT-TALL PLUMES OF ASH AND SMOKE

143-MPH FIRENADOES

1,500-DEGREE BLASTS OF HEAT

WILDFIRES IN THE WEST ARE BECOMING HELL ON EARTH. THEY ARE ALSO MELTING AWAY OUR UNDERSTANDING OF HOW FIRE WORKS—AND SCIENTISTS ARE RACING TO KEEP UP.

O

ON THE WINDY, HOT DAY OF JULY 26, 2018, AS RECORD 113-degree temperatures baked Redding, California, in the northern Sacramento Valley, Eric Knapp toiled in an air-conditioned government office. After work, he planned to meet his wife and 3-year-old daughter, and some family friends, for dinner. Slender and fair-skinned with a gentle smile, Knapp is a research ecologist for the US Forest Service. He was well aware that, three days earlier, in coastal mountains west of town, a wildfire had started when a trailer got a flat tire and the metal wheel rim scraped the asphalt, sending sparks into dry brush.

Like the vast majority of wildfires, this one, called the Carr Fire, burned initially as a wide but shallow band of flames advancing slowly, like a battalion of infantrymen marching shoulder to shoulder, and left behind charred grass and lightly scorched trees. The Carr Fire was also typical in that it moved according to the dictates of wind, ground slope, and flammable fuels—southeast around a lake, then up a hill, in part because heat rises. Early on that particular morning, the fire had crested a rise above Redding and, with a northwesterly breeze at its back, crawled downhill toward town.

Knapp was finishing up for the day when his friend Talitha Derksen, a wildlife biologist with a daughter close in age to Knapp's own, sent a text saying that her neighborhood might have to be evacuated. One of the agencies tasked with that judgment call, the California Department of Forestry and Fire Protection—aka CalFire—is one of the world's largest and most effective wildland firefighting organizations. CalFire bases evacuation recommendations on predictions of where, and how quickly, a flame front will move next. That day, the fire appeared likely to reach the floor of the Sacramento Valley at a subdivision called Land Park, about a mile northwest of Derksen's house.

Knapp and the others changed plans: They'd meet at Derksen's, order pizza, and help her get ready to leave in case it came to that. Knapp stopped at his house to grab fireproof Nomex clothing. As he headed to Derksen's, he considered dropping by the office again to pick up his hard hat and emergency fire shelter—a sort of fire-resistant pup tent—but decided he was unlikely to need them.

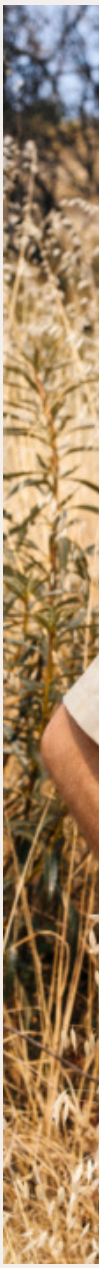
As he turned onto Derksen's street, the flame front was a couple of miles away and hidden by trees, but Knapp could see the smoke rising in a straight and tall plume that turned the sun orange. When he arrived at Derksen's house, she was already packing bags. Knapp, to be sure he knew what they were dealing with, jogged out the nearby Sacramento River Trail for a view. Upriver, on the far bank, he could see red flames torching gray pines and scrubby oaks.

Knapp was shooting photos when he noticed something odd: The wind where he stood blew out of the south, into the fire, but the flame front still moved the other way, driven by that northwesterly at its back. Then he saw something else: Portions of the smoke plume swirled in different directions, as if beginning to rotate.

Knapp knew this could signal a once rare and dangerous phenomenon known as plume-driven fire, in which a fire's own convective column of rising heat becomes hot enough and big enough to redirect wind and weather in ways that can make the fire burn much hotter and, with little warning, spread fast enough to trap people as they flee.

As Knapp ran back down the trail, he passed neighbors walking and recommended they turn around. But even he had no idea how much peril they were all in. At the house, as Derksen left, Knapp and others hosed down the roof and rain gutters and cleared the yard of flammable material like cardboard boxes and lawn furniture. Knapp was the last person there, spraying water on the fence and yard.

Even as Knapp cranked the spigot, the swirling smoke he'd seen was fast accelerating, transforming much of the Carr Fire's enormous lower plume into the biggest fire tornado ever observed, a whirling vortex of flame 17,000 feet tall and rotating 143 mph with the destructive force of an EF-3 tornado, the kind that



PHOTOGRAPH BY
ANDRES GONZALEZ

↑
Eric KNAPP has worked for the US Forest Service in Northern California for 16 years.

Previous spread: Marcus Yam/Los Angeles Times

erases entire towns in Oklahoma.

While Knapp blithely sprayed water around Derksen's house, that fire tornado—hidden from him by all the smoke in the air—leaped across the Sacramento River, touched down in Land Park, snapped high-tension power lines, uprooted trees, wrapped steel pipes around utility poles, and obliterated hundreds of homes, igniting and shredding them and hurling their burning debris up to altitudes at which commercial passenger jets fly.

Not far from where Knapp stood, CalFire captain Shawn Raley was evacuating a woman and her daughter in his truck when all the windows imploded, showering them with shattered glass. Close by, a 37-year-old fire inspector named J. J. Stoke radioed Mayday moments before the tornado lifted his 5,000-pound Ford F-150 off the asphalt and flipped it repeatedly down Buenaventura Boulevard, killing him. Three other CalFire workers were driving bulldozers on that same boulevard when their windows also shattered. One of the 25-ton vehicles got spun around and dropped on top of a truck driven by a retired police officer, who then jumped out and crouched behind the bulldozer's blade while his truck caught fire.

That's about when flaming debris that had been sucked into the Carr Fire's plume of smoke drifted out of the updraft column into what fire meteorologists call the fallout zone, which is exactly what it sounds like. Knapp couldn't possibly have seen that happening; it was tens of thousands of feet above him. Nor could he see the flaming remnants of homes and trees hurtling downward like firebombs, smashing onto roofs and igniting dozens of houses. While looking up into the black whirling darkness overhead, Knapp, who still thought the Carr Fire was advancing with the slow predictability of a classic shallow flame front, watched embers rain down on the bark chips upon which he stood, lighting them afire. At the same moment, with the very ground at his feet aflame, Knapp felt an even more powerful pulse of heat.

That fire tornado, and the blaze that raged for weeks after, ultimately destroyed more than a thousand homes and buildings, killed eight people, and scorched nearly a quarter-million acres. Yet it was neither the biggest California fire of 2018, nor the most destructive, nor even the only one to behave in frighteningly anomalous ways. The Mendocino Complex fire, about 100 miles south of the Carr, which started the day after Knapp lingered unwittingly below a tornado, was also briefly plume-driven and ultimately burned almost 460,000 acres in what was then the largest California wildfire of all time. In early November, the Woolsey Fire near Malibu destroyed 1,643 structures while ripping trees and power-line posts out of the ground with a force suggestive of yet another fire tornado. The infamous Camp Fire, likewise in November, burned 70,000 acres in 24 hours—about a football field a second, for a while—and created an urban firestorm

that destroyed more than 18,000 structures and killed 85 people, mostly in the town of Paradise, generating billions of dollars in insurance claims and bankrupting the state's largest utility, PG&E.

By the time California's 2018 fire season was over, it had burned more than 1.6 million acres to become the most destructive on record—a title it maintained for slightly less than 20 months, when it was overtaken not by the 2020 fire season but by a mere *four weeks* in late summer 2020, during which an estimated 3 million acres burned. But that's not the truly worrisome part. In making sense of Western wildfires, total acres burned are far less important than the increasingly capricious violence of our most extreme blazes. It is as if we've crossed some threshold of climate and fire fuel into an era of uncontrollable conflagrations.

"Not only is the size and severity increasing, but the nature of fire is changing," says David Saah, director of Pyregence, a group of fire-science labs and researchers collaborating on the problem. Still more concerning, given the trend toward fires dramatically more catastrophic than anything we've yet seen: The physics of large-scale wildfires remain so poorly understood that fire-modeling software is often effectively powerless to predict where they will next occur, much less how they will unfold once they do. If there is any good news, it is that, as Saah puts it, "the science for a lot of this stuff is under way."

A fire smolders in August in HEALDSBURG, California, part of a complex of blazes that burned nearly 400,000 acres in the area. ↓

PHOTOGRAPH BY IAN BATES

ABOUT A YEAR AFTER THE CARR FIRE, ON A BRIGHT June day in 2019, Brandon Collins, a big-jawed fire-science researcher at the University of California, drove a white pickup down a cedar-scented mountain road into the Blodgett Experimental Forest, a 4,000-acre university property near Lake Tahoe where he studies the effect of forest management practices on wildfire risk. All of those practices begin with the inescapable fact that California is flammable. It is hard for us moderns to accept—conditioned, as we are, by Smokey Bear—but fire is every bit as natural and inevitable in the American West as flooding in the Mississippi River Basin and hurricanes in Florida. Fire is not only guaranteed by climate and ecology; it is vital to the health of many ecosystems. The 20th century, in fact, during which large wildfires were far less common in the West than they are today, should properly be seen as the unnatural outlier. Prior to that, and especially before Anglo-American conquest, wildfire burned an estimated 6 million to 13 million acres each year in California, according to one study, far more than even the current record-setting season.

Most of those frequent fires past were different, though, in a critical way: Burning with a shallow flame front, like the early stages of the Carr Fire, they ripped through grass, pine duff, and fallen branches—so-called surface fuels—on the forest floor instead of torching whole trees and leaping crown-to-crown as our biggest fires do today. Those regular surface fires generally kept overall fuel loads so low that each subsequent fire could only do the same—scorch out

the understory without harming mature trees. Over time, this sustained forests of old-growth conifers, oak, and madrone widely spaced on carpets of grass and shrubs, which in turn made terrific forage for deer. Indigenous people lit wildfires all over the American West for millennia to manage land for this outcome—with such success that, in the late 19th century, Anglo-American ranchers and even lumbermen adopted the practice.

Collins, to show me what that looked like, stopped the truck at a section of the Blodgett Forest that had been managed for 16 years in the old way, with regular fire. We have all experienced varied responses to landscape, from apprehension at a bleak desert or dark cave to calm in a tropical cove. I can report that a forest, when allowed to burn the way it evolved to burn, feels wonderful, a sun-dappled gallery of enormous sugar pine, Douglas fir, and black oak shading meadow-like ground at once sheltered from weather but open enough to move freely.

The Forest Service, which currently controls about 20 million acres of California, put a well-meaning end to this kind of land management almost from the founding of the agency in 1905. Seeing forest in near-term dollar signs—lumber, watershed, game—and dismissing the idea that wildfire played any positive ecological role, the Forest Service learned to snuff every blaze in every forest as quickly as possible. The wrongheadedness of this approach became obvious to the agency itself by the 1940s, when its researchers began to catch on to the fact that the longer a forest goes without fire, the more fuel will pile up and the worse the blaze will be.

That insight made it into official Forest Service policy by the 1970s, encouraging regional employees to use deliberate controlled burns as a means of keeping fuel loads low. By that point, unfortunately, lumber and paper companies had come around to the burning-is-bad position, as had civilians who disliked smoky air, enjoyed recreation in national forests, and thought of fire in purely destructive terms. Combined with issues of legal liability—who pays for damage to private property caused by prescribed burns on public land?—it all made Forest Service officials understandably reluctant to follow through with any particular prescribed burn. Private property owners, who control California's other 13 million acres of forest, were (and still are) even less motivated to light their own land ablaze, much less to tolerate a neighbor doing so. CalFire, meanwhile, tasked with responding to every fire on 31 million acres of nonfederal land inside state borders, has, compared to the Forest Service, almost no fuel-management authority. CalFire's straightforward mandate, for which it spends upward of $2 billion a year and operates more than 700 fire engines and 75 aircraft, is to extinguish every blaze, fast—a job it does extraordinarily well on about 6,400 wildland fires annually.

CALIFORNIA'S 2018 FIRE SEASON BECAME THE MOST DESTRUCTIVE ON RECORD—A TITLE IT MAINTAINED FOR SLIGHTLY LESS THAN 20 MONTHS, WHEN IT WAS OVERTAKEN NOT BY THE 2020 FIRE SEASON BUT BY A MERE *FOUR WEEKS* IN LATE SUMMER 2020.

CalFire chief Brian Estes, who commands firefighting operations for just three of California's 58 counties, says, "We're running 400 to 500 fires a year. In the heat of summer, five or six a day—and most you'll never see. Anytime I have a 911 dispatch to a vegetation fire"—a grass fire, say, on somebody's lawn—"you're going to get seven engines, a battalion chief, two bulldozers, two air tankers, an air attack, and two hand crews. They're going to roll out the barn. But if you do that for a hundred years, and you don't allow people to do prescribed fire, the fuel just gets more and more dense."

Collins showed me a graphic example at our next stop, a patch of forest that hadn't been logged or burned in more than 100 years. Crowded tight with young trees among the big, old ones, it was piled deep not only with surface fuels like pine duff and leaves but so-called ladder fuels, the big fallen branches and shrubs that help surface fire leap up into the crowns and spread more quickly up high. That patch of forest also felt intuitively awful: dark, shadowy, maze-like, and cavernous, the nightmare forest of an old fairy tale.

Flammable as it looked, even forests mismanaged like that patch burned until recently in the historical way, at low severity along the forest floor. As a result, the entire field of wildfire science—including every modeling tool with which firefighters make life-or-death decisions and society structures itself in fire-prone areas—is based on that kind of fire behavior. The core mathematics of this science date to the early 1970s, when a Forest Service researcher named Richard Rothermel used small laboratory fires to produce equations expressing the relationship between wind speed, ground slope, and how fast a fire spreads. Rothermel knew his approach worked properly only for wildfire in light surface fuel like that in his lab—and failed to capture what happened when blazes got into treetops and jumped crown-to-crown. But

DANIEL DUANE *(@Danielduane) is the author of six books. He's at work on the next, about the Sierra Nevada. His last story for* WIRED, *about San Francisco's response to the pandemic, was in issue 28.09.*

these so-called Rothermel spread equations were applicable to so many wildfires that the Forest Service quickly developed paper-and-pencil ways for firefighters to plug in numbers for wind and slope angle and make reasonable guesses about how fast and in which direction a fire might spread—in a single heading, on a straight line. Eventually that modeling framework was run on cumbersome supercomputers, then on handheld calculators. In the early 1990s, PC-based software finally allowed firefighters to predict fire spread in two dimensions on a map.

That software, created by a Forest Service scientist named Mark Finney, was severely limited by a lack of mapping and fire-fuel data. It didn't do much good, in other words, if you couldn't load it with topographical maps and vegetation data for the fire you needed to fight. Over time, though, other researchers compiled these data sets on their own and shared them with one another until, in 2009, they were available for the entire US. Finney's software now does such a good job predicting fire spread in light ground fuels that it has become the industry standard, used thousands of times each year by firefighters nationwide. And versions that allow simulation of possible future fires are also used by land managers eager to prevent them.

As early as 1994, though, Finney could see that the contemporary modeling framework had more serious limitations. In central Washington state that year, a large and unusual blaze called the Tyee Creek Fire behaved in ways utterly outside the bounds of Finney's model. Instead of burning with a shallow flame front that followed wind and terrain, Finney says, "the fire basically spread in three directions, all about the same rate, every day in the afternoon"—as if the wind had somehow blown 360 degrees outward from the center of the fire.

The Tyee Creek Fire also kept its huge central area ablaze for days on end, a somewhat speculative phenomenon known as mass fire. "It would just kind of bulge out and put up a giant plume, and then just expand, expand, expand, every day," Finney says. "I remember thinking, 'Wow, this is so much beyond anything that we are able to model now, it'd be silly to even try.'"

Finney realized that no amount of modification to the Rothermel spread equations could ever make them account for a fire like Tyee Creek. Not only had they been developed around small lab fires, but 20 years' experience using them had focused on shallow flame fronts moving quickly through light fuel, with no accounting for slow-burning heavy fuels ignited along the way, much less feedback between ground fire and the immediate atmosphere. Put another way, as Finney recalls saying to a colleague at the time, "the truth is, we have no idea how this stuff really works."

To chip away at the problem, starting in the early 2000s, Finney went back to first principles, assuming nothing. He lit new experimental fires at a research station in Missoula, Montana, and revisited basic questions like whether wildfire spreads through simple heat radiation—conventional wisdom at the time—or through direct contact with flames.

"It's a very hard problem," Finney says, "because if you've ever sat around a campfire and watched it, the thing that keeps you transfixed is that the flames are always dancing around. How do you characterize such a nonsteady phenomenon in order to model it?" Light ground fuels, Finney learned, caught fire strictly through convection, and typically consumed themselves in 30 seconds or less at about 1,500 degrees. Heavy fuel like logs and fallen trees would smolder or glow with embers for hours or days, releasing heat all that time. They tended to burst into flaming combustion, quickly releasing their stored energy, under sustained wind. Like when you blow on a campfire.

While conducting that basic research, Finney happened across a book titled *Fire and the Air War*, about Allied bombing campaigns during World War II. He learned that British and American commanders, while pressing the war against the Germans and Japanese, had discovered that it was easier to burn cities down than to blow them up. The trick lay in first knocking the buildings over, then lighting them on fire. The Royal Air Force did just that to the German city of Dresden in 1945. Military intelligence officers studied recon photographs to identify older districts built largely of wood, then saturation-bombed them with high explosives. A second wave of aircraft hit those same districts with more than 2 million pounds of magnesium-thermite incendiary bombs. This had the desired effect of lighting the city afire, but it also triggered something unexpected. Shortly after all those buildings got to burning—30 minutes after, as it happened—a single giant plume of heat and smoke rose over Dresden, and took on a shape similar to a giant thunderstorm.

The Dresden firestorm famously produced hurricane-force winds powerful enough to uproot giant trees and snap them in half, suck up roof gables and furniture, and send countless humans flying like fallen leaves into the whirling fire tornado. Before it was done, that firestorm wholly incinerated several square miles of city.

THE PROJECT NOT ONLY PRODUCED SMALL TORNADOES; IT CONFIRMED THAT MASS FIRES OF WILDLAND FUEL BURN IN WAYS REMARKABLY SIMILAR TO THE FIRESTORMS OF WORLD WAR II.

→
Knapp took this photo of the CARR Fire in Redding as it began to twist itself into what would become one of the strongest fire tornadoes on record.

Courtesy of Eric Knapp (www.ericknappphoto.com)

Finney also unearthed a stack of obscure research reports, published during the Cold War, that analyzed the Dresden firestorm and a similar one above Hiroshima after the detonation of the atomic bomb (yet again, roughly 30 minutes after). One of these reports, commissioned by the Defense Nuclear Agency, compared bombing-induced firestorms with those generated by natural disasters, like during a 1923 Tokyo earthquake when a flaming cyclone lifted floating boats up off a river—and the river water itself nearly 50 feet into the air—before hitting a military depot in which 40,000 people had taken refuge, killing nearly all of them.

Yet another of these reports, titled *Mass Fire and Fire Behavior* and published by the Forest Service in 1964, looked at what might happen if a national forest got hit by a nuclear weapon. Detonation of a multimegaton warhead, the authors calculated, could simultaneously ignite as much as 1,200 square miles and cause a firestorm that ultimately burned out 10,000 square miles. The researchers involved were well aware that naturally occurring wildfires could, at least theoretically, cause the same level of damage. This was particularly frightening in light of the population boom in fire-prone wildlands out West. To better understand the risk, the Forest Service conducted a series of gigantic live tests in which, on federal land in Northern California, they laid out street grids similar to those in both urban and suburban neighborhoods. Each home site in these neighborhoods was piled with wildland fuel—juniper and pinyon trees, in one case—and set ablaze. This not only produced small tornadoes; it also confirmed that mass fires of wildland fuel burn in ways remarkably similar to the firestorms of World War II.

As he read all this stuff, Finney told me, something clicked. "I realized, 'Oh, my gosh, we're creating the conditions for mass fires,'" he says. "These fires aren't just big because of, say, climate change or some accident. They're big because we have a landscape full of long-burning heavy fuels, just like cities."

THE KEY INGREDIENT IN A FIRESTORM, WHETHER in a wartime bombing campaign, a plume-driven fire like the Carr, or a wind-driven fire like the one that destroyed Paradise, appears to be the simultaneous burning of many small fires in a combination of light and heavy fuels over a large area with light ambient wind. As that broad area continues to burn with glowing and smoldering embers over many hours, the separate convective columns of all those many little fires begin to join into a single, giant plume. As the hot air in that plume rises, something has to replace the air at its base—more air, that is, sucked in from all directions. This can create a 360-degree field of wind howling directly into the blaze with the same effect as vents on a forge, oxygenating the fire and pushing temperatures high enough to flip even heavy fuels (giant construction timbers, mature trees) into full-blown flaming combustion. Those heavy fuels then pump still more heat into the convective column, creating a feedback loop: The column rises ever faster and sucks in more wind, as if the fire has found a way to stoke itself.

That seems to be what happened during the Carr Fire. According to Neil Lareau, an atmospheric physicist at the University of Nevada, a weather balloon released on the morning of July 26 detected a lid of warm air, known as an inversion layer, several thousand feet above the Sacramento Valley.

While Knapp settled into work at his office, this inversion layer trapped the Carr Fire's heat plume near the ground. But as the day wore on, the heat plume forced its way to higher altitudes, steadily cooling.

About the time Knapp jogged out to the river to get a view of the fire, this plume reached 18,000 feet, high enough for water vapor, carried aloft, to condense into liquid cloud droplets, spawning a pyrocumulonimbus, or fire-generated rotating thundercloud. That process of condensing hot vapor or steam into liquid releases heat; you can think of it as the inverse of the cooling effect caused by evaporation, like we've all felt emerging from a swimming pool into wind. In the case of the fire plume, this condensation of water vapor into liquid cloud droplets delivers new heat to the plume itself, causing it to rise even faster and higher.

Back down at ground level, meanwhile, the rising plume pulled in new air by sucking at those two preexisting wind fields, the ones that Knapp noticed blowing into the fire, out of the south and northwest, respectively. Blowing toward one another at an askew angle and intersecting at the flame front, those two winds wrapped around each other and drew in flame to create a whirling vortex of fire. The higher the plume rose, the faster the vortex spun. Lareau likened it to a figure skater: "The skater starts a slow rotation with their arms out wide, and they draw their arms inward and maybe put them up over their head, and they suddenly start rotating very, very quickly."

As the fire tornado splintered homes and launched flaming debris into the sky over Knapp, it set up one of the most dangerous of plume-driven phenomena—the raining of firebrands. A classic surface-driven wildfire ignites only the immediate area crossed by the fire's own shallow flame front; falling firebrands, by contrast, allow plume-driven fires to propagate miles from the core burn, as if launching incendiary bombs to ignite entirely new mass fires like the one that burst up around Knapp.

Fires of this type can be nearly impossible to suppress, because they can move too quickly for firefighters to get out of harm's way and burn too hot to extinguish, but also because so many people in the West have settled in places where these fires are increasingly occurring—the wildland urban interface, or WUI (pronounced woo-ee), exurban sprawl in California's many mountain ranges.

"We have crammed millions and millions of people and roads and homes and yards into this highly volatile Mediterranean climate," says CalFire chief Estes, who grew up in the town of Paradise. Worse, Estes says, enormous numbers of these people have gravitated to quaint old Gold Rush towns that, like Paradise, happen to sit atop river and creek drainages where wildfire fuel accumulates and winds tend to blow especially hard.

"If you roll a map of California out," Estes says, "I can give you 150 communities that have exactly the same combination of factors as Paradise."

In every one of those communities, according to Estes, "when we have disastrous fires, we have to get those people out, and that makes it so much more complex, I can't even tell you." For at least the first 16 hours of the Camp Fire in his hometown, Estes adds, firefighters were mostly just pulling residents out of homes and using bulldozers to clear roads blocked with cars abandoned by drivers who'd gotten trapped in traffic and fled on foot. During that whole period, Estes says, "there was not a single fire engine fighting that fire. They were all trying to rescue people."

IV

THE FINAL ELEPHANT IN THE ROOM, OF COURSE, is climate change—and the likelihood that it is already pushing even our current nightmares toward holocausts beyond imagining. Knapp, Finney, Collins, and several other researchers (most of whom are now involved in Pyregence, the fire-science consortium) have already identified an especially frightening way in which that might happen. Current climate-change patterns suggest we are headed for ever-less winter snowfall in the West, with hotter summers, ever-worsening droughts, and ever-more acute spells of extreme fire weather—long periods of dry heat that bake moisture out of grass and trees, combined with winds ferocious enough to whip even a small spark into a conflagration. The collapse of commercial logging, meanwhile, mostly due to environmental regulation, has combined with our collective intolerance for prescribed burns (nobody likes smoky air) to let forests grow unnaturally dense with young trees. More trees means more roots competing for the same underground water. During the drought of 2011 to 2016 in California, that competition, with help from bark beetles, killed a breathtaking 150 million trees in the largest mass die-off ever recorded in the United States.

Nobody knows how all those dead trees will affect wildfire. Initial research suggested that tree mortality would moderately increase risk of severe fire for several years, as dry needles helped fire spread crown-to-crown instead of just along the forest floor. Once all those pine needles fell, which appears to be happening now, risk of severe fire was expected to decrease for a while. The scariest part was thought to lie at least 10 or 15 years in the future, when all 150 million dead trees—an estimated 95 million bone-dry tons of firewood—were expected to fall on top of an already deep kindling pile of fine conifer duff heaped with small twigs and ever larger tree branches. At that point, we would have collectively prepared the entire western slope of the Sierra Nevada, through more than a century's work with taxpayer dollars ostensibly aimed at preserving wilderness and the economic value of wood, to incinerate in the greatest firestorm ever seen by human beings.

"IF YOU ROLL A MAP OF CALIFORNIA OUT," ESTES SAID, "I CAN GIVE YOU 150 COMMUNITIES THAT HAVE EXACTLY THE SAME COMBINATION OF FACTORS AS PARADISE."

Neither this horrifying long-term risk nor the overall trend toward increasingly destructive fires has been lost on the California state government, which is how Pyregence came into being. Coordinated by Saah from the University of San Francisco, Pyregence has set out to create an entirely new software ecosystem, including for mass fires and plume-driven megafires. The idea is partly to help firefighters respond and partly to help the rest of us make smart decisions about urban planning and fuel treatments like prescribed burns. The overall challenge is too big and urgent for any single lab, so Pyregence has divided it up into a sort of distributed Manhattan Project of collaborative fire-modeling research.

Finney has joined a Pyregence working group studying the behavior of large woody fuels piled deep, like in our National Forests out West. Field researchers have gone out and taken detailed measurements of wildfire fuel beds, while Finney, back in Montana, has commissioned the construction of a new burn chamber the size of a grain silo. Once complete, that chamber will let Finney replicate wildfire fuel beds by piling logs and other material as much as a few feet deep. He will then ignite them, hit them with wind and moisture, and quantify their burn rate and energy-release rate—what he calls the "heat-engine part of mass fires."

"Really what we're looking for," Finney says, "is how these things transition to flaming. Instead of just smoldering on the forest floor, how do they become actively involved in these large fires?"

If all goes well, Finney's working group will eventually code three-dimensional digital simulations of various wildland fuel beds—digital cubes, in essence, not unlike *Minecraft* voxels—that can be stacked and arranged in infinite variation across landscapes generated by GIS mapping data.

Yet another group, led by Janice Coen of the National Center for Atmospheric Research, has split California into eight fire regions and studied severe past blazes in each. By analyzing how and when those blazes spread, Coen's team has identified days when fire grew at exceptional speeds, then combed weather-station and satellite data for two related sets of data: local weather conditions like hot local winds that are consistently associated with extreme fire growth; and large-scale weather patterns 500 miles wide and more that are consistently associated with those local conditions. The hope is to create a meteorological early warning system for extreme fire weather in every region. Coen has already run proof-of-concept testing with an experimental model called Coupled Atmosphere Wildland Fire Environment, or CAWFE (pronounced

coffee). An atmospheric weather simulator coupled with fire-spread algorithms, CAWFE has allowed Coen to plug in the precise local and large-scale weather that occurred around past events like, say, the Carr Fire. She has even triggered fire ignition at the exact point where the Carr Fire began and watched the fire tornado spin up on its own. The hope, according to Saah, is someday to supplement the fire-spread component of CAWFE with a fuel model like the one Finney hopes to produce, accounting for the enormous additional heat contributed by long-burning heavy fuels under open flaming combustion. By then feeding in live real-time weather data, Pyregence should someday be able to produce, for the first time, accurate near-term predictions of extreme plume-driven mass fire all over California.

At UC Merced, meanwhile, a climate researcher named LeRoy Westerling leads a Pyregence group tackling the crucial long-term problem of how to prevent apocalyptic fires in the future. This becomes especially pressing, says Westerling, when you consider that every future fire season in the American West is likely to be worse than the last, on average. "How do you adapt to that? It's not just California," he says. "It would be the whole West Coast and the Rockies and parts of Canada and Alaska all going off on a regular basis. So just the magnitude of managing fires over that geographical scale simultaneously is staggering, right down to the psychological impact of living with that." By way of solution, Westerling's group is even now developing what Saah calls "statistical machine learning monstrosities"—big simulation engines that will allow researchers to run various long-range climate scenarios in which ground fuel, regular fire, and even land-management practices like prescribed burns interact with each other. In an ideal world, this will let policymakers ask questions like, If we get stuck with doomsday-level climate change but do lots of smart prescribed burning while allowing only fire-hardened home construction in the mountains, what might the firestorms of 50 years from now look like?

PHOTOGRAPHS BY
IAN BATES

←
The aftermath of a blaze started by a dry thunderstorm in August, near NAPA, California.

V

CALIFORNIA'S CATASTROPHIC 2020 WILDFIRE season kicked off midway through the hottest August on record with a dry thunderstorm in which 12,000 lighting strikes ignited hundreds of fires over the course of a week. Three were among the state's largest of all time by early September, when hard northeasterly winds blew them into an entirely new realm of superlatives. Near the Blodgett Forest, those northeasterlies pushed the relatively small Bear Fire into a giant pyrocumulonimbus storm; in the space of 24 hours, it ripped across 230,000 acres, one of the largest single-day fire spreads ever observed, destroying hundreds of structures and killing 15 people. Across the Sacramento Valley, those same winds fused other wildfires into the gargantuan August Complex, the state's all-time biggest fire by nearly a factor of two, at more than 850,000 acres.

Still more astonishing is the Creek Fire, which ignited on September 4 in an area with a lot of dead trees in the southern Sierra Nevada. By the very next day, a huge pyrocumulonimbus formed and helped burn 115,000 acres through so many popular lakes and cabins and campgrounds—somehow tearing gigantic live trees out of the ground and hurling them across roads—that more than 360 people and 16 dogs got trapped on the shores of the Mammoth Pool Reservoir. That, in turn, forced the California National Guard to rescue hundreds of people overnight in military helicopters, something that had never been done before.

"That's a weird beast," says Saah of the Creek Fire. "In our research group, there's so much conversation around that specific fire, because it's doing things that are just out of the norm." Among the most peculiar was the fact that energy release across the Creek Fire's vast center remained just as hot and high as along its periphery. This classic hallmark of mass fire may well mean that the scary part—the future in which 150 million dead trees go up in flames—is already upon us. "If you look at satellite images of the Creek Fire," says Saah, "it looks like a nuclear bomb went off. It's crazy—just its behavior and its intensity and how fast it grew."

Lareau, the atmospheric physicist, was dumbfounded too. "I'm just kind of at a loss for words," he says. "Having looked at plenty of big fires that produced big pyrocumulonimbus clouds in the Sierra, I mean, this thing just blows everything out of the water. Instead of the cloud going to 40,000 feet, it's going to more than 50,000 feet. It's producing long-lived tornado-strain vortices for periods of hours."

Those vortices knocked huge live trees to the ground in circular patterns, some inside a campground and others onto roads, blocking escape routes. The fire's plume also generated lightning on and off for 12 hours, and another unusual behavior known as plume collapse in which all that hot rising air, upon cooling up high, suddenly reverses direction into a powerful downdraft toward the middle of the blaze, forcing fire outward in all directions, igniting huge new swaths of land.

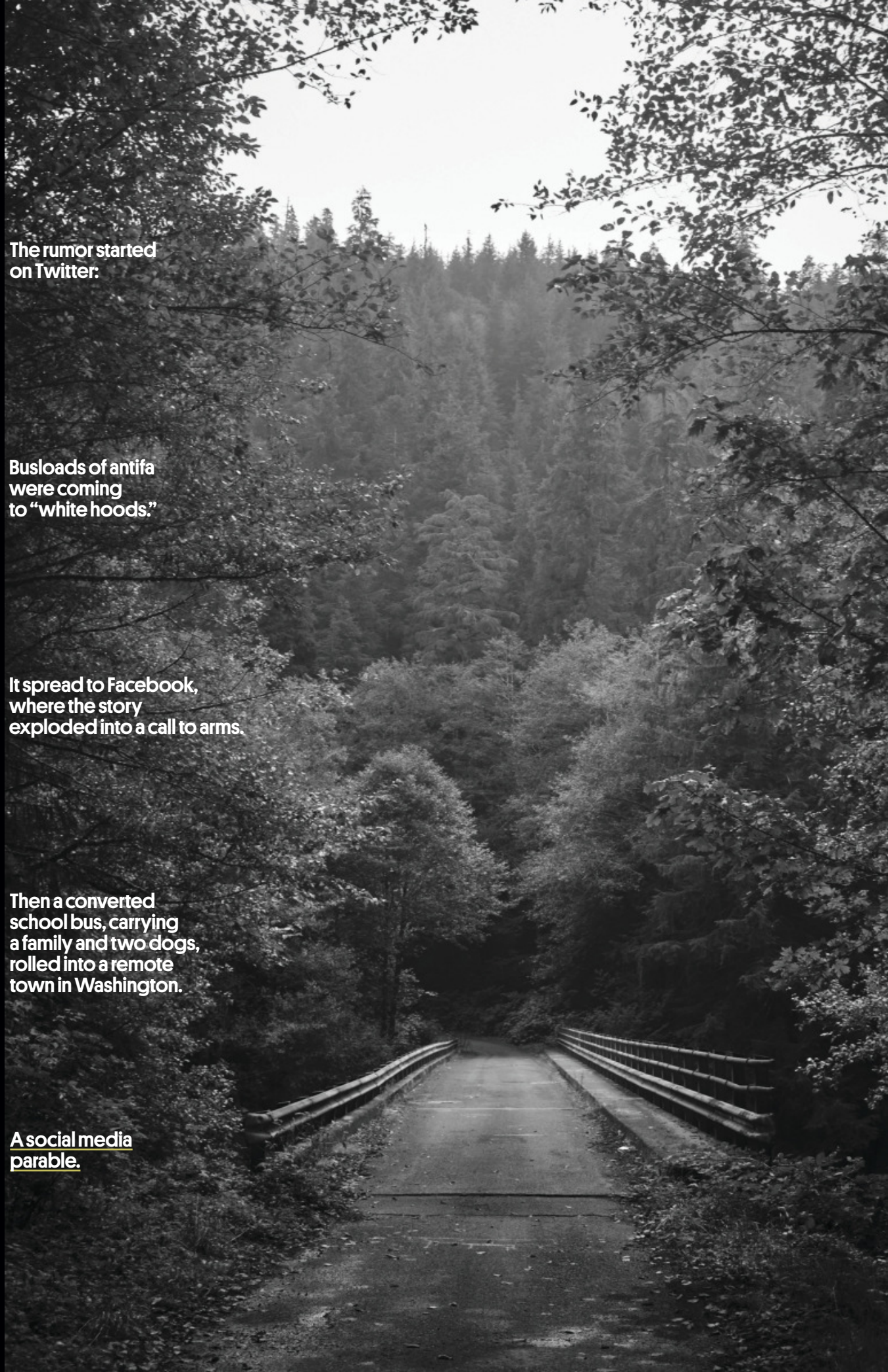
"It stands out to me as potentially one of the most intense firestorms we've ever seen," Lareau says. "I think it's in many ways a way more intense fire than the Carr Fire was."

VI

FOR KNAPP, OF COURSE, NO FIRE IS EVER LIKELY to be more intense than the Carr. Especially that moment when he found himself in the middle of a blazing patch of bark chips while burning firebrands ignited homes all around. At that point, Knapp told me recently, "I just had to recognize I didn't have all my safety equipment, I wasn't attached to any firefighting resource"—there was nobody to call for help—"and I had a family on the other side of town."

Heading for his car, Knapp drove right into a traffic jam of terrified neighbors. Slowly, with that tornado roaring overhead and their own homes afire all around, they inched their way down the road to safety. The next day, Knapp drove back to look at Derksen's house. More than 60 homes in her neighborhood had been destroyed overnight, including the one right next door. A single ember made it through a ground-level screen vent at Derksen's place, slowly igniting a floor board. It appeared that, before this fire could burn out of control, passing firefighters had snuffed it out.

The scene was "intense and sad," as Knapp put it, not least because he and everyone else—unable to see the forest for the trees—had been so unaware of how much danger they were in.



The rumor started on Twitter:

Busloads of antifa were coming to "white hoods."

It spread to Facebook, where the story exploded into a call to arms.

Then a converted school bus, carrying a family and two dogs, rolled into a remote town in Washington.

A social media parable.

They Look Sketchy as Shit

by Lauren Smiley

Photographs by Ian Allen

In a calmer spring—when facts weren't so slippery, social media so noxious, the country so ready to combust—what happened in Forks, Washington, on June 3 might have been a perfect plot for a farce. A giant white school bus known as Big Bertha puttered into a two-stoplight town far north on the Olympic Peninsula, in desperate need of a new battery, on the very day the town was on alert for a different bus, one full of violent antifa activists ready to riot.

But this was not a calmer spring. A week had passed since a Black man named George Floyd died while a white Minneapolis police officer knelt on his neck. People who had been trapped at home during a tense pandemic spilled into the streets, first in Minneapolis and then in other cities and even tiny towns. They marched and carried signs and chanted that Black Lives Matter. A much smaller number looted liquor stores and burned police precincts. The president tweeted threats—"when the looting starts, the shooting starts"—and smeared all protesters, including millions of peaceful Americans, as the Radical Left, "thugs," or, most menacingly, antifa, an ideology ascribed to a diffuse group of antifascists who sometimes stoke chaos and aren't opposed to fighting the far right with violence. Twitter, Facebook, and Nextdoor crackled with claims that antifa was coming to suburbs and rural towns. They were coming on buses, on planes, wearing black, coming, always, from somewhere *else*.

On the night of May 31, a Sunday, a new Twitter account styled @Antifa_Us issued a call to arms: "Tonight's the night, Comrades. Tonight we say 'Fuck The City' and we move into the residential areas... the white hoods.... and we take what's ours ...#BlacklivesMaters #FuckAmerica." A brown hand emoji raised a middle finger. Donald Trump Jr. posted it to his Instagram. "Absolutely insane," he remarked.

If the tweet sounded just a little on the nose, like shark chum tossed to a certain kind of white person, it was. The next day, Twitter deleted @Antifa_Us; it was not, as advertised, an antifa account, but rather one secretly run by a US-based white-supremacist group called Identity Evropa, one of the organizers of the infamous 2017 neo-Nazi rally in Charlottesville, Virginia.

Seth Larson didn't notice Twitter's fact check. The 45-year-old manager of Freds Guns, a firearms store 70 miles east of Forks in the town of Sequim, had already reposted the tweet on his Facebook. A few days later, when he saw a notice for a Black Lives Matter demonstration planned in his hometown, he worried that antifa rioters would come. Someone had to be on the alert.

On the day of the march, June 3, just hours before Big Bertha would roll into Forks in need of a battery, Larson cued up his Facebook Live. He walked by shops downtown, narrating the scene of people striding down the sidewalk carrying Black Lives Matter signs. "Sequim just got a busload of people ... They're not breaking windows yet." He also claimed to see out-of-towner antifa, 25 to 30 of them, pointing to people with skateboards and training his phone's camera on an occasional bicyclist whizzing by. "Head to Sequim, boys!" he told his followers. "All patriots, call to arms right now!" Over the next 50 minutes, he kept ringing the alarm. "The fuckery is here!" "It looks like Clallam County is going to get hit tonight." "There's the antifa group. You can totally smell the wanting-to-break-shit-up off of their body. They look sketchy as shit."

He told his viewers to buy bear mace and "less lethals" at Freds Guns. He said to fetch their gear, their long guns, and meet him at City Hall. A dozen followers showed up at the Sequim protest with pistols, some asking protesters for ID. At least one was carrying an assault rifle. Rumors about buses spread across the county—a guy called 911 about seeing a yellow bus at a gas station between Sequim and Forks, "all of them in black," cutting off the call frantically with "I gotta meet people!"

Dan Larson (no relation to Seth), a retired logger who lives in Forks, heard the rumor from a text. A friend had seen on social media that antifa was near; the citizenry needed to be warned. It was like the ride of Paul Revere, except on Facebook, and Larson thought he better light a lantern. He posted about busloads of rioters in Sequim and said that "Forks could be next." A former prison guard in town joined the cry. "Forks, let's get ready to rumble. Lock and load."

Facebook shares spiked. A City Hall staffer relayed that her husband had heard from truckers on CB radio that busloads of rioters were speeding their way. People called the True Value, urging the owner to batten down its inventory. Some doubted the chatter. The town of 3,500 people was known for two things: logging and as the moody backdrop for the *Twilight* vampire-romance novels and films. *What would antifa want in Forks? To loot sultry Edward and Jacob posters from the souvenir shop?*

But then Big Bertha lumbered into the Thriftway parking lot, proof, it seemed, that the rumor was true. Pickups, SUVs, and an ATV circled the 36-foot Trojan horse. A few men approached to talk with the driver, a young brown-skinned man who introduced himself as Tyrone Chevall. He was wearing a black T-shirt and red pants and told them that he and his family had come to camp. A white woman wearing a dark sweatshirt and capri pants stepped off the bus and walked

into the grocery store. People loitered in groups, leaned on their car hoods, pistols on hips, watching.

When the woman returned to the bus, it pulled out onto the town's main street. Trucks in the lot followed. A police officer studied the rare sight of a bona fide bottleneck in Forks: 20 vehicles, heading north to the city line.

The officer had heard the antifa rumors and stopped to talk to one of the men who had peeled off from the caravan following the bus. The officer told the man that no antifa were coming, that the rumor was false, but the man sniped, "Bullshit, I've got Three Percenters that posted video of buses dropping off antifa in Sequim for the exact bus that was here." He insisted that 50 people were on board, but the dark windows made it hard to know for sure. (Three Percenters are a national far-right militia that arose after Barack Obama was elected; the organization says it is pro-government, "so long as the government abides by the Constitution.") The man couldn't find the video for the officer, but he did show him the Facebook profile of Tyrone Chevall, the driver who'd introduced himself earlier in the parking lot. Another man told the officer that the bus had headed out to the A Road, an old logging byway north of town that leads into a federal forest. He said that the locals were "watching it."

Social media started pinging with live action. A Snap photo of the bus read "Get outta our town." Another Snap said "Later idiot," with a picture of the bus glowing white as a lamb against the dusk-darkened woods, stalked by a line of tightly packed pickups. Another showed a picture of a gun laid across someone's lap.

As the bus turned off the highway onto the A Road, the truck caravan split off. Having lost its pursuers, the bus entered the forest and crossed a river on a graffiti-scrawled bridge. It parked in a shallow pullout, and its occupants spilled out to set up camp. A group of ATVs sped by and skidded sideways near the bus, sending gravel skittering. Meanwhile, a small group of vehicles had appeared on the town side of the bridge's span. Someone started up a chain saw. Someone, maybe more than one, cut five moss-covered alder trees at their stumps, felling the white trunks and branches across the asphalt like a medieval barricade. Someone, maybe more than one, shot bursts of gunfire into the air, final exclamation points of menace. By the time the bus drove back to the bridge, scared off by the ATVs, it was trapped.

A new post popped onto the Facebook of Josh Fletcher, the thirtysomething son of Forks' mayor. Fletcher is one of Forks' old names, going back to the pioneer homesteading days. There's a Fletcher Street, a Hillcar & Fletcher rock crushing company, and, back in the day, a logging company too. The photo showed the alder blockade, the bus on the other side on the narrow mountain logging road, no other way out. Commenters chimed in:

"Wonder if they feel like they just drove into a horror movie?"

"It's like the purge."

"Let 'em starve!"

"It's just a strong message of get the fuck out."

Say what you will about Forks—and people in Clallam County always have—but don't think for a second that the entire town was on board with this. Even before officials confirmed that Chevall had been telling the truth—that there were no antifa in the bus, just Chevall, his partner, her daughter, and Chevall's mother—many in Forks saw social media and suspected the real crime wasn't some fantasy of black-clad rioters but the spectacle of their neighbors harassing and stranding travelers in the forest. The skeptics feared those actions would soon be deleted, not just from social media but from the realm of consequences too. They realized that what happened in Forks couldn't stay in Forks; it needed to be hurled into the summer's strife over power in America, a churning, white-hot debate over who gets coddled and who punished, who is a thug and who a hero. Suddenly, this episode in a patch of Washington woods seemed to have something to say about it all. So people in Forks did what you do in 2020 when you want evidence. They started to screenshot.

Forks

is circled by foothills covered in patches of pines logged in different years, uneven, like an awkward home haircut. Trucks stacked high with logs still rumble down the main street, but not as in the old days. Much of the forest can no longer be logged. In the '90s, the Clinton administration protected old-growth trees in the name of the threatened spotted owl, and changing global markets further depleted the industry. Today, *Twilight*-themed gift shops, java drive-thrus, and Tesla charging ports signal a newer tourist economy. The influx of visitors, however, hasn't replaced the jobs lost from logging, and disdain for government meddling is as common as American flags. Trump won 60 percent of the Forks vote in 2016. One of the bigger local logging companies made branded Trump baseball caps, a symbol of both national triumph and Left Coast dissent.

People call this part of the Olympic Peninsula the West End. A half-hour drive from the Pacific Ocean, Forks is one of the rainiest towns in the continental United States and one of the more isolated. This separateness breeds a sense of mutual reliance within the community. When the day comes that the Cascadia fault running the length of the Pacific Northwest coast ruptures, help might not arrive in Forks for a month, so a network of residents keep ham radios at the ready to coordinate survival logistics. This is not an area of great wealth; the median annual household income hovers around $36,000. Yet every year the town raises scholarship money—this year it was $113,000—for the graduating high school class. The town's seclusion also warded off Covid-19. There were only two cases before late July, one assumed to be related to tourism, and many resented the outsiders potentially harboring the virus who continued to trek to the peninsula. Someone put up "Go Home!" and "Locals Only" posters below the town's welcome sign.

The A Road falls into the Clallam County sheriff's turf, and in the days after the townspeople followed the bus into the woods, detectives fanned out to conduct interviews. The crime they were investigating was cutting trees on federal land, a misdemeanor. But they also wanted to learn more

about the pursuers' intent, which could push the charges into disorderly conduct, malicious mischief, harassment, or, if race were involved, a hate crime.

Once the identity of Big Bertha's inhabitants and their innocent intentions were made public, many of the get-out-of-town posts were deleted from social media, but now residents, troubled by their neighbors' actions, had screenshots in hand. They wanted to share the information and for the perpetrators to be caught, but they also wanted to be able to eat at Pacific Pizza without being hassled or shunned. So some fed images to Matthew Randazzo, a journalist and former Democratic Party county chair. Randazzo, in turn, set about lassoing Twitter outrage toward #ForksGoons with a thread of screenshots and commentary to ensure that authorities couldn't even think about letting it go.

The social media whirlwind got City Hall's attention: City attorney Rod Fleck texted Forks' mayor, Tim Fletcher, a screenshot of Twitter's national trending stories, one of which was "Forks." Emails poured in from campers and parents in mixed-race families who threatened to never stop in Forks again. The Chamber of Commerce denounced the incident. At a city council meeting the following week, Mayor Fletcher read an apology to the family. "I think it's absolutely crucial there are consequences," one council member said, adding that she might go for "the stocks and throwing tomatoes."

While some of Forks' old-timers didn't appreciate outsiders complaining on the town's Facebook groups, they too were outraged by the actions on the A Road. Teri Bagby Gaydeski, 57, and her sister, Tami Bagby Shaner, 60, are fourth-generation Forks. They both drive school buses and are partial to Day-Glo manicures and rhinestone-dusted baseball caps and caroling down the school halls at Christmas. "We're kind of liked," Teri told me. She says she's more Republican than not; Tami isn't political. Both were appalled by local men questioning visitors as if they had a right to. They thought about how frightened the family must have felt, with men pursuing them while carrying guns. "Can you imagine?" Teri exclaims. "I would have been terrified. Nothing about that is OK."

The sisters got in a spat with one of the guys who'd been in the Thriftway lot, first on Facebook, then on the phone. "They said to me, 'We're patriots!'" Tami says. "Gimme a break." The sisters saw on Facebook that some locals were raising money to buy ad space in Washington newspapers to run an open letter to the family. The letter said, "The greater Forks community stands against violence." Tami signed, along with more than 300 others. The sisters hope for justice. "We're pretty protective of our little town," Teri said, "but, in this case, these people need to be in trouble."

Tami Bagby Shaner and Teri Bagby Gaydeski, above right, are fourth-generation Forks residents who were appalled when their neighbors not only failed to welcome strangers but harassed and pursued them.

By midsummer, the sheriff's investigators had talked to around 40 people, homing in on 10 they believed were at or near the tree-felling. But they couldn't get closer: *Who* cut the trees? *Who* fired a gun? Among the people on the road, a

logging country omertà had settled like the morning fog. Investigators' phone calls went unreturned. National media had picked up on the story, and witnesses who did cooperate told investigators they were intimidated by the attention. Friends told friends they didn't *want* to know names, so they wouldn't have anything to snitch.

Clallam County chief criminal deputy Brian King lives in the county seat of Port Angeles, but he graduated from Forks High School, where his wife now works. He's been in law enforcement for 25 years, and in a county with so few people, he says, that means "I've arrested a lot of my friends or acquaintances." But he had rarely been so stymied by silence. His team resorted to plan B. People had used social media to broadcast the bus stalking. Maybe they'd used it to coordinate too. If they wouldn't speak, maybe their digital trail would.

Investigators served search warrants to Verizon for cell phone records and to Facebook for the activity of those people at or near the tree-felling. As July turned to August and Facebook searched its servers for clues, I drove over Puget Sound into the Olympic Peninsula. Internet disinformation often seems disembodied, its actors faceless, its path through hearts and minds hard to see. In Clallam County, the consequences were tangible, the players visible, and I knew where to start.

Freds

Guns, on Highway 101, sits on the outskirts of Sequim. While Forks is a logging town that still touts the slogan "Logging Capital of the World," Sequim is a growing retirement community surrounded by meadows of lavender. The mayor is a hair stylist and avid motorcyclist who attended the notoriously un-distanced Sturgis biker rally in South Dakota. He espouses the QAnon conspiracy theory on his personal Facebook page and in mayoral interviews. But he presides over a politically purple town where "you can't swing a dead cat without hitting a retired Californian," as one cop put it to me, and where Hillary Clinton eked out a win in 2016. When I visited Sequim, an older white man in suspenders sat on a corner downtown displaying a Black Lives Matter poster, gently waving to drivers. Many whooped in support. One white woman riding shotgun chided, "Did y'all forgot you're white?"

Courtney Thomas grew up in Sequim, her family having farmed and logged in the area for more than a century. Thomas, 33, is a massage therapist and the white mother of three adopted kids, one of them Latino. When Black Lives Matter protests sprouted across the country after George Floyd's death, and then two Black students in Atlanta were tased and pulled from their car, she posted a call for the June 3 march on Facebook and was thrilled when hundreds showed up. Then marchers showed her Seth Larson's Facebook video calling on his buddies with guns. Families at the protest—hers included—whisked their kids away. Some armed men started arriving. Thomas talked to a man wearing a bulletproof vest who'd come with two German shepherds. He told her he was there to protect the protest, to which she replied, "We need to be protected from *you*. You're here to look scary."

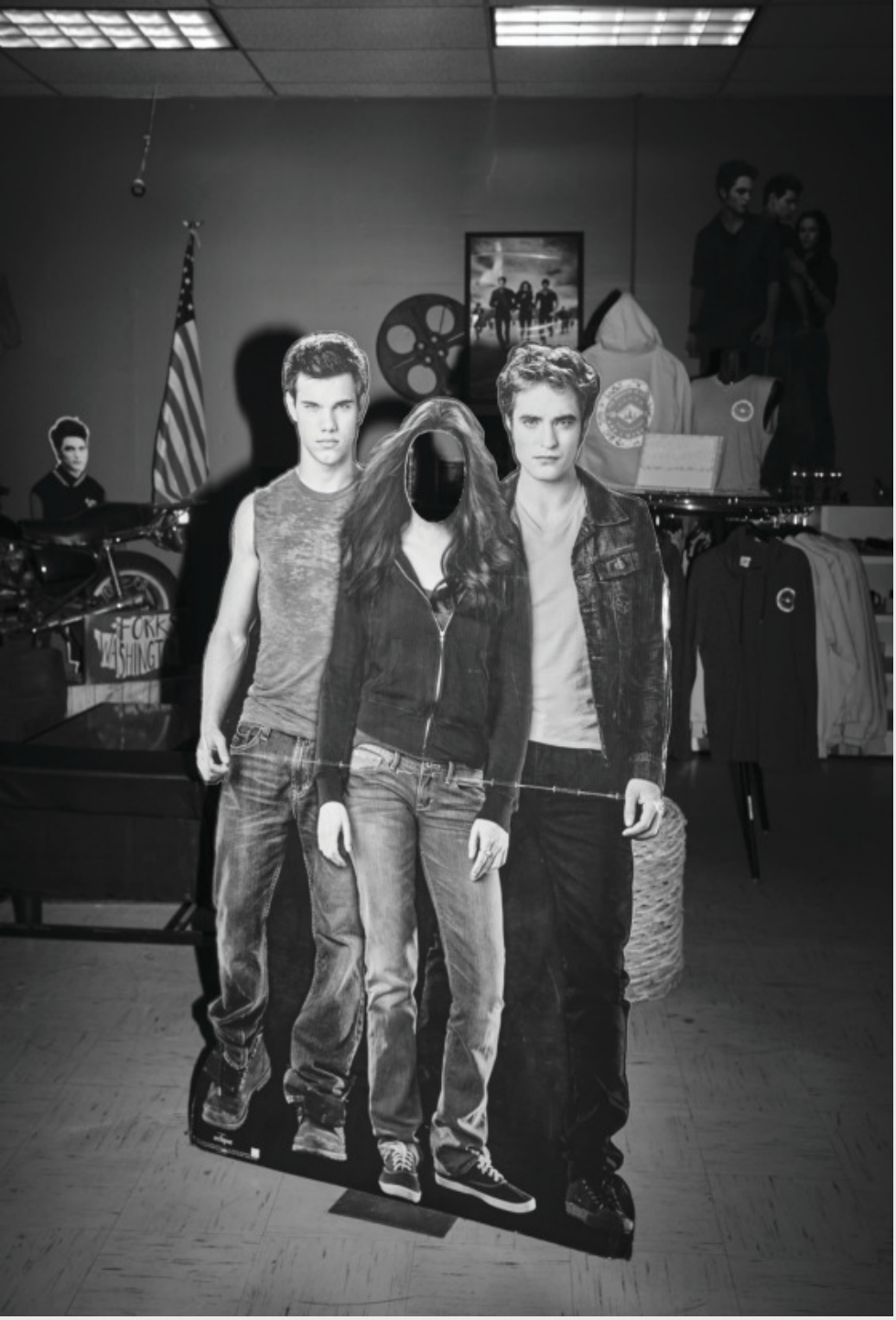
Outside Freds Guns, an LED screen shuffles images of hunting rifles and a "Don't Tread on Me" flag. Larson had ignored the message I'd sent, but once I showed up at the store he agreed to talk, somewhat warily. I stood next to him behind the cash register, below a surveillance camera that he called "a fact-checking thing." Larson is a lot to take in: He's built like a block, 6 feet tall, with the flip-flops, polo shirt, and shorts of a suburban dad. He wears a belt sporting tools to handle all manner of potential emergencies: a tourniquet in case someone gets shot, handcuffs to make a citizen's arrest, a Glock pistol, and an extra magazine. He didn't wear a face mask. A flyer sitting on a display case this summer described how "Bill Gates and the Global Health Mafia" were funding Covid-19 contact tracing to surveil the public.

Taking my station in front of the camera, I asked Larson why he had raised the alarm. He repeated that he'd seen the "white hoods" tweet about antifa bringing their fight to residential areas. "Everything that happened that day was totally twisted," he said. "All of my good intentions. I love this county. I love this town. Honestly, the Black Lives Matter group is really good at making you look like a racist. Hey, just because you're Black, it doesn't mean you're *more special than me*. We're all created equal, 'kay?" he said sharply. I thought of a meme that had been posted on the Freds Guns Facebook page that week: a vintage 1950s illustration of a blond-haired nuclear family and the tagline "What extremism in 2020 looks like."

After the Sequim police confirmed that no antifa were at the march, the police chief, Sheri Crain, who has known Larson since high school, asked him to delete his video. He did. He also admitted that he had been wrong and had "knee-jerked" about antifa. So I was surprised to hear him revert to his earlier position. His evidence was that he recognized only 30 to 40 protesters. The rest, he asserted, arrived from bigger cities in buses, and 10 percent "were bad." What about the police statement that there had been no antifa, that zero buses had arrived? "They're just falling with the same liberal quid pro quo of 'Let's cover this up,'" Larson told me. He then suggested that small-town cops wouldn't know how to identify antifa anyway. (In his Facebook Live video of the protest, Larson walks up to a parked black van in which a middle-aged white man is holding a camera. The man, Larson says to his followers, is "antifa or something." Police identified the man as one of their detectives; he was monitoring the protest.)

Freds Guns, above, where Seth Larson, who stoked antifa fears on Facebook, works. In Forks, skeptics of the rumor joked about antifa wanting to loot *Twilight* souvenirs from the gift shop.

Larson told me that the only reason the antifa activists lurking at the march didn't act out was because the presence of his friends deterred them. He told me that on the day of Sequim's protest, 85 Three Percenters—a label he used interchangeably with "Patriots"—answered his call. (Sequim police counted roughly a dozen of Larson's followers, several with pistols holstered on their hips.) As Larson recalled this scene to me, an elderly white customer in a US Army cap rolled up in an electric wheelchair,



listening with interest. He asked whether this Three Percenter group had regular meetings and if there was some information he could read about it.

"It's not really a group," Larson said, hesitantly, sandwiched between an eager recruit and a reporter, pen poised. "We don't have paperwork on it. It's just people that are Americans and they're for the Constitution and they're veterans and retired law enforcement people."

"How can I get the call?"

"Well," Larson replied, "you just leave your phone number here, and we tell you to show up."

After more than an hour, I brought up the fact that Twitter had tracked the antifa "white hoods" tweet to a white-supremacist group. Larson said he hadn't heard that, but, in any case, he couldn't trust Twitter CEO Jack Dorsey and therefore couldn't trust what Twitter said. He added that even if the tweet was false at the time, it had become true, because now protesters *were* invading small towns. He gestured to his latest Facebook post on his monitor, a news story about Black Lives Matter protesters at the Seattle police chief's house in rural Washington.

Though he still seemed feisty about antifa, Larson told me that the dustup had worn on him. He said he received online threats after posting his video of the march, and he had moved his family out of their home shortly after. A parade of pranks had arrived in the mail: a 6-foot-tall cardboard penis, an "Eat a Dick" ceramic, and, more concerning, a glitter bomb that exploded with a note saying, "Next time it will be real."

He knew about the debacle on the A Road but rejected the notion that his posts had set it in motion. "That means I have more power than you would ever know," he said. "And that would be scary, would it not?"

Larson then turned to the matter of the bus itself. "Just an FYI," he said, seeming to relish insider intel. "It wasn't just a family on a camping trip. There were seven grown men on the bus."

Where'd he hear that?

"It's local knowledge. Let's just put it that way."

Leaving

Sequim, I drove west on Highway 101, the same direction misinformation had traveled on June 3, when rumors spread from a white-supremacist tweet to Seth Larson's Facebook page and out through the social media accounts of Forks residents. One of those belonged to Terry Breedlove, the former prison guard who'd written, "Forks, let's get ready to rumble. Lock and load." He clarified in a comment that "Peaceful protestors are good. Rioters will be shot."

I'd arranged to meet Breedlove in a gravel lot just past the Forks welcome sign. He was waiting in a Toyota truck, and I hopped aboard for a tour of the nearby mountains. A necklace hanging from his rearview mirror swung side to side like a metronome as he sped over back roads.

Breedlove is 56, and for some 25 of those years he logged these ridges. An explosion in a logging shop when he was a teen blasted off the ends of his right fingers, and

a machinery accident took off three on his left. In his mid-forties, Breedlove turned to the security and pension of a job at Clallam Bay Corrections Center, one of two nearby state prisons. In 2016 an inmate beat him on the head with a metal stool. He's been on disability ever since. The assault caused traumatic brain injury, and at first Breedlove had trouble speaking. He would stumble while walking. For years, people or noise could overwhelm him: He might start crying for no reason or have to lie down at a moment's notice, feeling like "my brain was shutting me down." He'd retreat home to stay in bed for days at a time. Going out was difficult, but he could connect online. "Social media saved my life," he says. "I could always type just fine by myself in the dark, easy. That was the only place I felt comfortable."

Breedlove became one of the most prolific commenters on Forks' Facebook forums, typing complaints about "lily white social justice warriors." Acquaintances wondered if he had become more opinionated or had just found an outlet.

Breedlove told me that when he received a group direct message on Facebook—he won't say from whom—that a white bus full of antifa was coming to Forks, he "didn't have any reason to doubt that someone was coming down." He watched the news. "That was right in the middle of all the riots and the burning."

After bucking down an old mud logging path to show me a swimming hole, Breedlove turned his Toyota toward the scene of the A Road bridge standoff. We hopped out and walked over to inspect the freshly shorn alder stumps. The cut branches were still piled nearby. Breedlove never saw the bus, and when I talked to him on the phone a few weeks before coming to Forks, he downplayed the A Road incident, given that no one had been hurt. But now he was of the mind that things had gone too far. "I'd like to talk to them"—the people who followed the family. "Just, 'Why? Why? What were you doing?'"

Back in the pickup, we bounced up Hunger Mountain, and I asked Breedlove if he regretted putting up the antifa posts. "What I put up there, I don't think was very confrontational. It fed into it a little bit," he replied, "but I wasn't there"—meaning at the tree-cutting itself. As for the "lock and load" post, it was "just having fun on social media." He added, "If I did something wrong, I'm the first one that will apologize and say, 'Oh, I fucked up.'"

After posting a false rumor, Dan Larson quit Facebook. "If I can't control myself on there, I don't deserve to be on there."

A couple of days after the A Road fiasco, Breedlove heard about a Black Lives Matter protest happening in Forks, organized by four young white and Native American locals. Breedlove had only seen the protests filtered through the news and social media, and now that one was happening in his town he decided to see it with his own eyes, maybe talk to some people. Two hundred protesters showed up along the town's main street, at one point lying down on the sidewalk to mark the time the Minneapolis officer's knee was on George Floyd's neck. Members of several coastal tribes played in a drum circle, and Tim Fletcher, the mayor, came with a poster reading, "This Native American has never been for racism." Passing drivers replied with honks of support.

Returning home, Breedlove posted his report on Facebook. Overall, he concluded, it "was a really good walk with a lot of really good people." Among his posts of MAGA dictums and right-wing punditry, he posted artful black-and-white portraits of protesters with their signs.

Dan

Larson was away from Forks on June 3, but when a buddy texted saying that their Facebook friend needed help, he posted this warning on his Facebook page:

> *Three busloads of rioters dressed in black just showed up in Sequim! ... Local boys are gathering with their 'gear' and are going to protect their town! Forks could be next, they want guys from the peninsula to join together to protect our communities! We help them, they help us!*

The post took off, getting more than 60 comments and 120 shares within two hours. Some of the commenters accused him of spreading a hoax and pointed him toward Seth Larson's Facebook Live video. Dan cued the video, expecting to see a black-clad bicycle mob burning up Sequim. "I was like, 'Shit,

I don't see the guys carrying bricks or dressed in black. I mean, I don't see any of that. I got drawn into some ridiculous bullshit.'" Dan deleted his post. "It was really embarrassing and humiliating," he told me. A day later, he deleted his Facebook account. "If I can't control myself on there, I don't deserve to be on there."

Dan lives in a forest-green ranch house close to downtown Forks. He's in his sixties, with a full head of hair and an arsenal of old-timey expressions like "gee whiz" and "gosh darn." We talked in his driveway, and he told me how he'd moved to Forks as a long-haired teenager from the suburbs of the state capital. It was the mid-'70s, and the Forks High School football team tried to whoop him. "I wasn't used to this kind of attitude about strangers—the new guy. Once they got to know you, and you kind of earned your way, everything was fine. Just a whole little-town-type deal." After sprinting away that day, he dropped out of school and, at 19, started logging. He worked alongside the now-mayor, Tim Fletcher, for Fletcher & Fletcher.

In the '90s, logging companies introduced cheaper and more efficient machines, so the human loggers moved to steeper, more perilous slopes, where the machinery couldn't operate. Larson was working on one such mountainside when a 4-foot-wide log tumbled downhill at him. Larson hurled himself down the slope to escape, sprinting and somersaulting. He dislocated a shoulder and rib and shattered his clavicle; it ended his logging days. Logging "makes you feel like Superman," he said, but it's also, statistically, the most dangerous job in the US. "I got friends in wheelchairs," Larson says. "I have friends in the ground." Mayor Fletcher left the work to run IT at the school district and town hospital and now rents out his logging-themed house on Airbnb.

Dan said he wasn't missing Facebook. Mostly, he says, he would check his feed for a couple of minutes in the morning, sharing updates about fishing or checking posts about his far-flung grandkids. Some of those grandkids are Black and Native American, and he told me that he doesn't put up with "foul language about color or anything like that. I got African American people I happen to love, you know? So don't be talking shit about 'em in front of me. And my friends don't. They're not that way." He would occasionally get drawn into spats on Facebook. He remembered one particularly galling exchange with a white lady who wrote something about poverty. He responded that he knew what it felt like to grow up poor. His father had left the family, and his mom did what she could, like pulling bottles from the trash to buy food. Dan made money for school clothes by picking berries. The woman had responded dismissively, saying, "You weren't Black poor, you were white poor."

Recalling the exchange, Larson's face wrenched in annoyance. He typed back something about "going to bed hungry is going to bed hungry." But this dismissal of his experience by some disembodied stranger still irritates him so much that, while he sat out the 2016 election—"a goofy billionaire and Hillary, come on"—this year he's going to pick a side, and it's going to be Trump. "Now I *do* like him because of you stupid fuckers," he said.

Hearing about Dan's change of heart, I thought of a story Terry Breedlove told me. At the state prison, a young offender would arrive, scared of the more veteran inmates, and would hover around the officer's podium to chat. Yet over time, the old-timers would groom the new guy into the fold, and the kid would end up a "little punk," radicalized into a race-based prison gang. Dan had just described a similar effect with Facebook: He'd come in conservative but flexible and ended up defensively hunkered with a tribe.

I asked Larson what I'd asked Breedlove—whether he felt culpable in ginning up the A Road fervor. "If I did, that really sucks," he said. The idea seemed to eat at him, and he returned to it a couple of times. "I guess that could have sparked a ridiculous emotional reaction over that, and done that to those poor people ... But I got sucked in. I got sucked in too."

About

a week after the A Road incident, Shannon Lowe—the woman in capris on Big Bertha—gave an interview to the *Peninsula Daily News*. The issue of race came up. Lowe is white, but Chevall, her partner and the driver of the bus, is Black and Native American. Lowe told the newspaper that she didn't believe Forks people had targeted her family because of Chevall's race. Nearly every person I talked to in Forks repeated that quote. The point carried not just reputational but also legal heft: Racial targeting could tip any allegation of harassment into a hate crime, a felony that carries prison time. (Targeting a political group does not fall into the definition of a hate crime.)

In late June I connected with Lowe by phone. She and Chevall had driven to the farthest northeastern reaches of Washington, where they'd found work managing a campground. She could only make calls when she visited the nearest town. Lowe told me that she grew up in a speck of a place in Iowa. "I understand having that love for your hometown and not wanting anything bad to happen to your neck of the woods," she said. She worked as a news director in rural Iowa and later in casinos, where she met Chevall, 15 years her junior.

Three years ago, they bought a white Blue Bird school bus from a farmer, named it Big Bertha, and trekked west to Spokane, where Chevall had family. The couple sometimes stayed with his relatives and sometimes on the bus, which they outfitted with a bed, kitchen, and bathroom. They got jobs in casinos outside Spokane, but when Covid-19 shut down business in the spring, they embraced their unemployment. "We felt like we'd been set free," Lowe said. They hit the road in Bertha, their own social-distancing mobile. Shannon's 21-year-old daughter, who is white, joined them, along with Tyrone's mom, Sondra Rickard, who is Native, and their two dogs and three cats.

Sondra had been rereading the *Twilight* books and wanted to see Forks. On the 400-mile trek, Bertha's battery started flagging and its alternator busted. The family decided to push into town, order the parts, and camp until they arrived. Lowe noticed people taking photos of the bus while they drove across the Olympic Peninsula on June 3, but she's used to people waving and honking at Big Bertha.

As they drove into town for supplies, the driver of an ATV flipped Chevall off, and Chevall returned the gesture. Almost immediately after the bus parked in the outer reaches of the Thriftway parking lot, a surveillance camera recorded pickup trucks and an ATV arriving and parking around the bus. An older man wearing a bulletproof vest tried to push open the bus door. More men strolled up and asked Chevall if they were there to protest. The family's German shepherd mix barked madly. Lowe nervously walked past the men to go shop for dinner ingredients while the rest of the family stayed on the bus. In the store, Lowe overheard clerks talking to each other in the produce section, voices tinged with fear. "*Have you heard they're sending antifa?*" Lowe worried about getting caught in the middle of some incoming riot.

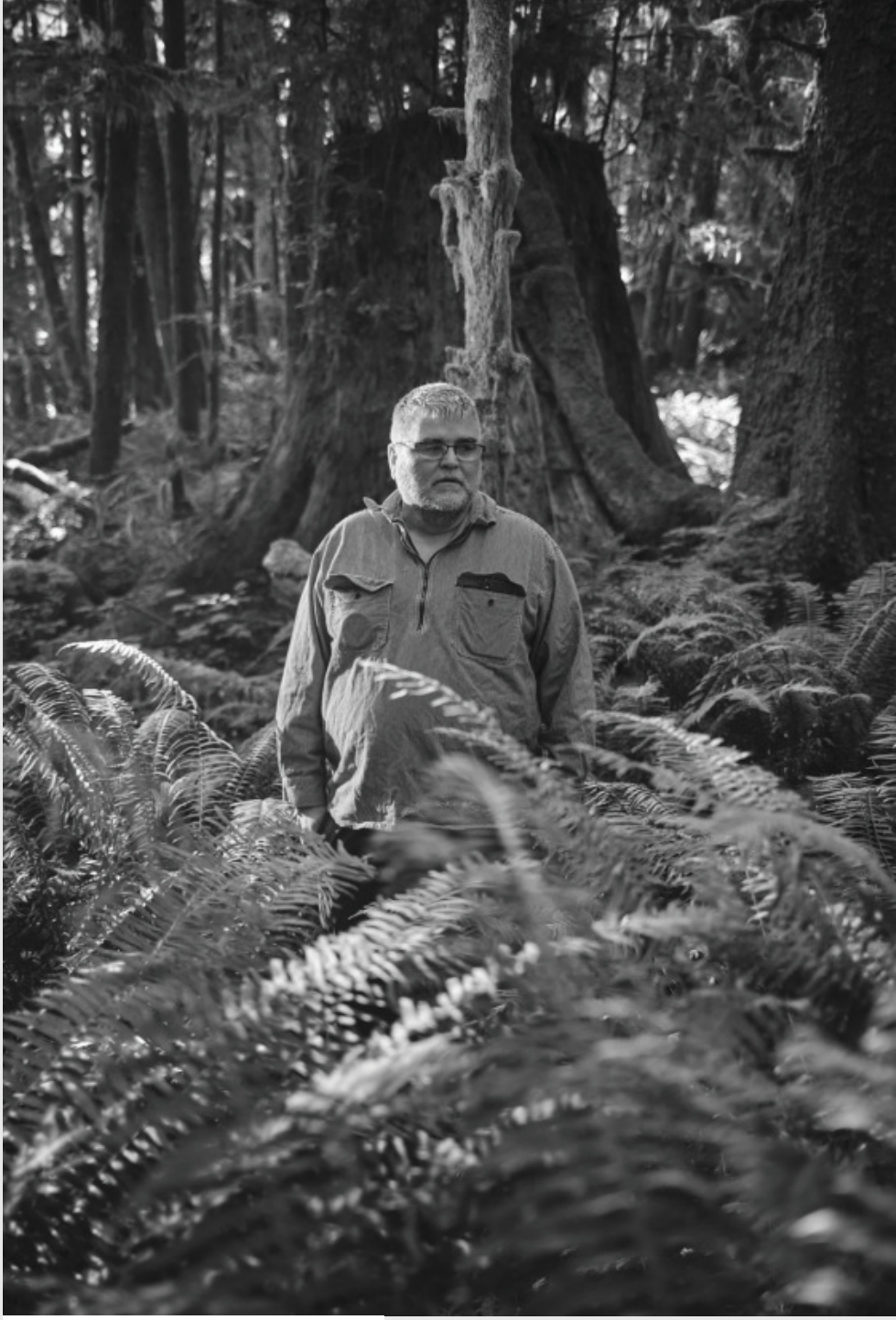
While shopping, Lowe realized she didn't have enough cash and headed back to the bus for Chevall's credit card. Some 10 trucks were now circling Bertha. People stood in small groups staring at the bus. Sondra remarked that it looked like a militia was out in force. Chevall said he'd been waging diplomacy: He'd apologized to the guy with whom he'd exchanged middle fingers and told the men they just wanted to camp. Someone mentioned *Rambo* was filmed in the surrounding woods. "Everything was very veiled in the parking lot," Lowe says. Some of the people held cell phones high, trying to take pictures inside the bus.

Lowe wanted to leave Forks, but Chevall thought that now that he'd said they were camping, it would look suspicious if they didn't. He navigated Bertha around the trucks in the lot and turned north on Highway 101. The line of vehicles followed them out. As Chevall drove through town, people in trucks poised at street corners flipped the bus off, and, Lowe says, one driver held a rifle out his window. She quipped that she felt bad for anyone trying to mess with this town. Chevall remained silent, guiding Bertha tensely. Neither wanted to worry his mom in the back.

Once the bus turned onto the A Road, the caravan disappeared. Chevall turned onto a smaller logging road, crossed a bridge, and slowed into a pullout littered with tent poles and old workout equipment. The family tumbled out to clean up the site and pitch their tent.

Lowe heard guns firing in five-round bursts but dismissed it as someone shooting at a range. Then, a bunch of ATVs sped by and skidded sideways near Bertha, sending gravel shooting toward the bus and pelting Chevall's pant leg. They decided to leave. As they dismantled the tent, they heard a chain saw, close, echoing around them. Chevall drove back to the bridge they had crossed to see if they could get cell service and to scout new camping locations. On the far side, a thicket of cut tree trunks and branches blocked the road, and behind the barricade there was a gathering of cars and trucks. The innocent explanations they had held onto withered: This was about them, and maybe something more.

"That was the first time that Tyrone started to feel like maybe it was about



"What I put up there, I don't think was very confrontational," said Terry Breedlove, who spread antifa rumors. "It fed into it a little bit." Above right, a sign on Highway 101.

race," Lowe told me. "At that point, I still wasn't. I'm a white girl from the Midwest, and I feel like out here in Washington people are a lot more open-minded. I guess I wasn't ready to let go of my fairy tale."

With no clear plan on how to get out, Chevall turned Bertha around on the skinny road and headed up the mountain, hoping to get cell service at a break in the trees. Shannon's daughter penned a journal entry that began, "If I'm dead and you just found this ..." Sondra kept dialing 911, trying to get a signal. Finally, she got through. Chevall told the dispatcher that their bus was barricaded in the woods and lost, and the dispatcher told them to meet deputies at the downed trees.

Careening back to the bridge, Chevall parked at the span's edge and told his mom to lock the bus and not to come after them, no matter what. Hands trembling, Lowe grabbed her Canon camera. She and Chevall tentatively treaded across the bridge as Lowe snapped photos of the people and cars still hanging around, for evidence. She pleaded with Chevall to stay behind her. "I'm 43 and I've lived a pretty good life, and if this is what I go down over, I felt like that's fine," she said, beginning to cry. "But I didn't want it to be the end for Tyrone."

She heard someone call out, "They have a camera." Engines roared, and cars peeled out. "I think at that point they had lost their nerve," she says. Heading back to their bus to await law enforcement's arrival, they heard another round of gunfire. Chevall said, "Well, I can see how this feels like *Rambo*."

Finally, an officer and sheriff's deputy arrived and asked four gawking teens who had driven up as the others were leaving to clear the alders with their chain saws. (It's standard in Forks to carry a chain saw in your truck.) After they made a report at the sheriff's station, the deputies guided them to a place to camp and told them that, for their own safety, they should leave at first light. The family left at dawn and bought a new battery at a Walmart 150 miles away, and Bertha rumbled off the peninsula.

A week later, Lowe made the comment to the *Peninsula Daily News* reporter that she didn't think race had been a factor. She did so for a few reasons, she told me. For one, she wasn't absolutely certain, but more important, she didn't want to start something. What if her assumptions riled up real antifa militants and they targeted Forks? "If we make Forks look like a racist town, then Forks will burn, and that's not what we want. We want it to all die down." But since then, she had reconsidered. "If our voices can make the hate stop, then I want to try to make it stop."

If race was at play, it wasn't broadcast on social media. Brian King, the chief criminal deputy, told me his investigation had found no indication of a hate crime. But the rumor had primed people in Forks to expect a bus of antifa rioters, and maybe the group of four adults inside, spanning three races and four decades, confirmed those expectations, looking just as much like a group of protesters as a family unit. People in Forks dismissed that idea: Interracial relationships are common; Native Americans and Latinos make up 7 and 26 percent of the town's population, respectively. Austin Pegram, a white man who left Forks after high school and only felt safe to come out as gay once he left town, suggested a subtler dynamic: Maybe the family wasn't harassed *because* of race, but that "the color of their skin didn't help." In the eyes of people in town, "it made them not believe them and

dismiss what they said." As Lowe put it, "They looked us right in the eye and didn't believe we were camping."

Lowe says they're willing to cooperate with prosecutors, even if she thinks the law misses who she sees as the greater culprits: "people spreading fear and anger and hatred online in joke form, and people getting swept up in it." She mentioned, in particular, the guy who had started the rumor in Sequim. Law enforcement did examine Seth Larson's video but ultimately concluded that his call to arms didn't cross into criminal territory. Spreading disinformation may be a scourge, "a cancer," as Forks' police chief put it to me, but it isn't a crime.

Lowe told me she still jumps at the sound of an ATV or a car backfiring. Chevall was done talking about it. "It's just really hard to try to continue to be ourselves without letting it change us." Forks is changed too; until someone faces consequences for the A Road incident, the entire town would be seen as culpable, reduced to the redneck epithet lobbed at it for years.

"We

have tons of guns in our house, and we never talk about shooting antifa," Kris Hull said, dryly. It was a wry diss, a tone that she excels at. It translates well to Facebook, where she used the eye-rolling emoji when people on a Forks Facebook page were initially doubling down on the antifa rumor. She typed: "A few paranoid residents did a great job of making us look like an intolerant, fearful, hick town. Great job, we are now safe from hippie campers."

Hull is in her forties, with long hair pulled into a ponytail. She's spent her whole life in and around Forks—"If you haven't been here since you were an embryo, you're an outsider," she jokes—and her humor about the place reflects her deep affection for it. Hull's son was one of the teens who helped remove the alders at the crime scene so that Chevall and Lowe could pass. He'd been mortified by the praise and gift certificates he'd received as a result.

Hull told me that her son got his first chain saw at age 9 and had cut firewood for pocket money all through high school. He can be a bit of a clown, she said. Like other teen boys,

Shannon Lowe's daughter penned a journal entry that began with, "If I'm dead and you just found this ..."

he grew his hair into a semi-ironic mullet that is salon-permed in the back and which he calls "majestic." He posed with his rifle for his senior pictures. He sometimes wore a MAGA hat to school. "Stupid hat," Hull says (she voted Libertarian in the last presidential election). "I think he did it for attention." Hull says she thanked another one of the teens who helped the family, and he answered with a mock manly, "That's what us redneck kids do." She laughed. "But they've never had bad experiences with rednecks."

Investigators have interviewed her son three times, trying to elicit names, but he told his mom that people had left by the time he pulled up to the site to see what all the excitement was about. Hull doesn't know who was there, either, but she speculates on the mentality: People in Forks like to be left alone, especially by the government or tree huggers. To some, the Covid shutdown seemed an overreaction imposed by a Democratic governor. People in Forks questioned why *their* businesses had to close, why *they* had to wear masks in public and stay home—especially as tourists disobeyed the stay-at-home orders, flocking to the coast and its closed beaches, lining up at Thriftway for toilet paper and supplies. Some people weren't working. They were restless and uneasy and then saw the violent disorder of Seattle—"and people here have very strong opinions on Seattle," Hull says. Once the antifa rumor began, "They had a target where they could focus their armchair rage. It was a perfect storm of stupidity."

In

the days right after the A Road event, some saw darkly comedic threads mixed into the Forks stew of outrage and shame. City attorney Rod Fleck received a wry text: "How is the anti-Antifa war?" Fleck responded with face-palm emojis and mused that he should write a Coen brothers film. The contact suggested some mix of *Tucker & Dale vs. Evil*— a B-list redneck send-up—and the iconic hillbilly thriller *Deliverance*.

But the joking dismissals didn't last long: Seth Larson had been completely serious when he called on armed people to monitor the protest. He too was carrying a

concealed weapon. And, in Forks, as Fleck noted in a text, the men at the Thriftway parking lot had "pumped their chests and walked around like fake cops." Chevall and Lowe weren't hurt, but they were terrified.

Paired with the president's drumbeat of antifa allegations, the fake tweet planted by Identity Evropa, the white-supremacist group, had its intended effect: a rippling radius of fear, distrust, and vigilantism. As the summer continued, men with guns took the law into their own hands. Boogaloo Boys organized on Facebook groups and are now charged with murder in Oakland and Santa Cruz, California. A 17-year-old named Kyle Rittenhouse, who told a reporter he came to Kenosha, Wisconsin, with his AR-15-style rifle to protect local businesses from rioters, was arrested for allegedly killing two people. The day after Rittenhouse was arrested, the Kenosha sheriff said at a press event, "I had a person call me and say, 'Why don't you deputize citizens?' And I'm like, 'Oh, hell no.' What happened last night is probably the perfect reason why I wouldn't." As of mid-September, a professor at Portland State University had tracked 610 incidents of far-right militants showing up at protests since George Floyd's death, instigating assaults and scuffles, firing shots, and driving cars into demonstrators; in more than 20 cases, disinformation led to their appearance at the events. FBI director Christopher Wray told Congress that a "majority of the domestic terrorism cases that we've investigated are motivated by some version of what you might call white-supremacist violence."

Yet antifa fearmongering has accelerated. In a Fox News interview with conservative pundit Laura Ingraham, President Trump spoke darkly of a plane full of black-clad "thugs" wanting to do "big damage," a nebulous description echoing the false rumors that had been making the rounds on social media. The mayhem of the "radical left" became the president's central message at the Republican National Convention. And then, in August, a man who claimed allegiance to antifa ideology did apparently kill a supporter of a right-wing group called Patriot Prayer in Portland, Oregon. Facebook rumors accused antifa and right-wing extremists of lighting the wildfires consuming the West, as law enforcement pleaded with people not to listen. Nationally, the question of who was creating the mayhem—police who shot Black men, people who burned buildings in response, vigilante militias, a president turning all of the above into a reelection strategy—grew increasingly muddled by the ideology of who was answering. One person's terrorist was another person's hero; one's lie was another's truth.

After Rittenhouse was arrested, the Freds Guns Facebook page posted a picture of him with his rifle strapped around his chest overlaid with the words "We Salute American Heroes." Facebook alerted Larson that the post violated its standards against violence and incitement. Larson wrote a new post putting into words what he claims "everyone is thinking" but is too "chickenshit" to say:

> *I am going to say it now. You all have purchased masses of fire power from me and are getting ready for the WAR. If on the election night Biden magically wins the next morning will be at best a scene from the movie "Escape from New York With Kurt Russell." Most likely Trump will win and the BLM movement will burn down Silicon Valley... Win Win.*

Toggling between Larson's posts and those of his critics, I was overwhelmed by the chasmal challenge of ensuring a factual center holds. There was evidence for the truth in Forks that June day. If people had slowed down and taken some time to look, most could have seen that there was no sign of rioting antifa on Seth Larson's Facebook Live video, despite his efforts to conjure them. They could have listened to the Sequim police or believed Chevall when he said he was camping. The Bagby sisters saw through the hoax. So did Kris Hull. Dan Larson looked at the evidence and admitted his error. Politics didn't factor into their assessment. It still seems possible to find factual agreement, but momentum is pushing the other way.

By September, Facebook had sent the Clallam County sheriff the evidence investigators had hoped would break the lace of loyalties in Forks. It didn't. The hundreds of pages provided little beyond what investigators already knew from screenshots and interviews. There's hardly any cell service on that part of the A Road, so the data returned from Verizon didn't get them any closer either.

Chief criminal deputy Brian King said he wasn't losing hope. "We're close, we're really close," he says, a tinge of ardor breaking through his even-keeled tone. "It just takes something small to really break this." It could turn on just one person speaking. "But," he added, "we've been close for a while."

The ongoing silence has infuriated the Bagby sisters. "If they're not talking," Tami told me, "throw them in jail! Maybe they'll talk then! I guess you can't do that. It's called kidnapping or something." Kris Hull said her friends no longer wanted to discuss the case unless there's a new development. Still, no one in Forks forgets, she says. "It's never going to quite go away."

Shannon Lowe told me about a person on the A Road who gave her hope, who listened in a way few people in 2020 seem able to. As she walked across the bridge with Chevall, snapping photos, a group of teens scurried away, but two of them turned and came back. One was white and had an "excellent mullet," she recalls, and the other, she thought, was Native American. (He is Latino and is the Forks police chief's nephew.) He explained that they weren't trying to mess with campers, but they'd heard there were "terrorists" in the woods.

At that point, Lowe's nerves were beyond frayed, and she told them to think for themselves. "They're talking about *us*!" Shannon recalls yelling at the teens, the bite of the word "terrorist" overflowing into anger. "But we're not terrorists! *You guys* are terrorists! You are terrorizing my family!"

She saw the Latino teen's face change. "You've blocked us in here," she continued. "We don't want to stay anymore, because we don't feel safe." When the deputies arrived, the teens dutifully cut and dragged the alder branches off the road, then loaded their chain saws back into a truck.

Before jumping in to drive off, the young man looked straight at Shannon and Tyrone with one final message: "I'm sorry." W

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O, ROBOT!

Lora Haddock DiCarlo's high-tech vibrator was supposed to redefine the sex-toy industry.

But the hype itself would be her master stroke.

BY
LUX ALPTRAUM

PHOTOGRAPHS BY

HOLLY ANDRES

ON A SUNNY MORNING LAST JANUARY,

a box truck with see-through walls drove down the Las Vegas Strip, showing off a set of sex toys. The company behind the truck, Lora DiCarlo, had come to town for CES, the Consumer Technology Association's annual showcase. This was the same event from which it had been disinvited just the year before, when its female-pleasure-focused products were labeled "obscene."

This time, Lora DiCarlo would get the royal treatment: prime positioning for its booth, panel-speaking slots for members of its team, nonstop party invitations, and scads of glowing press for its groundbreaking debut device—the very one that had been the source of scandal 12 months earlier, a sensual massager called the Osé.

CES itself had changed to make this possible. There would be no more booth babes on the floor for the 2020 show, pornography was banned "with no exceptions," and sex-related gadgets had a home within the Health and Wellness section. In sum, an industry whose primary consumers were women had at last been granted access to the boys' club. Sex toys were now sex tech.

There was, perhaps, no more important figure in this evolutionary leap than Lora DiCarlo's CEO, founder, and namesake. Her face was emblazoned on the side of the company's booth, set between scaffolds of yellow and white. A squad of roller derby players, brought in for the event, skated around the show floor wearing black and yellow tank tops printed with the phrase "Seize the Yes!" This was all a tribute, of a sort, to Lora Haddock DiCarlo: self-professed "anatomy geek," medical school dropout, self-taught inventor, feminist provocateur, and now a data-driven, visionary entrepreneur.

DiCarlo's fight with CES the year before had been the twist that turned her into a tech celebrity. It started with an angry open letter calling out the trade show for its "long, documented history of gender bias, sexism, misogyny, and double standards." Case in point: Just a few months before, CES had honored the Osé with an innovation award in its Robotics and Drones category, only to rescind the prize on account of its indecency. Yet, as the letter noted, the show had no problem making room for gynomorphic sex robots and VR porn for straight men.

Her critique was covered by *The New York Times* and NPR, on the WIRED website, and in blogs and newspapers around the world. (That summer, DiCarlo gave it once again on an episode of *This American Life*.) By the time CES 2020 kicked off, the show's parent organization had been shamed into offering an apology, along with numerous, new accolades for the company (including a restoration of its original CES award, plus two new ones). And when the company's website started taking presale orders for its device, on November 26, 2019, DiCarlo claimed it brought in $1 million in the first five hours. Now, with that revenue, plus several million dollars more from investors, she was ready to pursue her plan to "close the orgasm gap."

By the time she rolled back into Vegas nine months ago, with her truck of robot dildos on the Strip, DiCarlo was more than a CEO: She was a conference-hopping activist, an icon on a mission to erase the shame around women's sexuality. Her Instagram feed showed a growing global influence. There she was, snorkeling in Bora Bora, on the stage at Women in Tech Stockholm, touring the Vagina Museum in London, posing with the NBA All-Star power forward Blake Griffin, and on a panel at TechCrunch Disrupt with her pet Pomeranian, Enzo Ferrari Drift DiCarlo, stretched across her lap.

And then, there she was again at CES, like the X-rated version of Steve Jobs, as much on display as the breakthrough tech that she'd invented.

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THE OSÉ ROBOTIC Massager for Blended Orgasms doesn't look like a typical sex toy. Where others come in pink and purple hues, Lora DiCarlo's flagship product—an 8-inch-long curved device enclosed in silicone—is a neutral gray, reminiscent of the casing on a classic Mac. If the iMac G4 was meant to resemble a sunflower turning to meet the light, the Osé's limber neck suggests a bird-of-paradise flower arcing from a vase.

The genius of the Osé is more than just aesthetic, though. Like many other devices, it's designed for dual stimulation, with a palpating wand to activate the G-spot while a thrumming oval applies suction to the clitoris. This is a variation on the classic rabbit-style vibrator made famous by *Sex and the City*. But those one-size-fits-all devices tend to have a common problem: Any given rabbit might feel amazing to one person, while

another finds the parts are misaligned for their intended targets. The Osé, on the other hand, is meant to work for everyone.

To make that happen, DiCarlo had to do her own research, surveying women by the hundreds, asking them to measure the distances between their clitoris and vaginal opening and between their vaginal opening and G-spot. (She gave instructions.) With that data as a guide, she set out to build a product with a hinge flexible enough for any customer. "I saw an opening in the marketplace for a physiologically appropriate design for people with vaginas in the sex-tech space," DiCarlo told the Hustle last year, "and I decided to … fill it."

There was more: The Osé has "biomimetic" engineering and design, according to the company, which swaps machine vibration for something more like human touch; and its prototype was developed in partnership with the robotics department at Oregon State University. As the company scaled up, its employees' résumés got more impressive too. Director of engineering Kim Porter had worked with Nike, Intel, and Starbucks, and helped design space suits for NASA. Chief marketing officer Stephanie Hooper helped launch the Frappuccino and the first wireless-enabled phone. Senior retail marketing manager Ian Kulp had worked with Estée Lauder and Sharper Image prior to serving as the director of marketing at New York City's Museum of Sex. All this talent came together not to sell another cheap, plastic vibrator, but to redefine the sex toy.

Their dream, at least, was nothing new. In the century and a half since vibrators first appeared, variously powered by steam, water, and compressed air, the technology has been continually reimagined and improved. The devices were originally used by doctors in nonerotic ways, as a treatment for lumbago, constipation, and other ailments; they later morphed into sexual consumer products, in the form of electric-powered "vibratory apparatuses" for the home. The development of alkaline batteries made them smaller and more portable; lithium-ion batteries made them more powerful.

While some of these changes were rooted in scientific advances, others came from changing social mores. As attitudes toward sex loosened in the mid-20th century, sex toys got more graphic and anatomical; boxy, bulky designs gave way to phallic shapes (some were cast from penises). More recently, designs have tilted back to the earlier abstraction, objects with a Jony Ive inflection that's more at home in the MoMA Design Store than in a seedy porn shop.

"Sex toys always reflect the culture we live in," says Hallie Lieberman, the author of *Buzz: The Stimulating History of the Sex Toy*. And in the current moment, sex toys now attempt to mirror the prestige of tech. They've been recast, both in their mechanics and their branding, as disruptive gadgets. "In a culture where the biggest companies are Google, Amazon, and Apple, if you want your product to be taken seriously, you call it tech, which makes it highbrow," Lieberman says.

Lora Haddock DiCarlo was not the first sex toy entrepreneur to make a play for this prestige. By 2010 the San Francisco–based luxury brand Jimmyjane had raised $8.3 million in capital, much of it from the hedge fund Palo Alto Investors and venture capitalist Tim Draper. That same year, OhMiBod—which makes a vibrator that syncs its rhythm with a connected iPod—began exhibiting at CES. Three years later, Crave, the first company to successfully crowdfund a sex toy, announced that it had raised $2.4 million in angel funding from a group of prominent tech investors. In 2014, sex tech had its own dedicated block at New York's Social Media Week, with entrepreneurs given the opportunity to pitch investors in a *Shark Tank*–type event. By the end of that year, an MIT-educated mechanical engineer named Janet Lieberman-Lu, with close to a decade of experience designing and manufacturing at companies like MakerBot and Quirky, had cofounded another forward-looking, female-focused sex toy company, Dame Products.

For many in the business, DiCarlo's arrival on the scene in 2019 felt like the culmination of that long endeavor. She had promised a genuine technological advance: a toy that could work for any and every body, at a price point that wasn't fully out of reach. (The Osé retails for $290; competitors range from $10 for a vibrating bullet to $15,000 for a gold-plated G-spot vibrator.) Yet if her company had really managed this accomplishment, it was slow to make the big reveal. For all the glitz of its PR campaign—despite the roller derby girls, the box truck on the Vegas Strip, the speaking tour, and all the rest—the Osé Robotic Massager itself remained elusive.

For months, Lora DiCarlo kept the product under wraps. Even at the Adult Novelty Manufacturers Expo, held in summer 2019 at the Airport Marriott in Burbank, California, the company hid its prototype from everyone but a select group of industry insiders. It was an unorthodox rollout for a sex toy, says Coyote Amrich, director of purchasing and product development for the San Francisco–based boutique Good Vibrations and one of the few who did receive a private demonstration. "In our industry, we're shown products that already exist, that already are a bona fide item, and then they ship in the next two weeks." But this wasn't just another rabbit-style vibrator; it was microrobotic, biomimetic engineering—it was tech. Different rules applied, Amrich says: "You go to CES and items are shown that might not come out for a year."

Indeed, even in the lead-up to Las Vegas for this year's CES, the Osé—which had by then been named one of *Time*'s 100 Best Inventions of 2019, alongside the newest Impossible Burger and the Oculus Quest—was still something of a mystery.

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IN APRIL 2020, somewhere in Seattle, a 39-year-old man with a shaved head and scruffy facial hair lifts an Osé toward the camera of his laptop. Then he pulls a camping knife from his pocket and jabs the dual massager at the bottom of its bulbous head.

These are the early days of the Covid-19 lockdown, and Brian Sloan, the man in question, has apologized, via Skype, for his schlubby outfit: a light-gray fleece hoodie and dark-gray pants, the same ones he's been wearing for two weeks. Sloan, the inventor of the Autoblow, the Slaphappy, and the 3Fap, is no stranger to the inner workings of pleasure products. "I take apart most sex toys," he tells me, so as to better understand his competitors. (Many sex toy designers do the same.) Sloan has disassembled air-pressure-driven products like the Womanizer and the Satisfyer. He has deconstructed automated strokers like the Fleshlight Launch. "Anything that's mechanical, I've taken apart, pretty much," he continues. Today, Sloan is determined to peer inside the Osé, and I've invited myself along to watch.

His surgery begins with an excavation of the product's "robotic" G-spot stimulator—its hardware for come-hithering. Sloan slices into the silicone skin and peels it off as if he's

husking corn. The stimulator, thus denuded, is an oblong plastic pod with a serrated slot carved along one side. Sloan powers up the toy and watches as the motor starts to whir. There's a screw inside the pod, and with juice it begins to twist and push a plastic ball, about the width of someone's finger, that moves back and forth along the length of the housing's opening. The screw is positioned at an angle such that the ball protrudes each time it makes its way up along the treads and then recedes inside for each return. "It's like one of these genius, simple solutions to making something," pronounces Sloan—a clever, low-cost hack. ("Sloan's speculation about Osé technology and manufacturing costs for Osé is incorrect," the company said, noting that the US Patent Office has deemed the device novel and unique.)

At first glance, Brian Sloan seems like the yin to Lora Haddock DiCarlo's yang: Where DiCarlo makes products that help women discover their bodies, Sloan's flagship product, the Autoblow, advertises "unlimited, perfect blowjobs" for men. Where DiCarlo surveyed potential customers about their anatomical measurements, Sloan set up beauty pageants to find the world's most exquisite vaginas and anuses. (He promised the winners thousands of dollars in exchange for 3D scans of their orifices, which would be the basis for his future toys.) Where DiCarlo has been a champion of the industry's push into the "wellness" mainstream, Sloan is all too happy to wallow in the sleaze.

They also have their similarities. DiCarlo's marketing, aimed largely at direct-to-consumer sales, invokes the language of advanced technology: microrobotics, biomimesis, data-driven design. So does Sloan's: His Autoblow AI device, also sold directly through a website, is said to replicate fellatio techniques based on a machine-learning analysis of 1,000 hours of video footage. Like DiCarlo, Sloan was once on the path to a more conventional career. He made his way into the sex industry after getting a law degree from Penn State. She's said that she dropped out of medical school to form a tech company after having a powerful orgasm. In the aftermath, she lay there "drooling, thinking, 'That was cool. How do I do that again by myself?'"

Sloan has sold hundreds of thousands of blowjob machines, though his company has just a handful of full-time employees and no dedicated marketing team. And with production at his factories in China slowed by the pandemic, he's got all the time in the world to investigate the Osé. Having just pried apart its G-spot stimulator, he now turns to its flexible neck. Beneath the silicone skin he finds another tube, the structure that gives the sex toy its special flexibility. Coyote Amrich of Good Vibrations had been especially impressed by this innovation. Most sex toys aren't designed to be bent at all, she told me, but the Osé could be molded into seemingly infinite contortions. "The technology is something I haven't really seen before," she said.

Sloan studies the bendable tube and tries to guess at the mechanism. Perhaps it's something like the MysteryVibe Crescendo, he says—a flat, bendable vibrator. When Sloan dissected one of those, he found a skeleton of interlocking plastic parts inside. (I provided strategy and marketing consulting services for that product during the company's initial crowdfunding campaign.) Inside the Osé's tube, he sees no small parts at all—just a bundle of copper wires wrapped in fabric and tape. "This is smart," he tells me. "It's a really inexpensive way of doing it."

Finally he cracks open the clitoral stimulator: a motor attached to a soft cup that collapses and expands.

With the device in pieces, Sloan tells me he feels vindicated. He'd been skeptical of Lora DiCarlo's claim to have created a "microrobotic" device. "Unless it's so 'micro' that I can't see it with my human eyes, it's just normal stuff that belongs in consumer products," he says. When I put this to the company, the engineering director, Kim Porter, explained that the "microrobotics" were less about equipment size than precision of motion. She sent over a detailed list of specs related to its "come-hither motion precision" and use of infrared and magnetic sensors. I ran these by Eric Diller, a microrobotics expert at the University of Toronto, and he said they might satisfy a "loose definition" of the term.

But what had really bothered Sloan was the Osé's puffed-up presentation and DiCarlo's posture as a trade-show activist. It was unfair, he thought, to the many hard-working vibrator entrepreneurs who'd built the industry she now claimed to upend.

Yet Sloan was taking inspiration too. In the lead-up to CES's more inclusive and sex-positive 2020 show, he put out his own angry open letter—a burlesque of Lora DiCarlo's from the year before—that advocated for the lewder side of the industry. The event's more sensitive, updated policies were themselves discriminatory, the letter said. Now it was male sexuality that was being stigmatized and left out. In particular, Sloan took issue with the ban on pleasure products explic-

◀ Lora DiCarlo's founder and CEO, Lora Haddock DiCarlo

Could this be sex tech's Juicero—a humdrum gadget bested by your own two hands?

LUX ALPTRAUM *(@LuxAlptraum) is the author of* Faking It.

itly modeled after genitals—a ban the Lora DiCarlo team had championed. "While CES has (commendably) helped to lift the stigma against sexual devices for women by allowing them to be displayed as mainstream consumer electronics," he wrote, "CES has reinforced the stigma against sexual devices for men (and the related shame) by disallowing them based solely on the one feature that happens to be highly linked to their commercial success: human orifices."

Few tech publications reported on Sloan's letter. He did not get invited for an interview on *This American Life*.

The Baci, a robotic clitoral massager from Lora DiCarlo

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AROUND THE SAME time that Sloan dismantled the Osé over a video call, a disconcerting post appeared on Lora Haddock DiCarlo's Instagram feed. The Osé was finally going out to customers, and the company was gearing up to launch a second product, the Onda. But something else was on its founder's mind. "Hi folks, the last couple of weeks have been harder than I've let on," she wrote. "You all deserve to know ... I was positively diagnosed with Covid-19."

The accompanying photo featured DiCarlo apparently topless in her bed, a hint of cleavage visible above her sheets, with her fingertips resting coyly against her forehead. She was not wearing any makeup, and there were dark circles under her eyes. Save for those two details, it felt more like a soft-core glamour shot than a public health announcement.

"Lora is a PR dream, she's a marketer's dream," Stephanie Hooper, the company's chief marketing officer, told me. "She's so authentic. She is just who she is." (Hooper left the company this summer, along with Kulp and director of sales Sarah Brown.) Around the office, there's frequent talk among the team of "Brand Lora": the notion that, independent of whatever products the company might produce, DiCarlo herself is a marketable quantity, a femtech visionary ready to inspire the world.

Indeed, DiCarlo has gone the extra mile to promote her company and to emend its image—her image—as required. Her life story is one of iterated self-invention. She graduated from high school in California, feeling unsure of herself and adrift. Eventually she enrolled in junior college, but then something shifted inside her, and she decided she was meant for bigger things. At first she tried enlisting in the Navy, but that plan ran aground, she says, when her score on the military enlistment exam was so high that she wouldn't be able to pursue the Navy nursing job she wanted.

She landed a Navy scholarship to study nursing at a military college in Vermont, only to be derailed again when her mother's declining health forced her back to California. A few years later, DiCarlo told me, she was back in school for premedicine at Portland State University. That's when she had the orgasm that changed her path one last time. In starting a sex-toy company, she says, she found the sense of purpose she'd been seeking ever since high school.

From interview to interview, however, certain details of her background have been either tweaked or garbled: In some reporters' write-ups, for example, she's a Navy veteran and former nurse; in others (and on the company's website), she's said to be a med school dropout. Norwich University, the military college, confirms that DiCarlo was enrolled in its nursing program for a single semester in the fall of 2009. The California Department of Public Health confirms she was a certified nursing assistant from 2008 to 2010. An official at Portland State University said they had no record of her ever being enrolled there as a student. In response to further inquiries, the company told me that DiCarlo was never enrolled in medical school or at Portland State.

It's also not clear whether any robotics faculty at Oregon State were actually involved in the design of the Osé. (The company did work with OSU's Prototype Development Lab.) DiCarlo's project to collect anatomical data from hundreds of women was similarly hard to pin down: Though the data plays a large role in the company's mythology, none of the employees whom I interviewed ever

mentioned having seen it. DiCarlo later told me that she'd collected these measurements "out of sheer curiosity" and that they'd given her a "reason to drive forward" with creating the company.

Regardless, Brand Lora has had real results. With its top-tier marketing, the company managed to attract media attention and generate some early sales, all while helping to improve the way the tech industry presents sex. In the months after her company's open letter, the CTA approached DiCarlo, among others, for advice on revising the rules for sex-tech exhibitors. (The CTA declined requests for an interview.)

"Lora advocated that sexual health should be treated no differently than an adjustable bed or a standing desk," says Rachel Johnston, the company's former publicist. Other startup founders who have long pursued the same goal recognize the value of those efforts, and the publicity they spawned. More sex-tech companies at CES has meant more legitimacy for the product category, says OhMiBod cofounder Suki Dunham. "It raised the level of understanding for the space." Though someone else's company is getting the lion's share of the press, Dunham doesn't seem concerned. "A rising tide floats all boats," she tells me.

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MY OSÉ ARRIVED by mail in a yellow and white box. (The company sent me one for review, free of charge.) When I turned it on and dialed up the device to full power, it began to whine and pulse: With both stimulator mechanisms running at full power, the Osé was far louder than other toys I've tested. After multiple attempts, the hands-free, biomimetic robot did manage to provide me with the much ballyhooed blended orgasm, but—in my opinion—it was awkward to use and felt a little cheap.

Others, too, had "seized the yes" and found it somewhat lacking. Mashable, one of the few press outlets that reviewed the device, awarded it 2.5 out of 5 stars, a score boosted by some extra points awarded for its "cool factor." The handful of reviewers who have shared their opinion on ProductHunt were almost uniformly displeased. One suggested that the company's attempt at biomimesis had, perhaps, been too successful for its own good: "Overall this experience was worse than a toss with a boring inexperienced man."

In late April, a few weeks after I'd received my Osé, DiCarlo and I talked on Zoom. Brand Lora was in full effect: She looked fantastic, with her hair carefully tousled and her neck adorned with jewelry. But her tech-visionary hoopla was more subdued than I'd expected. Where in other interviews she'd boasted of her product's ability to remake the female orgasm, now she positioned the Osé as a baby step. "We're still a startup," she explained. "Nobody ever gets their first product to market perfect. Nobody ever gets it even close to perfect." A few minutes later, she pivoted to telling me about the company's newer offering, a sex-education and coaching platform called WellSX that will eliminate shame around sex by providing users with a "high-touch human experience."

Lora DiCarlo was on to other sex toys too. At CES 2020, the company debuted the Onda and the Baci—effectively the Osé's G-spot stimulator and clitoral suction device split in two. In February, Lora DiCarlo filed trademarks for two more unreleased devices, the Filare and the Carezza; and a redesigned Osé 2 is now on sale. As a way of doing business, this would be pretty normal for a tech firm, says Janet Lieberman-Lu, the engineer and cofounder of Dame Products. (Lieberman-Lu left that company earlier this year.) The tech-world mindset and funding strategy "pushes you into a trajectory where you have to grow really fast," she says. "You're building up the bubble, and then you're trying to build the structure in place in the hopes that when that bubble pops there's something there to catch your company."

That's not how things typically work in the sex-toy industry. For a company like Dame Products—or even Brian Sloan's Very Intelligent Ecommerce—consumers, not investors, provide most of the cash from the start. Not many adult companies have relied heavily on venture capital, and the handful of exceptions—like the hedge-fund-backed Jimmyjane—have tended to get their major investments years after their products have proved successful in the marketplace. Lieberman-Lu was struck by how things played out with the Osé, though, which was picking up awards before anyone had even held it in their hands. "It's a little bit jarring for people who work in the industry to see the artifice," she says. "It's not just a different way of doing things. It's an unhealthy way of doing things."

Indeed, once I saw the Osé up close, another fragile "health and wellness" startup came to mind: Juicero, the company that saw an opening in 2016 for its $400, Wi-Fi-enabled juicers in the fruit-smoothie-tech space and decided to fill it. In spite of $120 million from Silicon Valley investors, Juicero's product—described as a new "platform" for food delivery—turned out to be about as good at pressing the company's proprietary produce packets as a human's grip.

Could the Osé be sex tech's version of the same—a humdrum gadget potentially bested by your own two hands, dressed up as innovation and sold at twice the price of competing products? "We don't pretend that we know 100 percent exactly what we're doing," DiCarlo told me as we wrapped up our interview. "We're a young company. We're learning as we go." It was both the most honest and the most off-brand thing she said to me during our time together.

Her award-winning product may have been a dud, but it was clear that was only half the story. From DiCarlo's first moment in the spotlight, she'd been celebrated for her mastery of tech—for the way she'd used it to redefine the sex toy in service of her mission of empowerment. But the noisy, undistinguished vibrator that's now collecting dust under my bed was not, perhaps, her main invention. The company's success came not from the Osé but from the way it was promoted. DiCarlo had built a hype machine, precision-engineered with all the tools of startup culture, and there's no denying that it worked. It was Brand Lora, not the Osé, that recast a low-level health care worker with no background in either sex or tech as a thought leader in both spaces. It was Brand Lora, not the Osé, that helped the world accept that a sensual massager could be on par with Apple's AirPods, and that an industry long neglected and belittled should at last be taken seriously.

The Osé didn't have to be groundbreaking for this mission to succeed. It didn't even have to exist. That's an awkward truth about the tech-crazed culture of the moment: Startup founders may be treated as celebrities, but technology itself—what it does, how it works—can sometimes be an afterthought. We may venerate the gadget, but we're in thrall to something more abstract: the promise of a better, more satisfying world. W

CIPHER IN CHIEF

— BY GARRETT M. GRAFF

Meet General Paul Nakasone.

He has reined in years of chaos at America's most powerful spy agency and taught the US military how to launch pervasive cyberattacks.

And he did it all without you noticing.

ILLUSTRATIONS BY GEOFF KIM —

In the years before he became America's most powerful spy, Paul Nakasone acquired an unusually personal understanding of the country's worst intelligence failures.

Growing up, he was reared on his father Edwin's recollections of December 7, 1941: how Edwin, then age 14, was eating a bowl of cornflakes with Carnation powdered milk when he saw Japanese Zeros racing past the family's screen door on Oahu on their way to attack Pearl Harbor. They were so close that Edwin, who would grow up to become an Army intelligence officer, could see one of the pilots. "I can still remember to this day," Edwin would recall years later, "that he had his *hatchimati*—his headband—around, goggles on."

Decades later, Paul himself experienced another disastrous surprise attack on America at close range: He was working as an intelligence planner inside the Pentagon on the clear September Tuesday when American Airlines Flight 77 crashed into the building. He remembers evacuating about an hour after the attack and looking over his shoulder at the giant column of black smoke rising from the building where he went to work every day.

Over the next 15 years, as America waged the resulting war on terror, Paul Nakasone became one of the nation's founding cyberwarriors—an elite group that basically invented the doctrine that would guide how the US fights in a virtual world. By 2016 he had risen to command a group called the Cyber National Mission Force, and he was hard at work waging cyberattacks against the Islamic State when the US suffered another ambush by a foreign adversary: the Kremlin's assault on the 2016 presidential election.

This attack, however, happened not with a bang but with a slow, insidious spread.

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As it unfolded, Nakasone lived through the confusing experience inside Fort Meade—the onyx-black headquarters of both the National Security Agency and a then-fledgling military entity called US Cyber Command. As sketchy intelligence on Russian meddling coalesced through the summer and fall of 2016, his colleagues were so caught off-guard that one of the most senior leaders of Cyber Command told me he remembers learning about the election interference mainly in the newspaper. "We weren't even focused on it," the leader says. "It was just a blind spot."

Four years later, Nakasone is now the four-star general in charge of both Cyber Command and the NSA—one of the officials most directly in charge of preventing another surprise attack, whenever and wherever it may come, whether in the physical world or the virtual. He is only the third person to occupy what is perhaps the most powerful intelligence role ever created, a so-called "dual hat" in government parlance. As director of the NSA, he commands one of the greatest surveillance—or "signals intelligence"—machines in the world; as the leader of Cyber Command, he is in charge not only of defending the US against cyberattacks but also of executing cyberattacks against the nation's enemies.

Nakasone inherited and then steadied an NSA in crisis, shaken by years of security breaches, chronic brain drain, and antagonism from a president obsessed with a supposed "deep state" operation to undermine him. Nakasone's Cyber Command, meanwhile, is a once-restrained institution that has been unshackled to fight the nation's enemies online. A quiet beneficiary of Donald Trump's details-be-damned leadership philosophy, Nakasone has found himself with unparalleled, historic power—with more online firepower at his disposal than the US military has ever fielded before, as well as more latitude to execute individual missions and target adversaries than any military commander has ever been given. It's as if during the Cold War the White House had delegated targeting authority to the commander in charge of maintaining the nation's missile silos.

Nakasone's offensive cyber strategy, which was developed under the eye of Trump's former national security adviser John Bolton, represents a paradigm shift in how the US confronts its adversaries online. Rather than waiting to respond to an attack, Nakasone and US Cyber Command have shifted to talk of "persistent engagement," "defending forward," and "hunting forward," amorphous terms that encompass everything from mounting digital assaults on ISIS and Iran's air defense systems to laying the groundwork for taking down Russia's electrical grid.

While the precise operations remain tightly classified, and only two have been publicly reported—a 2018 campaign against the Russian Internet Research Agency and a 2019 attack on Iran—it is likely that Nakasone has already, in his short, two-year tenure, launched more cyberattacks against US adversaries than Fort Meade had initiated in the rest of its history. According to WIRED's reporting, Cyber Command has carried out at least two other sets of operations since the fall of 2019 without public knowledge. Without confirming specific numbers or operations, the White House made clear that's exactly what it expects of Nakasone. Trump officials say they charged him with dramatically stepping up the tempo of American digital warfare. "We weren't asking, 'Can we do two or three more operations right now?' We were asking, 'Can we do 10 times more activity right now?'" a senior administration official explains. "President Trump's answer was yes."

Nakasone was appointed to his position by Trump, but by custom his term will extend until 2022, and his influence stretches back at least a decade. He's done more than perhaps any other military or civilian leader over that period to push, drag, and pull the United States into thinking through what warfare will look like in the 21st century. As one of Nakasone's former bosses told me, America's way of cyberwar has developed over the course of a 10-year journey, ushered along by a select few, and "Paul's been on that journey since the beginning." Where American cyber strategy is concerned, we live where Nakasone has taken us.

THE QUIRKIEST THING ABOUT PAUL Nakasone is that he prefers to write with a pencil. Friends and colleagues—including dozens of people who have known him for decades and worked with him in offices and combat zones, sometimes in enormously stressful environments—universally struggled to come up with telling anecdotes about him or to identify his personal idiosyncrasies or eccentricities. Apparently, he purses his lips when he's thinking, and he reads a lot of books.

The pencil thing, though, made an impression. An oversize No. 2 pencil, a farewell gift from one of his former commands, today stands as one of the only pieces of personal memorabilia in his otherwise spartan office at Fort Meade. His workplace aesthetic largely eschews the plaques, coins, flags, and honorary photographs that often plaster the offices of four-star generals. But Nakasone has held onto that big yellow pencil, and he always has a regular-size one ready for jotting down thoughts in meetings; throughout

the day, his aide carries a ready supply of sharpened pencils in case of a broken tip.

Few Americans would recognize Nakasone if they saw him walking down the street. He throws off the vibe of a Midwestern suburban dad, which he is. (He and his wife have four children, the youngest of whom are just entering college, and Nakasone is deeply loyal to Minnesota, where he grew up.) "Level-headed, nonemotional, well-prepared, and exceedingly decent" is how Denis McDonough, a longtime friend who served as Barack Obama's White House chief of staff, describes him. Yet Nakasone not only leads Cyber Command, he was one of its architects, and he was a key figure in each stage of its operational trials and evolution.

All along, he's been a Zelig-like figure, the ultimate gray man, whose views about surveillance, intelligence, and war-fighting have remained remarkably opaque. He spent most of his career in the shadow of much larger and more visible personalities—serving as a key aide to Cyber Command's founding leader and visionary, Keith Alexander, and working under Mike Rogers' volatile tenure at Fort Meade—and he now studiously avoids attention amid the chaos and controversies of Donald Trump's Washington.

Not surprisingly, the NSA's public affairs office would not make Nakasone available for an interview. But this article draws on more than 50 hours of interviews with some three dozen current and former officials from the White House, government, intelligence agencies, and the military—including a half-dozen fellow generals—as well as Capitol Hill leaders, outside observers, and foreign intelligence partners; nearly all of them asked to speak anonymously in order to discuss sensitive intelligence, operational, and personnel topics. Their insights into Nakasone, and the story of how he ended up atop Fort Meade, don't just help explain how America is planning to fight the next war online—they help explain the wars it is already fighting.

It was war that brought the Nakasone family across the Pacific from Japan in the first place. In 1905, Paul's grandfather fled hostilities between Russia and Japan, two expansionist empires, and settled in Hawaii. Paul's father, Edwin, grew up selling strawberries door to door to his family's haole (white) neighbors. Four years after witnessing the surprise attack on Pearl Harbor, Edwin joined the Army; as a young intelligence officer, he was dispatched to occupied Japan as an interpreter. After his service, Edwin attended the University of Minnesota on the GI Bill in 1950. He met his wife, Mary Costello, a librarian, when he asked her for help with a paper about India. They were married in 1954, and their second son, Paul, was born just three days before John F. Kennedy was assassinated in 1963.

As he grew up, Paul kept faith with his family's devout Catholicism and his father's military service. He attended Saint John's University, a Benedictine institution in Minnesota, as an ROTC cadet. Immediately after graduation, he went off to Fort Carson, Colorado, following his father into Army intelligence.

The first 15 years of Nakasone's military career were relatively unremarkable. He spent much of the 1990s serving in Korea and working desk jobs at the Pentagon. But in the post-9/11 era, he became particularly attuned to the ways American intelligence had failed to keep pace with the digital age. As the US military was mobilizing to invade Iraq, he led a battalion at Fort Gordon, Georgia, a center of the military's signals intelligence work. He and his wife were juggling brand-new twins, their third and fourth children, while his team at Fort Gordon found itself struggling to overhaul the Army's slow approach to delivering intelligence to the field. "He wasn't in combat, but he found a way to make everything that we got relevant to those who were," recalls Jennifer Buckner, a now-retired brigadier general who served with him at Fort Gordon. In July 2005 he went to Iraq, experiencing firsthand how intelligence filtered down to soldiers—or didn't—on the modern battlefield.

In June 2007, the same month the iPhone was released, Nakasone landed at Fort Meade. He took over command of the Meade Operations Center, a unit designed to wrangle the NSA's capabilities to support combat troops around the world. (The NSA, which is part of the Defense Department but not part of the military, is technically something called a "combat support agency.")

At the time, Nakasone thought this might be his final assignment in the military. He had just made colonel, and the career path ahead of him narrowed sharply; there weren't many openings to become a general in Army intelligence. Up until then, Nakasone was seen as bright but not really a high-flier—not, say, a Michael Flynn, the hotshot officer a few years his senior who was then running intelligence for US Central Command in the Middle East. Plus, he was a cyber specialist; there wasn't much of a proven career path for someone with his area of expertise.

But Nakasone's arrival at Fort Meade came at an auspicious moment. The director of the NSA, Keith Alexander, then a three-star Army general, was growing frustrated that his agency was failing to support the men and women at war in Iraq and Afghanistan. He was on the lookout for like-minded leaders who could help him transform it.

The NSA that Alexander inherited was a proud institution, steeped in its own history of wartime code-breaking and code-making. "NSA's job at the end of the day is to exceed the expectations of its adversaries," one former top official told me. "That audacity is essentially steeped in the sense that 'we do the impossible and leave the ordinary to everybody else.'" It was also, however, an institution largely designed to counter Soviet aggression in a world of landlines. The NSA's historic strategy was to intercept the telecommunications of foreign governments, eavesdropping on fixed targets over long stretches of time. To explain its culture of strategic patience, NSA veterans sometimes point to the story of Laura Holmes, an internally legendary Cold War cryptologist. Asked about her success breaking Soviet communications, she once

said simply: "Nothing miraculous about it. I spent two years learning to speak Russian, two years learning to think Russian, two years learning to understand what experience, what arrogance, and what hubris they would bring to bear, and then I spent the rest of my career waiting for them to do that."

That culture was increasingly ill-suited to an era of fast-moving stateless terrorists, cell phones, and digital communications. As Alexander examined the support the NSA could provide to the surge in Iraq, he realized it was failing the troops on the front line—sending too little, too late "down range." The agency calculated that it was delivering roughly 10 percent of what it knew, 18 hours after the fact.

Alexander was a visionary technician. His management style was to set impossible tasks as a way of forcing an organization to rethink problems and come up with radical new approaches. He told his senior leadership that he wanted the NSA to start delivering 100 percent of its relevant intelligence and combat data to the war zone in a minute or less. The goal was clearly out of the question, but it touched off an audacious rethinking of how to connect back-end intelligence gathering with frontline troops.

One part of the solution was to place cryptologists in Iraq to receive encrypted intelligence from Fort Meade and then dole it out to combat units. The job of figuring out who to send fell to Nakasone, then a relatively young lieutenant colonel. He had served as the assignment officer for the Army's intelligence branch for a time in the 1990s and had a good grasp of the talent in the ranks, so he was able to assemble a particularly effective set of leaders for the job. "He was a soldier's soldier, selfless, very much people-oriented," says one of his colleagues from that time. "I wouldn't say he was brilliant—that's not a criticism. His approach was just 'Give me a hard job and I'll get to it.'"

Nakasone's performance so impressed Alexander that he soon tapped the young colonel to lead a new team that would invent a whole new way of war. In the years after that, Nakasone amassed four stars faster than almost any other officer of his generation.

IN OCTOBER 2008, NSA OFFICIALS made a startling discovery: Someone had managed to penetrate the military's classified network, which was supposed to be fully disconnected from the public internet. While they never figured out for sure what happened, US officials came to believe that Russia had seeded thumb drives infected with malware among the electronics for sale in the bazaars around US bases in Afghanistan. Investigators surmised that an unsuspecting service member may have purchased and used one, against regulation, on the classified system.

The US response came to be known as Buckshot Yankee—a secret, round-the-clock, 18-month effort led by Alexander to rid the Russians from the network. It forever changed how the military looked at cyberspace. Most important, it ushered in the idea that the internet wasn't just useful for intelligence gathering, it was also an actual theater of war. And if cyberspace was a battlefield, the US had better figure out how to command its own troops there.

In 2009, the Obama administration and Alexander started to think through what such a "cyber command" would look like. Alexander, who loved the domain of big ideas, assembled a small brain trust of senior officers to work out the details. Nakasone was one of them. In 2018 he joked to one audience about being cornered by Alexander: "He said, 'I've got this idea.' Now, for those of you that know Keith Alexander, that's either you run or you hide—and I missed both opportunities."

Nakasone found himself conscripted together with three other relatively young officers. The quartet was formally called the Implementation Team, but everyone came to refer to them as the Four Horsemen (despite the fact that one member, a cybersecurity whiz and lieutenant colonel named Jen Easterly, was a woman). They were faced with a once-in-a-generation opportunity to rethink how the nation would fight in a new century—a military revolution as significant as the 19th-century shift from single-shot rifles to machine guns, or the 20th-century move from fighting on land to a world of fighter planes and bombers.

Nakasone, the putative leader of the four, set up the team in a conference room down the hall from Alexander's office, and they spent months working through what the Cyber Command would look like. They worked six days a week, late into the evening, and usually a half-day on Sundays. Nakasone had a less-technical background than some of the others, but he intimately understood the world of military intelligence and—most important—had the boss's ear. "He was probably the guy that General Alexander trusted the most," recalls then-Army-colonel Stephen L. Davis, another member of the team.

The goal was to create an entity that could defend US military networks against cyberattacks but could also occasionally go on the offensive—to wage cyberattacks against the digital infrastructure of America's adversaries. But one of the biggest questions they wrestled with was whether to publicly discuss this latter ori-

THE QUIRKIEST THING ABOUT PAUL [redacted] NAKASONE IS THAT [redacted] HE [redacted] PREFERS TO WRITE [redacted] WITH [redacted] A PENCIL.

entation. In the late 2000s, Alexander's NSA, working together with Israel and the CIA, essentially raised the curtain on the modern era of cyberwar when they developed a worm called Stuxnet and used it to disable Iranian nuclear centrifuges. Stuxnet made headlines around the world, but the congenitally secretive NSA has never taken credit for the attack, and many in US intelligence preferred to keep playing dumb where cyberwar was concerned. "It was a big battle within the department," Davis recalls. The Four Horsemen, Davis says, were all in favor of plainly stating the command's full mission; the compromise was to state it, but vaguely.

As a unit operating in a gray area between two agencies, they also navigated institutional jealousies. The NSA was convinced, members of the team recall, that the group's closed-door sessions augured a hostile takeover of Fort Meade by the military, whereas the Pentagon was convinced the effort represented a land grab of the military's operations by the NSA.

A couple of nights each week, Alexander would stop by the conference room as he was leaving for the day, to check on the team's progress. He'd sit down at one of their desks, kick his feet up, and they'd talk through the thorniest problems they were facing. In coming up with a vision for the military's digital war machine, they had to figure out a whole new combat doctrine and the beginnings of an org chart. Recognizing that Cyber Command would start with no tools or digital infrastructure of its own, they decided that it would lean heavily on calling up the NSA's resources to do its job. Over time, they boiled a multi-hundred-page work plan down to a series of storyboards—an illustrated guide to the complex challenges of cyberwar and how to meet them, drawing on an extended metaphor that involved a gated community. "It ended up being essentially a top-secret cartoon," Davis recalls.

Storyboards in hand, they briefed officials at the White House, Pentagon, and on Capitol Hill. During one congressional briefing, they locked themselves out of their classified material "lock bag" and had to hack into it with scissors. "They had done two years of really hard work slogging through the operational mandate from Buckshot Yankee, and put that into a really compelling story on how we might think about doing things differently," recalls Buckner, who helped staff the effort.

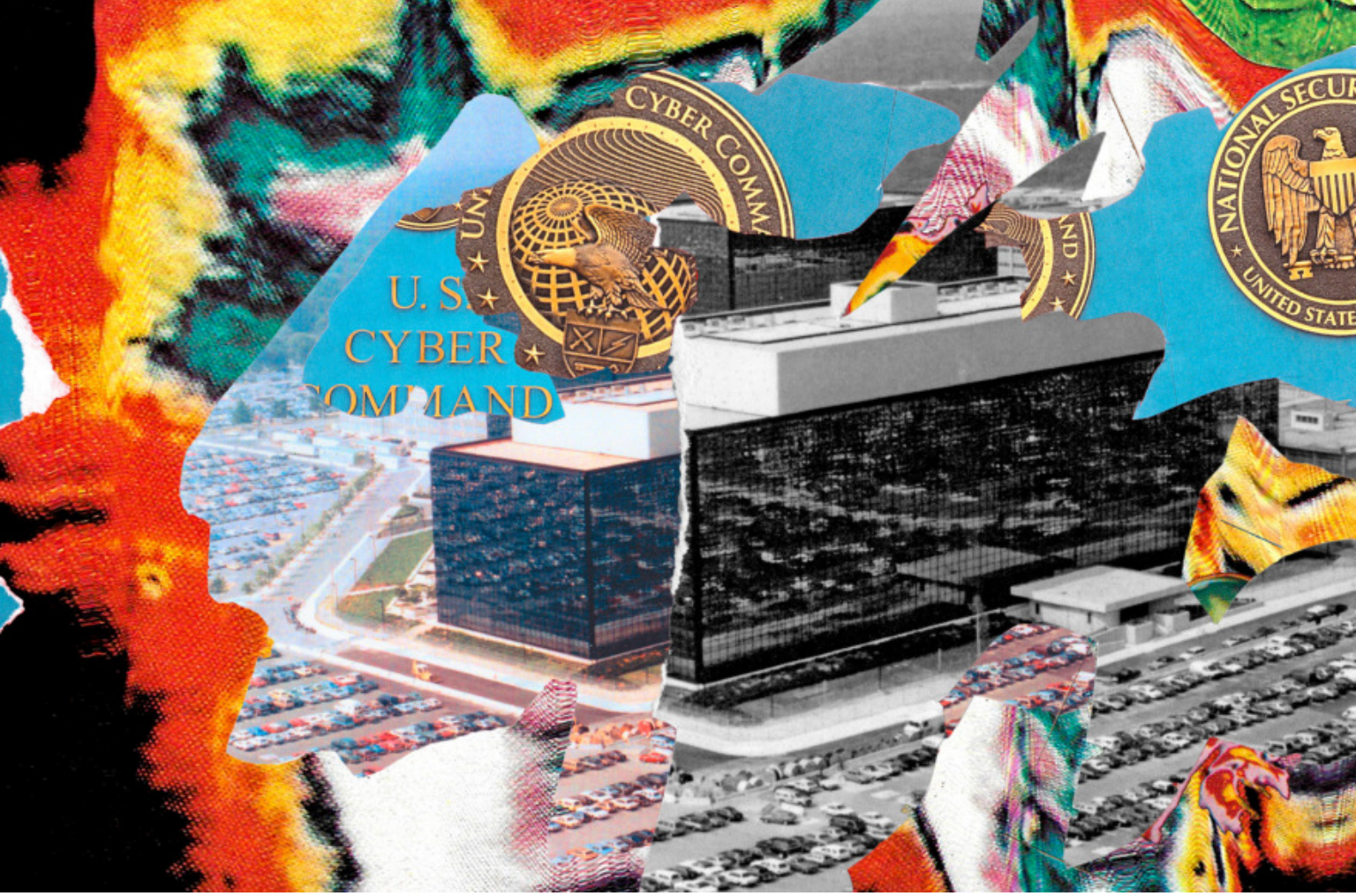
In 2010, Cyber Command officially came into existence, with Keith Alexander serving as its first commander. The new role earned him his fourth star as a general, even though it at first involved overseeing just a few hundred additional people.

In the end, the team's graphic designer came up with perhaps the nerdiest and most concrete way to memorialize their vision: They incorporated into Cyber Command's official emblem an encrypted Easter egg, a string of seeming gibberish wrapping around the center of the emblem, 9ec4c12949a4f31474f299058ce2b22a, that decodes, using the MD5 hash algorithm, into the mission statement drafted by the Implementation Team. (The decoded mission statement itself, written in intense Pentagon bureaucratese, is only slightly easier to parse than the 128-bit encoded version.)

4

THE BIRTH OF CYBER COMMAND BROUGHT disharmony to the household of Fort Meade. The NSA's largely civilian, analytical workforce had long meshed awkwardly with its military leaders—at 5 pm, when the standard military "retreat" bugle call was piped across Fort Meade, Alexander would chafe at civilians who didn't stand, hand over heart, and pay their respects to the daily lowering of the flag. Now that culture clash was exacerbated by the flood of uniformed Cyber Command personnel showing up at NSA headquarters, competing for attention, resources, and space on an already crowded campus. These military newcomers spread out like kudzu—"parasitically," as one NSA official would tell me—across Fort Meade, filling in whatever niches they could.

Moreover, the patient, long-term intelligence-gathering ethos of the NSA quickly collided with Cyber Command's desire to visibly demonstrate its capabilities. Officials at the top of the two organizations couldn't quite square how to do that without exposing the NSA's prized "sources and methods" to foreign adversaries. NSA observers also began to notice that Cyber Command seemed to be taking pride of place in the hierarchy. Public announcements



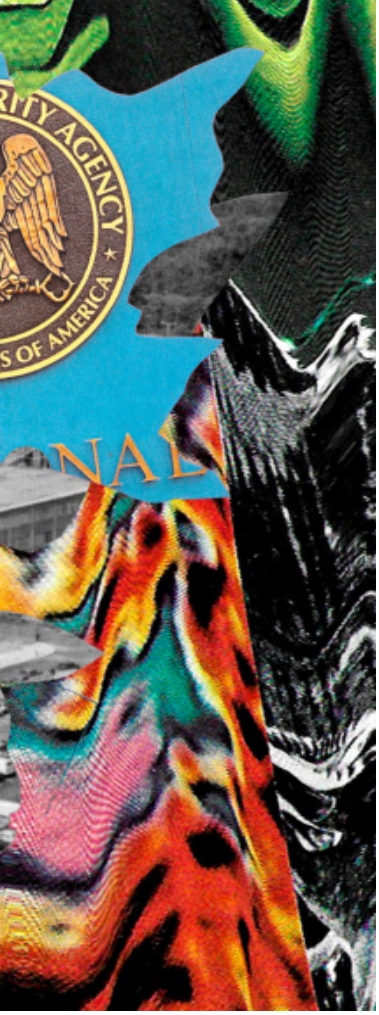
always listed Cyber Command ahead of the NSA, and its flag appeared to the right of the NSA's at official events—denoting in protocol a higher status.

In the midst of all that, the prim, buttoned-up older sibling that was the NSA landed in the biggest trouble of its life. In the spring of 2013, Edward Snowden walked away from his job as an NSA contractor, flew to Hong Kong, and turned over the agency's innermost secrets to journalists Laura Poitras, Glenn Greenwald, Barton Gellman, and others—more than 1.5 million documents that seemed to outline a terrifying global surveillance dragnet, far exceeding the public's imagination of US spy capabilities. Day after day, Fort Meade was rocked by new revelations and controversies. The NSA had long kept a uniquely low profile as an intelligence agency; its nickname in government circles was simply "No Such Agency." That low profile, though, also meant the agency was unaccustomed to public controversy and had little of the political savvy of the other big intelligence agencies in Washington, the FBI and CIA. Stephanie O'Sullivan, the principal deputy director of national intelligence and a career veteran of the much more politically fraught CIA, joked to NSA executives in one meeting, "Welcome to the club."

The public opprobrium at the Snowden revelations stunned the NSA rank and file. "It immediately caused us to question ourselves," recalls Debora Plunkett, one of the NSA's top officials at the time. Suddenly, in the public imagination, the NSA ran an omniscient panopticon that freely abused the civil liberties of the guilty and innocent alike; it didn't matter that agency officials prided themselves on rigorous adherence to the rule of law and felt that they'd kept congressional overseers informed about their activities. "The shock was a shock," then director of national intelligence James Clapper told me back in 2016.

The ongoing scandal further exacerbated tensions inside Fort Meade. The Snowden revelations savaged the NSA's public profile but left the growing Cyber Command's reputation unscathed. "Every time somebody talks about Cyber Command, you hear the angels sing," one senior official at the time says. "And every time you talk about NSA, you hear 'you dirty rat bastards with malevolence in your heart.'" All the while, the NSA was still carrying out much of Cyber Command's work, like a disfavored child who still does all the laundry.

Fort Meade was facing one of the darkest chapters in its history. "There was a lot of internal turmoil and infighting," recalls Edward Cardon, who took over as head of the Army's portion of Cyber Command in September 2013. Cardon had a reputation as an expert in organizational transformation, and soon he was joined by another leader known for his steady hand. Coming off a year in Afghanistan, Nakasone returned to the Washington area in August 2013 as the new deputy commander of Cardon's Army Cyber



Command, assuming the day-to-day operations of the branch's new online warriors.

As the Snowden leaks continued to be published week by week, Nakasone and Cardon worked together all day in a windowless SCIF—a "secure compartmented information facility" specially designed to prevent eavesdropping—at Fort Belvoir, just south of DC, trying to weave together three distinct cultures within the command: communication techs from the Army's signal corps, intelligence personnel from both the military and the NSA, and what Cardon called "the hardcore cyber people," the futurist techies and geeks, some of whom had little interest in military discipline and traditions. "Building that into a cohesive unit?" Cardon says. "Well, you can imagine."

Cardon and Nakasone were still establishing Cyber Command's most basic capabilities. Only about 100 people in the Army had the right set of cybersecurity skills; their goal was to figure out a way to ramp that up to about 2,000. Over the long haul, they realized, the answer was to professionalize a cyber career path in the Army, so there could be career cyber officers the same way there were career infantry, cavalry, and ordnance officers.

As part of that effort, in September 2014, the Army established a cyber branch, its first new branch since the special forces were created three decades before. By then, Nakasone had already moved on to his next role. In May of that year, he assumed leadership of what was known as the Cyber National Mission Force, the offensive arm of US Cyber Command. The new role marked Nakasone as perhaps the nation's foremost cyberwarrior. The only trouble was, it wasn't clear that the US had much interest yet in putting its cyberwarriors into battle.

When Keith Alexander retired in 2014, the tenor of his farewell ceremony drove home that policymakers wanted the US military to hold back its firepower in cyberspace. "DOD will maintain an approach of restraint to any cyber operations outside the US government networks. We are urging other nations to do the same," said defense secretary Chuck Hagel at Alexander's retirement.

Nakasone believed otherwise, Cardon says: "He was advocating pretty strongly that we need to demonstrate the capability of these teams and what they're doing." In part, this was just a matter of growing the institution. "Demonstrated capability brings attention and resources," Cardon says. "If people think you can do things, it attracts great players. We were like-minded. He knew how to go after this." They were just waiting for a moment when Cyber Command could prove itself. It would come sooner than they might have imagined.

5

THE AMERICAN FIGHT AGAINST ISIS came out of almost nowhere in 2015, throwing a nation already wary of an endless war in Iraq back into renewed combat in the Middle East and instilling a sense of growing dread at home. The years-old civil war in Syria had spawned a brutal terror group whose creative use of social media managed to inspire a global wave of would-be jihadists; deadly attacks by self-professed members of ISIS in London, Paris, and San Bernardino, California, put the West on edge in a way it hadn't been since the days following 9/11. "We then looked to anything—including the kitchen sink—to help bring things to closure in this fight," recalls one senior Pentagon official of that time.

The pressure inside the US government was crushing; ISIS proved to be a resilient adversary, and the situation in the Middle East risked engulfing the US in a geopolitical nightmare, as Russia, Iran, and Turkey waded in to support different rivals in the Syrian war. At home, Senator John McCain blasted the Obama administration for its seeming helplessness in the face of a growing humanitarian crisis.

Around this same time, a new set of national security leaders—ones who were less prone to restraint—had filled out the Obama administration. Hagel had been replaced as defense secretary by Ashton Carter, a technophile who quickly became frustrated that Cyber Command seemed to be stuck in park. On more than one occasion, says one NSA official, Carter vented his fury at Mike Rogers, the Navy admiral who had taken over as NSA director and the sec-

ond-ever chief of Cyber Command, urging him to put his new tool to use. Finally, ISIS seemed to present an opportunity for Cyber Command to prove itself.

This was the moment Cardon and Nakasone had been waiting for. On April 7, 2016, Cyber Command began assembling Joint Task Force-ARES, a small team of 50 to 100 named after the Greek god of war. By June, Cardon had put together what would turn out to be the nation's first publicly acknowledged combat force in cyberspace, and Nakasone would command it. One of the innovations of the Cyber National Mission Force was that all of the various service teams were trained to the same standard—an Air Force interactive operator had the same skills as a Marine one, which was a semi-radical idea for a military that normally lets each branch train according to its own pet priorities. It meant that Nakasone could bring together the best operators from across the services. Nakasone carved out a corner of his Cyber National Mission Force offices to house the ARES team, a short elevator ride down from his own.

The team—working in the open space amid screens and standing desks—would have looked familiar to a visitor from Silicon Valley; its esprit de corps was unusually egalitarian for the military. "We didn't care about rank or service," recalls Buckner. "We had a lot of really junior officers, soldiers, airmen, Marines, sailors—you were all equals in this fight."

Nakasone would make regular appearances on the operations floor. He'd listen closely as the team provided updates or batted around potential avenues of attack, his lips pursed in thought. "We'd do these briefings, and at the end of that 45- to 50-minute meeting, he would sit there and summarize the whole thing in two minutes," recalls Stephen Donald, a Navy reservist who served as the chief of staff for the ARES effort. "He has that uncanny ability to take it all in his head."

They had to build their battle plan from scratch. First they had to map out how ISIS operated online—a laborious process in itself—then figure out how to draw the right targets on that map. The deputy chief of Cyber Command, Kevin McLaughlin, who chaired the targeting committee, would often say in early briefings, "Tell me in English, what's this gonna do to them?" The answer, too often, amounted to a hack that would inflict a minor inconvenience at best. Instead, McLaughlin told the team to constantly ask itself, "What are the types of things that you can do in cyber that actually make a difference to the war-fighting side?"

As ever, the NSA often applied the brakes. The Snowden leaks had exposed many of its secret programs and capabilities, forcing the agency to painstakingly rebuild its exploits and infrastructure around the world. Now, Cyber Command risked revealing its surviving programs and new infrastructure. There were frequent debates about the trade-offs of using, and therefore jeopardizing, particular assets or exploits.

More broadly, Cardon recalls, there was the old, ingrained philosophical clash between military operators geared toward the battlefield and intelligence professionals, who operate in the shadows and whose instinct is to protect their hiding places and secret backdoors. With ARES, that clash seemed to come to a head. "They would say, 'If you do it like that, they'll know it's you!' " Cardon says. "I'd just look at them and say, 'Who cares? When I'm using artillery, attack aviation, jets—you think they don't know that it's the United States of America?' "

Throughout, the pressure from the top was unrelenting. Rogers "wanted to pull out all the stops to pass this test," a senior official recalls. Even while the effort was weeks old, Pentagon officials began complaining in the press about the slowness of the progress. The crew was working 14-hour days, seven days a week.

Finally, ARES had done the reconnaissance and laid its groundwork, penetrating ISIS' networks and communication channels, laying malware and backdoors to ensure later access. The president had been briefed. The plan was dubbed Operation Glowing Symphony, and it would attempt to combat ISIS online by exploiting a careless weakness. The ARES team had discovered that despite ISIS' sophisticated, multifaceted global media campaign, the terror group was just as lazy as most internet users. Nearly everything it did connected through just 10 online accounts.

On November 8, 2016—Election Day in the US—D-Day arrived. Methodically, ARES unleashed a digital assault targeting the terror group's ability to conduct internal communications and reach potential recruits. "We launched everything," Donald recalls.

Almost immediately, they ran into an unexpected roadblock: They were trying to break into one of the targeted accounts when up popped a simple security question: "What is the name of your pet?" A sense of dread permeated the operations floor, until an analyst piped up from the back. The answer, he said, was 1-2-5-7. "I've been looking at this guy for a year—he does it for everything," the analyst explained. And sure enough, the code worked. Glowing Symphony was underway.

The team moved one by one to block ISIS from its own accounts, deleting files, resetting controls, and disabling the group's online operations. "Within the first 60 minutes of go, I knew we were having success," Nakasone told NPR's Dina Temple-Raston in a rare interview last year. "We would see the targets start to come down. It's hard to describe, but you can just sense it from being in the atmosphere that the operators, they know they're doing really well."

For hours that first day, operators crossed off their targets from a large sheet hung on the wall as each was taken offline. But that was just the start. In later phases, the ARES team moved to undermine ISIS' confidence in its own systems—and members. The team slowed down the group's uploads, deleted key files, and otherwise spread what appeared to be IT gremlins throughout their networks with the goal of injecting friction and frustration into ISIS' heretofore smooth global march. The task force also moved to locate candidates for what it called "lethal fire." Taken together, ARES proved successful—ISIS' operations slowed as piece after piece of the terror group's media empire was shuttered, from its online magazine to its official news app.

The attack became a critical proof of concept that the US could go on the offensive in cyberspace. "Operation Glow-

ing Symphony was what broke the dam," Buckner says. "It gave an actual operational example that people could understand."

The success of ARES also stood out because very little else seemed to be going right at Fort Meade. Through the summer of 2016, a group known as the Shadow Brokers had been posting hacking tools and exploits somehow stolen from the NSA, and in August of that year the FBI secretly arrested a former NSA contractor for removing files—approximately 50 terabytes of data—from the agency. Agents investigating the leaks had been appalled by the inadequacy of some of the security procedures they uncovered in one of the NSA's most elite units. Both James Clapper, the director of national intelligence, and Carter, the defense secretary, began to feel that Rogers hadn't done enough to lock down the agency's crown jewels—and that he generally wasn't the right person for the job.

Though a brilliant technologist, the career Navy man seemed ill-suited for command of a large civilian workforce. He could be intemperate with staff, dressing down senior Cyber Command officers in meetings and clashing with the NSA's civilians, who sometimes seemed to regard his directives as more suggestions than orders. Clapper and Carter also chastised him for spending too much time on public speaking engagements and on the road, telling him to devote more of his attention to Fort Meade. ("Might be a good idea to stay home," Clapper told him in one conversation.) By that fall, they'd begun to finalize plans to ease Rogers out and to split the "dual hat" role in two—to break Fort Meade up into a military Cyber Command and a civilian NSA. Obama hesitated to pull the trigger on such a major reorganization, though, thinking it a decision best left to his successor, who at the time he assumed would be Hillary Clinton.

But then, as the first hours of Operation Glowing Symphony wrought havoc on ISIS, Donald Trump's surprise victory upended all those plans and assumptions. In fact, the election caught the intelligence community flat-footed in more ways than one. As Russia had carried out a sophisticated three-pronged attack—the hacking and leaking of Democratic Party emails, efforts to penetrate voting systems and databases, and a broad social media campaign to amplify partisan division—US intelligence officials had grasped only the vague outline of the campaign as it played out, and they worried that publicly confronting it might prompt Russia to attempt a sabotage of the November vote itself. Neither side of Fort Meade had responded adequately: The NSA failed to recognize the breadth of the Russian effort, and Cyber Command was never told to fight back; the military side, officials at the time recall, was never really involved at all. "I think it was just a blind spot for us," says one of Cyber Command's top officials at the time. "I don't remember anyone turning to us and saying we need to do something to help make this not happen." Now, with the election returns pouring in, the Russians seemed to have gotten away with their meddling and had even seen their desired outcome: the election of Donald Trump.

Rogers, who understood how vulnerable his position was with Clapper and Carter, quickly embraced Trump, using personal leave to meet with the president-elect at Trump Tower just days after the election. Suddenly, the Obama White House dropped any hope of changing the NSA's structure or leadership, wary of being seen as doing anything to punish a military leader politically aligned with his opponent, especially one who might seem central to the building Russia scandal. "They thought it was totally radioactive to fire him and talk about the split," a senior Obama administration Pentagon official explains.

So in the end, the NSA's dysfunction and the government's uncertainty about how America would fight in cyberspace was kicked over the transom to Obama's unpredictable Republican successor.

6

DONALD TRUMP'S FIRST WEEKS IN THE White House did not exactly lift spirits at the perpetually beleaguered NSA. Just weeks into his presidency, he angrily tweeted about leaks that he suspected were stemming from Fort Meade. "Information is being illegally given to the failing @nytimes & @washingtonpost by the intelligence community (NSA and FBI?).

LIKE MOST INTERNET USERS, [redacted] ISIS WAS LAZY: NEARLY [redacted] EVERYTHING IT DID CONNECTED THROUGH JUST 10 ONLINE ACCOUNTS.

Just like Russia," he wrote on February 15, as part of a 7 am tweetstorm. Soon he was writing off the whole intelligence and military apparatus in Washington as the "deep state." Such comments horrified NSA insiders, who saw their work as critical to providing any commander in chief with the daily knowledge to do his job and keep America safe. As one NSA insider told me, "It's like my father called me a whore; you couldn't wrap your head around it."

Yet despite the president's persistent attacks on the intelligence community, Trump also provided an opening for the most significant transformation of cyber policy since the creation of Cyber Command in 2010. From the administration's earliest days, Trump staffers knew they wanted to shake things up. Their instinct that America needed to be more aggressive online jibed with a frustrated countercurrent of thinking that had been building up in the defense establishment in the latter years of the Obama administration, catching up with cyber hawks like Nakasone.

Some members of an official Pentagon advisory group called the Defense Science Board had begun to argue that the traditional US restraint online was emboldening foreign adversaries. Although Glowing Symphony showed the US could take preemptive action, such actions were still the exception. Iran, China, North Korea, and Russia felt free to launch virtual attacks and operations that stayed below the traditional threshold of war to undermine American power. Time and again, the US weathered online outrages in relative silence: China's 2014 theft of government personnel records; North Korea's 2014 suspected hack of Sony; Russia's 2016 attempt to manipulate the presidential election. "They were taking our lunch," says one former senior White House official. "We say we have all these capabilities, but our bureaucratic process isn't living up to that." What's more, the Trump administration was hardly out on a limb on this particular issue: "There was broad bipartisan agreement," the official says.

Another senior cyber official summarized the three-part mantra from Trump's National Security Council at the start of the administration: "Stop the bleeding, stop building things that bleed, and make the other guy bleed."

In 2017, the Trump administration began developing a full national cyber strategy that aimed to put the US on a more agile, proactive footing. The effort came not a moment too soon. While Trump himself aggressively downplayed any talk of Russian election interference, everyone outside the Oval Office felt the ticking clock of the approaching 2018 midterms and the desire to take a harder line against foreign meddling. That sense of foreboding only increased in 2017 as two massive state-sponsored ransomware attacks circled the globe—the Russian NotPetya virus, which actually incorporated a hacking tool stolen from the NSA, and the North Korean WannaCry. The attacks seeded hundreds of millions of dollars of destruction through corporate networks.

The pervasive cyberattacks added yet one more complication to the deteriorating situation at Fort Meade: Corporations were poaching its talent. JPMorgan went so far as to open a security center just miles away, to lure NSA workers by eliminating the trouble of relocating.

In the spring of 2018, the news broke that Mike Rogers was about to depart. To those who had spent the past decade working alongside Nakasone, there was really only one surprise when his name was put forward as the next NSA director and leader of Cyber Command: It came "faster than folks thought," says one former top NSA leader. "He was quick to do that job."

7

AT A TIME OF INTENSE POLITICAL polarization, Nakasone distinguished himself by sailing through the Senate confirmation process. His biggest challenge was getting through the obligatory meet-and-greet sessions with senators during Lent. Nakasone, an observant Catholic, had chosen that year to give up meat and caffeine; he weathered the grueling process without breaking his vow, never succumbing to a cup of coffee. (Even now, as NSA director, if his travel schedules on the road coincide with holy days like Ash Wednesday, his motorcade stops at church.)

In the end, his confirmation hearing was notable only for a single, frank exchange. Alaska Republican senator Dan Sullivan suggested that the US had become "the cyber punching bag of the world." Nakasone bluntly concurred. "I would say right now they do not think that much will happen to them," Nakasone said of foreign attackers. "They don't fear us. The longer that we have inactivity, the longer that our adversaries are able to establish their own norms."

Sullivan asked Nakasone if that was good. "It is not good, senator," came the reply. It was perhaps the most succinct public statement of his own strategic vision that Nakasone has ever offered.

Nakasone's ascension at Fort Meade completed a little-noticed but important transformation at the nation's top three intelligence agencies: The three controversial, larger-than-life public personalities—James Comey, Mike Pompeo, and Mike Rogers—who had led the FBI, CIA, and NSA at the start of the administration were all replaced within 18 months by comparatively bland professionals: Christopher Wray, Gina Haspel, and Nakasone. By all accounts, the three are each content to fade into the background amid the daily pandemonium of American government in the Trump era, and all work together well and closely.

Nakasone's low profile and calm has been an especially welcome change at Fort Meade. "People like working for him. You can see it in any room. He is expert, engaging, and humble," says a former Trump administration official who oversaw Nakasone. Even the atmosphere at the NSA lightened. "In as few as six months, it changed dramatically. It was a pretty remarkable turnaround," says the former Trump official. "Now, all of a sudden, you have an NSA that is producing a lot of shockingly good stuff."

Nakasone assumed leadership at a moment when everyone knew the US wasn't moving fast enough to address the threat of pervasive cyberwar. "We're in the middle of 9/11 right now," one former official said to me in 2018. "It's like the day of 9/11 was slowed down to cover 5 to 10 years, so we can't

tell the towers are falling all around us."

Nakasone inherited a political and military landscape that had changed markedly since Alexander's time. Cyber Command had matured to more than 6,000 people, huge growth from the few hundred when Nakasone was first setting it up. The NSA, meanwhile, encompassed about 38,000 personnel, plus nearly 20,000 contractors.

But more than the sheer size of his empire, Nakasone had new powers. The White House bestowed on him an authority to make decisions on offensive operations that had always been tightly held by the president himself. Trump's National Security Council has turned to what it calls *Auftragstaktik*, a Prussian term that translates as "mission-type orders": The White House lays out the goal, the commander decides the tactics. As a senior administration figure says, "The president made his goals and strategic direction clear, then directed his team to carry out these goals and direction within applicable boundaries." (This approach seems to reflect both a genuine strategic vision that favors agility as well as a concession to the president's attention span. "Whether cyber or otherwise, the president is not particularly involved in the details," says the former White House official.) As one defense official explains it, "Trump, he alone had the courage—or maybe you call it recklessness—to say, 'Sure, do that thing, unleash this thing.' He didn't actually spend a lot of time thinking about what's the secondary or tertiary effects."

The approach was codified in September 2018 in the administration's completed cyber strategy, the first in 15 years, shepherded through by John Bolton, then the national security adviser. Bolton, who started at the White House just weeks before Nakasone took over at Fort Meade, also collapsed the National Security Council's approval process for cyber operations. "We've learned that you couldn't be more aggressive without being less bureaucratic," says a former White House official.

Nakasone quickly embraced his new authority under a philosophy he has dubbed "persistent engagement." In the fall of 2018, Cyber Command targeted the Russia hackers who had interfered in the 2016 election, an online operation only officially confirmed this summer by President Trump. Known as Synthetic Theology, the operation targeted the internet trolls of the Internet Research Agency, subjecting them to specific warnings (the message being "we know who you are") as well as knocking the Internet Research Agency offline on Election Day 2018 itself.

The idea, in part, is simply to bog adversaries down. "Some of the things we see today might just be screwing with your enemy enough that they're spending as much time trying to figure out what vulnerabilities they have, who screwed up, what's really going on," one official explains. "It takes the time and attention and the resources of your enemy."

Cyber Command's harassment of the IRA seemed to work; the midterm elections went off without much of a hitch. "The 2018 election was a resounding success," says US representative Elise Stefanik, a member of both the House Intelligence and Armed Services committees, which oversee Nakasone's world. The "persistent engagement" approach is, in many ways, an attempt to reconcile the lessons of the mission that Nakasone led against ISIS in 2016 with the old NSA philosophy of strategic patience. Online attacks can't be ordered up like a Tomahawk missile, deploying in hours to any place on the planet. "For cyber operations, you can't just ask the military, 'OK, we're ready for you now,'" says Buckner, who retired last year after heading cyber policy for the Army. "Those accesses and understanding of how an adversary works in cyberspace is built up over years, and if you want it years from now, you need to start now."

Eight months after the Russia mission, in June 2019, Iran shot down a US drone over the Strait of Hormuz. In response, Cyber Command attacked Iranian military communication networks and erased a tracking database that helped Iran target oil tankers and other ships in the Persian Gulf. A few months after that, Cyber Command dispatched a team to Montenegro to see firsthand how Russia was infiltrating networks there. Nakasone termed it a "hunt forward" mission, to be better prepared for future attacks on the US. Teams went to Ukraine and Macedonia too.

"We learned that we cannot afford to wait for cyberattacks to affect our military networks," Nakasone wrote this fall in *Foreign Affairs*. Writing with his senior adviser Michael Sulmeyer, he tried to outline the new strategy. "We learned that defending our military networks requires executing operations outside our military networks."

The NSA has also taken a few more steps into the light, communicating more with the wider security community; the tempo of bulletins warning of vulnerabilities and malware has notably increased in the past year, building in part on a formal disclosure process developed by the Trump administration in 2017. And Cyber Command has created a meeting space near Fort Meade designed to host unclassified briefings and conferences with industry.

Oddly, given the president's initial anger at the NSA as a key figure in his fantasized "deep state" conspiracies, the White House seems quite content with Nakasone and the work of the NSA and Cyber Command. "Nakasone" has never appeared in a single Trump tweet, and cyber policy has become one of the more stable planks in a chaotic administration. At the White House, the cyber portfolio has long been led by a young National Security Council staffer named Joshua Steinman—a former Navy officer, Silicon Valley luxury sock entrepreneur, and protégé of Michael Flynn—who has outlasted a dozen more-senior officials on Trump's senior staff. His three-piece suits, Windsor-knotted ties, and luxurious socks have become a rare constant, and he has been a steward of the vision that offensive and defensive NSA missions should be not the exception but the norm. "When the president came into office he made it very clear that we need to start competing more aggressively with our adversaries in cyberspace," says national security adviser Robert C. O'Brien. "Over the past three years, Josh and General Nakasone worked closely together to execute the president's objective."

Today, US cyberattacks are common enough—and the White House is happy enough with their outcomes—that O'Brien, who took over as Trump's fourth national security adviser in September 2019, has taken to writing personal notes,

typed and hand-signed, to Cyber Command troops after successful operations. Notably, O'Brien has sent at least two such letters since taking over, though there have been no publicly acknowledged US attacks since September 2019.

WHILE CYBER COMMAND AND THE NSA have remained silent about specific plans to defend the 2020 election, Nakasone has repeatedly said that the US will fight back harder and faster than in 2016. "We're going to act," he promised in July. "Our number one objective at the National Security Agency and US Cyber Command: a safe, secure, and legitimate 2020 elections."

Whatever happens in November, Nakasone's empire is liable to continue being an island of relative stability. "Paul has just calmed the herd in the various organizations," says one former Cyber Command official. By all accounts, Nakasone, who is one of only four members of a racial or ethnic minority among the military's top 41 commanders, carries his authority lightly at Fort Meade. He reads voraciously, hoovering up recommendations from friends at any opportunity and pestering them with his own favorites: "Have you read this?" (He's recently been pushing Raymond Kethledge's *Lead Yourself First: Inspiring Leadership Through Solitude,* a treatise on thinking detached from technology.) He is formal, gracious, and disciplined. Aides and colleagues joke that he rarely answers questions with more than two or three sentences, and his aides got used to him rattling off commands in three bullet points. "You see pens go to paper when he does it that way. There's a conciseness about his communication which is helpful for people who work with him," Buckner says.

Years ago, back at Fort Gordon, Nakasone's team and their families gathered every Friday night in his driveway for what they called "stone soup" potluck dinners and barbecues. In his current role, prior to the Covid-19 pandemic, he hosted senior government officials for four-person dinners in the NSA director's dining room. Greeted by printed menus and attended by his accomplished chef, guests would be given presentations by some of the NSA's brightest minds and then settle in for a discussion of agency challenges.

The biggest question now facing Fort Meade is whether Nakasone will be the last military commander of NSA; the decade-old "dual hat" role overseeing NSA and Cyber Command has outlasted numerous attempts to split the military arm of America's cyberwar machine from its civilian signals intelligence arm. James Mattis, Trump's first defense secretary, talked about splitting the roles at the end of 2018 but left office himself before seeing it though. Observers across the military intelligence community and Capitol Hill say they see little sign of any such movement now.

That may be partly because Nakasone's steadiness as a leader obviates the need, for now. Oddly, in an era where so much of government and the Washington bureaucracy seems broken or sclerotic or scandal-prone, Nakasone's greatest success seems to be simply avoiding attention—good or bad. Because on the question of whether to keep his current empire intact, Nakasone happens to have a strong opinion. "Paul is adamantly opposed to the separation of Cyber Command from the NSA," says one official. In this as in so many areas of American cyber strategy, the official says, "Paul has prevailed."

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COLOPHON

Good Vibrations That Helped Get This Issue Out:

The electric tingle of espresso, whipped cream, and sparkling water in a Snowy Plover; watching strategic and extremely belligerent ruby-throated hummingbirds hide in bushes to sneak-attack their enemies, hover protectively over their territory, and fight for hours on end over access to sugar water; whale song on loop—thaaAAaaNk yoOOou, YouTube; *Last Chance U* on Netflix; the haptic feedback on my PlayStation controller; Charli XCX's 11 quarantine bangers (and a 30-week-old fetus kicking out of rhythm to them); waking up to an AQI of 20; a paddleboard shudder on the Oakland Estuary—was that a rogue wave or something else?; bumping terrible club music for my toddler; "Tranceport" by numün; ditching the hand grinder for a Baratza Encore; the pitter-patter of tiny kitten feet.

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