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# WIRED

MAR 2028 • LET'S DO LAUNCH



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**HUMAN**  
WHEN WE LEAVE  
**EARTH BEHIND?**

The CARE and FEEDING  
of INTERPLANETARY CIVILIZATION

BY NICOLA TWILLEY

P. 38

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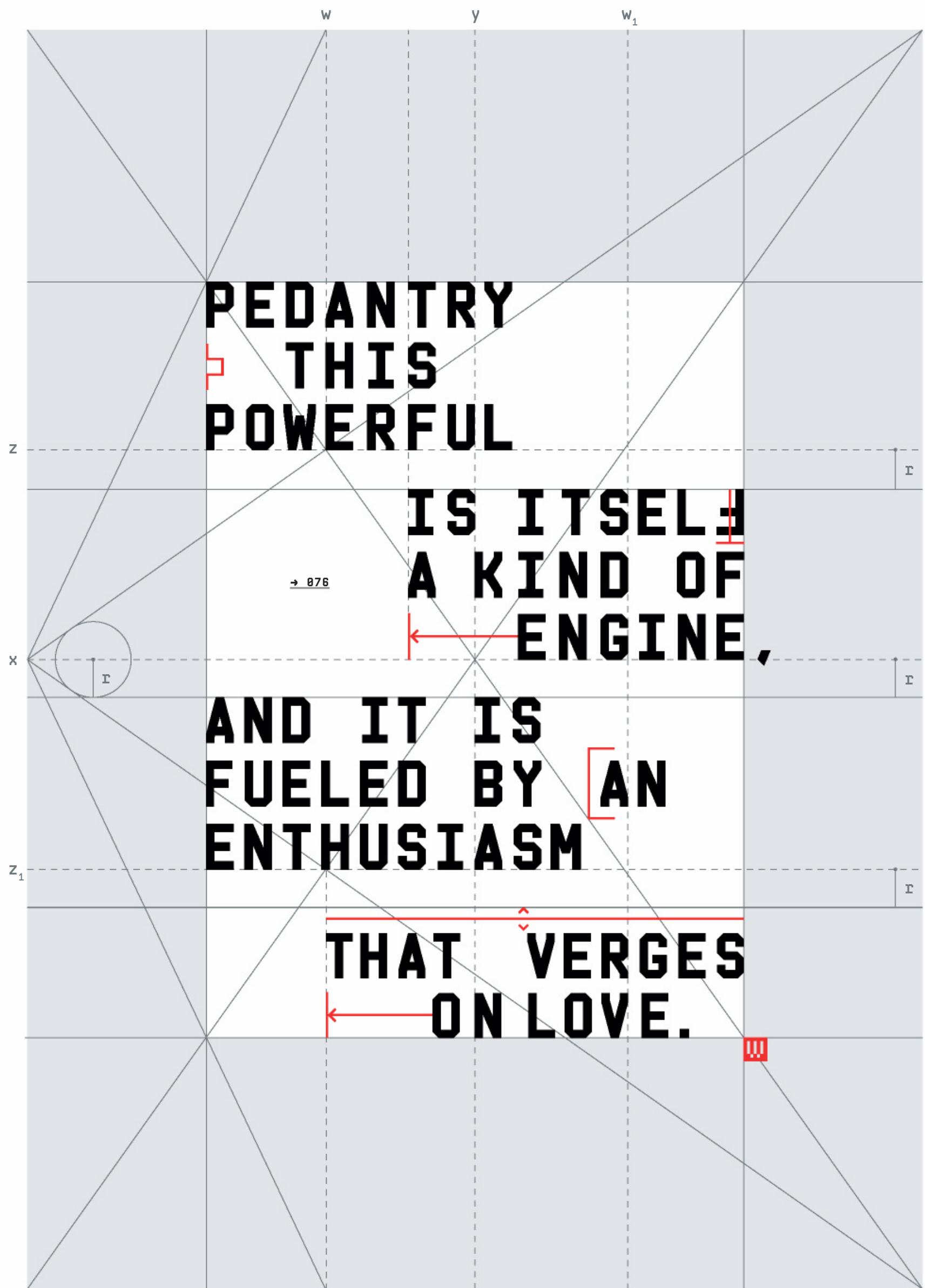
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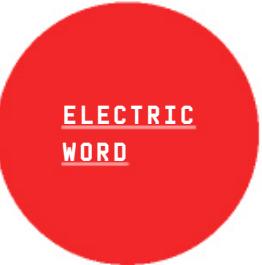
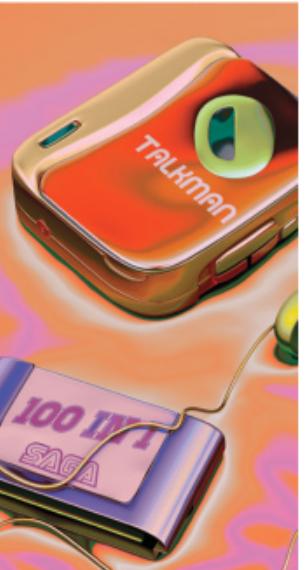
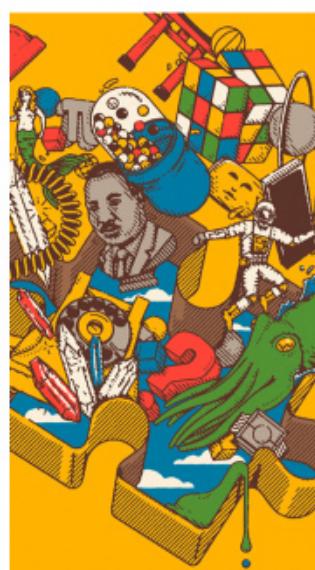
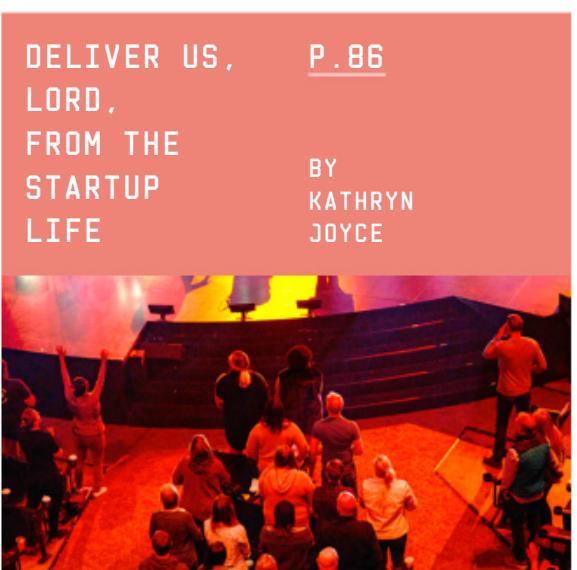
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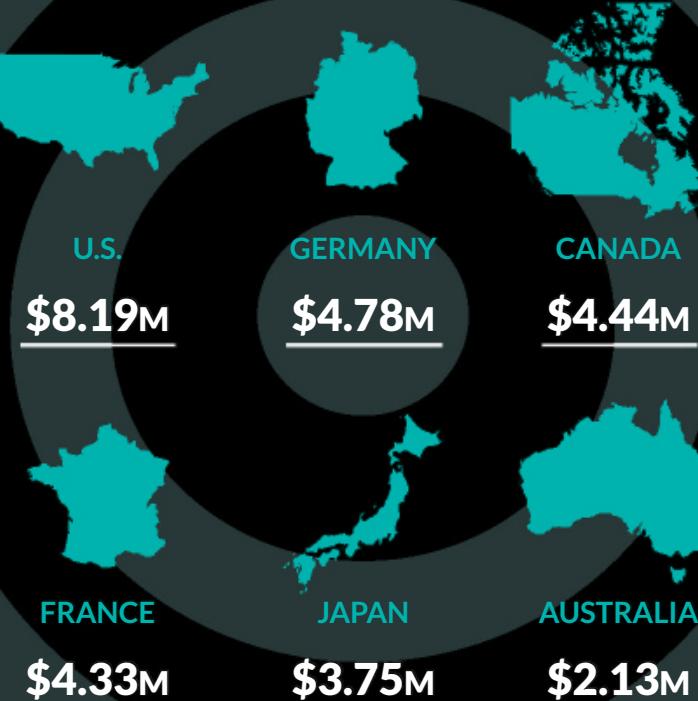
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# YOU'RE A TARGET

You lead a security team at an enterprise. Sophisticated cyberattackers want to steal and sell your data and the information you've been entrusted with by your customers. Fast and accurate threat detection and response are essential. Millions of dollars, your reputation, and your customers' trust are on the line.

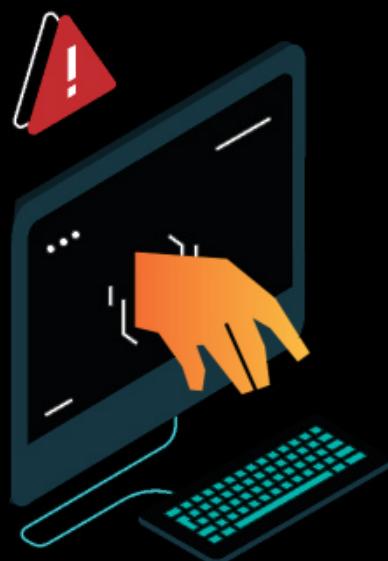
## COST OF A TYPICAL DATA BREACH:



SOURCE: Cost of a Data Breach 2019, Ponemon Institute

### 1 ALERT!

An attacker uses a fake domain controller (DC) as a way to retrieve employee password data. It's a dangerous form of a domain replication attack known as DCSync. ExtraHop Reveal(x) uses AI-powered threat detection algorithms to compare the real DC's past behavior to the spurious new actions, and flags them as suspicious.



### 2 HALT THE ATTACK

Your team initiates a firewall policy update via Reveal(x) through API integrations to isolate the fake DC backup. The attacker is locked out from grabbing the synced credentials.

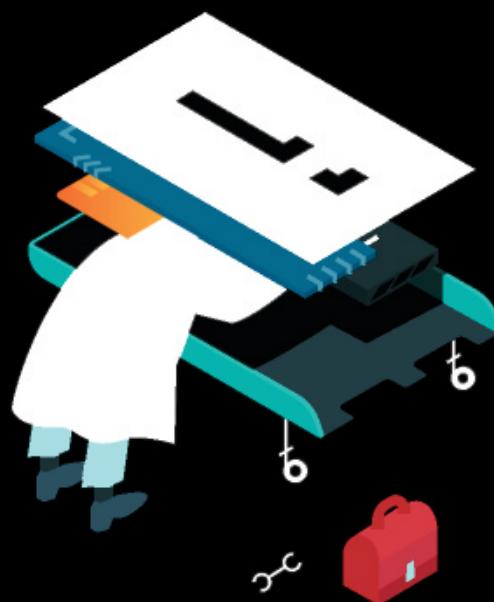


Reveal(x)  
provides up to  
**95%**  
faster threat detection.

SOURCE: IDC

### 3 ASSESS THE DAMAGE

How bad is the damage? Reveal(x) quickly reviews all the devices the fake DC connected to in the past week.



Detection and response costs account for

**60%**  
of security budgets.

SOURCE: Gartner Research

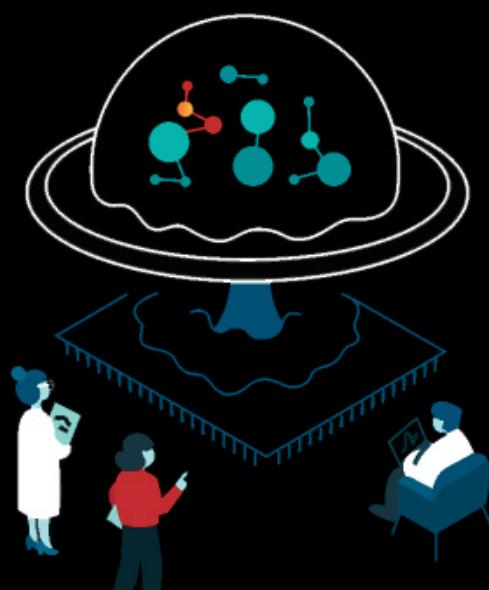
## 5 CONTINUE THE PURSUIT •

The file server isn't the only area of concern. Through secure decryption of your network traffic, Reveal(x) helps your team determine that the attacker connected to your public cloud storage via HTTPS.

More than  
**70%**  
of web traffic is encrypted.  
SOURCE: Google

## 4 DETERMINE THE BLAST RADIUS •

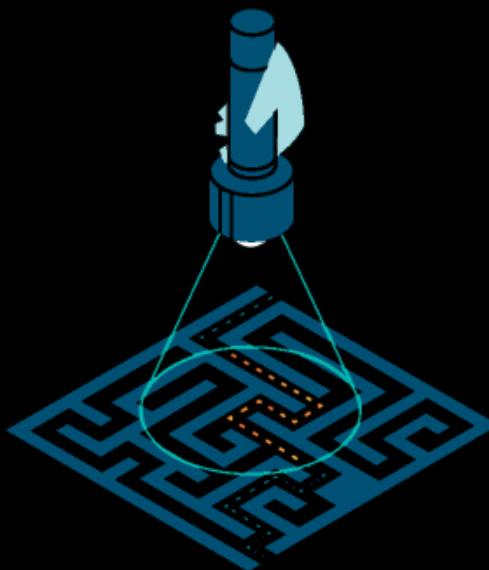
It looks like the bad guys also connected to a file server. The scope of this attack depends on what's on that server. Reveal(x) uses its understanding of file protocols to determine that no customer data was accessed.



You have

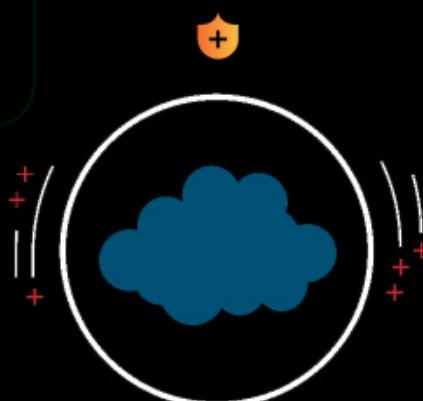
**72 HRS**

to disclose a data breach under the EU's General Data Protection Regulation.



## 6 CONTROL THE CLOUD •

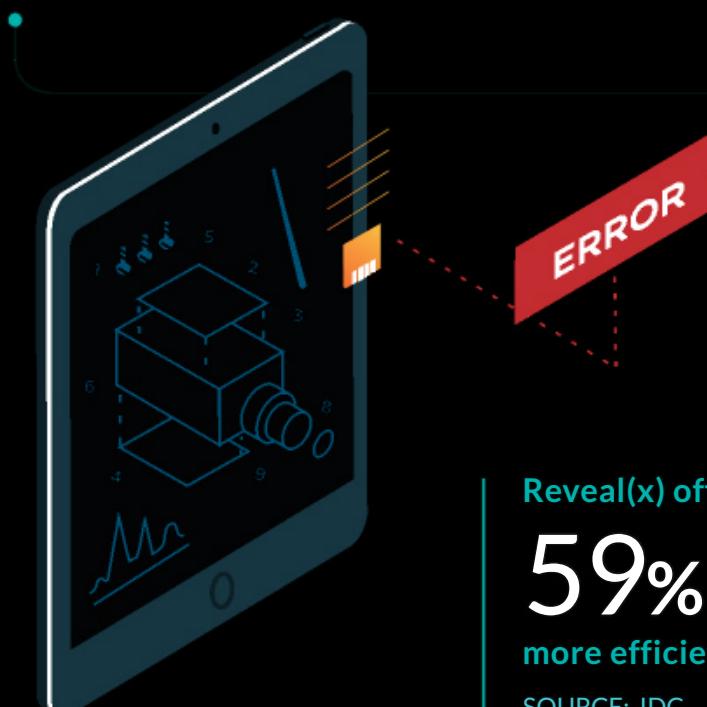
Upon further investigation, your team determines that the intruder used a Drupal exploit to attack one of your VPN-connected, cloud-hosted virtual machines. It was detected by Reveal(x) Cloud, halting any attempts to access any of your cloud resources and storage.



More than  
**70M**  
records were stolen or leaked in 2018 due to misconfigured cloud storage.  
SOURCE: Symantec

## 7 STRENGTHEN YOUR WEAK POINTS

Your data is safe, but it's time to determine how the attacker got in — the DC wasn't directly connected to the Internet. The fake DC accepted a connection from a security camera, one with a known remote code execution vulnerability. But the firmware was never updated.



## 8 CUT DWELL TIME

You don't know how long this security camera was compromised. How long threats go undetected is known as dwell time. Fortunately, Reveal(x) alerts you and helps your team respond the moment the attacker moves. Your data is safe, but vigilance is never-ending.

Reveal(x) offers

**59%**  
more efficient threat response.  
SOURCE: IDC



Average threat dwell time:

**78 DAYS**

SOURCE: 2019 Mandiant FireEye

# TOTALLY WIRED

DIARIES OF  
AN UNBRIDLED  
DIGITOPIAN



**For most of** my earthbound existence, I've ignored starry nights. Not *The Starry Night*, that swirly Van Gogh in my screensaver rotation. I mean the real thing, in the open air, looking up into the endless abyss.

Don't mistake me: I have nothing against the great outdoors. I embrace a bracing hike, climbing high in the high desert in my Vibram-soled boots, stopping to tickle the cute little lobes of the scrubby oak, bowing in respect to the spiky claw of the healing aloe. I gladly succumb to nature's codeless charms.

Then comes night. To my love, this is the best part. I try to understand, asking: *What is to be gained by staring at this static, aggressively pixelated screen overhead?* Patient as ever, my love replies: *It isn't static, it merely moves at a different speed.* Ah, yes, light speed (but not, alas, Ripley D. Light speed). Those twinkles are news alerts from long ago and trillions of miles away. Gagillions per minute. But what are they saying? "Man, it's hot out here!" "How long until we get there?" I cannot decipher them. No wonder the stargazers of old had to connect-the-dots them into crabs and lions and guys wearing blingy belts. All that data needed a human scale.

I try, friends, I try. I look up, neck tortured into an unnatural tilt, the inverse of its comfortable slant toward the phone's glow. I try to listen to the stillness and to read the messages but notice only that the ambient temperature is below optimal for my delicate flesh, even enrobed in a new Finnish fleece. The speed of light is a bore.

But then, Lo! What light from yonder cluster breaks the stillness? It moves at a speed of human comprehension across the sky—a signal, clear and strong! This satellite, sparkling fleck of future space litter, speaks to me. It could be triangulating coordinates that will guide my car to the best barbecue brisket. Or maybe it's one of those synthetic aperture radar jobs, sending out microwave pulses to detect shifts in land elevation. Or could it be a SpaceX pioneer, one of the first in a constellation of cosmic cans that will one day party together in low Earth orbit to bring all of us ever faster connections? Stars are unknowable, but we fill our skies with built wonder.

As I ponder the possibilities, it hits me. Perhaps this is a good old communications model, transponding its entertaining uplinks to the very satellite dish not 50 feet away. (You did not imagine, dear reader, that Ripley would be *camping*?) I look at the dish and think of all the chatter in my social feeds that I have not been able to join. I do not know what to make of Kendall's rap on *Succession* or why we need to talk about *Watchmen*. Now, thanks to my wandering space friend, perhaps I will. I kiss my love goodnight and leave them to the stars, while I retire to the house and rejoin mine.

RIPLEY D. LIGHT  
@RIPLEYDLIGHT

WE ASKED CONTRIBUTORS:

"IF YOU WERE MOVING TO ANOTHER PLANET, WHAT FOOD WOULD YOU WANT TO BRING?"

"Dessert: Mars Bars, Milky Ways, and a bag of Fermi Bears (if you can find them). A nice, quiet broccoli, since in space no one can hear you steam. If there's a grill, pale blue brats. And definitely ginger ale, because that's one giant Schweppes for mankind."

—Contributor Paul Ford (page 16)

"Everything bagels from Russ & Daughters." —Food stylist Maya Bookbinder (page 38)

"A Cox's Orange Pippin apple, which is the best apple, for one last taste of Earth. I'd then plant the seed to grow the first microgravity cultivar, whose fruit would not fall on my head if I sat underneath it like Newton." —Author Nicola Twilley (page 38)

"If this planet has Instant Pot, I'd bring all my butter chicken ingredients. You haven't lived until you've had my Instant Pot butter chicken." —Author Gordy Megroz (page 60)

"The question shouldn't be whether there is life on Mars but whether there are burritos on Mars." —Staff writer Daniel Oberhaus (page 70)

"Since finding out astronauts never ate Astronaut Ice Cream in space, I've been skeptical of space food. If the past is any guide, I'd develop a special interplanetary food with NASA and then leave it behind on Earth to sell in museum gift shops." —Author Richard Cooke (page 76)





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## BOUNDARY BREAKING

In our January issue, Vince Beiser took us inside a catfishing scam run by prisoners, one that ultimately drove a young man to suicide, and Chris Colin pondered the limits of billionaire Marc Benioff's philanthropy. Lauren Goode traced the evolution of YouTube star Simone Giertz from creating "shitty robots" to embracing more grand designs as an inventor—a transformation triggered by her brain tumor diagnosis.



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### Readers share their admiration, critiques, and rationales for censorship:

#### RE: THE PHONE CALL FROM HELL

When I was going through a hard time in a relationship, I was contacted by a female saying they were of age. They tried to blackmail me and extort over \$5,000 from me. But when I told them I worked in law enforcement, had already traced their IP address, and had obtained their cell phone's mobile equipment identity number and their location to turn over to my cybercrimes division, it stopped. Did I do any of that? Hell no. Didn't want to suffer any embarrassment by coworkers. But it stopped. —Anonymous, via mail@WIRED.com

"Describes methods of smuggling prison contraband." —Official reason given by New York's Wallkill Correctional Facility for impounding our January issue, citing a passage from this story that describes how prison inmates acquire cell phones.

#### RE: THE GOSPEL OF WEALTH ACCORDING TO MARC BENIOFF

The focus on the billionaire seems misguided. Let them win and give back. It's long been the American dream to come from nothing and build like Bezos, Jobs, Benioff, Car-

negie, and Sandberg. It seems like the loopholes that allow people to pay no taxes or 20 percent corporate tax are the problem. —Heidi Legg (@heidilegg), via Twitter

Can plutocrats be domesticated to serve rather than subvert democracy? Chris Colin's long read gives us a portrait of Benioff, whose corporate leadership and philanthropy reveal a different model of a billionaire and also the limits of voluntary domestication. —Rob Reich (@robreich), via Twitter

#### RE: BUILD WHAT YOU WANT

Your January cover story about Simone Giertz is the first time that I've laughed (watching "Wake-up Machine") and then cried (watching "I Have a Brain Tumor") within one page of a magazine article. Thank you,

Simone, for your courage in letting us in. —Todd Piccus, via mail@WIRED.com

She inspires me. Play is vital to innovation, and that means inevitable failure. The media has a responsibility to celebrate humanity, not perfection.

—Louisa, via mail@WIRED.com

Her two videos on dealing with her brain tumor were inspirational for those of us who have to deal with health issues.

—Sanjay Nasta, via Facebook

She made Truckla, which is a hundred times cooler than the Cybertruck.

—Peter Schmalz, via Facebook

She is an inspiration. I work with a number of kids' groups, and the usual complaint is "I don't have any ideas." I've run some of her videos and the kids come up with crazy things.

—Howard Eglowstein, via Facebook



#### RE: "BUILD WHAT YOU WANT"

# She's a legend. Period.

—Khian Josh Abesamis, via Facebook



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# SYMPHONIE DIGITIQUE

**When streaming costs you music's fantasia, there are ways to get it back.**

BY VIRGINIA HEFFERNAN

Alexa has no knack for pianissimo. Here's how to tell. Set her to living-room volume and ask her to play Berlioz's rapturous epic of sex and opioids: *Symphonie Fantastique*. The opening passages should be erotic and feather-light, but on the Echo the massive orchestra comes through as smothered whooshes, the exhalations of a pint-sized table fan caked in dust. ■ Is this thing on? The first movement is meant to conjure the fantasies of an artist in thrall to a woman of infinite allure; in the sway of the opening strings, she grazes his mind in her gentle, pre-coital theme, which becomes insistent, demanding, and then maddening. ("So many musical ideas are seething within me," Berlioz wrote at the time. "Must my destiny be engulfed by this overwhelming passion?") This is how Berlioz introduced the piece in Paris in 1830: "A young artist of morbidly sensitive temperament and fiery imagination poisons himself with opium in a fit of lovesick despair." ■ That's amore. But by the time the fantasia is performed, recorded, engineered, and mastered, and then internetted via Amazon's all-knowing cloud through the Echo's admittedly paltry tweeter-woofer combo, the piece has lost the volatility that makes it a masterpiece of sexual obsession. Forget about pianissimo's complexity; ➤

only at Alexa's top volume can the notes even be *heard*. Then, when the protagonist's fever intensifies to forte and fortissimo, the music coming from Alexa again turns to nonsense—although this time it's deafening.

The major streaming services, including Amazon, Apple Music, and Spotify, have tended to address dynamics in classical music with indifference and bewilderment. In pop music the founding principle of amplification is Nigel Tufnel's axiom: *These go to 11*. And pop music in digital, post-

aggressive.” On NPR, record-mastering engineer Bob Ludwig explained how new techniques diminish the 1989 recording of Paul McCartney's “Figure of Eight”: “It really no longer sounds like a snare drum with a very sharp attack ... It sounds more like somebody padding on a piece of leather.”

In classical music, overcompression all but deletes pianissimo and distorts high volumes to smithereens. But compression can also crush subtleties like timbre, the auditory minutiae that let listeners tell the sound of a trumpet from that of a trombone,

Ultimately, though, listeners make their choices. A study by the audio software engineer Chris Johnson about why contemporary pop-music careers end suddenly makes a fascinating discovery. Songs that are uniformly loud and tightly compressed may sound great on first listening—Oasis' hypercompressed (*What's the Story*) *Morning Glory?* was beloved off the blocks—but listeners soon tire of them. The ear evidently craves excitement; we tend to balk at listening to them for hours on end.

By contrast, as Johnson found, music that persists in popularity shows a remarkably wide dynamic range. According to Johnson's study, records that are successful year in and year out, warhorses like *Led Zeppelin IV* or the Eagles' *Their Greatest Hits (1971-1975)*, contain some of the most radical dynamic contrasts in the history of pop music.

When it comes to range, *Symphonie Fantastique* takes it to the limit every bit as much as the Eagles did, and the piece—composed 190 years ago and first pressed into vinyl in 1924—is, by most metrics, a lasting hit. Similarly, other evergreen classical compositions, especially the lavishly romantic ones (Berlioz, Strauss, Debussy, Dvořák), show breathtaking scope and spaciousness, and have sustained the popularity they gained as vinyl recordings in the 1950s.

Classical music survived the Loudness War largely because most producers were conscientious objectors and never enlisted. Sure, they were already suspicious of reverb and equalizers when the war broke out, but their resistance goes back even further. From the earliest days of stereo recording, the general rule was that R&B and pop were fair game for manipulation because they were built for improvisation at every stage, but, in Berger's words, engineers “wouldn't dare do that with hopped-up versions of Beethoven, Brahms, or Bach,” because they have a “150- to 200-year tradition behind them.”

And so, while the Loudness War may have wrecked hundreds of pop records, classical engineers have largely kept their focus on the art of traditional acoustics rather than the science of Auto-Tune. For many, the old ideal of “fidelity” in recorded music has always had a moral component—honesty, authenticity, truth. Breakthroughs in classical engineering are therefore delicate: Some control for sibilance, since

## **Today on the confounded Echo, the roller coaster of Berlioz's love song sounds closer to the depressive trudge through love taken by, say, Nirvana.**

Spinal Tap days is not merely played and recorded at 11, it's often heavily compressed, which reduces the volume range within individual songs. Soft sounds are boosted to bring them closer to the loud ones, but those loud signals are also processed within an inch of their lives to get them to blow past peak amplitudes allowed by digital systems. Only if you change your streaming settings to high or very high can you begin to hear a song or piece at near CD quality.

Greg Milner, the author of *Perfecting Sound Forever*, has tallied the damage done to pop recordings by the notorious Loudness War, which has raged for lo these 40 years. (Troops do seem to be drawing down lately; we must end endless loudness wars.) A brief military history: When music was first digitized for compact discs in the 1980s, engineers set a peak for how big and loud a signal could be, but over time producers found they could push further—and attract artists determined to drown out the radio competition. Thus were popularized signal-processing techniques, including the dread dynamic-range compression, which traps music's range in an ever-tightening band. Milner puts it this way: “With digital audio, a few mouse clicks can compress the dynamic range with brute force. The result is music that sounds more aurally

and *tempo rubato* (“stolen time”), which is the slight speed-up or slow-down of notes used by soloists or conductors taking liberties with a composition. When you erase tone color and edit out irregularities in a classical recording, you're on your way to losing the music entirely.

Whether or not contemporary engineering might have some upsides, the loud all-about-that-bass bass that still largely dominates pop music is a far cry from the sonic experience audiophiles used to seek. In the early 1950s, writing in *The New York Times Magazine*, Meyer Berger defined a “high-fidelity boy” as a “hot-eyed and intemperate fanatic whose chief pursuit is not music but extremes in sound—the lowest booming bass; the highest biting note, tremblingly caught before it takes off for infinity.” In those days, the very time that American pop music fans were discovering both Berlioz and the blues legend Lead Belly, high dynamic range let them savor their brand-new and often painfully expensive stereo equipment. Today on the confounded Echo, the roller coaster of Berlioz's love song sounds closer to the depressive trudge through love taken by, say, Nirvana. (Berlioz and Kurt Cobain both took opiates; maybe their heroin moods also had different dynamic ranges.)

an ASMR rush of esses by a soprano who misses a beat can be distracting. Light noise reduction to eliminate the sound of a page turn is also permitted.

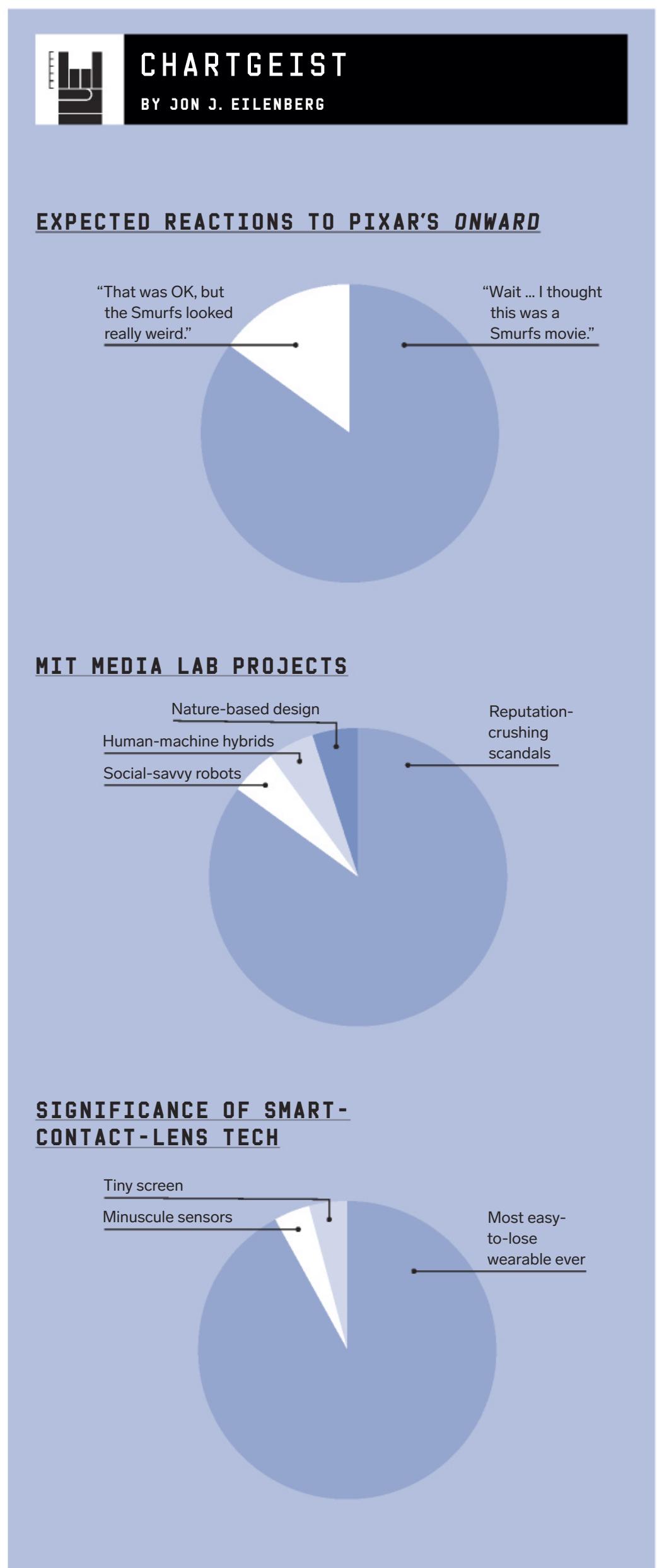
And then there's pianissimo. Classical music engineers need these passages to be both preciously soft and clearly audible. Rather than smash down the signal like a pressed panini, classical engineers do something called "gain riding." Gain is the term for how loud your input is, where volume refers to the loudness of the output. When you ride gain, you adjust the decibel levels while a piece is being recorded to avoid signal overload.

But none of this prevents Alexa from having her way with Berlioz and his sensitive temperament. And even if a streaming service purports to be lossless, it still pulls in electrical noise from routers and Ethernet cables. Thus, the final revelation for classical listeners: Nothing beats CDs, which were created with dramatic classical music, especially Beethoven, in mind. Though the gravity-blanket warmth of vinyl will always hit the spot for diehards, CDs offer better "punch, slam, tonal color, finesse," according to the audio equipment reviewer John Darko. Fifty-three percent of classical listeners prefer CDs to streaming and other formats.

Time to haul out an old CD player and order the *Symphonie Fantastique* disc. Ah, at last. The druggy longing. The freaky passion. The tilt into hallucination and psychosis. That's dynamic range for you, and passages in Berlioz, as I listen to the CD, bring to mind an outtasight too-muchness akin to that other high-dynamic ranger, "Stairway to Heaven." When you finish with Berlioz, put in *that* old CD and just give in. A cappella! Fortissimo solo! Corny-sexy leer of "bustle in your hedgerow"! Your head is humming and it won't go / In case you don't know / The piper's calling you to join him ...

The zany operatics of Led Zep, Berlioz, and all tempestuous evergreen musicians—you just gotta let them fly. Big emotions need big sonic landscapes. Loud bass is fine when you have your life together, but where would we be without the wide-ranging dynamics that alone can give voice—and thus solace—to the bipolar youth in ecstatic anguish? ■

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



# GENERATION VEXED

Immense changes show us, again and again, that we are the same as ever.

BY PAUL FORD

Among the detritus to survive my late adolescence are a few cases of cassettes, dozens of paper books, a crate of vinyl albums, and many plastic albums filled with CDs. Typical Gen X ephemera. Today, scanning all of that and creating digital versions would require about 20 gigabytes of storage. ■ Back then I would have needed to spend around \$15,000 to buy a bunch of hard drives to store that stuff, roughly the same amount as my student loans. I probably shouldn't say that so loud that millennials might hear, but it would have seemed like a lot of money at the time. ■ Today the local electronics store gives you 32-gig SD cards free with a coupon. Which is insulting. I lugged this essential information around for three decades and you tell me it fits on a black chip of plastic smaller than my (admittedly curiously broad) thumbnail? ■ I hate the concept of generations. Maybe it's because I'm Generation X, and I hate popular things. But that's not →



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a correct characterization—I enjoy things, dammit. I have been to therapy and I am capable of like. I tweet. I leave others' yums unyucked. I am glad you like Coldplay. I welcome feedback. It's cool that you believe in astrology (sound of grinding jaw).

A generation, at its footnoted best, is a sociological tool intended to make sense of behavior across large cohorts—i.e., if geography can influence a culture, then so can time: market crashes, earthquakes, war, the VMAs. Certainly a noble horseman of the Khan had a different worldview than I do, and drank more horse blood. But that's not what generations represent right now. Generations are drama.

capacity, I fell prey to the 20 or 30 articles a day about dread millennials entering my feeds. I've plopped down in a conference room to moan over the youth with their crying and social media and their refusal to prioritize my exact goals. Why won't young people simply submit to my whims and admit I am right? I am only trying to profit from their labor.

The pop concept of generation is about placing us in a box of singular, predictable, manageable identities, branding us so that we might more readily hate each other, and then stepping right into River City to market to the carnage ("and that stands for pool"). Don't we have enough of all that?

into global climate catastrophe, but then again, we're only facing doom because for 75 years no one started a nuclear war.

We aren't so different, are we? Just born along different curves.

I trundled from concert to concert in the waning days of the Clinton administration. Recorded music was precious and carried from place to place; my 20 gigs weighed a lot. Now music is more like food—something to be enjoyed, digested, remarked upon in passing. We all still like it, though. And in 20 more years you'll have a personal petabyte nearby, enough storage to hold a hi-def video recording of 30 continuous years of your life, sleep included.

## **One day a furry will win major public office in a fursuit, and wear their suit to chambers, and that'll be that. The world is unruly and will not behave.**

Oh poor millennials. "They are largely self-absorbed and extremely focused on personal appearance. But they are vaguely aware that identity is primarily a construct of culture and family conditioning, variables over which they have little control." Actually that's a description of Generation X as drawn by marketers trying to sell them stuff at Lollapalooza. In 1958, teen researchers were talking about the "young phone addict" developing his personality. And so on, back to clay tablets, where I'd guess a dude named Timgiratee complained that teens don't buy enough barley.

Anyone can make a pop generation. Do it with me: Subtract 20 from the current year and round to the nearest multiple of five. Give it a name, like the Double Zeros or the Naughties, and describe the universal qualities of youth (Jealousy, Sex Drive, Openness, Narcissism, or JSON) as the side effect of new technologies and trends. "The critical thing to know about Naughties," an imaginary critic might say, "is they're obsessed with their communication devices and social status. They will never invest in low-yield bonds."

Worse, I found myself starting to buy in. After 20 years of never giving the tiniest hoot about my own generation, and as a person of a certain age in a management

My children are roughly the same as I was, just less into computers. My grandfather grew up on a farm between the wars, trapping raccoons. Later, together, we watched *Knight Rider*.

One of the things that is joyful about the current youth, for me as a mid-old, is that they are creating a new world of zillions of identities, in an age of chaotic recombination and Finstas. One day a furry will win major public office in a fursuit, and wear their suit to the chambers, and that'll be that. The world is unruly and will not behave. As someone who struggled (still struggles) to figure out what I was even about, I've always believed that people had the right to define themselves, and it's thrilling to see it suddenly in practice, even if sometimes I'm a little uncomfortable with all the drama.

Not that they care what I think.

Generations imply some giant disruption in the universe. I like curves more. Moore's law (always more transistors), Metcalfe's law (bigger networks are more valuable), experience curves (making things gets cheaper when you learn by doing), and so forth. I like these thumbnail rules because they encapsulate the Great Muchness more than some theory of intergenerational strife. It's terrible that we're headed

Or you could download all of Sci-Hub, the great illegal archive of 80 million scientific articles, now available via torrent and presumably forevermore, and have most of science on your phone, with room left over for porn and recipes. You will always have enough space for your thoughts, and all the other thoughts too.

So our sleep will be transcribed and robots will deliver our sneakers, which will themselves be computers. Technology will not solve bad marriages, bad eating, or racist thoughts, nor stop DisneyWarnerNetflixQuibiPlus from making superhero movies. I find it profoundly helpful, then, to not just reject the concept of generations but to invert it: The immense changes in technology show us, again and again, year after year, that we are basically the same as ever, just reacting to our place along curves of life well out of our control. One can get very mixed up about what makes us human. And it would, in fact, behoove all of us on the grayer side to get to know and love our peculiar youths, so that they might speak well of us when we do not matter anymore. ■

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PAUL FORD (@ftrain) is a programmer, award-winning essayist, and cofounder of Postlight, a digital product studio.

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# WORD'S WORTH

What the transcription economy tells us about the future of work.

BY CLIVE THOMPSON

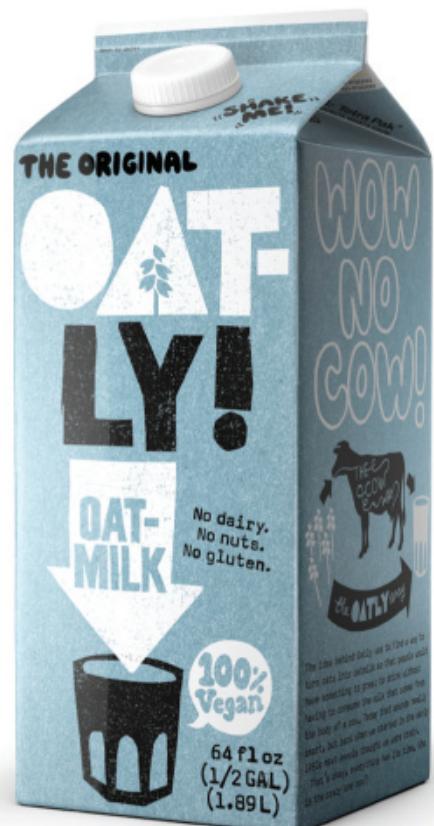
Gabriel is a professional transcriber, and for years he earned a middle-class living. In the early 2000s he'd make up to \$40 an hour transcribing corporate earnings calls. He'd sit at his desk, "knock it out" for hours using custom keystrokes, and watch the money roll in. "I sent my son to private schools and university on transcribing," he tells me. "It was a nice life." ■ But in the past decade, the bottom fell out. As audio recordings went digital and broadband spread, clients could ship work to India and the Philippines. Meanwhile, buzzy Silicon Valley startups emerged—like Rev, a sort of Uber and 800-pound gorilla of the transcription world. It has moved the industry toward an on-demand gig model. Since Rev charged customers a flat rate of \$1 per audio minute—less than half what transcription firms historically charged—Gabriel's pay sank even further. On top of it all, AI started nipping away at the industry, with machines now able to rapidly transcribe some audio as well as humans do. ■ Today Gabriel clears \$12 an hour—if he's lucky. Some of his peers make \$6. Starbucks would be a step up. ■ "The whole transcription life," he →

Unique Opportunity for Readers of Wired

# POST MILK GENERATION



The POST MILK GENERATION is a nonprofit mindset that works to inform the public about the health and sustainability advantages of eating a plant-based diet. That's right, it is a state of mind that is both real and influential and not just a crazy t-shirt slogan that people are wearing around the festival scene during the summer. Well, it's that too. Anyway, if you would like to become part of this generation and pledge to keep things real in the future then feel free to get started today with your temporary membership card. Cut it out and carry it with you wherever you go.



sighs, "has gone to garbage." (Gabriel is not his real name, though you probably figured that out. He doesn't want to burn bridges.)

Why do I raise the seemingly arcane subject of transcription? Because if you want to understand the future of work, it offers a succinct capsule.

Change is murky and weirder than you might expect. For example, demand for transcription has actually exploded in recent years. "It's big across every area," says Jill Kushner Bishop, who runs Multilingual Connections, a Chicago transcription and translation firm. Why? Because audio is

(As this story was going to press, Rev announced the rate it charges customers would go to \$1.25 but did not specify a higher base pay rate for transcribers.)

Meanwhile, the sheer profusion of phone-recorded audio can mean that some is murky and muddled, making it mind-wracking to decipher. It can also be psychologically ghastly: Transcribers have opened Rev audio files to discover victims describing abuse or graphic files from police body cameras. Disturbing content is nothing new, but at an old-school firm the manager might warn a transcriber

## **Humans disambiguate bad audio by grokking the context, by deploying common sense. Today's AI is not good at that.**

easier than ever to capture (via our pocket computers), so people are recording ever more meetings. Plus, video and podcasting have become the dominant forms of rhetoric. Daily communication is increasingly multimedia.

But multimedia is cumbersome; we still can't search the contents of video or audio very well, so we need to transcribe it. "We're in this world where we are overwhelmed by spoken word that's recorded, and it piles up and up," says Jeffrey Kofman, the CEO and founder of Trint, an AI transcription firm. Gutenberg would savor the irony. The growth of the shiniest new media has made the dustiest—text—ever more relevant.

Now, theoretically, exploding demand would drive up the price of labor, right? Except that globalization and the gig business model have exploded the supply of workers. Much as with Uber, Rev made it so easy to start transcribing that many more folks now do it as a side hustle.

"They give a lot of people opportunity, which is cool," as one Rev transcriber told me. And as with most gig companies, Rev seems obsessed with making things simple and frictionless for the customer—hence that sweet, flat rate of \$1 per audio minute. But a low rate winds up screwing the worker. This fall Rev abruptly dropped its pay for some content to 30 cents per audio minute, which works out to a bleak income of perhaps \$4.50 an hour.

in advance. Many Rev transcribers have said they get none. After a few hours of intense material, "I need to have a drink—I need to smoke a joint," Gabriel says. (Rev declined to comment on the conditions for its transcribers.)

By now you may be thinking, hey, aren't machines going to destroy all these jobs anyway? Not yet. Despite all the deep-learning hype, AI struggles with the messiness of reality. Background noise, cross talk, non-Western accents all tend to flummox transcription AI.

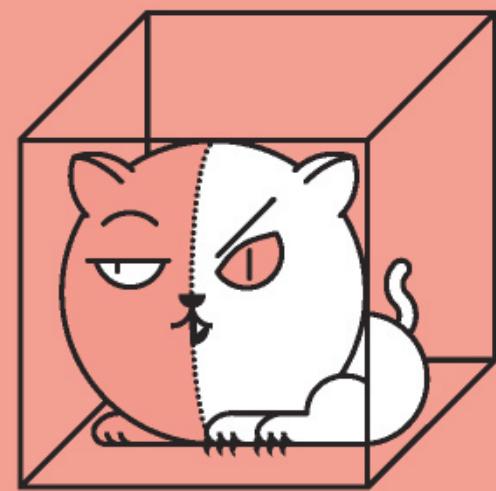
It could take a very long time to get over that hump. Humans disambiguate bad audio by grokking the context of the conversation, by deploying common sense. Today's AI is no good at that, and AI experts are still figuring out how to engineer it. Sure, the machines will increasingly be able to transcribe clear and simple audio. But the hard stuff? That'll require humans. Pissed-off, overworked, underpaid humans.

So ponder their fate the next time you think about the future of work. AI doesn't always win. Tech—and today's sharklike gig-work business models—don't always destroy jobs.

They just make them a lot more likely to suck. ■

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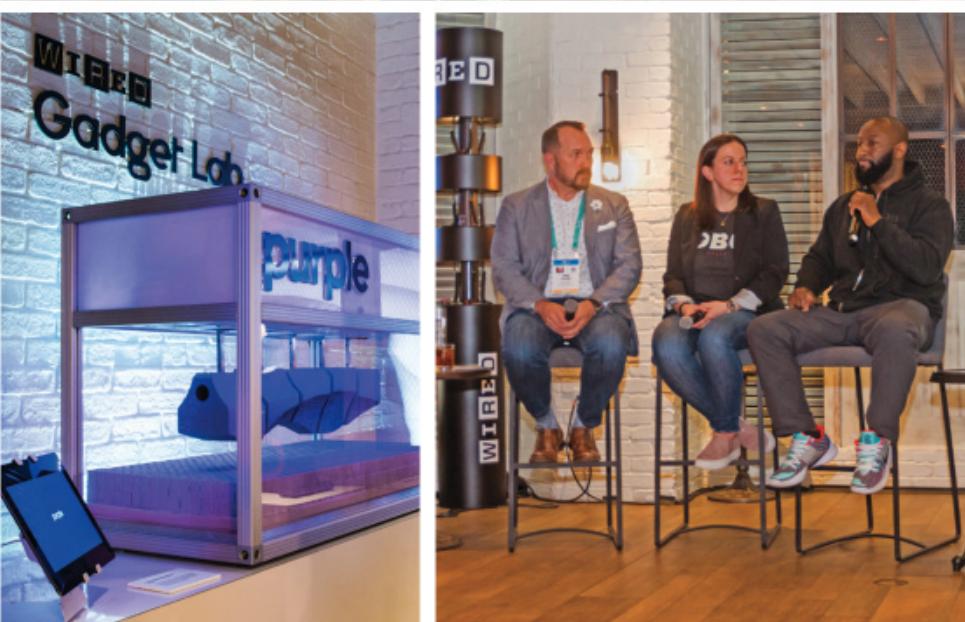
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## **THE QUANTUM CON**

Have you ever really looked at a photon? Part wave, part particle, all perfection. Yet they bring out the worst in some people, who bring out the worst in me. Let's start with the obvious: Photons, in all their quantum quintessence, can improve the security of internet connections. Anybody can poke around standard-issue encryption keys undetected, but when the 1s and 0s are hooked into specific photons, that snooping triggers telltale state changes—revealing the presence of a hacker! Clever, right? What's less clever, and more maddening, are the ways companies overhype this style of quantum cryptography. They witter of an "unbreakable" and "unhackable" internet. I like quantum engineering projects as much as any midichlorian-blooded nerd, but a cybersecurity panacea? Au quantraire! The suggestion turns me into Schrödinger's sourpuss: neither angry nor disappointed but a superposition of both. Only someone with the brains of a baryon—they are delightful but not smart—would claim quantum cryptography promises foolproof protection. Fancy tech is built by the skin-bags of water and viscera we call people, and people are not all perfection. Go ahead and give a highly trained someone a top-secret mission and a computer with a quantum-encrypted connection. Before long, they will turn lusty or sleepy or bored. They'll forget about software updates, share their passwords, and click links they should not. (Don't ask me how I know.) A canny hacker can wait for you to de-quantize your supersecret key and then steal it. Quantum encryption is cool, but the marketers need to cool off. Photons have an intrinsic angular momentum of 1, and that's all the spin they need.

PROMOTION



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for a glimpse into how technology is set to change and how brands are playing a major role in that transformation. WIRED helps consumers to navigate these next-generation innovations.

WIRED HQ was a thoughtful retreat from the frenzy of the show floor, hosting more than 1,200 guests, in partnership with Arrow Electronics, BMW, IBM, Purple, Salesforce, and Spotify. In addition, attendees were immersed in WIRED's perspective on CES and the latest news and trends in technology.

Michael Kratsios, the Chief Technology Officer of the United States, spoke about the country's strategy for artificial intelligence. The head of product for Twitter, Kayvon Beykpour, discussed how the platform is evolving online conversations. Attendees even got the chance to try their hand at beating Deepstack, the poker-playing A.I., coached by professional poker player Maria Konnikova.

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# HEY THERE, COW BUOY

Floating farms may someday help reinvent the world's food ecosystems.

BY LAURA MALLONEE

Karma, Courage, and Sustainabetty are special heifers. They have uninterrupted views of Rotterdam harbor, poop on a poop deck, and walk that gangplank to a pasture. They and 31 other Meuse–Rhine–Issel cows clomped aboard the world's first floating dairy farm last May.

"It's the best milk in the world," says Peter van Wingerden, founder of the Dutch property development company Beladon, which built the barge. In 2012, hearing that floods from Hurricane Sandy had crippled New York City's food distribution system, he imagined that waterborne urban farms could boost food security. Why Rotterdam? A quarter of the Netherlands is below sea level. Why 1,500-pound bovines? "If we could put big animals inside the city on a floating barge, we could do anything."

Getting a green light required years of answering questions from local officials: Crucially, do cows get seasick? On a steady platform, their research concluded, heifers likely won't spew their cud. The 4,843-square-foot stable floats on concrete pontoons anchored by two steel beams driven 65 feet into the seabed. The structure rises and falls with the 8-foot tides and never tilts more than 11 inches, even in winds topping 70 mph or if the herd crowds the stern to watch passing crustaceans.

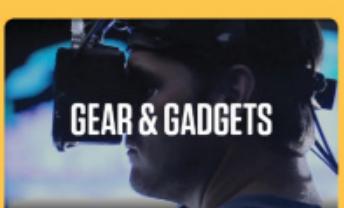
Each day aboard this largely self-sustaining ecosystem, cows eat potato peels and grass clippings, then set free 5,700-plus pounds of dung, which a Roomba-like robot sucks up and dumps down a shaft to a deck below. There it's turned into fertilizer for the soccer fields and parks that grow the grass feed. A milking robot pulls around 5 gallons from each heifer, which is bottled or made into yogurt and then trucked to local grocery stores.

Van Wingerden has talked to food companies and developers seeking to bring buoyant dairies to Singapore, Dubai, and New York. Alas, experts say large-scale floating farms would be prohibitively expensive and rely on too many resources to remain sustainable. But van Wingerden hopes the sight of cows grazing on a boat sparks creative thinking for future food production. Humans must produce 56 percent more food to feed a global population of 9.8 billion by 2050. Sure, seems like that'll happen when pigs fly. Or, when cows float. ■

LAURA MALLONEE (@LauraMallonee) writes about photography for WIRED.







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# Mist Connection

Moen's luxury low-flow showerhead turns the morning routine into a steamy, spa-like experience. —Adrienne So

NEBIA BY MOEN

Conserving water while taking a shower no longer has to be an exercise in monastic self-denial. The new Nebia swiveling showerhead cuts the waste without dialing back the opulence. The main head is a massive eight inches in diameter and uses six mini-nozzles to disperse millions of droplets in a fine, wide-angle spray—*nebbia* is fog in Italian—providing a lot of coverage with as little water as possible. The Nebia flows at 1.35 gallons per minute, which is about 35 percent less than most low-flow showerheads and 45 percent less than a standard one. The head is mounted on a vertical slide rail that gives it a range of 17 inches. I lowered mine so the Nebia's fine mist could soak my thick head of hair. I appreciated the hand wand for rinsing off my legs and feet, as well as for its convenient magnetic dock. The only negative: I had to downgrade my dog to chilly outdoor showers, since too much fog engulfed the bathroom when I tried to get her fully rinsed off.

\$199



GADGET LAB → CLEAN UP

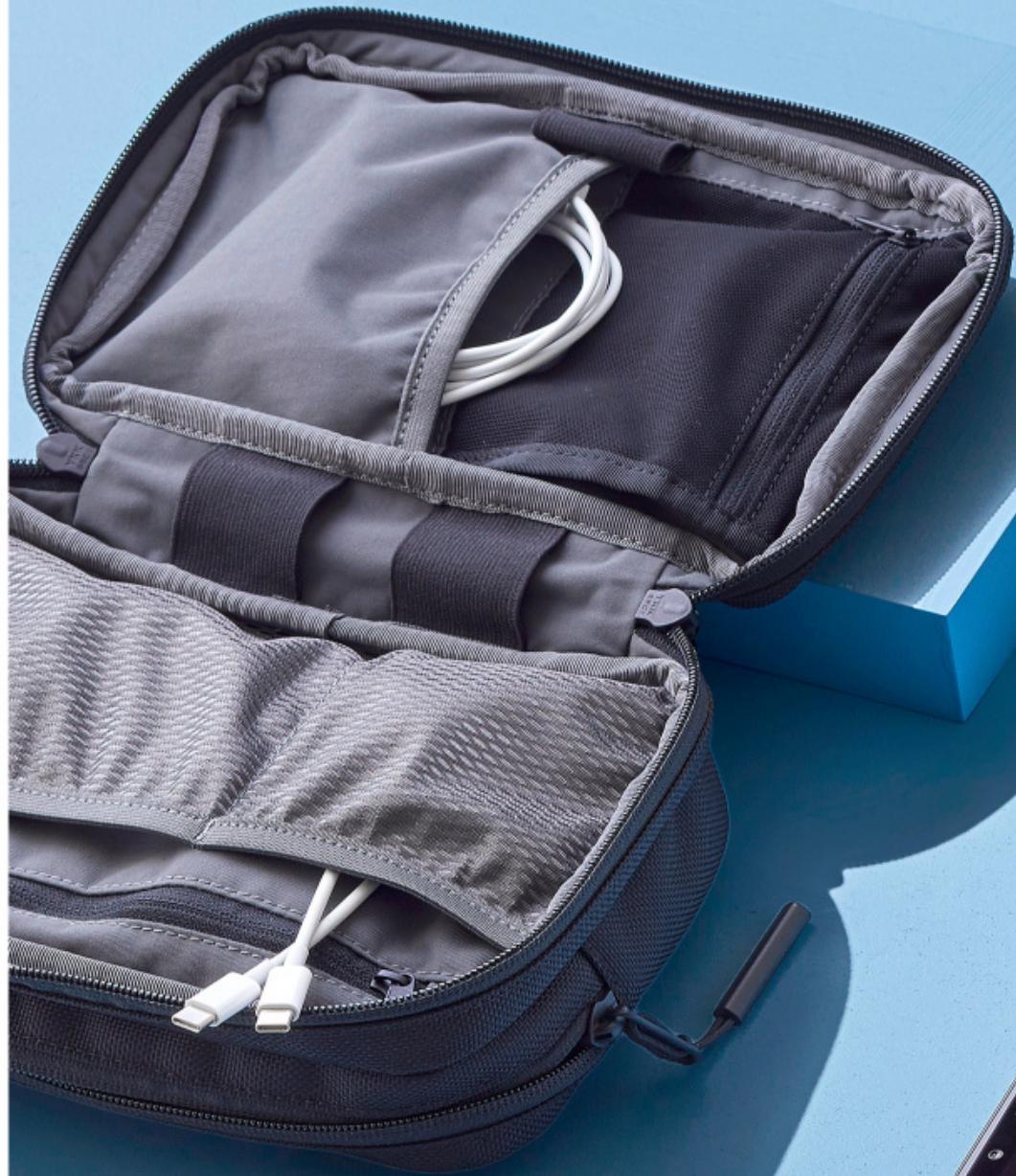
# Tabula Rasa

Whether you toil at home or in an open-plan office, these tools will keep your space clean and your mind clear. —Boone Ashworth

## OXO GOOD GRIPS SWEEP & SWIPE LAPTOP CLEANER

Oxo's dual-purpose cleaner has two ways to make your laptop less disgusting. The soft brush plumbs the crevices of your keyboard to sweep out crumbs, then retracts with a snap for easy storage. Flip the device around and use the microfiber pad to wipe all the gunk and fingerprints off your screen.

\$10



## AER CABLE KIT

The Law of Cables is clear: Place them next to each other and they will become tangled. Aer's ballistic nylon case has two compartments with a bevy of pockets, pouches, and elastic strips to eliminate cord chaos. When it's time to travel, toss it in your carry-on.

\$50



### MUJI DESK BROOM SET WITH DUSTPAN

The Japanese home-goods brand Muji excels at designing elegant implements for your desktop. This horsehair brush is an excellent tool to send scattered debris to the bin: pistachio shells, three-hole-punch chads, soil from the succulent garden. If you eat lunch alone at your desk, use it to sweep away the evidence.

\$5

### POPPIN SUPER STACKED

Capture all the wayward desk stuff (print-outs, utensils) with this handsome organizer. It comes with two letter trays, a pen cup, and two smaller trays—one of which has soft silicone sides that make it easier to pluck out tiny things. Poppin sells the elements separately, but this bundle is the quickest route to tidy.

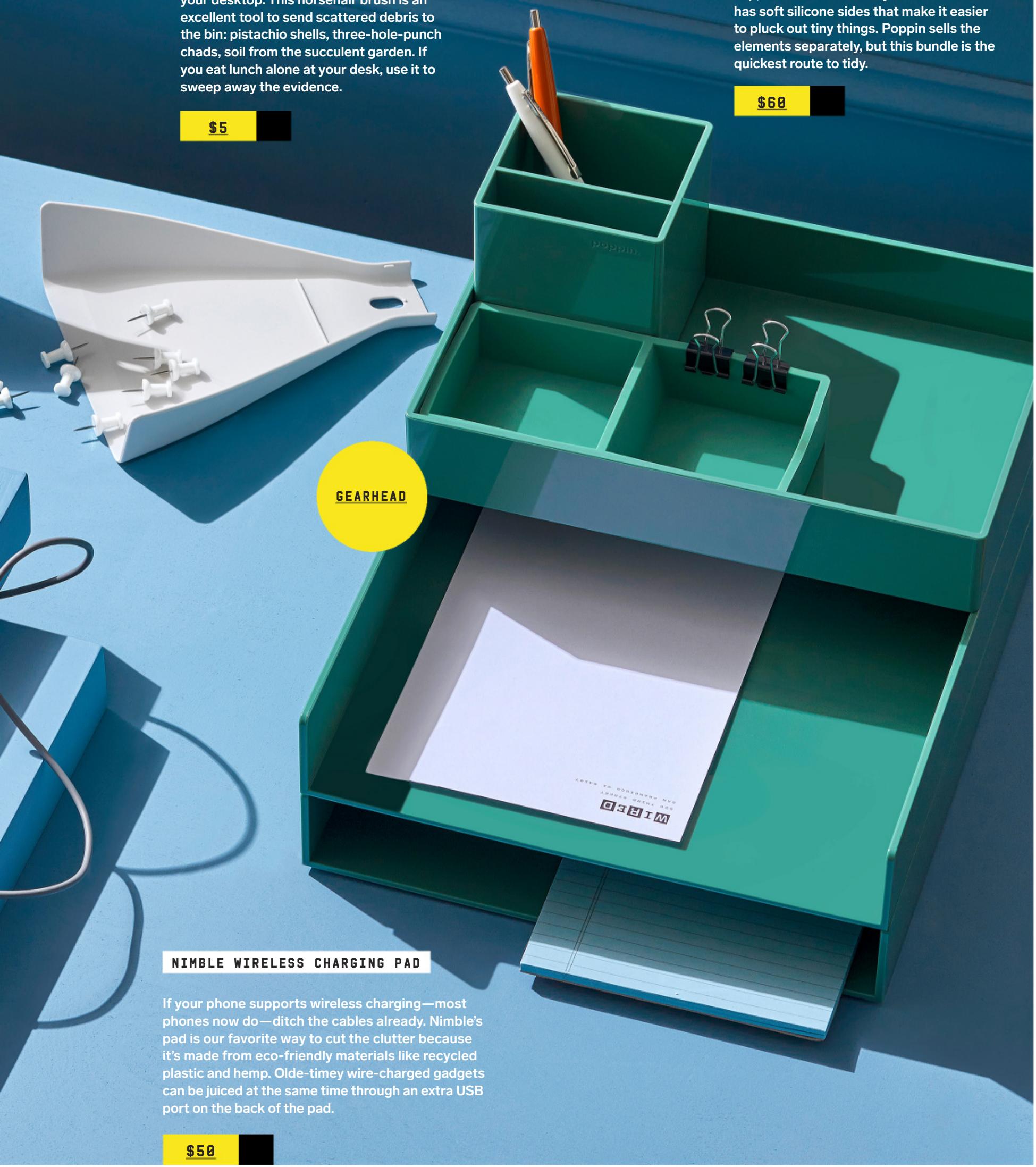
\$60

 GEARHEAD

### NIMBLE WIRELESS CHARGING PAD

If your phone supports wireless charging—most phones now do—ditch the cables already. Nimble's pad is our favorite way to cut the clutter because it's made from eco-friendly materials like recycled plastic and hemp. Olde-timey wire-charged gadgets can be juiced at the same time through an extra USB port on the back of the pad.

\$50



GADGET LAB → CLEAN UP

# Bum Rush

According to the CDC, the average person leaves a little something behind—0.14 grams of something—when they wipe. There's an appliance for that.

—Adrienne So

## FIRST CLASS

KOHLER C3-430  
NIGHTLIGHT  
HEATED SEAT

Relieve yourself from uncomfortable contortions with Kohler's heated bidet. The handheld remote (not shown) lets you create two custom settings for temperature, angle, and water pressure. At this kingly price, the throne also has a quiet-close lid, a stainless steel nozzle that self-sterilizes with UV light, and an LED night-light that gives the bowl a welcoming glow. Yes, you need to plug this one in.

\$649

## ECONOMY

### TUSHY CLASSIC

Even the least handy homeowner can install this simple spritzer in minutes. The Tushy fits under any existing toilet seat and works with the most basic plumbing connection and no electrical wiring. A console on the side lets you adjust both the nozzle angle and the water pressure—alas, not temperature, so the water will stay refreshingly brisk.

\$99

## BUSINESS

TOTO WASHLET  
A100

Toto's bidets are reliable, priced fairly, and easy to use—you may have encountered the Japanese brand's rear wipers in fancy sushi restaurants. A side module has controls for angle, water temperature, and pressure of the aerated flow. Plus, the seat is heated to make chilly winter mornings a bit less bracing. This one requires an electrical outlet too.

\$499





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**WIRED**

# Dust Brothers

**Pushing around a vacuum is so last century. Let these robots corral your crumbs. —Michael Calore**

**TOP 3**

**SHARK IQ ROBOT**

Our favorite feature on the Shark IQ is its self-emptying bin. After cruising around the house for about 10 minutes, the bot scoots home and—*whooosh*—deposits its payload into the 1.85-liter canister in the docking station. While it's there, a blast of air cleans the roller brush, prepping it to tackle the next filthy sector of the house. The IQ is slow to recharge and, with a single optical sensor, slow to map and navigate your home, but otherwise it's the best choice for homes with multiple children, pets, or anything else that generates a lot of bin-filling detritus.

**EUFY 11S MAX**

The Eufy is the most affordable of the robot vacuums we recommend. The trade-off is you skimp on luxe features: It doesn't empty its own 0.6-liter bin like the higher-priced bots, and it uses infrared and touch sensors to navigate your home instead of scanning your floor plan and creating a virtual map to follow. But if you're OK with the 11S Max bumping around as it picks its way along your baseboards and around your ottomans and chair legs, it does a great job. Bonus: The lack of internet-connected smarts is a boon for privacy, since you never have to sync the vac to your phone.

**IROBOT ROOMBA S9+**

The newest flagship Roomba also tosses its garbage into a receptacle in the charging base, but the best feature is the machine's exceptional wayfinding. iRobot based its vSLAM (visual simultaneous location and mapping) navigation system on the same tech that helps military robots locate land mines. A 3D sensor on top of the S9+ scans its surroundings 25 times a second to draw a hyper-detailed map of your home. The map doesn't just help the vacuum plot the most efficient path, it also keeps it from getting stuck—unlike cheaper botvacs, this one rarely needs rescuing.

\$450	\$270	\$1,100
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GADGET LAB → DISPATCH



# Best of CES 2020

The most promising products we saw at the annual consumer tech bonanza.



2

Over the course of five days in early January, the consumer electronics industry brings its dog and pony show to Las Vegas. It's a tidal crush of gadgets—tens of thousands of whirring contraptions competing for the attention of the media, dealmakers, and technophiles. For a product to stand out among the thicket of lithium-ion-fueled gewgaws, it needs something special: a smart design, some new material, an unbeatable value. This year a handful of products got over that high bar.

1

## SAMSUNG GALAXY CHROMEBOOK

### BEST LAPTOP

The sleek, 2.3-pound aluminum body of the Galaxy Chromebook signals it's a high-end machine—as does the \$1,000 price tag. But it has features you wish your work laptop had: USB-C ports, SD card reader, built-in stylus, and up to 1 TB of storage. The gorgeous 4K touch-screen folds all the way around the back too, so it can be held like a tablet for reading or streaming video. Sure, it only runs Chrome OS, but that's all most people need.

2

## SEGWAY NINEBOT T60

### BEST IN TRANSPORTATION

This e-scooter, intended for use in scooter-share programs, has Segway's usual self-balancing tech that corrects for bumps and stabilizes the ride. Even cooler: Users can summon it with an app. If a T60 is nearby, it'll drive itself to you, steering around obstacles on the way. Ride-share companies can also summon scooters to charging stations. We don't know how well the automated features will work (Watch where you're going, buddy!), but they could make scooter sharing even more frictionless.

3

## VIZIO OLED

### BEST TV

OLED televisions have a reputation: killer picture, lethal price. That could change in 2020, thanks in large part to the value-minded TV maker Vizio. The company's 4K OLED looks as astonishing as higher-end TVs we've seen from LG and Sony, with perfect black levels and insane contrast. Pricing hasn't been announced, but we expect this to be the first great

55-inch OLED that flirts with \$1,000. We look forward to watching Baby Yoda on one soon.

4

## IMPOSSIBLE PORK

### BEST IN FOOD

Pork is the most consumed meat on the planet. Impossible Foods' new plant-based faux pig meat brings the company one step closer to its goal of eliminating animal farming by 2035. Impossible also served up sausage at CES, and consumers in some parts of the US can already try it in a Burger King breakfast sandwich. No word yet on when I-Pork will get a wide release, but we're looking forward to cutting more animals from our diets—as soon as Impossible improves the crumbly texture.

5

## KLIPSCH BAR 54

### BEST IN HOME AUDIO

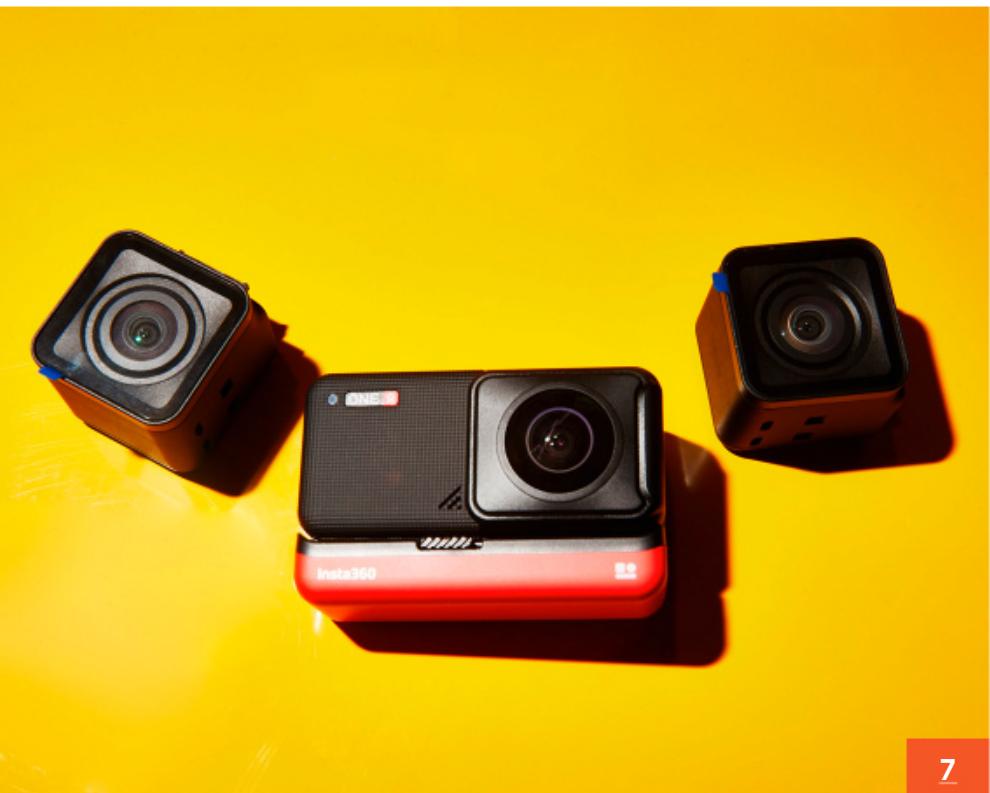
Soundbars with Dolby's immersive Atmos technology have been getting better (and cheaper) every year, but none of them has quite matched the cinema-perfect sound you get from traditional six- or seven-speaker surround-sound systems. Klipsch's latest soundbar comes closer than ever, with just four speakers—the bar itself, two Atmos-enabled surrounds, and a massive 12-inch wireless subwoofer—and 1,000 watts of earth-shuddering boom. \$1,500



6

**JABRA ELITE ACTIVE 75T  
BEST HEADPHONES**

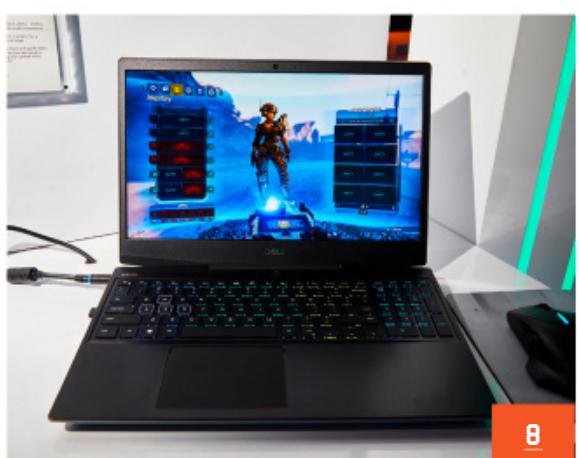
The new, sportier edition of Jabra's excellent workout earbuds are amazingly comfortable and have some of the best sound we've ever heard from wirefree earbuds. But maybe the coolest thing about them is the warranty. Jabra guarantees the Elite Active 75t against water-related damage for two years, which means you'll never have to worry about sweating through your \$200 investment. You can even wear them in the shower.



7

**INSTA360 ONE R  
BEST CAMERA**

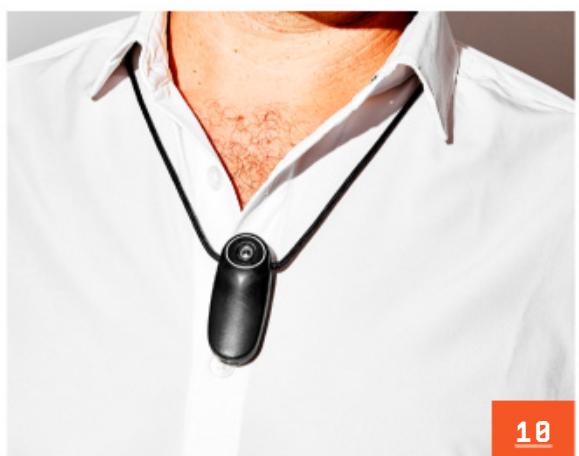
If GoPro set the standard for action cameras, Insta360 upends it. The One R has a modular design that lets you swap out lenses and sensors. Lens options include a 360-degree module, a wide angle, and, thanks to a partnership with Leica, another wide angle paired with a 1-inch sensor capable of capturing 5K video. The editing software is smart too: Dump your 360-degree footage onto a computer, then reframe the shot using the AI-powered object-tracking algorithm to keep your stupid human tricks front and center. \$550



8

**AMD SMARTSHIFT  
BEST IN GAMING**

Rather than just announce some updates to its videogame-focused graphics processors, chipmaker AMD unveiled something that benefits both gamers and the rest of us. Its new SmartShift tech lets the two core drivers of a computer's performance—the GPU and CPU—share power depending on need. If a game has intensive graphics, SmartShift borrows power from the CPU to feed the GPU and make the graphics smoother. Likewise, if



10



11

a CPU is crunching away at a large Photoshop file, SmartShift shunts power over from the GPU to help it finish the job faster.

**PHYN SMART WATER  
ASSISTANT  
BEST IN SMART HOME**

The first Phyn impressed us. The water-monitoring device tracked usage per fixture, detected small changes in H<sub>2</sub>O pressure throughout the house, and used algorithms to pinpoint leaks or frozen pipes. Unfortunately it was huge and cost \$850. Now, Phyn has debuted a great-looking slimmed-down version. At \$299, it's within reach of non-gajillionaires. And unlike so many smart home gadgets, this thing doesn't have a camera.

**ORCAM HEAR  
BEST IN ACCESSIBILITY**

Israeli startup OrCam has a new take on the hearing aid. Its Hear device, worn around the neck, uses cameras and machine intelligence to tell which person in a crowded room is talking to you. It pairs with your existing hearing aid or headphones, sending just the voice of your conversation partner to your ears. This solves a problem with traditional aids, which have a hard time filtering background chatter from direct conversation—the so-called cocktail party effect. Price TBD

**4MOMS MAMAROO SLEEP  
BASSINET  
BEST IN PARENTING**

The wonderful and terrible thing about babies is that many of them demand to be held and soothed. All. The. Time. The original Mama-Roo bouncy seat saved the arms of many new parents, and this year, 4Moms introduced a sleep bassinet. The device follows the American Academy of Pediatrics' safe-sleep guidelines and has five rocking, swaying, and vibrating motions. If you're an exhausted parent who's been eyeing Snoo's \$1,300 robo-bassinet, this rival will keep baby happy at a quarter of the price.

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Contributors: Brian Barrett, Michael Calore, Julian Chokkattu, Scott Gilbertson, Jess Grey, Parker Hall, Adrienne So, Louryn Strampe

GLOVE

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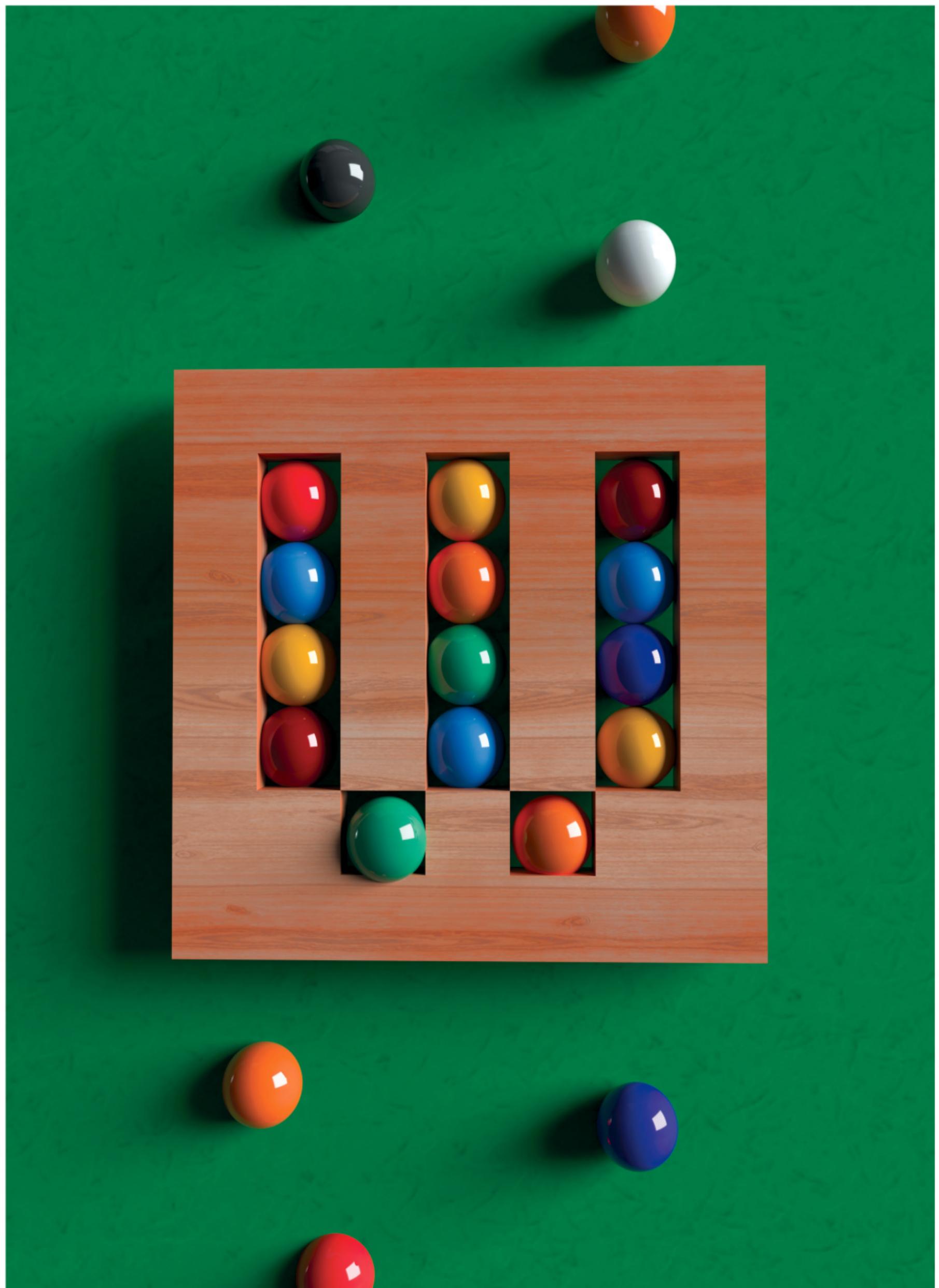
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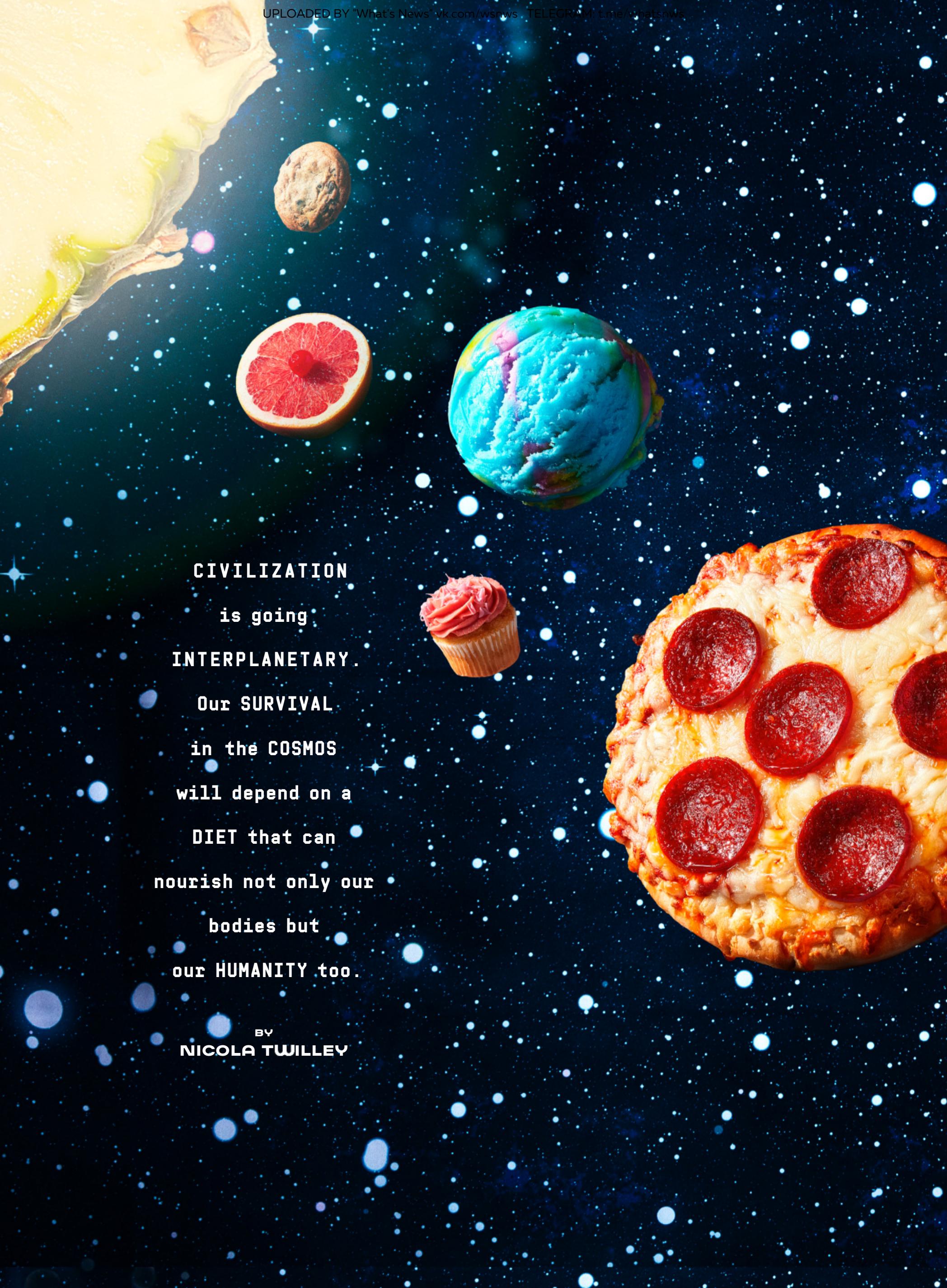
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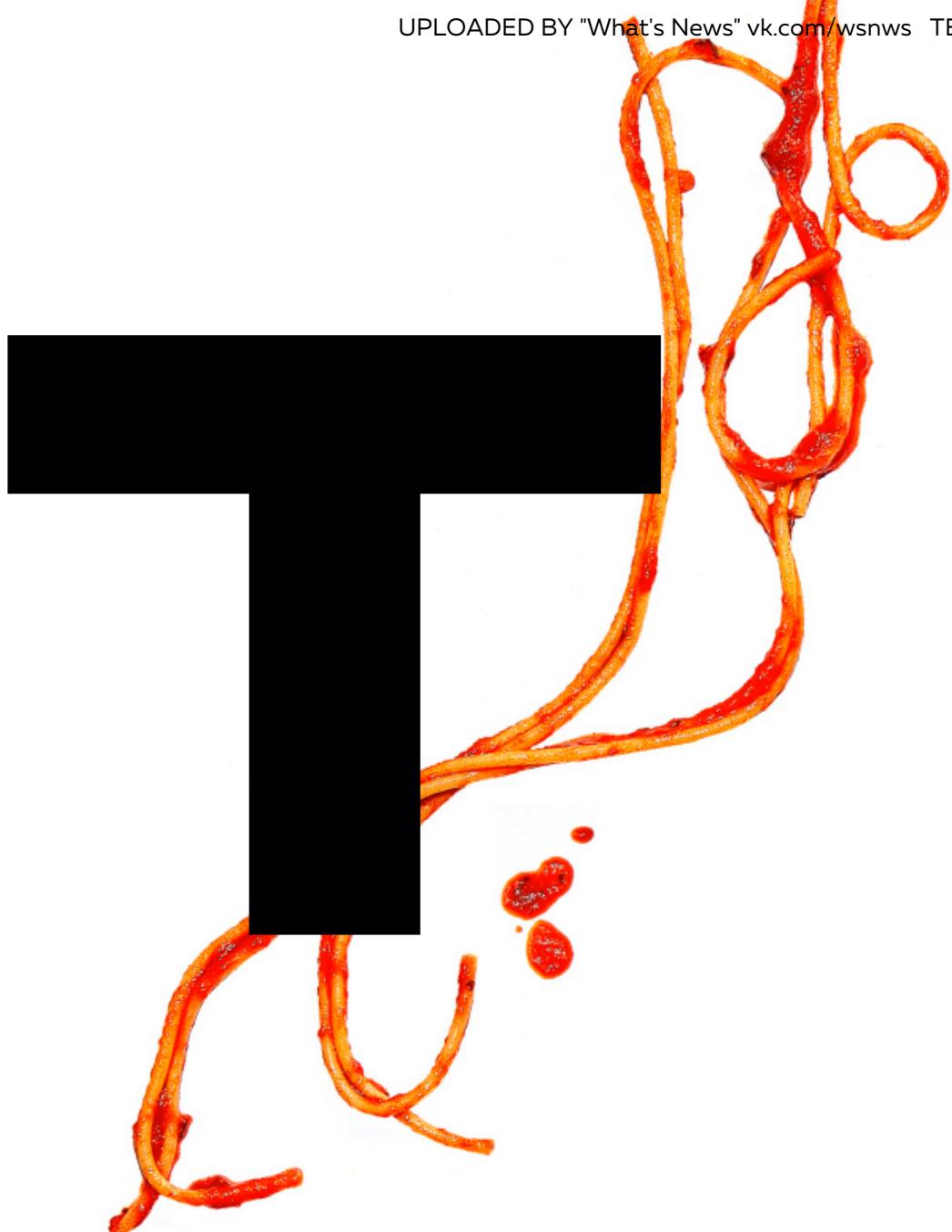
BY  
**NICOLA TWILLEY**

# Filling the void



PHOTOGRAPHS BY  
STEPHANIE  
GONOT

FOOD STYLING BY  
MAYA  
BOOKBINDER



**TO ANYONE WHO** happened to be looking up that morning, perhaps from the deck of a boat off the coast of Portsmouth, New Hampshire, the plane would have appeared to be on an extremely alarming trajectory. It rocketed into the cloudless late-summer sky at a 45-degree angle, slowed momentarily and leveled out, then nosed down toward the ocean, plunging 17,000 vertical feet in a matter of seconds. At the last moment, it leveled out again and began another climb, looking for all the world as though it were being piloted by a hopelessly indecisive hijacker.

Onboard the plane, the mood was euphoric and a little hysterical. The main cabin had been converted into a kind of padded cell, lined with soft white tiles in lieu of seats and overhead bins. Two dozen passengers, clad in blue jumpsuits, lay on their backs on the floor. As the plane neared the crest of its first roller-coaster wave, a member of the flight crew got on the PA. “Pushing over, slow and easy,” he shouted over the roar of the engines. “Release!” Moments before he uttered that final word, the passengers began to levitate. Their feet, hands, and hair lifted first, then their bodies, arms dog-paddling and legs kicking ineffectually as they giggled and grinned like fools for a fleeting, floating instant. “Feet down, coming out,” the crew member said 20 seconds later. The passengers hit the floor ass first and lay spread-eagled, staring at the ceiling.

The plane flew 20 parabolic arcs that day, for a total of around six minutes of weightlessness. Each time gravity loosened its grip, the blue-suited occupants

frantically got to work on a range of activities and experiments. I hovered in the middle of the cabin, toes down, hair up, and took in the scene. Up by the cockpit, a square-jawed jock raced to strap himself into a vertical rowing machine. Not far away, a waifish young woman sculpted spidery 3D figures in midair with a hot glue gun, sucking on her lip piercing with a look of deep concentration. Behind me, toward the rear of the fuselage, the world’s first musical instrument designed exclusively for performance in microgravity—a sort of metallic octopus called the Telemetron—emitted plaintive digital chimes as it spun. A woman wearing a seahorse-inspired robotic tail rotated serenely, twirling around its flexible ballast like a stripper on a pole.

A few feet away from where I hung, Cady Coleman, a former NASA astronaut with six months of spaceflight experience, took a nostalgic joyride, somersaulting and gliding like a pro. Nearby, silkworms in varying stages of development bounced gently in the hammock of their freshly woven cocoons, largely unnoticed inside a small acrylic box. I struggled to keep hold of my pencil and notebook as I watched industrial designer Maggie Coblenz, immaculately costumed in a Ziggy Stardust–inspired white jumpsuit and matching go-go boots, chase down and swallow a handful of boba pearls, nibbling at them like a goldfish.

The flight had been chartered by Ariel Ekblaw, the intimidatingly accomplished founder of the MIT Media Lab’s Space Exploration Initiative. Ekblaw has a round face, long curls, and the earnest demeanor that comes with being a Girl Scout Gold Award winner and high school valedictorian. Her mother set the bar for overachievement in a male-dominated field: She was a reservist instructor in the US Air Force back when female trainers were unheard of, and she would have flown fighter jets if women had been allowed to at the time. But it was Ekblaw’s father, a fighter pilot himself, who kindled her obsession with space. He was a sci-fi buff, and Ekblaw grew up devouring his paperback copies of Isaac Asimov and Robert Heinlein. She also watched *Star Trek: The Next Generation* at a formative age, imprinting on its impossibly optimistic vision of the future. After majoring in physics, math, and philosophy as an undergrad, she earned a master’s degree in blockchain research. Then, four years ago, at the age of 23, she decided to return to her first love.

The Space Exploration Initiative’s goal is to bring together “artists, scientists, engineers, and designers to build a real-life Starfleet Academy.” Ekblaw and her expanding team of more than 50 collaborators are getting ready for the day when humanity becomes a space-native civilization, as comfortable in the cosmos as we have been on Earth. “People say we’re putting the cart before the horse,” Ekblaw concedes. “But the complexities of space are such that we really should be at least designing the cart while the horse is being prepared.”

As the billionaire rocket bros never tire of reminding

us, we stand on the cusp of a new era of space travel. In the coming decades, there will be celestial cruises aboard Richard Branson's Virgin Galactic. There may be off-world factories and lunar mining operations, courtesy of Jeff Bezos and Blue Origin. There will probably be hydroponic grow houses at Elon Musk's SpaceX colony on Mars. Even the bureaucrats at NASA have grand plans for the future. But while a new generation of aerospace engineers toils over the tech that will get us into orbit and beyond—reusable launch vehicles, rocket-bearing planes—an important question remains unanswered, Ekblaw says: "What will delight humans in space?"

Even in the near term, this is not a frivolous concern. A one-way trip to Mars will take about nine months, which is a long time to spend inside a hermetically sealed tube hurtling through a cold, dark void. Like all animals, humans require stimulation; without something to break the monotony, most of us end up like a tiger pacing its cage—stressed, depressed, and prone to problematic behaviors. Indeed, many scientists believe that boredom is one of the most serious challenges facing future spacefarers.

Until now, design for space has focused on survival. But Ekblaw thinks it's possible, even essential, to imagine an entirely new microgravitational culture, one that doesn't simply adapt Earth products and technologies but instead conceives them anew. Cady Coleman amused herself by playing her flute on the International Space Station—another astronaut brought his bagpipes—but future travelers might instead pick up a Telemetron. They might wear clothes spun of special zero-g silk, or sculpt delicate forms that couldn't exist on Earth, or choreograph new forms of dance, assisted

by their robot tails. They might, in other words, stop seeing themselves as homesick earthlings and begin to feel like stimulated, satisfied spacelings.

Whatever else they do, they'll require nourishment, which is why food is a central focus of the MIT program. NASA and other government space agencies have traditionally treated food as a practical challenge—an extreme version of provisioning for an outback camping trip. But while a highly trained astronaut might be able to subsist on space gorp without losing her mind, what about a civilian with a one-way ticket to Mars? Coblenz, who is leading the Space Exploration Initiative's gastronomic research, argues that, as much as art or music or movement, good food will enable us to thrive as we leave Earth behind. It has always been the glue that connects us to each other and to the environment around us. Our pursuit of food has shaped the evolution of our sensory apparatus—the very tools through which we, as a species, perceive the world. The choices we make every day about food selection, preparation, and consumption lie at the foundation of our identities and relationships and affinities. As the Italian historian Massimo Montanari succinctly put it, food is culture.

This truth will surely endure into our interplanetary future—even as far as the 24th century, if Ekblaw's beloved *Star Trek* is to be believed. When Captain Jean-Luc Picard narrowly survives an attempted body-snatching by the Borg, a group of pasty technosupremacists who invade his mind with nanoprobes and threaten to steal his humanity forever, the place he goes to recuperate is his family's ancestral vineyard in France, where his brother still works the soil, tends the vines, and harvests the grapes, and where the meals are made from scratch. Picard was lucky: Real-life spacefarers won't have the option of hightailing it back to Earth to regain their sense of meaning and identity. They'll need to make it fresh in whichever brave new world they find themselves. As Coblenz puts it, "What will the terroir of Mars be?" To find out, she's compiling a speculative guide to the kinds of culinary tools, tastes, and rituals that might help humans feel at home in space—an interplanetary cookbook.

**COBLENTZ GREW UP just outside of Toronto and spent her summers canoe-tripping in the Canadian wilderness. After high school, she studied design in New Delhi and New York; she favors the all-black wardrobe common to the field. Yet her love of backcountry exploration has translated into a fascination with extreme environments. Before she came to MIT, she investigated the role that food plays in prisons and on the battlefield. Still, outer space presents challenges all its own; before she could begin developing interplanetary recipes, some market research was in order. And so, on a sunny morning in September, she invited Cady Coleman, Italian astronaut**



Paolo Nespoli, and a handful of MIT colleagues to a day-long workshop at the Media Lab.

The focus group gathered in a fluorescent-lit conference room decorated with large-format photos of lollipops and Buffalo wings and coiled spirals of salami. On the table, Coblenz had laid out small plastic cups of M&Ms, freeze-dried cheese bites, and Tang; these would serve as both snacks and design inspiration. Nespoli showed up with props of his own—some silvery foil packets from NASA's current menu rotation; some cans filched from the Russian supplies and the European Space Agency, including one simply labeled SPACE FOOD; and a translucent plastic package filled with what looked like yellowish plugs of ear wax but were apparently dehydrated mashed potatoes. "Nobody goes to space for the food," Coleman said.

Coblenz began by making her pitch. Humanity's off-world survival, she said, will depend on a diet that can nourish not only travelers' bodies but their minds and souls. Space food must inspire and unite; it must reflect both the grandeur of the endeavor and the majesty of the surroundings. Coleman, a kind-faced, nurturing type who wore a T-shirt depicting a Martian mountain range, nodded. Nespoli, a rugged former special-forces operator from Milan, raised his heavy eyebrows in polite skepticism.

Undaunted, Coblenz invited Coleman and Nespoli to describe their culinary experiences aboard the International Space Station—the challenges, the frustrations, and the highlights. "You know, people ask me, 'Why don't you cook pasta in space? You're Italian!'" Nespoli replied, still seemingly determined to deflate Coblenz's grand aspirations. "And I'm like, 'Well, I would love to. But you simply cannot.' I think you will not understand food in space unless you start understanding some of the practical problems that make food in space what it is."

Those practical problems have been the focus of sustained research for more than half a century. In the earliest days of the original space race, scientists worried that it might not be possible to eat in zero g at all. The human digestive system evolved to function in Earth's gravitational field; prolonged weightlessness might cause choking, constipation, or worse. The problem required research, but at the time there was no way of duplicating the proper conditions on Earth. "Gravity as a physical factor of environment has the outstanding property of being omnipresent and everlasting," a 1950 technical report explained. "Not a single individual has as yet been away from its influence for more than one or two seconds."

The scientists attempted a number of workarounds, the most memorable of which involved a German-born aeromedical doctor, Hubertus Strughold, numbing his buttocks with novocaine. Once anesthetized, he had a pilot fly him through a series of acrobatic maneuvers, reasoning that the lack of any seat-of-the-pants sen-

sation would be a decent substitute for weightlessness. According to contemporary accounts, "he found the experience very disagreeable." (Strughold was one of many former Third Reich scientists who were brought to the US after World War II to work on the space program. Although he was revered for decades as the so-called father of space medicine, his reputation has since been tarnished by his alleged association with Nazi war crimes. He denied any involvement.)

By 1955, the Air Force had refined the art of parabolic flight and could reliably provide up to 30 seconds of microgravity at a time. Although some test subjects initially struggled, choking and gasping when they tried to eat or drink, it was clear that scientists' earlier concerns had been overblown. Still, there is a reason planes like the one Ekblaw chartered are known as "vomit comets." Somewhere between half and three-quarters of all spacefarers suffer from what NASA calls space adaptation syndrome, triggered by a sudden lack of data from the otoliths. These ancient organs in the inner ear, made up of tiny crystals of chalk embedded in a gelatinous membrane, normally tell the brain where it is in relation to Earth's gravitational field.

Most astronauts get over their motion sickness within a few days, but nausea is far from the only hunger suppressant they face. For one thing, there's no way of cracking a window in space, which means the enclosed environment could easily smell, as Ekblaw described it, "like everyone who has ever been there, every meal that has been eaten, and every dump that has been taken." Coleman was quick to point out that the ISS has an excellent filtration system, but the fight against funkiness never ends. "They tell you if you open a package of food you have to eat it, all of it, if you like it or not," Nespoli said. "Whatever you have left over, it will start rotting and it will stink. And you are a good disposal machine." This organic tendency in food—its inevitable trajectory toward decay—is a major headache for space agencies. When Nespoli asked to bring aged Parmigiano-Reggiano aboard the ISS, NASA said no, because the artisans who produced the cheese could not provide its expiration date. (He had better luck with lasagna.)

Mitigating the malodor, but reinforcing the appetite loss, is a condition known as "space face." In the absence of gravity, body fluids pool in the head. This is the suspected cause of the irreversible vision problems reported by some astronauts, but it also means that, for many, eating in orbit is like eating with a severe head cold here on Earth. Astronauts have reported cravings for stronger tastes that cut through the flavor-muffling congestion. Coleman says she "liked sugar up there a little bit more" and began taking her coffee sweetened; her crewmate Scott Kelly, who'd never much cared for desserts on the ground, became something of a chocoholic during his year aboard the ISS.

But the "practical problems" Nespoli alluded to exert by far the biggest effect on astronauts' diet. Every pound

#### FLOATING RESTAURANT

Maggie Coblenz, the Space Exploration Initiative's head of food research, created a special helmet for eating in zero g.



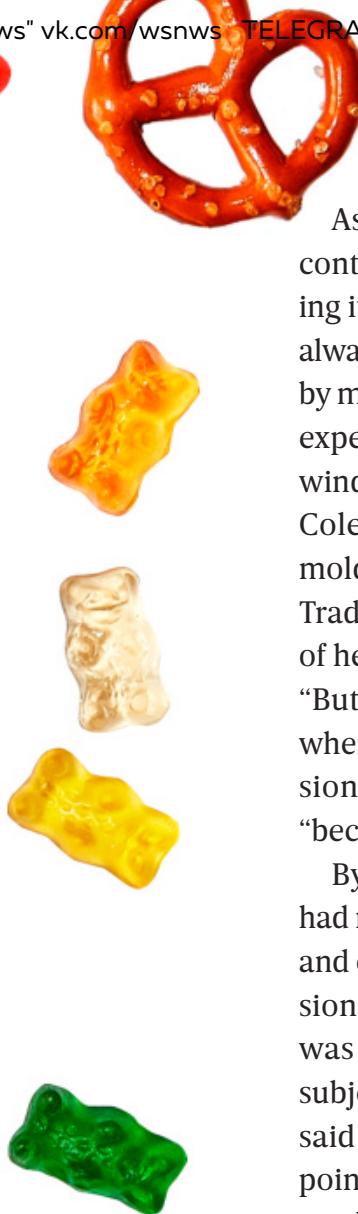
that NASA transports to and from space costs thousands of dollars, which means food must be lightweight and compact. It also has to last a long time. Like Nespoli's mashed potatoes, many of the dishes on offer—shrimp cocktail, chicken teriyaki, or one of a couple hundred other options—come dehydrated. And they tend to share another property too, Coleman said: “Everything is kind of mushy.” This is a side effect of NASA’s all-out war on crumbs. On Earth, crumbs fall; in microgravity, they can end up anywhere, including inside critical equipment or astronauts’ lungs. On the earliest space missions, food came in the form of squeezable purées and “intermediate moisture bites” such as bacon squares and brownies, which were coated in a crumb-proof layer of gelatin. Today’s menu is more expansive, but certain foods, like bread, remain off limits. In its place is the all-purpose flour tortilla, to which rehydrated sauces and stews adhere thanks to surface tension.

Although it’s possible to eat, say, Fig Newtons or Doritos in space, Coleman said such friable indulgences require careful planning. “You really need to open them near a vent so that any crumbs go on the vent,” she explained. “Then you take the vacuum cleaner and you vacuum the vent, like a good space station citizen.” (Identical rules apply to clipping one’s fingernails.) Even so, astronauts often notice little edible-looking things drifting by. In Kelly’s 2017 memoir, *Endurance*, he relates a stomach-turning anecdote in which the Italian astronaut Samantha Cristoforetti confesses to having eaten an unidentified floating object she thought was candy but turned out to be garbage.

Nespoli’s longed-for spaghetti is not crumbly, but even if he did find a way to cook it, there would be no appropriate way to eat it. For the most part, space cutlery has been reduced to a pair of scissors, for opening packages, and a spoon, for scooping out their contents. (As it happens, Nespoli’s ancestral compatriots were the first Europeans to adopt the modern fork. It was a multi-tined improvement on their previous tool—a combination ravioli spear and spaghetti twirling rod.) The process of cooking is similarly simplified. On the ISS, the astronauts typically rehydrate their food by adding hot water from a nozzle mounted on the ceiling, then kneading the package. Dinner is ready to eat at this point, but most dishes are apparently greatly improved by also being warmed inside a slim aluminum briefcase with a heating element in the middle. “This is where it gets crazy,” Nespoli said. “You have a space station that cost a gazillion dollars, built by engineers that can build the most amazing things, and the food warmer is a briefcase that takes 20 minutes and only fits enough food for three people at a time.”

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**NICOLA TWILLEY** is the cohost of *Gastropod*, a podcast that looks at food through the lens of science and history. She is at work on two books, one about refrigeration and the other about quarantine.



As a result, finding something to eat in the storage containers, rehydrating and kneading it, then warming it can easily take 30 or 40 minutes. Astronauts are always short on time; their days are tightly programmed by mission control, and overruns on repairs or science experiments frequently cut into their already limited window for meals. During the Media Lab focus group, Coleman described a favorite dinner that involved molding rice into sticky balls and then mixing it with Trader Joe’s Thai curry, which she’d brought up as part of her personal allowance. “I really loved it,” she said. “But it took me probably twice as long to eat dinner when I did that.” Especially toward the end of her mission, she was more likely to eat a food bar instead, “because it was just efficient.”

By this point in the meeting, Coleman and Nespoli had rattled off an extraordinarily long list of challenges and constraints. Finally, though, they made the admission that Coblenz had been chasing all along: Food was an important part of daily life in orbit—and the subject of many of their fondest memories. Coleman said their entire crew, even the cosmonauts, made a point of eating together on Friday evenings. “It’s how you become a team,” she explained, to Coblenz’s evident delight. Coleman opened her laptop and flipped through her favorite photographs from her time aboard the ISS. One showed the kitchen table, which juts out into the corridor between the Russian and American segments of the station. “Everybody had bruises on each hip—one for the way there, one for the way back,” she said. “It was exactly in the way.” Of course, there’s no real reason for a table to be horizontal in space; packets of food and drink have to be secured using Velcro either way, so it could just as easily lie parallel to the wall. But Coleman said there was an unspoken resistance to such an arrangement. The crew needed a place to “hang around,” she explained, and to ask that most human of questions: “How was your day?”

Nespoli’s favorite ISS snapshots involved food too, in a way. He pulled up an image he captured of clouds over Lake Garda, Italy. “That looks like a margherita pizza,” he said. “And then the next picture—that looks like a *quattro stagioni* pizza.” Earth was pizza, pizza was Earth, and both were entirely out of reach. This was the obstacle Coblenz was determined to surmount.

**THE FIRST PEOPLE** ever to leave Earth orbit and strike out into space were the three crew members of Apollo 8. They were surprised to find that the most compelling thing they saw on the quarter-of-a-million-mile-long journey lay in the rearview mirror. “We set out to explore the moon and instead discovered the Earth,” astronaut Bill Anders wrote 50 years after the mission’s end.

It was Anders who captured the iconic “Earthrise” photo on Christmas Eve of 1968: a shiny blue jewel

wreathed in clouds, floating above the pockmarked lunar surface, alone in the pitch-black void. Reflecting on the image in 2018, he recalled the powerful emotions that led him to ignore his assigned task—documenting potential landing sites—and turn his lens toward home. “Once-distant places appeared inseparably close,” he wrote. “Borders that once rendered division vanished. All of humanity appeared joined together.” His sublime experience, an overwhelming feeling of oneness coupled with a sudden awareness of Earth’s beauty and fragility, became so common among future generations of astronauts that it earned a name: the overview effect. It offers an escape from the confined, smelly conditions, the mushy, repetitive meals, and the endless checklists. When Coleman was aboard the ISS, she played her flute in the Cupola, a windowed observatory purpose-built for world-watching.

On a journey to Mars, or beyond, that will no longer be an option. Psychologists have no idea how the so-called

“Food assumes added importance under all conditions of isolation and confinement because normal sources of gratification are denied,” Jack Stuster, an anthropologist and NASA consultant, wrote in *Bold Endeavors*, his 1996 book on the behavioral issues associated with extreme environments. “Usually, the longer the confinement, the more important food becomes.” Managers of offshore oil rigs, supertankers, and Antarctic research stations all appreciate the importance of food to maintaining group morale and productivity in isolated, remote, and confined situations. Stuster noted that “food has become such an important element onboard fleet ballistic missile submarines that, for years, meals have been served at cloth-covered tables in pleasant paneled dining rooms.”

Outer space is perhaps the most extreme environment humans will ever confront. To mitigate the inevitable burnout, NASA has developed a range of what it calls “countermeasures.” During his yearlong mission

aboard the ISS, for instance, Scott Kelly tested a pair of rubber suction trousers, designed to combat fluid shift. (Afterward he reported feeling, for the first time in months, “like I wasn’t standing on my head.”) He and his crewmate Kjell Lindgren, the man with the bagpipes, also grew and ate some red romaine lettuce—a first for American astronauts.

Research by Marianna Obrist, a professor of multisensory experiences at the University of Sussex, suggests orbital agriculture could be a promising countermeasure. “In a way, that appreciation of what it takes to grow food and how wonderful and alive fresh food tastes—that’s something you don’t often think when you are eating here on Earth,” she told me. Perhaps a crunchy leaf of romaine could serve as the edi-

ble equivalent of the overview effect. For the foreseeable future, though, onboard farming will never provide more than a tiny portion of a crew’s dietary requirements. The MIT team will have to look elsewhere.

Obrist’s recent work has documented exactly the void that Coblenz is trying to fill. In anticipation of mass-market space tourism, she and her colleagues conducted a survey in which they asked ordinary people about the eating experiences they would want on a flight to the moon or Mars. The responses were clear: For the shorter lunar trip, travelers were perfectly happy to provision themselves like campers, provided there would be treats. But when it came to the longer Mars journey, the respondents said they’d require a wide variety of

## **“You have a space station that cost a gazillion dollars, built by engineers that can build the most amazing things, and the food warmer is a briefcase that takes 20 minutes and only fits enough food for three people at a time.”**

break-off phenomenon—the sense of detachment that can arise when our planet slips from view—will affect future astronauts’ mental state. What’s more, any communication with the now-invisible Earth will be subject to as much as a 45-minute lag. Kelley Slack, one of the experts on NASA’s Behavioral Health and Performance team, recently told NBC, “It will be the first time that we’ve been totally disconnected from Earth.” Since the summer of 1975, when NASA convened a group of experts to discuss permanent settlement in space, researchers have warned of a psychological condition called “solipsism syndrome,” in which reality feels dreamlike and lonely astronauts become prone to self-destructive mistakes. Mars could be the theory’s first real test.



flavors, textures, and temperatures. They also felt it would be important to re-create some of the rituals and environments that accompany eating on Earth.

In short, Coblenz said, making better space food means thinking bigger than countermeasures. “If humans are going to thrive in space, we need to design embodied experiences,” she told me. She has even looked to zoos for inspiration. “For predatory animals like tigers, instead of just throwing a carcass into their cage, they might have a hunting contraption that drags and twitches the meat,” she explained. “They’re manufacturing this more challenging experience to make eating more engaging for the animals, and I wondered what the space food analogy might be.” Hiding food around a spacecraft to encourage foraging behavior might not be feasible, she concluded, but what about meal preparation? What kinds of culinary transformations are possible in space—and what kinds of rituals could be built out of them?

Like generations of chefs before her, Coblenz began by taking advantage of the local environment. Liquids are known to behave peculiarly in microgravity, forming wobbly blobs rather than streams or droplets. This made her think of molecular gastronomy, in particular the technique of using calcium chloride and sodium alginate to turn liquids into squishy, caviar-like spheres that burst delightfully on the tongue. Coblenz got to work on a special spherification station to test in zero g—basically a plexiglass glove box equipped with preloaded syringes. She would inject a bead of ginger extract into a lemon-flavored bubble, or blood orange into a beet juice globule, creating spheres within spheres that would deliver a unique multipop sensation unattainable on Earth. And unlike their terrestrial counterparts, Coblenz’s spheres would float rather than sit on a plate, meaning they could be appreciated in 360 degrees, rather than 180, and garnished accordingly. The entire process, as whimsical as it might seem, could offer future space travelers a welcome chance to express their culinary creativity and enjoy eating as a sensory experience, even if “space face” means the flavors themselves are subdued.

Coblenz also had weightier weightless recipes in mind. Many of Earth’s most deeply comforting foods rely on the byproducts of microbial digestion. Because metabolism works differently in microgravity, for microbes as well as humans, the resulting flavors might differ too. What would a wheel of space-aged Parmigiano-Reggiano, a loaf of space-risen sourdough bread, or a tube of space-fermented salami taste like? Coblenz is planning to send a batch of miso paste to the ISS later this year, to learn how its flavor profile changes. She has also developed a new way of consuming it. Pondering the station’s lack of cutlery, she struck upon the idea of creating silicone “bones”—solid, ivory-colored crescents that resemble oversize macaroni more than the ribs that inspired them. Nibbling and sucking foods

directly off a silicone bone might reduce spoon fatigue, she explained, and perhaps even put spacefarers in touch with humanity’s most ancient foodways.

Coblenz has also considered sending brine into orbit, to evaporate into salt. As Phil Williams, who recently launched the world’s first astropharmacy research program at the University of Nottingham, told me recently, “One of the problems of making crystals on Earth is that you have convective currents.” Driven by gravity, these currents affect the quality of crystal growth. “You can get far bigger crystals with fewer defects in microgravity,” he said. Chefs and foodies already pay a premium for the large, hollow pyramids of Maldon sea salt, a shape preferred for its crunch, its intermittent bursts of saltiness, and its superior adhesion to baked goods. No one yet knows what culinary properties the crystalline perfection of space salt might possess. Many pharmaceuticals rely on crystallization too, and any alteration in those structures can change the drug’s therapeutic effects. “There may one day be compounds that we can only make off-planet and bring back,” Williams said, conjuring up a dazzling vision of the future in which drug factories and gourmet brine ponds orbit Earth.

In the weeks leading up to the parabolic flight, as Coblenz surveyed her prototypes, she decided she’d like to spend her precious moments in zero g actually eating stuff, not just fiddling with the spherification station. She would set aside time to inject a few test spheres, but for now she was more interested in replacing some of the ambiance, texture, and flavor that astronauts complain is missing aboard the ISS.

“I’ve designed a special space food helmet and a tasting menu,” she told me on our last call before we flew. “Have a light breakfast.”

**AS ASTRONAUTS AND** entrepreneurs alike are fond of saying whenever something goes horribly wrong, “space is hard.” The same rule seemingly applied to MIT’s zero-gravity flight. Initially slated for March, it was delayed for months, owing to a government shutdown, scheduling conflicts, and then at the last minute—with all the passengers, including the silkworms, ready to go—the FAA’s refusal to recertify the plane until a single part was replaced. Finally, the morning dawned. I ate a quarter of a bagel, applied a motion-sickness patch, and boarded the team bus to ride up to an airstrip at Pease Air Force Base in New Hampshire.

We gathered in a hangarlike space haphazardly furnished with plastic tables, folding chairs, a metal detector, and an x-ray machine. Staff from Zero-G Corporation, the company operating the flight, issued us



our blue onesies, complete with name badges, and our boarding passes. Flight ZG491 was scheduled to depart at 9 am.

As the passengers suited up and checked their experimental equipment one last time, the preflight briefing began. There would be no somersaults, no flipping, no spinning without permission—seriously, no horsing around of any kind.

"Don't look down," one staffer warned. "You'll feel like your eyeballs are falling out."

"Don't take off a ring and try to float it while you take a picture," said another. "There's still a wedding ring in there somewhere from the last guy that tried that."

After the briefing, I tried on Maggie Coblenz's food helmet, a sort of giant plastic goldfish bowl with two hand holes carved out. "It was injection-molded for me by people who make aquariums," she said. "When you put it on, you're in a world of your own—and it catches crumbs. I've tried it in bed." There was a built-in lazy Susan on which she had mounted five small containers. I spotted boba pearls in one and Pop Rocks in another. The hardware was spray-painted an Instagram-friendly rose gold.

We went through our own private TSA security line, after which Coblenz handed me some contraband boba pearls. As a potential hazard to the equipment onboard, they were approved for flight only on the condition that they remain contained within her helmet. I didn't have a helmet of my own, so I stashed them in my breast pocket, sealed it with velcro, and boarded the plane. Several rows of seats were installed at the back, and we sat and listened to a modified safety spiel. If the airplane lost pressure, we were told, oxygen masks would *not* drop automatically; instead, we would have to make our way over to the oxygen boxes mounted along the center aisle and walls. After a perfectly normal takeoff, the seat-belt sign switched off and we all moved forward to our appointed stations, next to the bolted-down equipment.

On the first weightless parabola, my shoelaces came undone. They remained that way for the duration. My instinct was to swim, but that didn't work. Moving gingerly, I hovered to one side, trying not to get in the way as Coblenz injected her spheres. (We wouldn't be eating them on the flight, mostly because there wasn't time to fish them out of the plexiglass box; still, the experiment would serve as proof of concept.) She was struggling too, her arms visibly shaking as she tried to control the speed at which the liquid came out of the syringes. Before either of us had any idea what was going on, it was time to serve the tasting menu.

Coblenz put on her helmet and immediately relaxed. She told me later that it functioned almost like noise-canceling headphones, allowing her to focus on eating amid the uproar. She piped in a soundtrack of frying onions, then opened a canister that released a matching scent—an attempt to increase her appetite and induce



#### ↑ SURF & TURF

Coblenz holds a dish of algae-based "caviar," designed to remind space-faring earthlings of their faraway home.

salivation, both known to enhance food enjoyment. The helmet became both restaurant and plate as she unleashed a handful of Pop Rocks and boba pearls and chased them in circles. Immediately, Coblenz sneezed: Most of the popping candy appeared to have gone straight up her nose. I set loose my contraband pearls and promptly lost half of them; perhaps they would reappear on a future flight. The few that managed to connect with my mouth bounced around on my tongue, a sensation that made me snort with laughter.

As we entered our final few parabolas, Coblenz sucked miso paste from her silicone bones. I floated the length of the cabin, marveling at an agility and grace I'd never demonstrated on Earth. Behind me, two unfortunate researchers were hunched, barf bags in hand, stricken by space adjustment syndrome. For the rest of us, weightlessness was over far too quickly.

Back at the airfield, Zero-G had laid out a sandwich buffet for our "regravitation celebration." I dragged myself to it, heavy-limbed and slow. As I lifted my turkey club baguette to my mouth, I could hardly believe I'd have to eat this way for the rest of my life. At least for now, the psychological benefits of earthly terroir seemed hardly worth the price of being permanently rooted to the ground. I glanced at Coblenz. She was draped over a chair, eyes closed, with a huge smile. Slowly, her right arm floated up and she began gently combing Pop Rocks from her hair. ■



**BALENCIAGA**



“Think outside of the shoebox.”

**TYREX**

IN THE EARLY  
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BUT A  
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## The Notebook.

BY  
STEVEN  
LEVY

IN THE EARLY DAYS OF EAGER WORK



SURVIVED LINE PAGES

# I first met Mark Zuckerberg in March 2006.



At the time, I was the lead tech writer at *Newsweek* and was working on a story about what we were calling Web 2.0—the notion that the next stage of the internet would be a joyful, participatory creation of individuals. I'd heard about a social networking startup that was spreading like kudzu on college campuses. I wanted to learn more about it, perhaps give it a name-check in the story. Luckily,

Zuckerberg, its cofounder and CEO, was scheduled to appear that month at PC Forum, a conference I regularly attended, at a resort in Carlsbad, California.

We agreed to meet at the lunch hour on the conference grounds. We sat side by side at one of the big, crowded, round tables set up on a lawn under the bright sun. He was accompanied by Matt Cohler, who had left LinkedIn to join Facebook. Cohler, unable to nab a seat next to us, sat across the table, barely within ear range.

I took it in stride that Zuckerberg looked even younger than his 21 years. I'd been covering hackers and tech companies for long enough to have met other peach-fuzz magnates. But what did shake me was his affect. I asked him a few softball questions about what the company was up to, and he just stared at me. He said nothing. He didn't seem angry or preoccupied. Just blank. If my questions had been shot from a water pistol at the rock face of a high cliff they would have had more impact.

I was flummoxed. This guy is the CEO, isn't he? Is he having some sort of episode? Was there something I'd written that made him hate me? Time seemed to freeze as the silence continued.

I looked over to Cohler for guidance. He smiled pleasantly. No lifeline.

Stumbling for a way out of the awkwardness, I asked Zuckerberg if he knew anything about PC Forum. He said no, and so, as a resident Methuselah, I explained its roots as the key industry gathering in the personal computer era, where Bill Gates and Steve Jobs would go at each other with smiles on their faces and shivs in their fists. After taking in that bit of lore, he seemed to thaw, and for the rest of the lunch he was able to talk, albeit sketchily, about the company he started in a dorm room and which had grown to 7 million users.

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MARK ZUCKERBERG IN FACEBOOK'S PALO ALTO OFFICE IN 2006, THE YEAR HE WROTE "BOOK OF CHANGE" AND OPENED FACEBOOK TO THE WORLD.

Though I was unaware at the time, I had joined the club of those stunned by Mark Zuckerberg's trancelike silences. Facebook VP Andrew Bosworth once called this stare "Sauron's gaze."

Zuckerberg and Facebook got four sentences in my cover story, "The New Wisdom of the Web." If I'd known the things that Zuckerberg hadn't shared with me that afternoon at the La Costa Resort and Spa, I might have devoted more space.

Zuckerberg was entering one of the most productive periods in his life. A few weeks after I met him, he would lay out a ludicrously ambitious vision for Facebook. In a journal with unlined 8-by-10 paper, he sketched his mission and product design and explored how a tiny company might become a vital utility for the world. In detail, he described features called Open Registration and Feed, two products that would supercharge his company.

Zuckerberg found focus in that notebook and others. In his jottings are the seeds of what would come—all the greatness and the failings of Facebook. Over the next 10 years, Zuckerberg would execute the plans he drew up there. Facebook would transform itself from a college student hangout to the dominant social media service, with a population bigger than that of any country in the world, and was on its way to having more members than any religion. Zuckerberg's gospel insisted that more and more sharing was an inherent good. In addition to bringing people together, Facebook became a source of news, entertainment, and even life-saving information. The company monetized its user base with ads, and Zuckerberg became one of the richest people in the world, his name hoisted into the pantheon of PC Forum legends.

And then came the 2016 election. Suddenly, simmering complaints about the service boiled over into anger. Facebook's most cherished accomplishments became liabilities. The enormous numbers of people who connected, "We Are the World"—style, on the service now became alarming evidence of its excessive power. A platform that allowed the voiceless to be heard also allowed trolls to broadcast bilious provocation at ear-splitting decibel levels. It was a tool for deadly oppressors and liberation movements alike. And above all, it was

an egregious privacy offender: Facebook's long-held ethic of sharing was now viewed as a honey trap to snare user data. And that data—information provided wittingly and unwittingly by all of us—was the substance on which Facebook grew fat and prospered.

Since 2006 I've been watching Zuckerberg and, over the past three years, have been writing a history of his company. I've spoken to him nine times and observed as he's adapted—and, in some ways, refused to adapt—to the most challenging circumstances. The shift in public attitudes toward Facebook mirrors the reputational fall of the tech sector itself. But Facebook's unique circumstances emanate largely from its founder's personality, vision, and approach to management. To understand Facebook, you have to understand Zuckerberg.

That isn't the easiest task. Even he admits that there's a robotic coolness to his public persona. After many conversations, he got relatively candid with me, but there was always a measure of reserve. He never forgot that I'm a reporter and was understandably protective of himself and the company he built.

But I did find one venue where Zuckerberg was utterly frank and unfiltered about his plans and dreams for Facebook, providing vital clues about the man running the world's most powerful companies. It was in the notebook he kept in the spring of 2006.

# A

**S A KID** growing up in Dobbs Ferry, New York, a bedroom community north of New York City, Mark Zuckerberg loved playing games. One was a PC-based strategy game called *Civilization*, with the tagline "Build an empire to stand the test of time." Gameplaying stoked a desire to learn programming. His parents, a dentist and a psychiatrist, hired a coding tutor.

Zuckerberg quickly surpassed his local public school's computer science offerings, enrolling in a graduate course in eighth grade. After his second year of high school, he asked to attend a private school with more AP and computer courses. His parents wanted him to go to nearby Horace Mann, a highly selective preparatory school, but Zuckerberg, once described by his father

as “strong-willed and relentless,” preferred the more rarefied Phillips Exeter Academy. Exeter it was.

Zuckerberg thrived at the exclusive New Hampshire prep school, seemingly unimimidated that classes there might include a Rockefeller, a Forbes, and a Firestone. Besides establishing himself as a computer whiz, he was the captain of the fencing team. He was an avid Latin student, developing a fanboy affinity for the emperor Augustus Caesar, an empathetic ruler who also had an unseemly lust for power

Not”—like program that encouraged students to rate each others’ looks. To populate the picture database, he’d hacked into various protected university housing websites, which led to his investigation by Harvard’s Administration Board. He was reportedly one decision away from suspension. People close to him confirm that he was oddly unperturbed by the threat. (At a festive “Goodbye, Mark” party, 19-year-old Zuckerberg met his future wife, Priscilla Chan. The potential suspendee was wearing party glasses with a message that made a coding pun about beer consumption.)

“He had this real self-confidence,” says his classmate Joe Green. Once, while Green was walking to dinner with Zuckerberg and Chan, Zuckerberg impulsively darted into a busy street. “Watch out!” Chan said.

“Don’t worry,” Green told her. “His confidence force field will protect him.” Zuckerberg avoided suspension. It wouldn’t be the last time he managed

to skate away from the consequences of his actions. In February 2004, he cofounded TheFacebook. Cameron and Tyler Winklevoss, fellow students who had hired him to help build a social network website, eventually sued. The twins and their partner had been brainstorming for over a year, with apparently little urgency, and charged that Zuckerberg had plundered what would otherwise have been a successful idea. They had probably overestimated their own product, but it is indisputable that Zuckerberg dragged his feet on the project, stalling for around two months while brainstorming his own competing product. (Even now, despite the evidence of his own digital

## WHITEBOARDS APPEARED IN EVERY FACEBOOK OFFICE, AND EMPLOYEES COULDN'T SURVIVE WITHOUT EXCELLENT DRY-ERASER SKILLS. BUT A ZUCK NOTEBOOK CARRIED THE SANCTITY OF A PAPAL DECREE.

and conquest. Zuckerberg still indulged in games; his favorite was a successor to *Civilization* set in outer space called *Alpha Centauri*, in which players chose to lead one of seven “human factions” to control the galaxy. Zuckerberg always took the role of the quasi-UN “Peacekeeping Forces.” The spiritual leader of the peacekeepers was a commissioner named Pravin Lal, who opined that “the free flow of information is the only safeguard against tyranny.” Zuckerberg would later use a Lal quote as the signature on his Facebook profile:

*Beware of he who would deny you access to information, for in his heart he dreams himself your master.*

Zuckerberg entered Harvard University in 2002 and immediately ignored the things you were supposed to do at Harvard University. He spent a lot of time at a cheap wooden desk in the common room of Suite H33 in Kirkland House creating software products. He cared about these more than his grades or his classes, which he attended only occasionally.

And then came FaceMash, the “Hot or

trail, Zuckerberg denies intentional deception: “I think I may have been conflict-avoidant,” he told me.) Facebook eventually had to pay \$65 million in cash and stock to settle the case. But that wasn’t until 2008, and by then the settlement was a pittance compared with the company’s multibillion-dollar valuation.

Facebook seemed charmed. Though Zuckerberg knew little about fundraising or running a business, the pieces fell into place. By the end of 2005, Zuckerberg had somehow pulled off millions in financing—his early mentor Sean Parker got things rolling with an introduction to Facebook’s first big investor, Peter Thiel. He gathered a team of experienced advisers. “Whether it’s Peter Thiel or Sean Parker, these people thought they were manipulating Mark,” surmises one early Facebook employee. “I remember in hindsight thinking how genius it was that Mark convinced Sean Parker to raise all the money for him ... Mark saw Sean as a useful tool to do the job that sucks the most,” that is, fundraising.

T

HE YEAR I FIRST MET Zuckerberg, he was living in a one-bedroom apartment a short walk from the Facebook offices, which were spread among a few buildings in downtown Palo Alto. Always with him was one of his notebooks. Those who visited his apartment, with its mattress on the floor and barely used kitchen, might spot a stack of completed journals. But most of his time was spent in the crowded, chaotic Facebook offices, where he could be seen, head down, scrawling in his crabbed, compact script. He sketched out product ideas, diagrammed coding approaches,



ZUCKERBERG AND FACEBOOK EMPLOYEES AT THE LAUNCH OF NEWS FEED IN 2006.

and slipped in bits of his philosophy. Page after page were filled with straight lines of text, bullet-pointed feature lists, flow charts.

Zuckerberg was no longer doing much coding; he was focused mostly on the big picture. The notebooks allowed him to work out his vision in detail. When Facebook engineers and designers rolled in to the office, they would sometimes find a few photocopied pages from the notebooks at their workstations. The pages might contain a design for a front end or a list of signals for a ranking algorithm. He was still finding his way as a communicator, and the pages often opened up a conversation between the recipients and their boss. They also imbued Zuckerberg's thoughts with a kind of inevitability. The printed page can't be deleted or altered, or forwarded in infinitely duplicable digital form. Whiteboards appeared in abundance in every Facebook office, and employees couldn't survive without excellent dry-eraser skills. But a Zuck notebook carried the sanctity of a papal decree.

The notebooks have now mostly disappeared, destroyed by Zuckerberg himself. He says he did it for privacy reasons. This is in keeping with sentiments he expressed to me about the pain of having many of his early IMs and emails exposed in the aftermath of legal proceedings. "Would you want every joke that you made to someone being printed and taken out of context later?" he asks, adding that the exposure of his juvenile jottings is a factor in his current push to build encryption and ephemerality into Facebook's products. But I discovered that those early writings aren't totally lost. Snippets, presumably those he copied and shared, present a revealing window into his thinking at the time. I got ahold of a 17-page chunk from what might be the most significant of his journals in terms of Facebook's evolution. He named it "Book of Change."

Dated May 28, 2006, the first page has his address and phone number, with a promise to pay a \$1,000 reward for return of the book if lost. He even

scrawled an epigram, a message to himself: "*Be the change you want to see in this world.*" Mahatma Gandhi.

The writing reveals an author with focus and discipline. He dated nearly every page. Some of the entries seem to have been created in a single burst of energy. They cover three or four pages of detailed road maps with neat sketches of sample screens. Nothing is crossed out. This is the work of someone in a maximum state of flow.

The Book of Change outlines the two projects that would transform Facebook from college-and-high-school network into internet colossus. On May 29, he began a page called Open Registration. Up until that point, Facebook had been limited to students, a gated community where only classmates could browse your profile. Zuckerberg's plan was to open Facebook to everyone. He diagrammed how someone could create an account. People would be asked whether they were in college, high school, or "in the world." He mused about privacy. Could you see profiles of "second-degree" friends in your geographical region? Or anywhere? "Maybe this should be anywhere, as opposed to just your geo," he wrote.

"That would really make the site open but probably not a good idea just yet."

He wanted Facebook to be wide open eventually, but on the pages of the notebook, you could see him grappling with the implications. What distinguished Facebook from other social networks was the assumed privacy provided by its gated setup. Open Reg would throw open those gates to the masses. But would people then no longer see Facebook as a safe space? In designing Open Reg, he posted one final question to himself.

"What makes this seem secure, whether or not it actually is?" He seemed at least as concerned about the *perception* of privacy as with privacy itself.

The tension between expanding the boundaries of Facebook and maintaining an appearance of privacy preoccupied Zuckerberg's mind and filled his notebook in other ways. He took three pages to lay out a vision for something he called "Dark Profiles." These would be Facebook pages for people who, whether by omission or intention, had not signed up for Facebook. The idea was to allow users to create these profiles for their friends—or really just about anyone who didn't have a Facebook account—with nothing more than a name and email address. Once the profile existed, anyone would be able to add information to it, like biographical details or interests.

As presented in the Book of Change, the dark profiles would serve as a tool to motivate stragglers to sign up, perhaps through email alerts about what people were posting about them on Facebook. Zuckerberg was aware that allowing the creation of profiles for people who had no desire to be on Facebook might stir up privacy concerns. He spent some time pondering how this could avoid being "creepy." Maybe, he mused, dark accounts might not be included in search engines.

(It's not clear how much of this came to pass. In her 2012 memoir, Katherine Losse, a former Facebook employee, wrote that in 2006 she worked on a project that "created hidden profiles for people who were not yet Facebook users but whose photographs had been tagged on the site." She told me recently that "it was kind of peer-to-peer marketing at Facebook, directed at people who had friends on the site but hadn't signed up yet." Another early Facebook employee confirms this, also saying that Facebook

brainstormed Zuckerberg's idea of allowing people to create and edit dark profiles of friends, Wikipedia-style, but it was not executed.)

Back in 2006, when Zuckerberg ticked off the potential virtues of implementing dark profiles in the Book of Change, he mentioned user recruitment, the addition of more data to Facebook's directory, and his sense that "it's fun and kind of crazy." Twelve years later, Zuckerberg would be questioned in Congress about whether Facebook kept tabs on people who had not signed up for the service. He punted the question, but Facebook later clarified. The company said it keeps certain data on nonusers for security purposes and to show outside developers how many people are using their app or website. But, it asserted, "we do not create profiles for non-Facebook users."

# Z

**ZUCKERBERG'S OTHER** preoccupation in the Book of Change was a product he called Feed. (Trademark issues meant it would ultimately be branded News Feed.) Feed was a dramatic rethinking of the entire Facebook experiment. In 2006, to browse Facebook profiles, you'd have to jump from one to another to see if your friends had posted updates. News Feed would bring those updates to you in a stream and become Facebook's new front page.

In his notebook, Zuckerberg thought hard about what would appear on the News Feed. His priority was to make it easier for people to see what was important among the friends they had consciously connected to on Facebook. One word stood out as a yardstick for inclusion in the Feed: "interesting-ness." It sounded innocent. "Stories need context," he wrote. "A story isn't just an interesting piece of information. It's an interesting piece of information plus other interesting things about it AND why it's interesting."

Zuckerberg envisioned a three-tier hierarchy of what made stories compelling, imagining that people are driven chiefly by a blend of curiosity and narcissism. His top tier was "stories about you." The second involved stories "centered around your social circle." In the notebook, he provided examples of the kinds of things this might include: changes in your friends' relationships, life events, "friendship trends (people moving in and out of social circles)," and "people you've forgotten about resurfacing."

The least important tier on the hierarchy was a category he called "stories about things you care about and other interesting things." Those might include "events that might be interesting," "external content," "paid content," and "bubbled up content." Here is where Zuckerberg sketched out his vision of News Feed as a kind of personalized newspaper. (The idea that Facebook might one day disrupt the news industry itself was apparently not part of his contemplations.)

Zuckerberg was only getting started with this notebook. Over the next few days he feverishly outlined ideas about privacy and how Facebook would expand beyond colleges and high schools to everybody, old and young. He described the design of a "mini-feed" on the profile page that would track the activities of users—essentially a stalker's paradise. ("The idea is to produce a log of a person's life but hopefully not in a creepy way," he wrote, suggesting that people should be able to add or delete items from their mini-feeds, "but they shouldn't be able to turn it off.")

At one point, his pen seems to have run out of ink, and he switched writing implements. "Sweet, this pencil works better," he wrote, and two pages later he was sketching out what he called The Information Engine, along with what seems to be a grand vision for Facebook.

*Using Facebook needs to feel like you're using a futuristic government-style interface to access a database full of information linked to every person. The user needs to be able to look at information at any depth ... The user experience needs to feel "full." That is, when you click on a person in a governmental database, there is always information about them. This makes it worth going to their page or searching for them. We must make it so every search is worth doing and every link is worth clicking on. Then the experience will be beautiful.*

Designing Facebook for the future seemed to be pure pleasure for Zuckerberg. But that year he also faced his greatest agony. Yahoo, then an internet giant with considerable power, had offered to buy Facebook for a reported \$1 billion. This was a huge sum—one many founders would have leapt at with little hesitation. Not Zuckerberg. Ever since TheFacebook had exploded at Harvard, Zuckerberg had been decisive, opportunistic, and ambitious. This decision, though, left him reeling in doubt. He was, after all, still in his early twenties, with little life experience and less understanding of high finance. He didn't want to sell, but how could he be sure things would really work out? Who was *he* to do this? Almost all his investors and employees thought it was insane to turn down that money. Making things worse was the fact that, with the spread to colleges and high schools pretty much reaching its limits, Facebook's growth had slowed. To investors and his executive team, that was another sign that selling was the obvious path.

"I definitely had this impostor syndrome," he told me in 2018, reflecting on the Yahoo bid. "I'd surrounded myself with people who I respected as executives, and I felt like they understood some things about building a company. They basically convinced me that I needed to entertain the offer."

He did verbally accept the offer, but then Yahoo CEO Terry Semel made a tactical error, asking to renegotiate terms because his company's stock had taken a downturn. Zuckerberg used that as an opportunity to end the talks. He believed that the two products he wrote about in the Book of Change would make Facebook more valuable.

The executives who had urged him to sell would either quit or be fired. "It was just too broken a relationship," Zuckerberg says.

**A**FTER ZUCKERBERG REJECTED Yahoo, he turned to the launch of the key products he had outlined in the Book of Change. After almost eight months of intense preparation, News Feed launched in September 2006. The rollout was a disaster, and the flash point was privacy.

News Feed hit your social groups like a stack of tabloid newspapers crashing on the sidewalk. Every one of your "friends" now knew instantly if you made an ass of yourself at a party or your girlfriend dumped you. All because Facebook was showing the information in their faces! Over 100,000 people joined just one of many Facebook groups urging the product's retraction. There was a demonstration outside headquarters.

Inside Facebook there were calls to pull the product, but when employees analyzed the data, they discovered something amazing. Even as hundreds of thousands of users expressed their disapproval of News Feed, their behavior indicated the opposite. People were spend-

ing more time on Facebook. Even the anger against News Feed was being fueled by News Feed, as the groups organizing against it went viral because Facebook told you when your friends joined the uprising.

Zuckerberg did not panic. Instead, at 10:45 pm on September 5, he acknowledged their complaints, albeit in a condescendingly titled blog post: "Calm down. Breathe. We hear you." For the next few days the News Feed team worked all-nighters to gin up the protections that should have been in the product to begin with, including a privacy "mixer" that let users control who would see an item about them. The rage was quelled, and in a breathtakingly short period of time, people got used to the new Facebook. News Feed turned out to be crucial to Facebook's continued rise.

Zuckerberg seemed to take a lesson from his first public crisis, possibly the wrong one. He had pushed out a product with serious privacy issues—issues his own people had identified. Yes, a crisis did erupt, but quick action and a dry-eyed apology defused the situation. People wound up loving the product.

"It was a microcosm of him and the company," says Matt Cohler, who left Facebook in 2008 but is still close to Zuckerberg. "The intent was good, there were misfires along the way, we acknowledged the misfires, we fixed it, and we moved on. And that's basically the way the company operates."

Zuckerberg became comfortable as the ultimate decider on all things Facebook. Sam Lessin, a Harvard classmate who later worked as a Facebook executive, says that multiple times he was in a room where Zuckerberg made a decision that conflicted with everyone else's opinion. His view would prevail, and he would be right. After a while, people came to accept that a Zuck decision would turn out to be the wise one.

Zuckerberg wanted growth. As he had out-

**"YOU'VE KNOWN ME FOR A LONG TIME," ZUCKERBERG SAID. "I DON'T OPTIMIZE FOR FUN."**

lined in his notebook, Facebook grew when people shared their information, and he believed that, as happened with News Feed, people would come to see the value of that sharing. Facebook did offer privacy controls, but as with all software, default settings rule: Providing privacy controls is not the same as providing privacy. *"What makes this seem secure, whether or not it actually is?"*

At many of those decision points, there were heated internal discussions, with some of Zuckerberg's top lieutenants raising objections. In 2007, Facebook introduced a feature called Beacon, which stealthily tracked people as they bought things on the web and then—by default—circulated the news of their private purchases. His team begged him to make the feature opt-in, but “Mark basically just overruled everyone,” an executive at the time told me. Beacon was predictably a debacle. After that, he hired Sheryl Sandberg as chief operating officer. Zuckerberg would be the lord of engineering—what Facebook *built*—and Sandberg would be in charge of everything Zuckerberg wasn’t interested in, including sales, policy, legal, content moderation, and, eventually, much of security. “It was very easy,” Sandberg told me. “He took product, and I took the rest.”

But Zuckerberg was still the final decision-maker. In 2009, Facebook changed the default settings for its new users from “friends” to “everyone,” and recommended that its existing 350 million users do the same. In 2010, it introduced Instant Personalization, a privacy-busting feature that gave more personal information to outside app developers. Time and again, over internal objections, Zuckerberg chose growth and competitive advantage over caution and privacy-consciousness. The result was a series of hasty apologies, not to mention charges and a \$5 billion fine from the Federal Trade Commission.

“It’s within every leader’s right to make edicts,” says someone who was in the room for many Zuckerberg decisions. But “leaders fail when they convince themselves that everyone disagreeing with them is a signal for them being right.”



IN HIS NOTEBOOK, ZUCKERBERG DESCRIBED THE FACEBOOK HE WAS BUILDING AS “THE INFORMATION ENGINE.” ABOVE, ZUCKERBERG AT A 2008 DEVELOPER CONFERENCE.

# I

**N LATE SUMMER** of 2016, I traveled to Nigeria with Zuckerberg. He showed up at a center for tech startups in Lagos and greeted folks there as if he had just popped in from around the corner. “Hi, I’m Mark!” he chirped. He charmed everyone: a local businesswoman selling Facebook-supported Wi-Fi access, Nigerian entertainment stars, even President Muhammadu Buhari, who was particularly impressed that Zuckerberg took a run on the city’s public thoroughfares. Zuckerberg was instantly a national hero.

In retrospect, it was peak Facebook. Two months later, Donald Trump was elected president of the United States. Over the course of the next few years, it would become clear that Facebook had committed a number of sins: It had been the vessel of a Russian misinformation campaign; it had broken privacy promises to users, whose information was harvested without their consent; it had circulated false information in Myanmar that led to a riot where two people were killed; it had helped destroy the business model supporting independent journalism.

Zuckerberg’s initial reaction to criticism was most often defensive. But when misinformation could not be denied and Congress came calling, he clicked back into apologize-and-move-on mode.

At least in public. Inside the company, he was taking a different tack. In July 2018, Facebook’s “M Team,” which consists of about 40 of its top leaders, held one of its periodic meetings on the company’s Classic Campus, former offices of Sun Microsystems. It started out as usual. In M Team meetings, executives do a brief check-in, sharing what’s on their minds, both in business and in life. It can get pretty emotional: *My kid’s sick ... my marriage ended ...* Zuckerberg always speaks last, and when his turn came, he made a startling announcement.

He had recently read a blog post by venture capitalist Ben Horowitz, in which the author defined two kinds of CEOs: wartime and peacetime. Wartime CEOs are fending off existential threats and must be ruthless in confronting them. This made a big impression on Zuckerberg. Since the election, his company had been attacked by critics, regulators, and the press. In this climate, he told the group, consider him a wartime CEO.

He emphasized one shift in particular. Horowitz put this way: “Peacetime CEO works to minimize conflict ... Wartime CEO neither indulges consensus building nor tolerates disagreements.” Zuckerberg told his management team that as a wartime CEO he was going to have to tell people what to do.

True, Zuckerberg always had made the final call. But now he seemed to be saying that he would act more expeditiously, even if it meant forgoing the lively conversation, in person and on email threads, that had preceded his decisions. Some in the room thought he was saying that they should shut up and obey his directives. Zuckerberg resists that characterization. “I basically said to people, this is the mode that I think we’re in,” he told me of the declaration. “We have to move quickly to make decisions without the process of bringing everyone along as much as you would typically expect or like. I believe that this is how it needs to be to make the progress that we need right now.”

I wondered whether he found the role of wartime CEO more stressful or more fun?

A Zuck silence. Sauron’s gaze.

“You’ve known me for a long time,” he finally said. “I don’t optimize for fun.”

**N**OT LONG BEFORE the July 4 holiday in 2019, I met with Zuckerberg at his home. The person who sat across from me on the couch couldn’t have been more different from the 21-year-old I’d met 13 years before. He had sat with presidents and autocrats, been ripped apart by legislators, amassed a multibillion-dollar fortune, started a family, and was financing, through an enterprise led by his wife, an effort to cure all diseases by the end of the century. His company had done the unprecedented: bound almost a third of humanity in a single network. Now he was trying to mitigate the damage.

In another sense, though, he felt an urgency to maintain the optimism and creativity he had in 2006, when things fell easily to him and he could change the world by leaving photocopies of journal pages next to the computers of his developers and designers. He was determined not to let Facebook’s attempts to fix itself hamper its ambitions for even greater power.

We’d had several conversations over the course of the year. When I asked him about the company’s errors, he was candid about his personal failings. Maybe it was a mistake to distance himself from the policy issues that would cause Facebook so much trouble. Maybe in his competitive zeal to crush Twitter, he made the News Feed too susceptible to viral garbage. Maybe he didn’t pay enough attention to the things in Sandberg’s domain. The split of their duties made sense originally, as he sees it, but now he is determined to devote more energy to things like content moderation and policy.

But a worse sin, he believes, would have been timidity.

“I just think I take more chances, and that means I get more things wrong,” he told me. “So in retrospect, yeah, we have certainly made a bunch of mistakes in strategy, in execution. If you’re not making mistakes, you’re probably not living up to your potential, right? That’s how you grow.”

When we spoke in July, he conceded that some of those mistakes have had terrible consequences but insisted that you had to look beyond the present.

“Some of the bad stuff is very bad, and people are understandably very upset about it—if you have nations trying to interfere in elections, if you have the Burmese military trying to spread hate to aid their genocide, how can this be a positive thing? But just as in the previous industrial revolution or other major changes in society that were very disruptive, it’s difficult to internalize that, as painful as some of these things are, the positive over the long term can still dramatically outweigh the negative. You handle the negative as well as you can.”

He added: “Through this whole thing I haven’t lost faith in that. I believe we are one part of the internet that’s part of a broader arc of history. But we do definitely have a responsibility to make sure we address these negative uses that we probably didn’t focus on enough until recently.”

He still believes that Facebook is doing good. “I couldn’t run this company and not do things that I thought were going to help push the world forward,” says the man who some think has done as much destruction to that world as anyone in business. Facebook may have to change, but Zuckerberg thinks it’s on the right path.

When it was time for me to leave, Zuckerberg walked me to the door. Earlier, I’d told him I had pages from the Book of Change he wrote in 2006, and standing on the top of the steps outside his house, he said it would be cool to see it now. I had a scan of it on my phone, and I opened the file and handed it to him.

Zuckerberg gazed at the cover page—with his name and address and the promise of a \$1,000 reward to anyone locating it—and his face lit up. *Yes, that’s my handwriting!*

As he swiped through the pages, a rhapsodic smile spread across his face. He had been united with his younger self: the boy founder, unacquainted with regulators, haters, and bodyguards, blissfully relating his visions to a team that would alchemize them into software, and then change the world in the very best way. It was a treasure that seemed irretrievably lost.

He seemed almost reluctant to break the trance and hand me back the phone, but he did, and turned back to his house. ■

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**STEVEN LEVY** (@stevenlevy) is WIRED’s editor at large. He wrote about Jeff Bezos and Blue Origin in issue 26.11.

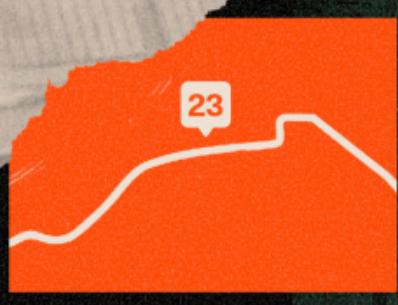
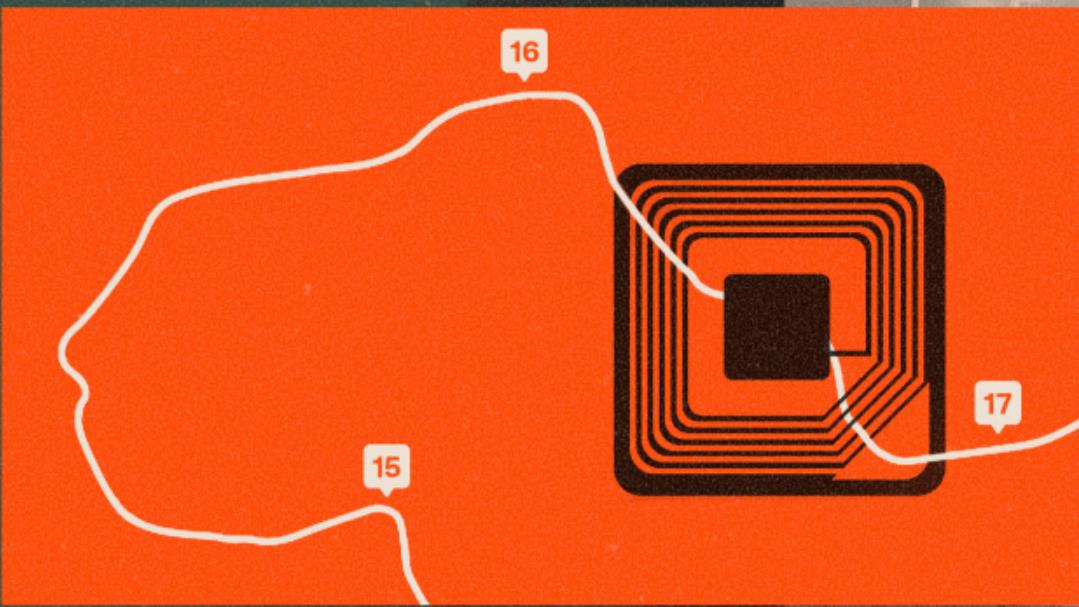
# Across the Line



Derek Murphy started his Marathon Investigation website to report on runners who cheat. Relying on hard data mined from race results, he zeroes in on people whose times seem suspicious—like a 70-year-old doctor named Frank Meza.

by  
Gordy Megroz

Illustration by  
Mark Weaver



# On a warm Saturday evening in late May, Derek Murphy, wearing cargo shorts and a polo shirt, sat on his living room floor,

his back against the couch, his legs stretched out, his computer on his lap. A baseball game was on the television, but Murphy, 49, wasn't paying much attention to it. He was too busy scrolling through hundreds of photos and combing over data on his computer. Occasionally he'd stop to sip from a can of diet soda. During the week, Murphy, who lives outside of Cincinnati, worked as a data analyst for a health insurance company. But in his free time, he pursued an unusual hobby: exposing cheaters in endurance races.

Four years earlier, Murphy had started a website called Marathon Investigation, and recently he'd been looking at the results of the 2019 Los Angeles Marathon, which had taken place on March 24. With more than 24,000 runners competing, the LA Marathon is one of the largest 26.2-mile races in the country. It's also a qualifying race for the Boston Marathon, the most prestigious in the United States. Murphy had been particularly interested in the results for a runner named Frank Meza.

Meza, a prominent 70-year-old doctor from South Pasadena, California, hadn't just qualified for the Boston Marathon; he'd run an exceptional time of 2 hours, 53 minutes that day, setting a record for the fastest marathon ever run by a man his age. This stood

out to Murphy; over the years, he'd analyzed race results for thousands of amateur athletes and written about dozens who had cheated in various competitions. He typically starts his probing by looking at race splits—the time it takes a runner to cover a particular segment of a course. During many races, especially big ones like the LA Marathon, radio-frequency identification chips are embedded in runners' bibs and record when the racers run over an RFID-enabled mat. Meza's splits were consistent, showing that for the entire race, he ran six-and-a-half-minute miles. Still, several commenters on a popular message board for running enthusiasts, LetsRun.com, doubted Meza's result. They had posted photos in which it appeared that Meza entered the run from a sidewalk during the middle of the race, suggesting the possibility that he cut part of the course and then reentered.

On May 24, Murphy emailed the photos that had been posted on LetsRun to Meza and asked him to confirm that the picture was of him. "The above link is the sequence of photos that appear to show you entering the course from the cross street," Murphy wrote. "I was hoping that you could provide some context. Was that you entering from the cross street, and if so, can you

explain what happened? Did you exit the course for some reason, and for how long? Any information you can provide would be helpful."

Meza responded soon afterward: "I looked at the photos and I can assure you I did not cut. I cannot recall exactly where on the course but I did pull off to pee one time I was not able to find a portapotty so I found a building wall maybe 20 yds from street. In 2018 I had a similar problem so I waited and ran into a hotel I lost 2 min this time I was hell bent on not losing 2-3 min."

The next morning, Murphy opened his email to find a link to several hundred more photos in a Dropbox folder. They were taken, he says, with an official race camera set to snap photos every few seconds. (He won't say who sent them.) Murphy was anxious to dig in to them but had other obligations. He closed his laptop and took his young daughter to her soccer game. Then they met up with his wife and son for lunch. Afterward, they all went to the park. But the entire day, he says, he was wondering if the photos would provide concrete evidence that Meza cheated.

That night, Murphy set up his gear, and for two hours, using editing software that he'd bought online for \$50, he spliced

together 600 time-stamped photos to create a three-minute video.

Once finished, Murphy found that at about mile 11.5, Meza, who was wearing a black baseball cap, black shorts, and a grayish-blue shirt on top of a long-sleeved black shirt, appeared to enter the course from a sidewalk and begin to run. Assuming that's the place where Meza stopped to relieve himself, there should also have been images of him ducking off the course. But in the images leading up to that moment that Murphy viewed, Meza was nowhere to be seen.

Convinced that he had proof that the doctor had cheated, Murphy reached out to Meza again. "You were not pictured leaving the course 'to pee,'" he wrote. "It will be my determination that those photos show that you cut the course. If you have anything to contradict my findings, please forward it on."

Meza wrote back four minutes later: "You are clearly trying to harm my reputation and discredit me. I will no longer respond to your emails. You will be contacted in the next few days by my legal counsel."

**A**s a kid growing up in Cleveland, Murphy says, he was scrawny and socially awkward. He played soccer, "but I wasn't good at it," he says. "Technically I was on the golf team. But I was horrible at that too." He was, however, good with numbers. "I had about a 2.0 GPA in high school, but I did really well in math," he says. At home, Murphy would race Hot Wheels on a plastic track and make graphs to determine which car was consistently the fastest. On his Commodore 64, he'd plug in football team statistics to try to create gambling odds.

After graduating from the University of Cincinnati, where he majored in marketing and finance, he started a series of sales jobs. In the spring of 2005, feeling out of shape, he started running. "I couldn't run a mile," he says. "I'd have to start walking halfway through." To stay motivated, Murphy signed up for a marathon. Since then, he's run 11 of them. Murphy is a slow marathoner—his personal best is 5 hours, 11 minutes in 2006—but snagging a podium was never the objective. "I just really enjoy doing them," he says. "Before I started running, it seemed unattainable. But anybody who puts in the work can complete the goal."

To gather running tips and find out about races, Murphy became a dedicated reader of running forums, particularly message boards like LetsRun.com. In 2015 he watched the message boards come alive with debate over a runner who qualified for the Boston Marathon with a significantly faster time than the guy had ever had in previous marathons. The chatter intrigued Murphy. What struck him was not so much the did-he-or-didn't-he question, but just how easy cheating could be. "I was like, why are we so fixated on this one guy? Is there anybody else who's doing this?" He decided to examine the results of the first race he came across, the 2015 Fort Lauderdale Marathon. The race website listed multiple splits for each participant. After

less than 10 minutes of scrolling through the data, Murphy noticed an anomaly.

"I could see one person with gaps—two missed splits," he says. "And her pace increased significantly where she missed the split. I was like, hey, this woman cheated." Murphy went on the woman's Facebook page and discovered that she'd run a Boston-qualifying time. This incensed him. It was one thing to try to make your time look better for your own vanity. But the Boston Marathon, like other elite marathons, caps the number of runners within each age group depending on their qualifying times. Cheating to gain entry was no victimless crime.

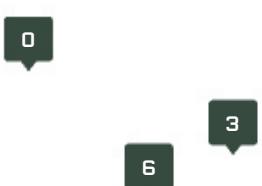
"I posted what I'd found on LetsRun," he says. "And a commenter said, 'Somebody needs to start a blog to expose these people.' So I said, OK, I will. I'll start the blog." A few days later, he launched Marathon Investigation.

Murphy's first order of business was to ensure that Boston Marathon entries went to actual qualifiers. As he caught more cheaters, the feedback he got from runners was mostly positive. "I love that you do this," wrote one reader, responding to a 2016 story Murphy wrote about a Boston Marathon qualifier who he caught course cutting at the Philadelphia Marathon. "Keep up the great work!" wrote another.

Soon, Murphy was spending 10 to 20 hours each week investigating. In his first six months running his website, he accused eight people of cheating, writing about his extensive detective work in long blog posts stuffed with charts, photos, screenshots, and other corroborating materials.

In late 2016, a friend developed a data scraper for Murphy that pulls all the published race result splits into an Excel document, making it easier for Murphy to see anomalies. "If there are splits missing, or there's one split that's considerably faster than the other splits, then it raises red flags," he says.

A few months later, Murphy was tipped off about questionable results from the Fort Lauderdale A1A Half Marathon, a 13.1-mile race. Jane Seo, the second-place female finisher, had run the second half of the course nearly two minutes faster than the first, an improbable margin. Murphy looked at race photos and noticed that Seo was wearing a Garmin fitness-tracking watch





and that, in a photo of Seo near the finish line, the face of her watch was visible. Murphy bought the race photographer's high-resolution photo and zoomed in on the watch. Amazingly, he could see that Seo had run only 11.65 miles of the 13.1-mile race. On February 21, 2017, Murphy posted a story about Seo. The site blew up.

Seo was disqualified from the race. Several outlets picked up Murphy's story, including Yahoo Sports. *The Washington Post* published a piece breaking down Murphy's analysis. Within a month, Murphy's blog post had more than 100,000 views, and the site's daily engagement jumped from 800 to 10,000 unique visitors. The popularity of the site eventually encouraged Murphy to start a podcast, which he launched in December 2018. (WIRED was not able to reach Seo for comment.)

With more readers also came more tips. "People weren't just emailing me about Boston qualifiers," he says. "They'd be asking about smaller races that I wouldn't normally look at. But if five people reached out to me because they were suspicious that somebody cheated in a race, I'd look into it."

**One of the racers** Murphy had been watching for a while was Parvaneh Moayedi, a 56-year-old woman based in San Antonio, Texas, who held the Guinness World Record for the most marathons run by a woman in one year (168) and the most marathons run on consecutive days by a woman (17). She also claimed to be the only woman in history to have run more than 1,000 marathons, having completed more than 1,250 to date.

Moayedi owns and operates a race series called I Ran Marathons, which stages weekly marathons, half marathons, 10Ks, and 5Ks. Moayedi holds her races on San Antonio running trails, but she was born and raised in Iran—thus the punny name of her series.

Over the years, fellow runners had flagged Moayedi's behavior at several high-profile races. In 2013, after logging a suspiciously fast split time late in a 100-mile race in Texas, she was disqualified. She was disqualified from the 2016 Houston Marathon after her timing chip failed to register splits at several checkpoints. Murphy also suspected Moayedi didn't run all of her own races, even though she's often listed in the results, in order to boost her record numbers. A few years ago, he noticed that she was listed in the results of an I Ran marathon in San Antonio on June 1, when her social media account seemed to indicate she was 8,500 miles away in Nepal, having run a marathon there on May 29. He alerted Guinness, but officials there reviewed the evidence provided and wrote back saying they had "not found any grounds to disqualify her attempts."

Murphy was undeterred. He was set on proving his case and decided there was only one way to get her records invalidated: catch Moayedi in the act. He invited me to come along.

On February 16, 2019, I met Murphy at 6 am at a hotel in San Antonio. I'd been talking to him on the phone, but this was

our first in-person encounter. Murphy, who has close-cropped, receding gray hair and a bit of a paunch, was dressed for the occasion in black Nike running shorts and a gray Under Armour sweatshirt. We made our way to the race site and crouched behind a parked minivan, slinking around like a couple of middle-aged Hardy Boys, then fixed our eyes on a dozen runners who had gathered at a trailhead. They were standing near a green, white, and red banner that read I RAN MARATHONS START/FINISH.

"That's her in the black coat," Murphy whispered, pointing to a short woman with curly gray hair dressed in black track pants, puffy coat, and baseball cap. "She definitely doesn't look like she's dressed to run a marathon."

The run began at 7:30, but Moayedi didn't join the racers as they ambled off. Murphy walked over to the start line, where several copies of her self-published book, *Iran to America*, were displayed on a folding chair, on sale for \$20. He picked up a copy and began flipping through it.

Moayedi approached us and Murphy greeted her with a cheerful "You did all this!" as he held up her book describing her record-setting runs. "You're a legend! Can I get my picture with you?" This struck me as an awkward move, but I played along, snapping a photo of Murphy and Moayedi.

Two days after the San Antonio event, race results were posted on the organization's website. Though we'd seen no evidence that Moayedi left the starting area, she was listed as the 10th-place finisher, with a time of 7 hours, 29 minutes.

Murphy sent an email to Moayedi telling her what we witnessed and questioning her Guinness records. Moayedi didn't respond. I also reached out to her, many times, by email, voice message, and also certified letter. I wanted to hear her side of the story, but she never answered.

Murphy contacted Guinness again. The organization responded with a nearly identical email to the one Murphy received a few years before; there would be no disqualification. In late April, Murphy reached out to another Guinness employee, an adjudicator who, Murphy says, might be more serious about getting old records invalidated.

I wondered if he was obsessing too much over Moayedi. After all, she was doing good

**"It doesn't matter if it's a big race or a small race,"** Derek Murphy says. **"The point is to preserve the integrity of the sport."**

for health and well-being, and her race series allowed casual runners to try out long races without much pressure. "At what point do you just let it go?" I asked.

"I won't," he said. "Not until Guinness takes a legitimate look at Parvaneh. Those records are now untouchable."

# M

**Murphy was similarly** focused on Frank Meza. On May 28 he posted his first story about Meza on his website. It included his video and some of the comments Meza had emailed him. It also reported that Meza had been banned from the California International Marathon due to anomalous split times and because race officials were unable to find photos of Meza running certain sections of the course in two races.

Murphy had also further analyzed Meza's run in the 2019 LA Marathon. When Meza was photographed reentering the course, he began running behind a man using Strava, the social fitness network that uses GPS tracking to record an individual's performance. When he's tracking suspected cheaters, Murphy scans images to find runners nearby using Strava. He then finds their names by their bib numbers; if he can find those runners' public Strava accounts, he can chart another data point. Using the

Strava data from the man just in front of Meza, Murphy was able to calculate when Meza reentered the track. With Meza's data from the next timing mat, he determined a pace of 8 minutes, 23 seconds, nearly 2 minutes per mile slower than his average pace in the marathon's official race results.

I asked Murphy how it was possible, then, that Meza had recorded consistent splits during the race. Murphy has no way to know, but says that he saw in images that Meza wore two watches. He speculated that one watch tracked Meza's total elapsed time, and Meza would start the other once he went across a timing mat. He'd then get himself to the next timing mat—via bicycle or some other form of transportation—then wait until the second watch hit the 6:30 mark (the split time Meza consistently recorded throughout the race) before crossing the mat.

A day later, Murphy wrote about Meza again, this time accusing him of cheating at a marathon in Phoenix, a race that took place a little more than a month before the LA Marathon.

By the middle of June, other publications, including *People* and the *New York Post*, had picked up the Meza story. The *Los Angeles Times* wrote a long article that recapped some of Murphy's findings and detailed Meza's distinguished life as a doctor and coach.

Meza had grown up poor in Los Angeles, the son of Mexican immigrants. His father died when Meza was 4, and his mother, a seamstress, raised him. He spent lots of time at a local boys club playing various sports but didn't begin running until he joined the cross-country and track teams at Cathedral High School.

At Cal State Northridge in the early '70s, Meza mostly put the sport aside—still running some to stay in shape. Just before starting medical school at UC Davis in 1974, Meza met Faustina Nevarez at a medical conference in Texas. She was a premed student at UC Davis, and the two began dating. They were married in 1976 and had two children, a son, Francisco, who would also become a doctor, and a daughter, Lorena, who is a nurse.

When Meza started his residency in family medicine at Kaiser Foundation Hospital in LA in 1978, he started running seriously again. He began entering 5- and 10-kilometer races, and then the inaugural

LA Marathon. His coworkers began calling him the running doctor, and he would usually wear running shorts under his work clothes. "For lunch, instead of eating, he'd turn his beeper on and run up to the Hollywood sign," Faustina says.

In the mid-'80s, Meza began organizing races in parks around LA and later became an assistant coach for the cross-country team at Loyola High School. "He'd go run with the kids he coached at 6:30 in the morning," says his son, Francisco. "Then he'd go see patients, sometimes run with me at lunch, then run again with the kids after work." When he retired at age 65, he started competing at longer distances. In 2009 he ran the Santa Clarita Marathon in 3 hours, 20 minutes. By 2014, when he was 65, he was clocking sub-three-hour marathons. The same year, *Runner's World* named him a Masters Distance Runner of the Year.

When his daughter read Murphy's first Marathon Investigation story to him, Meza shook his head and tried to smile. "There's a lot of crazy stuff on the internet," he said. But commenters on the LetsRun message board were ruthless. "I bet his résumé is a fraud too," said one. "He's pathological," wrote another. Meza was clearly rattled. "All kinds of allegations were being thrown at me," he told the *LA Times*. "It was pretty traumatic."

In late June he received a phone call from Loyola's head running coach. The school had decided that, because of the allegations against him, he would no longer be able to serve in his position as assistant coach. (Loyola did not respond to a request for comment.) He'd held that job for about 25 years, training hundreds of boys, mostly working with the elite runners. "He was devastated," Faustina says. "It was more than running. He mentored those boys. It was his life."



**E**

**Endurance races have** proliferated in recent years. Globally, about 1 million people run marathons each year, up from about 500,000 in 2001. And with that explosion in participation seems to have come a rash of cheating. In September 2018, more than 5,000 runners were disqualified from the Mexico City Marathon for course cutting. Just two months later, 258 runners at a half marathon in Shenzhen, China, were disqualified after traffic cameras and photographers caught them cutting through bushes. This April, three runners were disqualified from Boston, one for recruiting a faster competitor to run as a proxy (known in racing as a mule) and two for forging their personal-best certificates to meet the Boston Marathon's qualification standard. Murphy argues that his work helps understaffed race officials catch the cheating that seems to have become endemic in the sport.

Murphy mostly blames social media for the compulsion to cheat. "Amateur athletes cheat for the likes," he says. But social media likes can just as quickly turn to hate. In 2018, Murphy accused Maude Gorman, a runner who'd finished second at an ultramarathon in Maine, of cutting the course. She was later disqualified from the race and confessed that she had, in fact, skipped parts of the course. "Shame is powerful," she wrote last summer in an Instagram post. "And after cheating in a few ultra-marathons ... I wasn't sure how to deal with the overwhelming sense of shame placed on me ... I was standing on a bridge, ready to commit suicide."

Later, I reached out to Gorman via Instagram private message, where she described the effect the aftermath of Murphy's revelation had on her. "I do believe [Murphy] created an atmosphere online where cyberbullying and harassment became a valid 'punishment' for those on his site," Gorman told me. "This is one of the reasons I struggled with wanting to commit suicide."

**"If what happened to Frank happened physically and not in the virtual world, they would all be in jail."**

**O**

**On June 28,** officials from the Conquer Endurance Group, the organizers of the Los Angeles Marathon, emailed a statement to the media that read, "Dr. Frank Meza violated a number of race rules during the 2019 Skechers Performance Los Angeles Marathon, including re-entering the course from a position other than where he left it." They disqualified him and invalidated his race results.

Murphy felt vindicated. But he wasn't satisfied. He spent a few days looking into some of Meza's earlier results, and on July 3 he wrote on his website that he had several photos of Meza from the 2017 LA Marathon that showed him off the course.

The next morning, July 4, Murphy posted another story, titled "'Frank on a Bike' Evidence Can't Be Dismissed." In the post, Murphy called out a man who headed a running club that Meza had helped found in the '70s and who had said to a television reporter, "Until I get a more deeper understanding, I support Frank." It seemed Murphy would not be satisfied until every last person—friend or foe—condemned Meza. "After multiple disqualifications, a strong statement by the LA Marathon, and a large amount of photographic evidence, Frank still has his defenders," he wrote.

In the story, Murphy included a picture that he insisted was Meza riding a bike during the 2014 San Francisco Marathon. "The bike rider is Frank. 100%. It is irrefutable," he wrote. "No one can question the evidence. There are no excuses to explain this."

At about 8:30 that same morning, Meza left his house in South Pasadena. For several days, he'd been cooped up inside, trying to avoid TV vans parked outside his home. "I'm gonna go for a short run," he told his wife. "And then we'll go get some lunch."

"That sounds good," said Faustina.

"I love you," Meza said.

Meza's neighbors were already pulling out their grills and setting up decorations

One of Murphy's sharpest critics is Scott Kummer, a lawyer in Chicago whom Murphy invited to be his cohost on his Marathon Investigation podcast. The show explores famous cheating cases, and often the pair butt heads. ("I wanted somebody to debate with on the show," Murphy says.) "There's a fine line between newsworthiness and creating an internet pile-on for an otherwise sad person," Kummer told me. "If it's an elite runner who's caught, that seems OK. But if it's just Joe Average, who are we really helping with that? Anybody who goes to great lengths to cheat in a marathon probably has some issues to begin with, and having 4 million people on Facebook talk about what a piece of garbage they are isn't good."

Murphy is unyielding. "It doesn't matter if it's a big race or small race," he told me. "If somebody is reaching the podium and they cheated, it's wrong. The point is to preserve the integrity of the sport."



for the holiday. Kids were riding bicycles up and down the street.

Driving his wife's car, he headed to Frogtown, the neighborhood where he had grown up. He parked, then started on a running trail that winds by the Arroyo Seco, where the dry riverbed meets the Los Angeles River. He made his way along the path above the river, then he stopped at a bridge near Dodger Stadium and leaped off. He was killed on impact.

**Frank Meza's family:**  
his daughter, Lorena;  
wife, Faustina; and  
son, Francisco. "He  
was a man of integrity,"  
Faustina says.

**A few months** after Meza's death, I went to meet his family in South Pasadena. Faustina greeted me at the door and welcomed me inside, to the living room, where she had put out chips and guacamole. Frank Meza collected art, and the home is decorated with several original paintings by Latino artists, including one that depicts a running race in a pastel city with Day of the Dead skeletons cheering on the competitors. On a large shelf in one room were dozens of Meza's trophies. Above a pile of medals was a framed photo of Meza running. In a corner of one room was a large photo of Meza, beneath it incense, several crosses, and a photo of a saint. Beside it a wreath of red roses.

Faustina, who was wearing blue jeans and a blue button-down shirt, has graying hair and brown eyes. She offered me a glass of water, and soon her son and daughter,

and Francisco's wife, Sara Tartof, joined us.

Over two hours, Meza's family told me dozens of stories. As a family doctor, Frank Meza would give people free care and make house calls. "He sutured lacerations right at our dining room table," Francisco said. "He'd make big pots of soup to bring to his patients," Lorena added. They described how Meza rarely missed his daily run and read every book on the sport. Faustina learned, after Meza died, that he'd been paying to support kids' running camps. "I didn't even know about that until they came up and thanked me at the funeral," Faustina said.

Nearly 1,000 people attended his funeral, including Antonio Villaraigosa, the former mayor of Los Angeles, as well as several of Meza's former high school classmates. "All these old men spontaneously stood up and sang the Cathedral fight song," Faustina said.

"All the stories were about how engaged he was in the community," Tartof said of the anecdotes told at the funeral. "Which is something that's really being lost. Now there are online communities."

"What happened to him online ... " Francisco interjected.

"If what happened to Frank happened

physically and not in the virtual world," Faustina added, wiping away tears, "they would all be in jail."

At some point on July 4, before Meza got out of the car, he'd recorded a video and left it on the front seat. On it, he apologized to his family for what he was about to do. He told them he loved them. "I can't go on with life with the whole world attacking me," he said. "It feels like it's never going to stop, and I can't be pushed down any further. I just can't continue like this."

The family blamed Derek Murphy for inciting the hate. They felt that if Murphy had just let it go, the story would have gone away and Meza would have been able to recover and go on with his life.

"He was obsessed," Tartof said. "What motivates him? He finds pleasure inflicting pain and shame on others."

Faustina grabbed her daughter's arm and her eyes welled. "He was a man of integrity," she said.

"Frank was one of the good guys," said Tartof, who was also crying. "He was one of the good guys in this world."

LetsRun, somebody had posted the news of Meza's suicide. "I thought, this is just a horrible joke," Murphy says. "At first, I didn't want to believe it."

He walked back outside into the humid evening. Wanting to be present with his daughter, he blocked the news from his mind and sat in the cool grass. They watched the sky light up yellow, red, and green. When he walked into his house a few hours later, he opened his computer on his desk and looked at his email. He'd received several media requests asking him to comment. "That's when I believed it," he says.

First, he went into crisis management. He emailed a friend, somebody who helps moderate his Facebook page, alerting them to what had happened. "If things blow up," he said, "make sure people are being respectful in the comments." Then he walked over to his couch, sank into the cushions, and sobbed.

The next day, Murphy wrote on his website: "I am deeply saddened to learn of Frank Meza's death. My heart goes out to his family and friends, and I wish for everyone to be respectful and to keep his loved ones in mind. There will be a time for comment and a broader discussion, but at this point, I feel that we should all allow those close to Frank the space to grieve. At this time, I will have no further comments to the media."

For several weeks, Murphy stayed quiet. But other people in the running community were speaking out. Several tweeted directly at Murphy, unleashing a slew of hateful comments. "Your pursuits are neither noble nor justifiable," wrote one user. "You are a worthless loser with nothing better to do." "Shame on you! His blood is on your hands," wrote another. "Great reporting on Frank Meza," wrote yet another. "Whose life are you destroying next?"

Other people offered suggestions for preventing something like Meza's death from happening in the future. "Let's put pressure on race directors to put on quality races and catch & ban cheaters," wrote another person on Twitter. "Why is some rando data analyst doing the job of race directors?" (For its part, the LA Marathon says it is taking steps to prevent cheating but has not publicly disclosed what they are.)

Murphy also had defenders, several of whom wrote him encouraging notes via email and social media. A few months after Meza's death, I ran into Bart Yasso, a famed

runner and running journalist. "People shouldn't gang up on people on the internet," he said. "But we don't want anybody cheating. Derek does amazing work, and I admire him. He has a place. Maybe more races should be reaching out to him."

For a few months after Meza's death, Murphy saw a therapist. "There were hours—days—when I broke down," he says. "I'm not comparing it to what his family went through, but it was traumatic." He considered shutting the site down, but after receiving support from fans, decided against it. "Intellectually I knew that I didn't do anything wrong," he says. "Other journalists told me I didn't do anything wrong." And Murphy still believed the work was important.

On August 2, he posted a story to Marathon Investigation that recapped his probe of Meza. In it he defended himself. "Meza's family says that he was harassed and bullied," he wrote. "They say that they knew that this was taking a toll on Frank ... I strive to be fair and complete in my reporting. I don't embellish or sensationalize. I didn't show up at Frank's door. Writing factual articles is not harassment or cyberbullying by even the most liberal of definitions." He also included this note: "Integrity Matters. It matters as much now as it did on July 3rd. The tragic story of Frank Meza does not change that. Marathon Investigation is not shutting down. I believe that my reporting on Frank Meza was appropriate."

Not long after, Murphy was publishing several stories a week. On the evening of October 23, he forwarded me an email with no comment, just a note from the PR department at Guinness. It read, "After further review from our Records Management Team, we can now confirm that Parvaneh no longer holds the titles for Most Marathon Run in One Year (Female) and Most consecutive days to run an official marathon (female)." (Guinness did not respond when asked to explain the reason for its decision.) I texted Murphy, asking if that meant the Moayedi case was closed.

"If she keeps promoting Guinness or makes any more claims about her marathon counts," he texted back a few minutes later, "I could write more." ■

**GORDY MEGROZ** (@gordymegroz) is a writer based in Jackson, Wyoming. This is his first feature for WIRED.

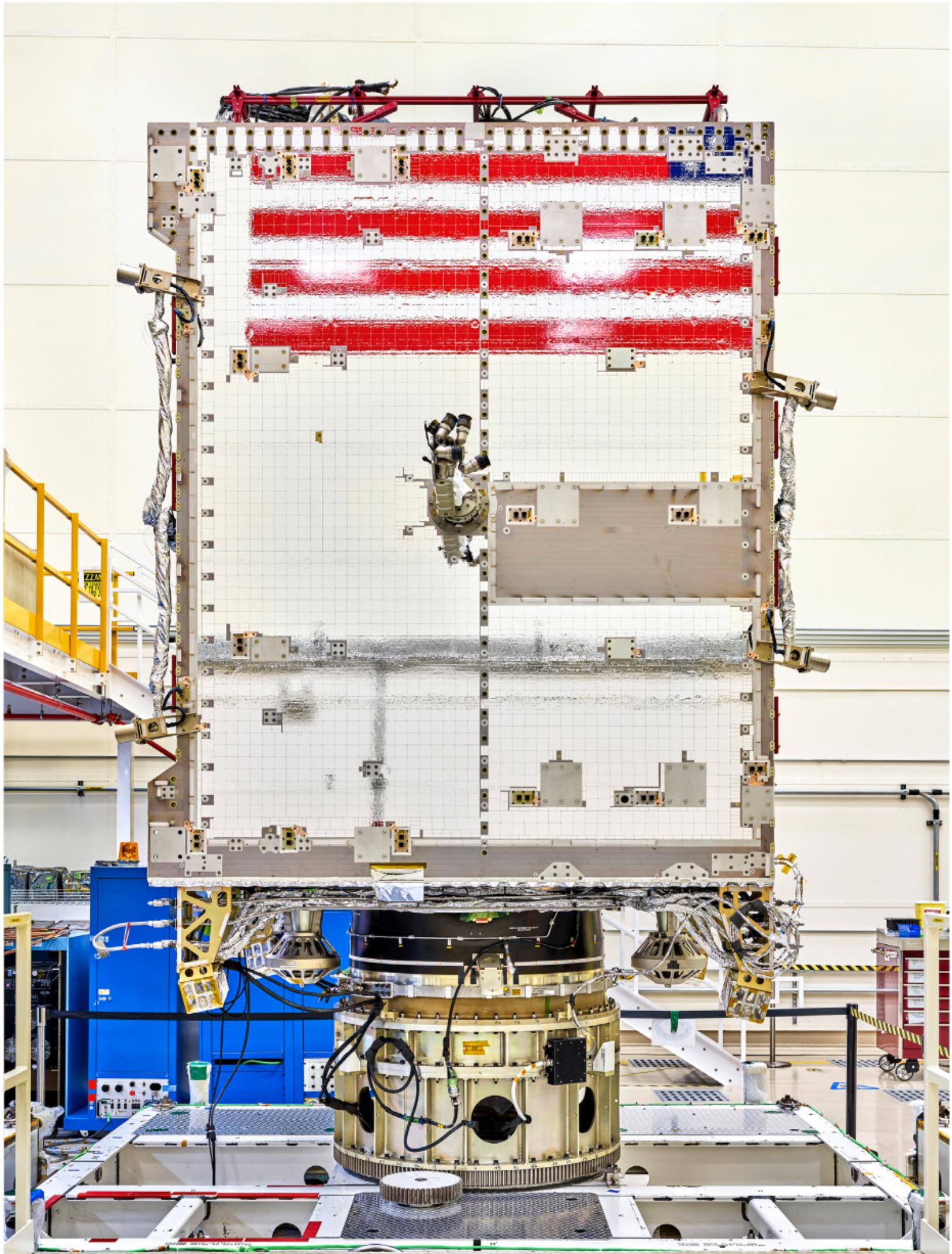
# O

**On the evening** of July 4, Murphy and his daughter went to King's Island Amusement Park in Mason, Ohio, to watch fireworks. Shortly before the first bottle rockets were launched, he stepped into the restroom and started scrolling on his phone. On

# THE SENTINELS

High above the earth, a new array of satellites will track nearly every bolt of lightning across the Western Hemisphere, powering an early-warning system for climate change-fueled superstorms. Photographer Christopher Payne documents their preparation for liftoff.

BY DANIEL OBERHAUS



The American flag is reflected in optical solar reflectors on the fourth and final satellite that will be launched as part of the National Oceanic and Atmospheric Administration's next-generation fleet of Earth-monitoring satellites. Four of these panels surround the satellite's body and help regulate its temperature by protecting it from the sun's heat. The gold ring is where the satellite will connect to the rocket that will launch it into space in 2024.



Lockheed Martin technicians work on thrusters, which will make microadjustments to keep the satellite's position steady.



# F

**or ages**, earthlings regarded lightning as an indicator of godly wrath. To understand what displeased a higher power, you followed the damage from Thor’s hammer strike, Raijin’s drumbeat, or the javelins hurled down by Zeus.

Today scientists have their own God’s-eye view of lightning, with instruments that orbit about 22,000 miles above the planet, monitoring nearly every single strike that flashes across the Western Hemisphere. Lightning, it turns out, is still an indicator: Increased electrical activity in the atmosphere is a bellwether for the onset of severe storms—a reflection of the damage inflicted not by any god but, at least in part, by human-made climate change.

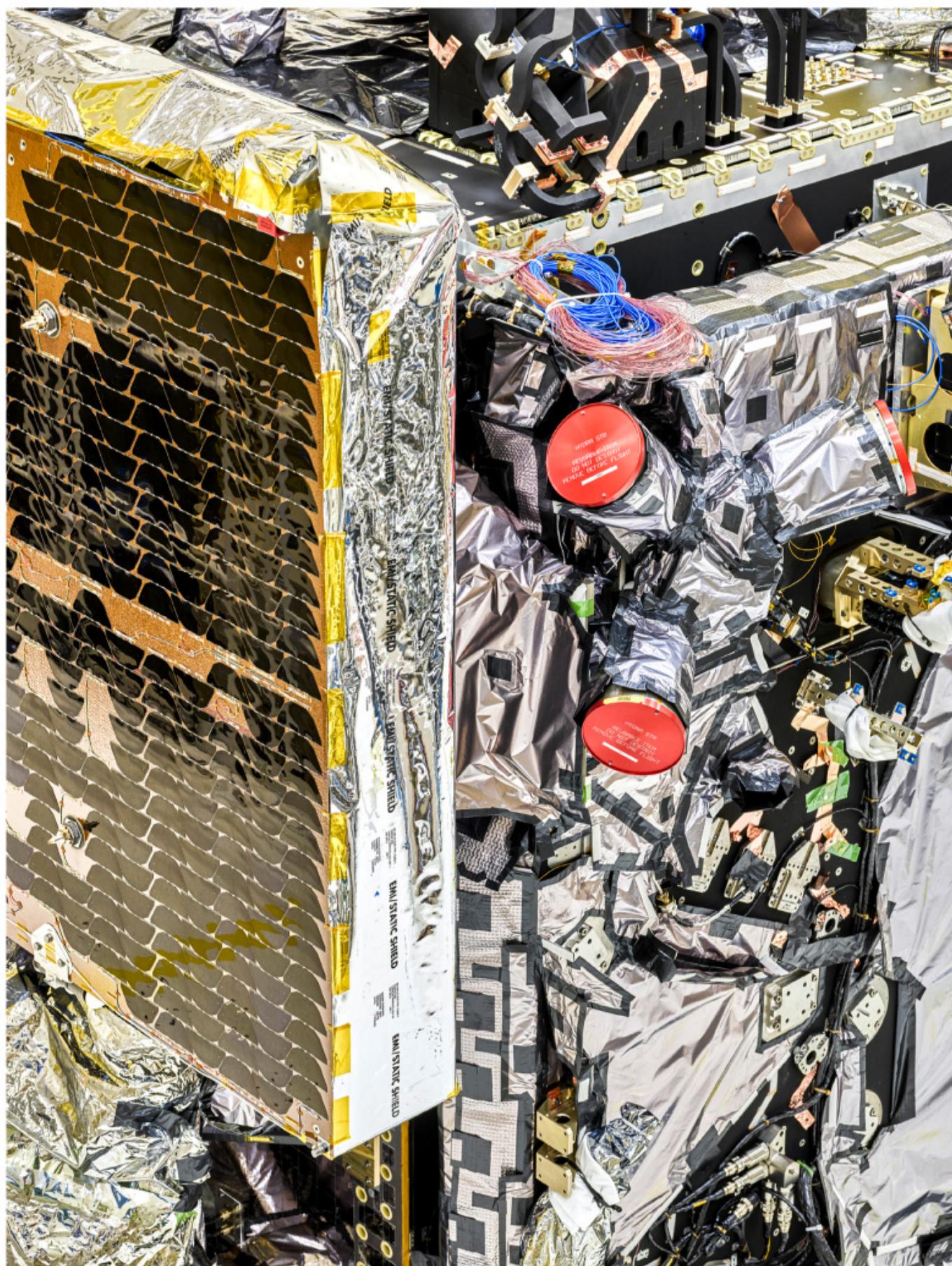
To be sure, the National Oceanic and Atmospheric Administration has used a network of weather satellites to track storms since the mid-1970s. But six years ago, engineers at Lockheed Martin began assembling a new generation of four 6,000-pound weather satellites—known as GOES, or Geostationary Operational Environmental Satellites—with an array of instruments that can track everything from plumes of volcanic ash to space weather. In orbit, each satellite looks like an old-fashioned movie camera pointed toward Earth, with a boom sticking out the back (a device for measuring changes in the planet’s magnetic field to study solar wind) and a massive solar panel where you’d expect to see a film reel. In the place where the lens would go is a device that picks up emissions from oxygen molecules that get excited by the energy of an electrical storm: a lightning detector.

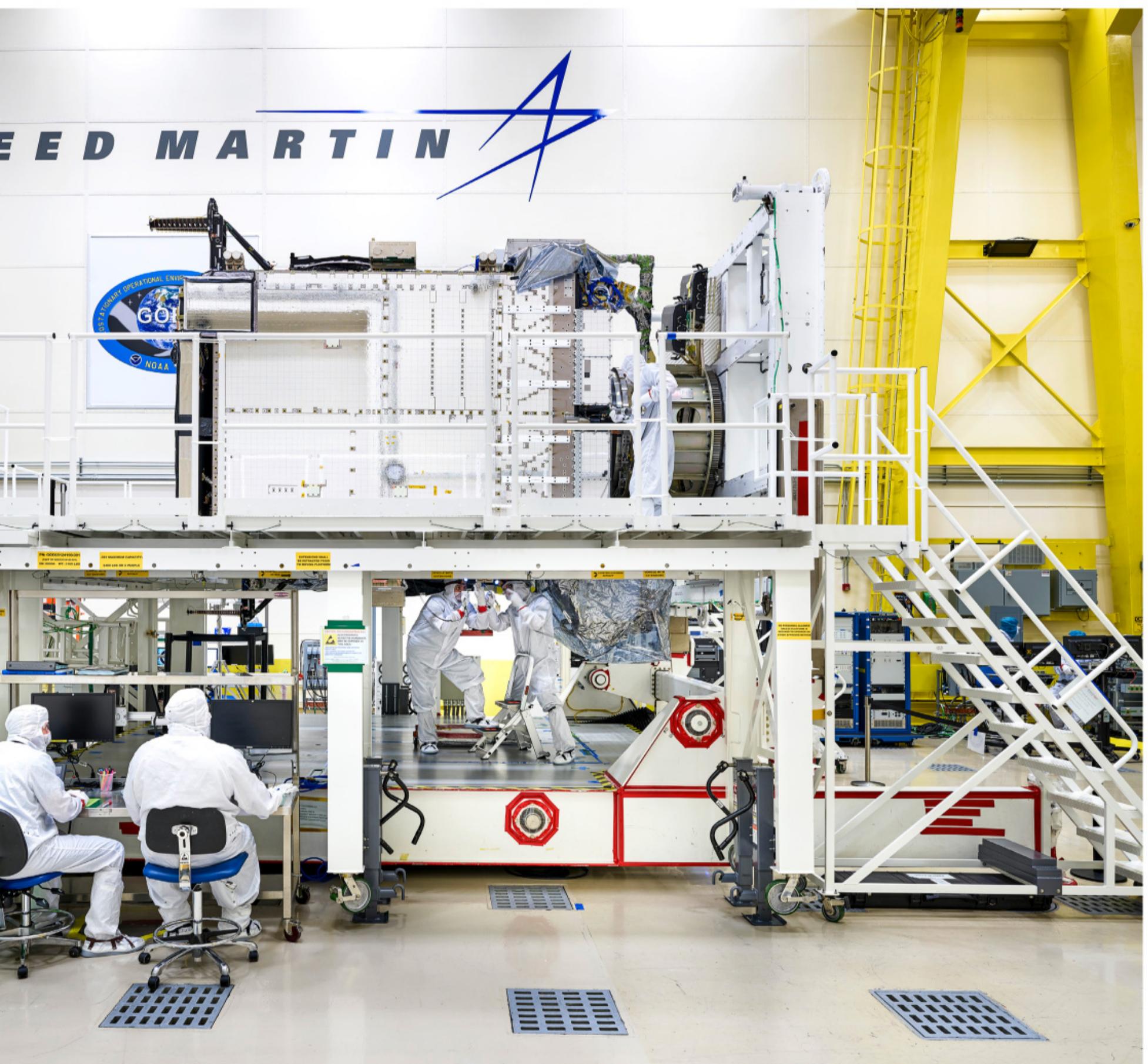
The first of these new satellites was launched in 2016. Within six months, it had collected more data than all 15 previous GOES satellites amassed over four decades. A second new satellite went up in 2018, and the two have already changed our understanding of lightning. Unlike weather stations down on terra firma, these satellites have no trouble watching electrical current zip between distant clouds. Bolts of lightning, it turns out, have a far longer reach than earthbound meteorologists ever realized. “That old phrase about a ‘bolt from the blue’ can really happen,” says Pam Sullivan, NOAA’s system program director for the new satellites. “Lightning from a storm can actually reach out and strike ground that’s hundreds of kilometers away.”

Two more satellites will be launched in 2021 and 2024. With all four in orbit, they’ll provide data that helps power NASA and NOAA’s forecasting models. All told, the \$10.8 billion fleet could dramatically improve our ability to understand severe weather—and stay safe on the ground during megastorms. In December, photographer Christopher Payne visited Lockheed Martin’s facility in the hills of Littleton, Colorado, to capture their assembly.

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**LEFT :** Red caps cover the three star trackers, which help the satellite determine its position in space. Not only do the satellites need to know where they're pointing, they also need to remain incredibly steady. They use six sophisticated flywheels to help stabilize against pressure from solar radiation. When the wheels accumulate too much momentum, the satellites turn to good old-fashioned propulsion. **ABOVE :** Dozens of companies from across the US built the satellite's roughly 500 components, but they're all assembled at Lockheed Martin's facility in Littleton, Colorado. Once built, the machine is run through a battery of tests—extreme heat and cold, intense vibrations, and a total vacuum—to make sure it can handle the unforgiving environment of space. If it passes, the satellite is loaded onto a massive C-5 military transport plane for delivery to Kennedy Space Center in Florida, to be launched into orbit 22,000 miles above the earth.

# The Last Best Place on the Internet

by Richard Cooke



People used to think Wikipedia represented all that was wrong with the web—a site where any idiot with a keyboard could say anything. Now it's a beacon of so much that's right.



Illustrations  
by Michael  
Haddad



**Remember  
when Wikipedia  
was a joke?**



words; edits materialize at a rate of 1.8 per second. But perhaps more remarkable than Wikipedia's success is how little its reputation has changed. It was criticized as it rose, and now makes its final ascent to ... muted criticism. To confess that you've just repeated a fact you learned on Wikipedia is still to admit something mildly shameful. It's as though all those questions that used to pepper think pieces in the mid-2000s—Will it work? Can it be trusted? Is it better than *Encyclopedia Britannica*?—are still rhetorical, when they have already been answered, time and again, in the affirmative.

Of course, muted criticism is far better than what the other giants at the top of the internet are getting these days. Pick any inflection point you like from the past several years—the Trump election, Brexit, any one of a number of data breaches, alt-right feeding frenzies, or standoffish statements to Congress—and you'll see the malign hand of platform monopolies. Not too long ago, technoutopianism was the ambient vibe of the elite ideas industry; now it has become the ethos that dare not speak its name. Hardly anyone can talk abstractly about *freedom* and *connection* and *collaboration*, the blithe watchwords of the mid-2000s, without making a mental list of the internet's more concrete negative externalities.

Yet in an era when Silicon Valley's promises look less gilded than before, Wikipedia shines by comparison. It is the only not-for-profit site in the top 10, and one of only a handful in the top 100. It does not plaster itself with advertising, intrude on privacy, or provide a breeding ground for neo-Nazi trolling. Like Instagram, Twitter, and Facebook, it broadcasts user-generated content. Unlike them, it makes its product de-personified, collaborative, and for the general good. More than an encyclopedia, Wikipedia has become a community, a library, a constitution, an experiment, a political manifesto—the closest thing there is to an online public square. It is one of the few remaining places that retains the faintly utopian glow of the early World Wide Web. A free encyclopedia encompassing the whole of human knowledge, written almost entirely by unpaid volunteers: Can you believe that was the one that worked?

Wikipedia is not perfect. The problems that it does have—and there are plenty of them—are discussed in great detail on Wikipedia itself, often in dedicated forums for self-critique with titles like “Why Wikipedia is not so great.” One contributor observes that “many of the articles are of poor quality.” Another worries that “consensus on Wikipedia may be a problematic form of knowledge production.” A third notes that “someone can just come and edit this very page and put in ‘pens are for cats only.’” Like the rest of the tech world, the site suffers from a gender imbalance; by recent estimates, 90 percent of its volunteer editors are men. Women and nonbinary contributors report frequent harassment from their fellow Wiki-

**IN ITS FIRST DECADE OF LIFE, THE WEBSITE** appeared in as many punch lines as headlines. *The Office*'s Michael Scott called it “the best thing ever,” because “anyone in the world can write anything they want about any subject—so you know you are getting the best possible information.” Praising Wikipedia, by restating its mission, meant self-identifying as an idiot.

That was in 2007. Today, Wikipedia is the eighth-most-visited site in the world. The English-language version recently surpassed 6 million articles and 3.5 billion

pedians—trolling, doxing, hacking, death threats. The site’s parent organization has repeatedly owned up to the situation and taken halting steps to redress it; several years ago, it allocated hundreds of thousands of dollars to a “community health initiative.” But in a way, the means to fix Wikipedia’s shortcomings, in terms of both culture and coverage, are already in place: Witness the rise of feminist edit-athons.

The site’s innovations have always been cultural rather than computational. It was created using existing technology. This remains the single most underestimated and misunderstood aspect of the project: its emotional architecture. Wikipedia is built on the personal interests and idiosyncrasies of its contributors; in fact, without getting gooey, you could even say it is built on love. Editors’ passions can drive the site deep into inconsequential territory—exhaustive detailing of dozens of different kinds of embroidery software, lists dedicated to bespectacled baseball players, a brief but moving biographical sketch of Khanzir, the only pig in Afghanistan. No knowledge is truly useless, but at its best, Wikipedia weds this ranging interest to the kind of pertinence where Larry David’s “Pretty, pretty good!” is given as an example of rhetorical epizeuxis. At these moments, it can feel like one of the few parts of the internet that is improving.

## One challenge

IN SEEING WIKIPEDIA CLEARLY IS THAT THE FAVORED POINT OF comparison for the site is still, in 2020, *Encyclopedia Britannica*. Not even the online *Britannica*, which is still kicking, but the print version, which ceased publication in 2012. If you encountered the words *Encyclopedia Britannica* recently, they were likely in a discussion about Wikipedia. But when did you last see a physical copy of these books? After months of reading about Wikipedia, which meant reading about *Britannica*, I finally saw the paper encyclopedia in person. It was on the sidewalk, being thrown away. The 24 burgundy-bound volumes had been stacked with care, looking regal before their garbage-truck funeral. If bought new in 1965, each of them would have cost \$10.50—the equivalent of \$85, adjusted for inflation. Today, they are so unsalable that thrift stores refuse them as donations.

Wikipedia and *Britannica* do, at least, share a certain lineage. The idea of building a complete compendium of human knowledge has existed for centuries, and there was always talk of finding some better substrate than paper: H. G. Wells thought microfilm

**Wikipedia  
is built on  
the personal  
interests and  
idiosyncra-  
sies of its  
contributors.  
You could  
even say it is  
built on love.**

might be the key to building what he called the “World Brain”; Thomas Edison bet on wafer-thin slices of nickel. But for most people who were alive in the earliest days of the internet, an encyclopedia was a book, plain and simple. Back then, it made sense to pit Wikipedia and *Britannica* against each other. It made sense to highlight *Britannica*’s strengths—its rigorous editing and fact-checking procedures; its roster of illustrious contributors, including three US presidents and a host of Nobel laureates, Academy Award winners, novelists, and inventors—and to question whether amateurs on the internet could create a product even half as good. Wikipedia was an unknown quantity; the name for what it did, crowdsourcing, didn’t even exist until 2005, when two WIRED editors coined the word.

That same year, the journal *Nature* released the first major head-to-head comparison study. It revealed that, for articles on science, at least, the two resources were nearly comparable: *Britannica* averaged three minor mistakes per entry, while Wikipedia averaged four. (*Britannica* claimed “almost everything about the journal’s

investigation ... was wrong and misleading,” but *Nature* stuck by its findings.) Nine years later, a working paper from Harvard Business School found that Wikipedia was more left-leaning than *Britannica*—mostly because the articles tended to be longer and so were likelier to contain partisan “code words.” But the bias came out in the wash. The more revisions a Wikipedia article had, the more neutral it became. On a “per-word basis,” the researchers wrote, the political bent “hardly differs.”

But some important differences don’t readily show up in quantitative, side-by-side comparisons. For instance, there’s the fact that people tend to read Wikipedia daily, whereas *Britannica* had the quality of fine china, as much a display object as a reference work. The edition I encountered by the roadside was in suspiciously good shape. Although the covers were a little wilted, the spines were uncracked and the pages immaculate—telltale signs of 50 years of infrequent use. And as I learned when I retrieved as many volumes as I could carry home, the contents are an antidote for anyone waxing nostalgic.

I found the articles in my ’65 *Britannica* mostly high quality and high minded, but the tone of breezy acumen could become imprecise. The section on Brazil’s education system, for instance, says it is “good or bad depending on which statistics one takes and how they are interpreted.” Almost all the articles are authored by white men, and some were already 30 years out of date when they were published. Noting this half-life in 1974, the critic Peter Prescott wrote that “encyclopedias are like loaves of bread: the sooner used, the better, for they are growing stale before they even reach the shelf.” The *Britannica* editors took half a century to get on board with cinema; in the 1965 edition, there is no entry on Luis Buñuel, one of the fathers of modern film. You can pretty much forget about television. Lord Byron, meanwhile, commands four whole pages. (This conservative tendency wasn’t limited to *Britannica*. Growing up, I remember reading the entry on dating in a hand-me-down *World Book* and being baffled by its emphasis on sharing milkshakes.)

The worthies who wrote these entries, moreover, didn’t come cheap. According to an article in *The Atlantic* from 1974, *Britannica* contributors earned 10 cents per word, on average—about 50 cents in today’s money. Sometimes they got a full encyclopedia set as a bonus. They apparently didn’t show much gratitude for this compensation; the editors complained of missed deadlines, petulant behavior, lazy mistakes, and outright bias. “People in the arts all fancy themselves good writers, and they gave us the most difficult time,” one editor told *The Atlantic*. At *Britannica* rates, the English-language version of Wikipedia would cost \$1.75 billion to produce.

There was another seldom remembered limitation to these gospel tomes: They were, in a way, shrinking. The total length of paper encyclopedias remained relatively finite, but the number of facts in

the universe kept growing, leading to attrition and abbreviation. It was a zero-sum game in which adding new articles meant deleting or curtailing incumbent information. Even the most noteworthy were not immune; between 1965 and 1989, Bach's *Britannica* entry shrank by two pages.

By the time the internet came into being, a limitless encyclopedia was not just a natural idea but an obvious one. Yet there was still a sense—even among the pioneers of the web—that, although the substrate was new, the top-down, expert-driven *Britannica* model should remain in place.

In 2000, 10 months before Jimmy Wales and Larry Sanger cofounded Wikipedia, the pair started a site called Nupedia, planning to source articles from noted scholars and put them through seven rounds of editorial oversight. But the site never got off the ground; after a year, there were fewer than two dozen entries. (Wales, who wrote one of them himself, told *The New Yorker* “it felt like homework.”) When Sanger got wind of a collaborative software tool called a wiki—from the Hawaiian *wikiwiki*, or “quickly”—he and Wales decided to set one up as a means of generating raw material for Nupedia. They assumed nothing good would come of it, but within a year Wikipedia had 20,000 articles. By the time Nupedia’s servers went down a year later, the original site had become a husk, and the seed it carried had grown beyond any expectation.

Sanger left Wikipedia in early 2003, telling the *Financial Times* he was fed up with the “trolls” and “anarchist types” who were “opposed to the idea that anyone should have any kind of authority that others do not.” Three years after that, he founded a rival called Citizendium, conceived as an expert-amateur partnership. The same year, another influential Wikipedia editor, Eugene Izhikevich, launched Scholarpedia, an invitation-only, peer-reviewed online encyclopedia with a focus on the sciences. Citizendium struggled to attract both funding and contributors and is now moribund; Scholarpedia, which started out with less lofty ambitions, has fewer than 2,000 articles. But more notable was *why* these sites languished. They came up against a simple and apparently insoluble problem, the same one that Nupedia encountered and Wikipedia surmounted: Most experts do not want to contribute to a free online encyclopedia.

This barrier to entry exists even in places where there are many experts and large volumes of material to draw from. Napoleon Bonaparte, for instance, is the subject of tens of thousands of books. There are probably more dedicated historians of the Corsican general than of almost any other historical figure, but so far these scholars, even the retired or especially enthusiastic ones, have been disinclined to share their bounty. Citizendium’s entry on Napoleon, around 5,000 words long and unedited for the past six years, is missing events as major as the decisive Battle of Borodino, which claimed 70,000 casualties, and the succession of Napoleon II. By contrast, Wikipedia’s article on Napoleon sits at around 18,000 words long and runs to more than 350 sources.

The Wikipedia replacement products revealed another problem with the top-down model: With so few contributors, coverage was spotty and gaps were hard to fill. Scholarpedia’s entry on neuroscience makes no mention of serotonin or the frontal lobes. At Citizendium, Sanger refused to recognize women’s studies as a top-level category, describing the discipline as too “politically correct.” (Today, he says “it wasn’t about women’s studies in particular” but about “too much overlap with existing groups.”) A wiki with

a more horizontal hierarchy, on the other hand, can self-correct. No matter how politically touchy or intellectually abstruse the topic, the crowd develops consensus. On the English-language Wikipedia, particularly controversial entries, like those on George W. Bush or Jesus Christ, have edit counts in the thousands.

Wikipedia, in other words, isn’t raised up wholesale, like a barn; it’s assembled grain by grain, like a termite mound. The smallness of the grains, and of the workers carrying them, makes the project’s scale seem impossible. But it is exactly this incrementalism that puts immensity within reach.

## The heroes

OF WIKIPEDIA ARE NOT GIANTS IN THEIR fields but so-called WikiGnomes—editors who sweep up typos, arrange articles in neatly categorized piles, and scrub away vandalism. This work is often thankless, but it does not seem to be joyless. It is a common starting point for Wikipedians, and many are content to stay there. According to a 2016 paper in the journal *Management Science*, the median edit length on Wikipedia is just 37 characters, an effort that might take a few seconds.

Wikipedia  
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mound.

From there, though, many volunteers are drawn deeper into the site's culture. They discuss their edits on Talk pages; they display their interests and abilities on User pages; some vie to reach the top of the edit-count leaderboard. An elect few become administrators; while around a quarter of a million people edit Wikipedia daily, only around 1,100 accounts have admin privileges. The site is deep and complex enough—by one count, its policy directives and suggestions run to more than 150,000 words—that its most committed adherents must become almost like lawyers, appealing to precedent and arguing their case. As with the law, there are different schools of interpretation; the two largest of these are deletionists and inclusionists. Deletionists favor quality over quantity, and notability over utility. Inclusionists are the opposite.

Most dedicated editors, whether deletionist or inclusionist, are that category of person who sits somewhere between expert and amateur: the enthusiast. Think of a railfan or a trainspotter. (Wikipedians disagree on which is the better term.) Their knowledge of trains is quite different from an engineer's or a railway historian's; you can't major in trainspotting or become credentialed as a railfan. But these people are a legitimate kind of expert nonetheless. Previously, their folk knowledge was deposited in online forums, radio shows, and specialist magazines. Wikipedia harnessed it for the first time. The entry on the famous locomotive the *Flying Scotsman* is 4,000 words long and includes eye-wateringly detailed information on its renumbering, series of owners, smoke deflectors, and restoration, from contributors who seem to have the most intimate, hard-won knowledge of the train's working. ("It was deemed that the A4 boiler had deteriorated into a worse state than the spare due to the higher operating pressures the locomotive had experienced following the up-rating of the locomotive to 250 psi.")

Pedantry this powerful is itself a kind of engine, and it is fueled by an enthusiasm that verges on love. Many early critiques of computer-assisted reference works feared a vital human quality would be stripped out in favor of bland fact-speak. That 1974 article in *The Atlantic* presaged this concern well: "Accuracy, of course, can better be won by a committee armed with computers

than by a single intelligence. But while accuracy binds the trust between reader and contributor, eccentricity and elegance and surprise are the singular qualities that make learning an inviting transaction. And they are not qualities we associate with committees.” Yet Wikipedia has eccentricity, elegance, and surprise in abundance, especially in those moments when enthusiasm becomes excess and detail is rendered so finely (and pointlessly) that it becomes beautiful.

In the article on the sexual revolution, there was a line, since deleted, that read, “For those who were not there to experience it, it may be difficult to imagine how risk-free sex was during the 1960s and 1970s.” This anonymous autobiography in miniature is an intriguing piece of editorializing, but it’s also a little legacy of the sexual revolution all by itself, a rueful reflection on a moment of freedom that didn’t last. (The editor who added “Citation needed” is part of that story as well.) In the article on the anticommunist intellectual Frank Knopfelmacher, we learn that “his protracted, usually freewheeling, invariably slanderous late-night telephone monologues (visited alike upon associates and, more often, antagonists) retained a mythic status for decades among Australian intellectuals.” The Hong Kong novelist Lillian Lee, we are told, seeks “freedom and happiness, not fame.”

Pedants have a reputation for humorlessness, but for Wikipedians a sense of humor is at the core of the good-faith collaboration that defines the project. There is probably no need for an exhaustive history of a giant straw goat erected in a Swedish town each Christmas, but the article on the Gävle Goat chronicles its annual fate fastidiously. It is prone to vandalism by fire, and the article centers around an exacting timeline that lists the date of destruction, the method of destruction, and the new security measures put in place every year since 1966. (In 2005, it was “burnt by unknown vandals reportedly dressed as Santa and the gingerbread man, by shooting a flaming arrow at the goat.”)

Why do Wikipedians perform these millions of hours of labor, some expended on a giant straw goat, without pay? Because they don’t experience them as labor. “It’s a misconception people work for free,” Wales told the site Hacker Noon in 2018. “They

have fun for free.” A 2011 survey of more than 5,000 Wikipedia contributors listed “It’s fun” as one of the primary reasons they edited the site.

This is why the meta side of Wikipedia—the Talk pages, the essay commentaries, the policies—is suffused with nerdy jokes. We’re so used to equating seriousness with importance that this jars at first: It’s hard to square the encapsulation of all human knowledge with a policy called “Don’t be a dick” (since revised to “Don’t be a jerk”). But expressing the directive that way carries a purpose. It’s the same purpose that drives Wikipedians to collect and celebrate the site’s “Lamest edit wars,” which include long-running skirmishes on Freddie Mercury’s ancestry, the provenance of Caesar salad, the proper pronunciation of J. K. Rowling’s surname (“Perhaps it rhymes with ‘Trolling?’”), the wording of certain captions (“Is the cat depicted *really* smiling?”), and the threshold of notoriety required to appear on a list of fictional badgers.

Few architects of a world encyclopedia would think to include a forum for jokes, and in the unlikely event that they did, no one could anticipate that it would be important. But on Wikipedia the jokes are very important. They defuse tensions. They foster joyful cooperation. They encourage humility. They promote further reading and further editing. They also represent a surprise return to the earliest days of Enlightenment reference works. Samuel Johnson’s dictionary, compiled in 1755, gives one definition of “dull” as “not exhilarating; not delightful: as, to make dictionaries is dull work.” Perhaps the most important encyclopedia of the late modern period, the *Encyclopédie*, is barbed with satirical and anticlerical quips: The entry on “Cannibals” cross-references with “Communion.”

## If it is a mistake

**TO KEEP COMPARING WIKIPEDIA TO BRITANNICA, IT IS ANOTHER KIND** of category error to judge Wikipedia against its peers in the internet’s top 10. Wikipedia ought to serve as a model for many forms of social endeavor online, but its lessons do not translate readily into the commercial sphere. It is a noncommercial enterprise, with no investors or shareholders to appease, no financial imperative to grow or die, and no standing to maintain in the arms race to amass data and attain AI supremacy at all costs. At Jimmy Wales’ wedding, one of the maids of honor toasted him as the sole internet mogul who wasn’t a billionaire.

The site has helped its fellow tech behemoths, though, especially with the march of AI. Wikipedia's liberal content licenses and vast information hoard have allowed developers to train neural networks much more quickly, cheaply, and widely than proprietary data sets ever could have. When you ask Apple's Siri or Amazon's Alexa a question, Wikipedia helps provide the answer. When you Google a famous person or place, Wikipedia often informs the "knowledge panel" that appears alongside your search results.

These tools were made possible by a project called Wikidata, the next ambitious step toward realizing the age-old dream of creating a "World Brain." It began with a Croatian computer scientist and Wikipedia editor named Denny Vrandečić. He was enthralled with the online encyclopedia's content but felt frustrated that users could not ask it questions that required drawing on knowledge from multiple entries across the site. Vrandečić wanted Wikipedia to be able to answer a query like "What are the 20 largest cities in the world that have a female mayor?" "The knowledge is obviously in Wikipedia, but it's hidden," Vrandečić told me. To get it out "would be huge work."

Drawing on an idea from the early internet called "the semantic web," Vrandečić set out to structure and enrich Wikipedia's data set so that it could, in effect, begin to synthesize its own knowledge. If there were some way to tag women and mayors and cities by population size, then a correctly coded query could return the 20 largest cities with a female mayor automatically. Vrandečić had edited Wikipedia in Croatian, English, and German, so he recognized the limitations of using plain English semantic tagging. Instead, he chose numerical codes. Any reference to the book *Treasure Island* might be tagged with the code Q185118, for example, or the color brown with Q47071.

Vrandečić assumed this coding and tagging would have to be carried out by bots. But of the 80 million items that have been added to Wikidata so far, around half have been entered by human volunteers, a level of crowdsourcing that has surprised even Wikidata's creators. Editing Wikidata and editing Wikipedia, it turns out, are different enough that they don't cannibalize the same contributors. Wikipedia attracts people interested in writing prose, and Wikidata compels dot-connectors, puzzle-solvers, and completionists. (Its product manager, Lydia Pintscher, still comes home from a movie and manually copies the cast list from IMDb into Wikidata with the appropriate tags.)

As platforms like Google and Alexa work to provide instant answers to random questions, Wikidata will be one of the key architectures that link the world's information together. The system still results in errors sometimes—that's why Siri briefly thought Bulgaria's national anthem was "Despacito"—but its prospective scale is already more ambitious than Wikipedia's. There are subprojects aiming to itemize every sitting politician on earth, every painting in every public collection worldwide, and every gene in the human genome into searchable, adaptable, and machine-readable form.

The jokes will still be there. Consider Wikidata's numerical tag for the author Douglas Adams, Q42. In Adams' book *The Hitchhiker's Guide to the Galaxy*, a group of hyperintelligent beings build a vast, powerful computer called Deep Thought, which they ask for the "Answer to the Ultimate Question of Life, the Universe, and Everything." What comes out is the number 42. That wink of self-awareness—at the folly and joy of building something as preposterous and powerful as a world brain—is why, with Wikipedia, you know you are getting the best possible information.




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**In the Midwest,  
Christian entrepreneurs  
are banding together  
to find relief from the  
corrosive grind of  
startup life—while some  
faith leaders preach the  
gospel of crushing it.**

by Kathryn Joyce  
photographs by Michelle Groskopf

## In 2012, Chad Reynolds *found himself*

on a South Carolina beach at midnight. He was there for a destination wedding, sitting on the sand with friends, when he decided to wade into the ocean alone. As he floated in the dark water, he had what he describes as his first real conversation with God. What was he doing with his life? he asked. Why wasn't he with someone? Why did he feel so empty?

Reynolds, a 36-year-old designer and startup founder from Cincinnati, Ohio, had been fending off burnout, in fits and starts, for years. He'd started a company designing websites for movies and other products right out of college, and managed to land big clients like Warner Bros. But he worked relentlessly, rarely taking vacations, ignoring his health, and neglecting his family and friends.

In 2008, as he was contemplating leaving his first company, Reynolds set aside a few months "to sit still." During his hiatus, he went with a friend to a Sunday service at Cincinnati's Crossroads Church—which was, at the time, a megachurch of about 9,000 members. Sitting in the back row of the cavernous auditorium, Reynolds felt something igniting inside him. "You could tell there was something extremely creative and entrepreneurial happening in that church," he remembers. It occurred to him that if he could somehow incorporate his budding faith into his next venture, "it could be different."

But after starting a second company, in 2009, he found himself slipping back into a familiar pattern: maintaining a frenetic pace, traveling to multiple cities per week, constantly doing more. By the time he ended up on the beach at night in South Carolina, he was feeling lost, unable to enjoy the quiet of the barrier island, fretting about Wi-Fi signals and missed work appointments, and wondering what was wrong with him.

As he bobbed in the dark Atlantic, Reynolds says, he heard a message in reply: that God had given him talents and gifts so they could be put to use helping other people, and that he needed to be more aggressive about doing so—that, in effect, he had to take a leap of faith. God's side of that midnight conversation was half encouragement, half dare: "Even though you can't see the bottom, I've got you; I'm going to protect you; I'm going to help you."

When he got back to work, Reynolds recommitted himself to his company. His second startup was called Batterii, a consumer research firm that recruits civilians to provide personalized feedback to brands via smartphone videos. Reynolds, who describes his midnight conversion as "getting an upgrade to [his] operating system," came to see the mission of his own company as a way of fulfilling the charge God had given him. If he'd been burned out before by trying to do too much on his own, his work now was to facili-

tate other people's creativity by building a technology that brings a whole community into the design process.

If that sort of talk sounds a little elevated for a product that is, as Reynolds also acknowledges, basically "a focus group on your phone," or if you're not used to metaphors that compare salvation to a software update, welcome to the worlds of both Christian and startup evangelism—worlds that, as recent trends in the American Midwest demonstrate, are increasingly intertwined.

## *Over the past decade or so,*

the amount of venture capital flowing into the Midwest has expanded from a trickle into a fairly substantial, multibillion-dollar tributary—enough for thousands of tech startups to sprout up in the old-line cities of the Rust Belt.

The story of this transformation, as told from the coasts, tends to be one of down-and-out heartland cities hustling to remake themselves in the image of Silicon Valley, often with the help of missionary venture capitalists like AOL cofounder Steve Case and *Hillbilly Elegy* author J. D. Vance, who unveiled a \$150 million investment fund called Rise of the Rest in 2017. And there's some truth to that account. But as the demographics of tech have become incrementally more Midwestern, those regional outposts have also set about remaking the industry in their own likeness—particularly where matters of faith are concerned.

The Bay Area, which devours about 45 percent of all US venture funding, is one of the least religious parts of the country. Although this March will mark the 26th annual Silicon Valley Prayer Breakfast (recently renamed Silicon Valley Connect), Big Tech is still considered, almost axiomatically, allergic to expressions of faith. At a recent conference in Nashville, one software developer said, "I'm afraid that when people hear I'm a Christian, they're going to start questioning my competency as a developer." A 2018 episode of the comedy series *Silicon Valley* spoofed the travails of an LGBTQ dating app founder who was terrified of being outed—as a believer.

For some Christians, accordingly, the industry's shift toward the heartland has been liberating. Jason Henrichs, the founder of several Midwestern finance

and tech organizations, has worked in tech on both coasts, including a stint in Boston. “When my wife and I moved back to the Midwest, it was so much easier to be a Christian than in all those other places,” he says. In Chicago, he goes on, “if you were to casually mention you’re going to church, there’s no set of assumptions that you’re a Trump supporter, a gun toter, out protesting on weekends.” (Though in fact, he corrected himself, he and his wife would be out protesting that weekend—against gun violence, at the March for Our Lives.)

The heartland’s tech boom has sparked the emergence of a loose faith-and-tech movement, one that

salient for believers and nonbelievers alike, is the way people there have begun to question the culture of tech entrepreneurship—and try to make it more humane. “Being an entrepreneur, you go through some very dark moments,” says Kristi Zuhlke, the 37-year-old cofounder of KnowledgeHound, a Chicago-based data visualization startup. “Raising funding is very lonely. You’re basically convincing everyone that your idea is amazing while they constantly shoot you down.” It’s the sort of thing that can make people question their faith, she continued, “or, if you don’t have a faith, you start to clamor for hope that there’s light at the end of the tunnel.”

Cincinnati, which has become one of the Midwest’s leading tech cities, has also become a hub for people trying to find some



has grown in pockets around the world but is based indisputably in the American Midwest. The region has hosted an explosion of conferences and meetups, yoking together a host of different goals: evangelical techies devising projects intended to spread the faith (Bible “chat bots” and savvy Google ad campaigns to connect desperate searchers with local pastors); Christians driven by the social gospel discussing how to create technological solutions to problems like suicide and sex trafficking; religious thinkers pondering the ethical implications of rapid technological change.

But perhaps the most interesting part of the Midwestern convergence of faith and technology, the most

relief from the loneliness at the heart of an industry that prizes unending drive and competition. That they had a place to connect was thanks in part to Chad Reynolds. Not long after returning from South Carolina, Reynolds banded together with a group of entrepreneur friends—including Tim Brunk, cofounder of a personal style app called Cladwell, and Tim Metzner, cofounder of a software startup called Differential—to start an organization that would eventually be called Ocean, named after Reynolds’ dark night of the soul. They were, in large part, responding to a hunger among their fellow entrepreneurs to redefine what it means to be successful in tech. But in an area of the country that increasingly sees tech as its salvation, that can be easier said than done.

*Tim Metzner,  
Chad Reynolds,  
and Tim Brunk,  
the cofounders  
of Ocean.*

## Crossroads, *the congregation that helped usher Reynolds*

toward his conversation with God, has in recent years become a major emblem of the fusion in sensibilities between tech and evangelical Christianity. Today it is a 52,000-member megachurch, with 13 campuses, a presence in six prisons, a streaming app called Crossroads Anywhere, and ambitions to expand nationally. Its lead pastor, Brian Tome, likes to say that Crossroads is “more like a startup than a church.” In 2017 it was named the fastest-growing congregation in the country, and also the nation’s fourth largest.

The story of Crossroads’ rise runs pretty neatly in tandem with that of Cincinnati, which 20 years ago was an urban cautionary tale. Although the city is home to the headquarters of eight Fortune 500 companies, including Procter & Gamble, Macy’s, and Kroger, by the 1990s it had also become synonymous with stereotypes of urban blight. Decades of white flight left central city neighborhoods like

Over-the-Rhine—named for the long-departed Germans who first settled there—roughly 75 percent black and overwhelmingly poor. Businesses were boarded up, and crime reached the point that one author compared Over-the-Rhine to *The Wire*’s fictional Hamsterdam, a designated area where police agreed not to interfere with nonviolent lawbreakers. A late-’90s attempt at gentrification and renewal that rebranded the neighborhood as the Digital Rhine fizzled with the dotcom bust, and after a 2001 police shooting of an unarmed black teenager sparked days of civil unrest, one conservative magazine declared the neighborhood “ground zero in inner-city decline.” Landlords abandoned the downtown’s Italianate housing stock, fleeing one of the largest historic districts in the country.

Crossroads was founded in the mid-’90s by a group of Cincinnati executives, including several from Procter & Gamble. They conducted surveys and market research and decided to build a church that would appeal to non-churchgoers, young business professionals, and men, who would then bring their families along. They hired Tome—a tan, boisterous minister who rides motorcycles and would go on to tape a regular video message called “Brian Brings a Beer”—as their lead pastor. The church hosted events like adventure “man camps” and an annual “Super Bowl

*In 2017,  
Crossroads  
was named  
the fastest-  
growing  
church in  
America.*



of Preaching." (A tenet of the church's manifesto holds that "beer = authenticity" and that the church should "do anything short of sin" to bring people to God.)

Then, in the mid-2000s, came what the city's current mayor describes as "the Cincinnati Miracle." A nonprofit development corporation created by some of the city's anchor businesses, including Procter & Gamble, invested more than half a billion dollars in Over-the-Rhine, buying hundreds of properties and presiding over an intensely micromanaged revitalization plan. Tech companies began to trickle in, buttressed by the Fortune 500 old guard, and they in turn gave birth to startup accelerators, seed-investment firms, and venture capital funds. By the mid-teens, when Cincinnati was declared one of the fastest-growing startup economies in the country, the media was more likely to compare it to Greenwich Village than down-and-out Baltimore.

With the transformation came a predictable list of collateral consequences: the displacement of roughly 65 percent of the neighborhood's black population, the loss of 73 percent of its affordable housing, and some of the highest income inequality in the nation. Some neighborhood advocates spoke about the development corporation as if it were an occupying colonial force. But to the outside world it became a shining example of a general Midwest flourishing of the tech-and-startup industry, or at least the promise of it.

Around 2013, says Tome, a young entrepreneur who was planning his child's baptism at Crossroads came up to him and asked if he realized what was happening right under his nose. "I don't know if you know," the visitor said, "but there's startup CEOs all over this place." For many months, the atrium of Tome's industrial-chic church had been used as an informal workspace by a couple dozen young congregants, including Reynolds, Brunk, and Metzner—most of them twenty- or thirtysomething tech or startup workers drawn to the church's free Wi-Fi, free coffee and soda bar, and seven-day-a-week access.

Tome invited a group of the young founders working in his church lobby to a group entrepreneurs' breakfast. "I just started getting a real education on angel funding, seed funding, series A, series B, series C, scalability, pivoting, and on and on and on," he says.

At the time, recalls Brunk, there was little in the way of a support system for the young tech entrepreneurs who were starting to proliferate in Cincinnati. Tome encouraged the folks at the breakfast gathering to continue meeting on a weekly basis and become one of Crossroads' numerous interest-oriented small groups.

Right away, Brunk says, the meetings took on an intimate tone. "All of us were a few years into our ventures," he says—long enough to have seen "vision and optimism turn to disappointment and betrayal." Brunk himself was haunted by the fictional depiction of Mark Zuckerberg at the end of *The Social Network*—a lonely

tycoon who'd ruthlessly alienated everyone—and other stereotypes about the worst excesses of tech. "You really hit that trough of sorrow and ask yourself, why keep doing this? Asking existential questions: What's a satisfying life?"

The things people shared in those early meetings were a refreshing break from the usual ways entrepreneurs talked about their ventures. They were "very vulnerable stories of failure," Reynolds says. Tales of people struggling to find funding, or scaling their company, or breaking up with their cofounders; anxieties about making payroll and taking out family loans.

"Everyone's guard was down; nobody was pitching," agrees Brunk. The group seemed to converge on the same general question: "How do you get to this healthy, sustainable place" in an industry where many people eventually burn out? And they all seemed hungry for a definition of success that went beyond raising large rounds of capital and netting more users for their products.

In time, the organizers decided to expand. They launched a public "story-sharing" event series where, every six to eight weeks, local entrepreneurs could come in and talk openly about their struggles and aspirations. They called the series Unpolished, for the real talk they wanted to encourage, "warts and all, no pitching," Brunk says. The three organizers assumed a few dozen people would come, but at their first event close to 400 showed up; they ran out of both chairs and beer.

They realized they had tapped into something, so they kept going. They called upon business owners from outside the tech realm, like Chris Sutton, cofounder of Noble Denim, a jeans business that used US-made, organic materials. Sutton was a former missionary kid who'd come to believe he could live out his faith just as well by integrating his values into his business. In a video promo for his company that screened at an Unpolished event, Sutton speaks to the kind of consciousness Unpolished hoped to raise: "If we die with empty pockets but a full life, I think we'll have succeeded, or come damn close."

## *Unpolished started holding what it called office hours*

at Crossroads, advising would-be entrepreneurs on "starting lean" and then expanding those lessons into workshops. A team at Metzner's company developed an online message board called Supporter where members of the Unpolished community could recruit for jobs or services. And Unpolished's founders watched as people came together to form businesses.

By mid-2014, Brunk, Reynolds, and Metzner decided to transform the community into something more formal: a nonprofit business accelerator that could help launch companies and build into their DNA a healthier sense of balance. The sort of accelerator they say they wished they'd found when they were setting out. Officially, the organization's goal was to cement Cincinnati's status as a startup-friendly city and "to increase God's presence in the marketplace" by cultivating founders "who will be good stewards of their success." The group decided to call their accelerator Ocean.

Housed in a former car dealership building owned by Crossroads, Ocean received its first operations budget through a sizable grant from the church—the bounty of Crossroads' annual Beans and Rice Week, when members eat frugally and pool their savings into several major church donations. The support enabled Ocean to start working with its first class of 10 startups. By 2015 Brunk and Metzner had recruited a friend of theirs to launch a for-profit venture called Ocean Capital, which would pool money for seed investments in each startup going forward. If the companies do well, Ocean Capital and its investors receive a return in the form of either cash or discounted stock.

Under the Ocean Accelerator program—which is open to entrepreneurs of any or no faith—founders are given seed investments of \$50,000 each, along with access to a network of business mentors affiliated with Crossroads or the broader Cincinnati community, plus personal and spiritual mentoring. The curriculum builds up to a public Demo Day, where participants present their products to an audience of potential investors from the stage of one of Crossroads' churches.

Unlike more typical sources of early startup capital, Ocean seeks to instill the notion of "Christ leadership" in its participants, and its dual business and spiritual mentorship program straddles a somewhat sinuous line between product planning, life coaching, and evangelism. Scott Weiss, a retired Fortune 500 veteran who was tapped to become Ocean's founding CEO, is eager to ward off the impression that Ocean's counseling is just for believers, or that it preaches an old-fashioned prosperity gospel. "We in no way teach that because you came here, God ordains your business for success," he says. What's more important, he says, is that "we don't want you to be one of those high tech founders who have gotten a divorce, suffered depression, or tried to commit suicide."

Ocean's is not the first spiritual mentorship program that's sprung up in Midwest tech. In Indianapolis in 2009, senior staff at the marketing software firm ExactTarget—which was later acquired by Salesforce for \$2.5 billion, in one of the Midwest's most fabled success stories—helped spawn Edge Mentoring, which pairs young entrepreneurs with more experienced mentors who guide them in business and spirituality. What that can look like in practice, one Indianapolis tech worker told me, is going to pitch meetings looking for investment and being offered spiritual mentorship instead. And indeed, Weiss' discussion of the broader potential impact of Ocean's work carries a certain missionary edge. "A new business, on average, will hire three people in its first 12 months, 10 people by the end of year two," he says. "That's 13 souls. Thirteen souls a business owner can influence."

But the program is also intent on changing the culture of the tech industry in ways that are not exclusively Christian. Ocean says it selects business mentors who can not only help draw up a marketing plan but also model decent work-life balance. And according to Brunk, the accelerator's idea of "stewardship"—an evangelical watchword for responsible management—includes notions about being a good boss, giving employees decent benefits, and reinvesting profits locally. In part, Brunk says, that's just holding up Midwestern norms of community-mindedness against the perceived ruthlessness of tech's origins. While Silicon Valley's leaders have sometimes reinforced a culture of fear and greed, Brunk says, "there's more consideration for things other than power and success here."

## *While Ocean was trying to convert*

startup values into something more recognizably Christian—and, perhaps, human—Crossroads was going through a conversion experience of its own. The church was leaning hard into the idea that entrepreneurs were the key to remaking Cincinnati, as Tome would explain to *Christianity Today*. While Crossroads had long been active in ministering to Cincinnati's poor—including its support for a controversial social services center that sparked substantial NIMBYish protest in the mid-2000s—Tome had come to believe that "downstream problems in the kingdom of God" occurred because of things that happened "upstream." As *Christianity Today* summarized it, "Tome wanted to shift tactics to also encourage the people making money" while still keeping up support for the working-class poor. Ocean and Unpolished, as the church leadership saw them, were a big part of that shift.

In a sleek promotional video for Unpolished, produced in 2014 by the church's creative team, a child's voice narrates a vision of Cincinnati's rebirth. "A long time ago, pioneers went west into the wilderness. They saw a river and imagined a great city," the child says, as the video cycles through a montage of shots of Cincinnati at dawn. "Somewhere along the way, people settled, and dreams vanished. Things got broken. We forgot who we were," the narration continues, as the



Brian Tome,  
the lead  
pastor of  
Crossroads

images shift to buildings with boarded-up windows, empty strip malls, and plastic bags snagged in barbed-wire fences. “Maybe God lets things break just so he can make everything new,” the child says. “Maybe he’s calling for new pioneers, brave enough to start rebuilding.” The promo resolves onto a background shot of blond wood, superimposed with the logo for Unpolished.

It’s an affecting spot. It also spoke to a certain dissonance that arose as Crossroads put its stamp on the young faith-and-tech community: When filtered through the church’s production machine—which, as a 2017 *Bloomberg Businessweek* profile of Ocean noted, includes a 75-person “experience team” that serves as “the equivalent of an in-house advertising agency”—Unpolished became something significantly glossier. What had started out as a trust exercise in enabling raw honesty about the travails of startup life seemed to have morphed into a platform for glorifying entrepreneurs as the new heroes of the church. And in this context, the message at the movement’s core, that money doesn’t equal success, sometimes seemed to waver.

Tome, who was on his way to leading one of the nation’s largest churches, had acquired a wide range of influential contacts, and he began calling in big names to support his latest venture. In early 2014, Unpolished hosted reality TV maven Mark Burnett, executive producer of *Survivor*, *The Voice*, and, of course, *The Apprentice*, to discuss how America was built on the Bible and free enterprise. (In his talk, Burnett regaled a crowd of 2,500 with the story of how he’d convinced Donald Trump to join *The Apprentice* after a campaign of carefully applied public flattery.)

By mid-2015, Crossroads’ support had helped transform Unpolished’s lecture series into a full-blown multiday conference with high-profile speakers. In

his introductory remarks, Tome, wearing an untucked flannel shirt and cargo pants, set the tone, declaring that while entrepreneurs were not God, they were like Him. “You have creative capacities that no one else has except for God,” he told the audience. “Improving current processes never changes the world; doing something more methodically never changes the world; growing something incrementally never brings life. It only slows down death.”

“You’re here today because God wants to grow your business!” Tome continued. He recounted the Parable of the Talents, a story Jesus tells in the Gospel of Matthew, Chapter 25. It describes a master who gives his servants various quantities of money to watch over and, upon returning, rewards the two servants who invested and increased that gold but punishes the third, who hid his in the ground for safe keeping. Tome called it “the most ancient reference we have to investment banking.” The moral: “Jesus says if something of a spiritual nature is not growing, there’s something wrong with it.”

More than a dozen speakers took the main stage over the course of the conference, and their messages weren’t uniform. One, a former Procter & Gamble executive who’d become a bigwig at Google, recalled how much he’d once been like Gordon Gekko, the “greed is good” antihero of 1987’s *Wall Street*, until the sudden illness of his daughter snapped his priorities straight. Sutton, the cofounder of Noble Denim, described a new venture he’d begun: a clothing line housed in the shell of a failing Tennessee garment factory that had been forced to lay off most of its workers. After fundraising on Kickstarter, Sutton’s team had helped the factory owner rehire those workers, at living wages, to manufacture sweatshirts and other high-end basics—proof, he said, that believers could build the Kingdom not just on the mission field but in whatever field they chose.

A number of speakers, though, reinforced Tome’s capitalist apologetics, declaring that God had created entrepreneurs “for creation and conquest”; that the Apostle Paul was an entrepreneur; that when Jesus wanted to spread the gospel, he eschewed “the religious elite and the academicians” for brass-tacks businessmen. John Gray, an associate pastor at Joel Osteen’s 40,000-member

Lakewood Church—long associated with prosperity gospel teachings—declared that the US was “not simply a capitalistic society” but also a “theocratic” one. And Wendy Lea, then the CEO of Cintrifuse, a nonprofit network trying to make Cincinnati the startup capital of the Midwest, admonished aspiring entrepreneurs that victims were not welcome in her world. “I don’t want to talk to you if you feel sad, you’re not sure, someone took that away from you. I’m not into that,” she said. “What I’m into is an abundance of resources.”

Perhaps most jarringly, Calev Myers, an Israeli lawyer, delivered a long presentation on a new sort of Christian maxim: “Gold Is Good.” Amid a smattering of line-treading Jewish jokes (“This is something Jews have known for centuries,” he riffed) and a revisionist reading of Matthew 19:24—the verse that says it’s easier for a camel to pass through the eye of a needle than for a rich man to get to heaven—Myers told the audience that gold was good because it represented “the value you’ve brought to humanity.” Gold was a record of services rendered to other people, he continued, asking audience members to hold aloft money from their own wallets and then give themselves a hand. “This is a certificate of appreciation for your service!” he said. Following this logic, he continued, Bill Gates was arguably a better servant than Mother Teresa—a fact deducible from their bank accounts. “The reason Bill made billions,” Myers concluded, “was because he helped billions.”

## The conference seemed to embody a tension

in the movement, a choice between two dueling trajectories the faith-and-tech world could take: a frenetic, always-be-crushing-it emulation of Silicon Valley, armored with biblical justification; or the humbler embrace of more modest goals and the necessary trade-offs between business and life success.

“Both of those messages are important,” Tome says. “Everybody in that audience is going to be in a different season, and we need to speak to all of those seasons in somebody’s life, or in somebody’s business.”

Looking back on the evolution of Unpolished and Ocean in a recent phone call, Brunk says, “There have definitely been speakers in the past where we looked at each other and thought, ‘Whoa,

this isn’t what we want to promote.’” Messages about revering profits and disowning vulnerability didn’t just feel wrong, they felt stale. “There’s a million forums where you can talk about the hustle,” he continues. “We wanted our emphasis to be on the softer side.” But as Unpolished grew, he says, “it was harder to control that message.”

“I know that what we were standing for is that money doesn’t define success,” Reynolds says. During the conference, he allows, there was a divide between the main stage keynotes—with “the big names that get people in the seats”—and the side stages where local entrepreneurs were continuing to share moments of struggle.

But there’s reason to believe that, as the movement spread beyond Cincinnati, the message on those side stages had a more enduring resonance. Kristi Zuhlke, the cofounder of Chicago’s KnowledgeHound, went to Unpolished’s 2015 conference and appreciated how the speakers addressed both practical questions of getting funding and also “how to have a heart” as an entrepreneur. She returned to Chicago and, together with Jason Henrichs, started a small group for entrepreneurs at a downtown Chicago WeWork. Occasionally, they also met at their church, Soul City—a progressive, diverse community where the husband-and-wife pastor team reference Tinder in sermons and staff wear “Black Girl Magic” T-shirts. As happened in that first small group at Crossroads, the group quickly gravitated toward discussing immediate, intimate concerns: What is the Christian way to fire someone? How should you grapple with investors who want you to scale up too quickly, even if that means misleading your customers? Should Christian entrepreneurs build businesses with an evangelizing or social justice mission, or is it enough to live out your faith by being an honorable boss?

“That’s helpful because, as an entrepreneur, you struggle with what success looks like,” Zuhlke says. “You have to remember that success might not be the big exit. It might just be impacting people’s lives because they have a job they love and you’re paying them money and they get to feed their family with that money.”

Zuhlke also reached out to Victor Gutwein, the founder of an early-stage micro-venture-capital fund called M25 that targets Midwestern companies, who had invested in her startup. Only after getting funding from Gutwein did she realize that he was Christian too. (M25 is a reference to Matthew 25 and the Parable of the Talents.) Now she was getting in touch with Gutwein to suggest that there might be enough folks like them in Chicago to support a speaking series like Cincinnati’s Unpolished—because she felt that there was “a groundswell of people talking about what a crazy faith journey it is to be an entrepreneur.”

They held their first event, called InnoFaith, in 2017. They didn’t publicize the event widely, but, like that first public gathering of Unpolished, they maxed out the room. (Since their first event, the group has come

under the umbrella of a Canadian group, FaithTech, and adopted the name FaithTech Chicago, which now meets monthly.)

To Gutwein, all of these developments reflect how the “democratization of tech,” as the industry spills past its enclaves on the coasts, may change some of the industry’s character as well. Slower and less cutthroat than New York or San Francisco; perhaps more collaborative too. In Chicago, Zuhlke says, those differences have been draws for some coastal expats who have moved to the region: Sure, there are fewer corporate perks like foosball tables and beer taps, but there’s better work-life balance and fewer struggles to find housing on a six-figure income. To Brunk, the culture of the Midwest—and the fact that the region is relatively underfunded—both lead to a different sort of workforce. “People here are loyal,” he says. “Most of my team has at one point or another taken a pay cut.”

This winter, Ocean welcomed its sixth class of startup entrepreneurs and has begun working on a curriculum it can put online. But Unpolished is no more. The founders decided to subsume all of their efforts under the banner of Ocean on the occasion of the accelerator’s fourth Demo Day, on April 24, 2018.

That afternoon several hundred tech startup employees, venture capital investors, and Crossroads parishioners gathered in the dark, cavernous auditorium of Crossroads Florence, one of the church’s several campuses in Kentucky. On three jumbo screens flanking the main stage, a roiling seascape moved in stormy waves under the logo for Ocean. Waiting in the wings were eight nervous entrepreneurs, about to take the stage for individual 10-minute pitch sessions, where they shared the products they’d been developing for the past five months. After the presentations there would be local craft beer and artisanal ice cream served in the church atrium—as airy and bustling as a midsize corporate headquarters—as well as a side room where the Ocean entrepreneurs could meet privately with investors. But first came the primary pitch, for Ocean itself.

Even with the Unpolished brand now defunct, plenty of the original spirit seemed to survive. Metzner, the group’s chair at the time, took the stage and told the audience how, when he quit a job to start his own business, he realized he was unwilling to follow the common tech entrepreneur narrative of putting his life on hold for five to 10 years, ruining his marriage and friendships, and having kids who didn’t like him, for the sake of business success. The event’s featured motivational speaker, the entrepreneurial podcast guru Dane Sanders, continued on the same theme, saying that while the investors in the room were bound to be on the lookout for gaps in people’s business plans, those entrepreneurs should also be on the lookout for the gaps in their personal lives—the places “where people blow their life up.”

There were other messages too, more in line with stereotypes about both tech optimism and franchise churches: that they served a creative God, that entrepreneurship was a leap of faith, that through small-scale mentorship and support groups God would unveil his plan for their businesses. But the more enduring message, and the one the organizers and founders of the event repeated, was that, in an industry that seems by nature to demand imbalance in the lives of those who work in it, they hoped to find a different way. ■

**KATHRYN JOYCE** (@kathrynajoyce) is a journalist and the author of *The Child Catchers and Quiverfull*.

# COLOPHON

## Simple pleasures that helped get this issue out:

Thumbing through a new book on a lazy weekend; breathing in cool, foggy air in the early morning; wine club memberships; a slow bike ride to the ocean and back; homemade chili oil; Thomas Jane’s weird hair in season 1 of *The Expanse*; homemade soup that’s as delicious as it is photogenic; biting my nails (don’t tell Mom!); “Puppy Dog Bouncin (in the Box)”; jigsaw puzzles with my son, absolutely no technology involved; 3 am spoonfuls of cashew butter; a showerhead without a flow restrictor; Orion’s belt; snorkeling off Playa del Amor; hot-boxing a tree house at a 57-year-old’s birthday party; finding City Cycle Werkes after losing Bavarian Cycle Works; the dog giving an appreciative look back during our walk; focusing on Neil Peart’s drums while listening to “Tom Sawyer”; the apartment might be small, but it is easy to heat; perfectly brewed coffee; strutting around in my bright red cowboy boots; Aesop hand balm after a hard rock-climbing session; hot tea; the regulars at my local neighborhood café waving hello on Sunday mornings; walking on the sunny side of the street; Billy—we’ll miss him.

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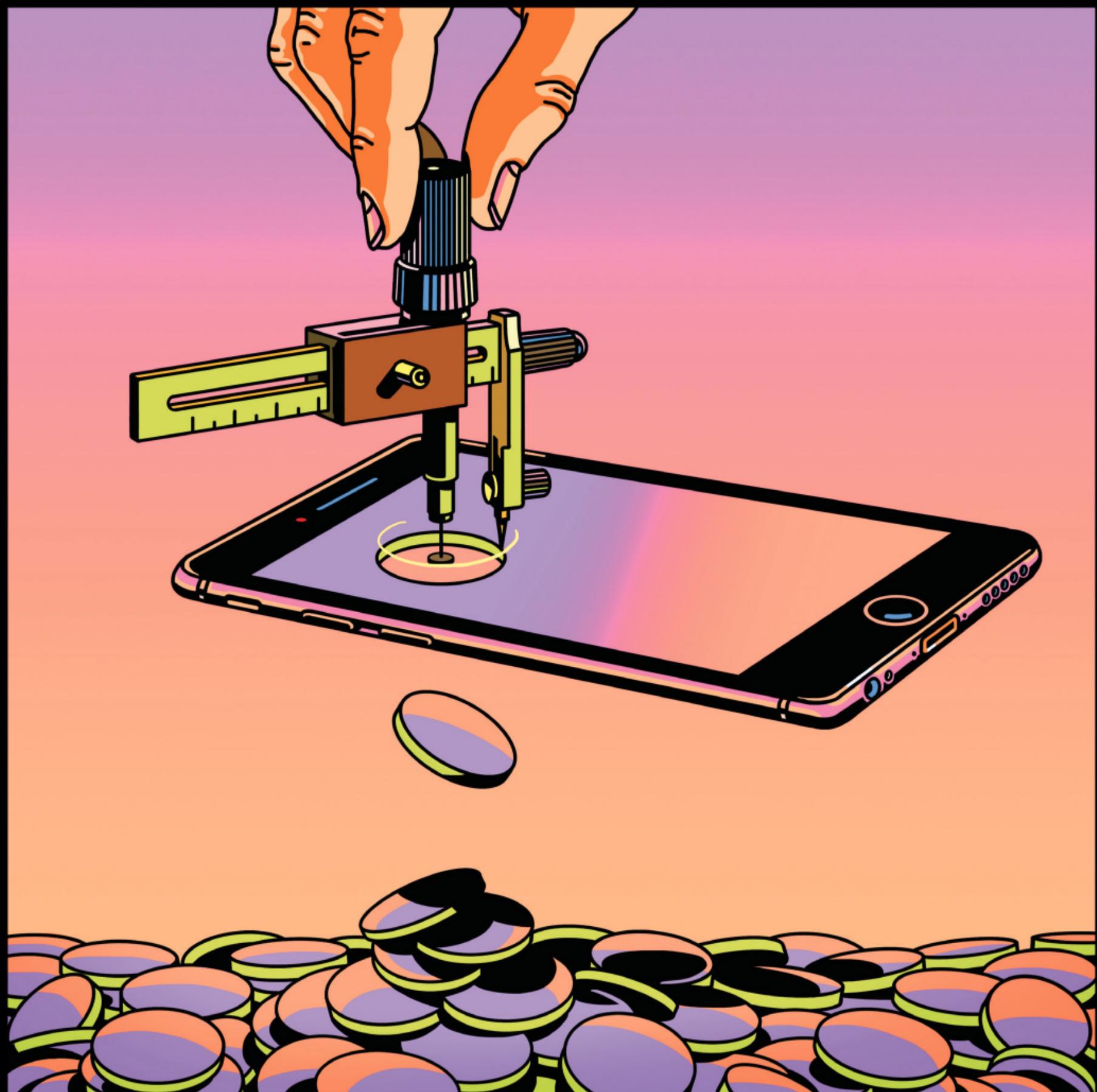
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